



Journal of Geology and Mining Research

Volume 9 Number 1 February, 2017

ISSN 2006-9766



*Academic
Journals*

ABOUT JGMR

The Journal of Geology and Mining Research (JGMR) (ISSN: 2006-9766) is an open access journal that provides rapid publication (monthly) of articles in all areas of the subject such as mapping of deformed rock bodies, recovery of natural resources, geotechnical engineering, numerical modelling in geological studies etc. The Journal welcomes the submission of manuscripts that meet the general criteria of significance and scientific excellence. Papers will be published shortly after acceptance. All articles published in JGMR are peer-reviewed.

The Journal of Geology and Mining Research (ISSN: 2006-9766) is published twice a month (one volume per year) by Academic Journals.

Contact Us

Editorial Office: jgmr@academicjournals.org

Help Desk: helpdesk@academicjournals.org

Website: <http://www.academicjournals.org/journal/JGMR>

Submit manuscript online <http://ms.academicjournals.me/>

Editors

Prof. D.P. Tripathy

*Head, Department of
Mining Engineering
National Institute of
Technology, Rourkela-
769008.
India.*

Dr. D.S Subrahmanyam

*Geotechnical Engineering
Division, National Institute of
Rock Mechanics, (Govt. of
India) ITI Annex Building,
Dooravani Nagar Bangalore,
Karnataka – 560 016*

Prof. K.C. Tiwari

*Department of Geology
The Maharaja Sayajirao
University of Baroda
VADODARA - 390 002
Gujarat State – India*

ARTICLE

- Artisanal gold mining in Batouri area, East Cameroon: Impacts on the mining population and their environment** 1
Kouankap Nono Gus Djibril, Tah Bong Cliford, Wotchoko Pierre, Magha Alice, Chiane Beng Japhet Kuma and Tene Djoukam Joëlle Flore

Full Length Research Paper

Artisanal gold mining in Batouri area, East Cameroon: Impacts on the mining population and their environment

Kouankap Nono Gus Djibril^{1*}, Tah Bong Cliford¹, Wotchoko Pierre¹, Magha Alice¹,
Chiane Beng Japhet Kuma² and Tene Djoukam Joëlle Flore³

¹Department of Geology, HTTC, University of Bamenda, P. O. Box 39 Bambili, Bamenda, Cameroon.

²Department of Geography and Environmental Science, University of Dschang, P. O. Box 49, Dschang Cameroon.

³Department of Earth Sciences, Faculty of Sciences, University of Yaoundé I, P. O. Box 812 Yaoundé, Cameroon.

Received 30 October, 2016; Accepted 3 February, 2017

Batouri is located in the East region of Cameroon; geologically the area is made up of Pan African granitoids, which are the host rocks of gold mineralization. Batouri gold deposits have long been subjected to artisanal mining activities carried out by the indigenes for livelihood. Majority of the mining population (45%) is made up by youths (15-30 years), followed by the adults (35%) within the age range 46-60 years old. Adults within the age range 31-45 years constitute only about 5% of the mining population. Female artisans constitute 35% out of the total mining population and are involved in all the stages. The artisanal gold mining has caused damage on the environment which directly or indirectly affects the population. The standard of living of the miners in Batouri is still very poor giving rise to high rate of school drop outs, high rate of prostitution, poor hygienic conditions and health challenges. Artisanal gold mining is also very destructive to the environment causing severe deforestation; land degradation; destruction of the forest ecosystem. From these findings, it is recommended that the government re-enforce committees that will do a daily follow up of mining activities; train artisans on doing sustainable mining.

Key words: Batouri, socio-economic, environmental impact, artisanal gold mining.

INTRODUCTION

Cameroon is one of the countries in Central Africa that is endowed with many mineral resources such as gold, diamond, rutile, iron ore, bauxite. Gold production in Cameroon dates back to 1934 with a production peak of 717 kg in 1942 (Laplaine, 1969). From that date till now

gold mining is still artisanal and is located in the East, South and part of Eastern Adamawa regions where gold mining is undertaken by the local indigenes for livelihood. Apart from abject poverty that characterizes the gold mining communities; major socio-economic and

*Corresponding author. E-mail: kouankap@yahoo.fr. Tel: +237 699 782 431.

environmental problems brought about by the mining boom have prolonged effects in the mining communities as well as the miner's livelihood sustainability. Most individuals in Batouri depend on artisanal gold mining for their livelihood; the deposit has attracted small scale mechanized companies. In the process of exploitation by both the artisanal miners and the mechanized companies, unavoidable impact is caused to the mining population and their environment. Awudu (2002) state that extraction companies have been found to be largely responsible for vegetation clearance and land degradation, waste disposal, mineral processing and misuse of mining chemicals leading to streams and river pollution thus diminishing safe drinking water for humans and loss of biodiversity due to decreasing forest cover. This assertion is exactly what is happening in the gold mining communities in the Batouri locality in the East region of Cameroon. This paper seeks to characterize the mining population and to identify the socio-economic and environmental impacts of artisanal gold mining on livelihood sustainability in Batouri East Region of Cameroon.

Study area setting

Batouri is located in the East region of Cameroon between latitude 4°25'0"N and 4°29'0"N and longitude 14°22'0"E and 14°26'0"E. Geologically Batouri belongs to the Central Domain of Pan African Fold Belt in Cameroon (Figure 1). This domain is characterized by multiple major strike slip faults and the wide distributed syn- to post- tectonic granitoids (Djouka-Fonkoué et al., 2008; Njiekak et al., 2008; Kouankap Nono et al., 2010; Nzina Nchare et al., 2010; Chebeu et al., 2011). Those granitoids of Panafrican ages are the gold host rocks, the mineralization is diffused within the rock masses and in some place carried by hydrothermal quartz veins (Suh et al., 2006). The main rock type in Batouri is Granitoids which include porphyritic biotite-amphibolite granites and granodiorites cross-cut by numerous quartz veins bearing localized gold mineralization. The metamorphic unit in Batouri area is made up of Schist, generally observed as large xenoliths in the granitoids and well-deformed gneisses and amphibolites, Penaye and Hell (2013) which constitute the country rock intruded by the Pan African granitoids.

METHODOLOGY

Direct field observations were carried out in various mining sites in order to appreciate the rate of environmental destruction and the various phases involved in the artisanal gold mining. The fieldwork in Batouri was conducted between March and April 2015. Data collection from the field was done by the use of guided questionnaires, interviews and focus group discussions with key informants. A total of 100 questionnaires were administered in two mining communities of Batouri: Kambele and Mungonam. Since the two communities are almost of the same population size, the

questionnaires were equally distributed: 50 questionnaires at Kambele and 50 questionnaires at Mungonam. The sampled households were chosen at random. The first household was randomly selected and the rest of the households were selected every after five household counts. This was to avoid collecting the same information at the nearest household neighbor. Apart from administering questionnaires, interviews and a number of focus-group discussions were organized with the artisans, field actors associated with livelihood sustaining activities linked to mining. Stakeholder consultations were also done. The data collected through questionnaires were sorted, decoded and classified into different variables before analysing. The data was then treated with the aid of EXCEL to obtain summarized tables and figures.

RESULTS

Artisanal gold mining in Batouri

Gold artisans in Batouri often use the simple method of "panning" for gold. They use a pan to scoop silt and sand from the river bottom, and sift through it for bits containing gold. This type is mostly done by women (Figure 2A, B, C). The men use the "open-pit" technique which involves drilling, blasting, and removing quantities of soil and sub-soil with their axes, and then extract the ore (Figure 2D, E). When the gold is located too far underground for an open-pit mine, they used underground mine. In this case, shafts are dug into the ground, with tunnels branching out, leading to the gold deposits (Figure 2F). In the mining communities, individuals as well as grouped artisans work more than 8 h per day digging, crushing and panning. Pits depths are 10-15 m on average respectively and tunnels of approximately 75 m are abandoned after mining. These open pits after a while are covered by shrubs and therefore become dangerous traps for visitors, animals and are breeding grounds for mosquitoes. Some of the pits are more than 50 years old.

The mining population

Artisanal gold mining in Batouri became more intensified in the early 1960s with more families involved in the activity. From oral interviews in the field most of the elderly people who were involved in the mining activity before 1960 acknowledged that in the past, artisanal gold mining was mainly the activity of men since physical power was highly needed while the women were involved in gathering food crops in the forest. Today, gold mining has become an essential livelihood activity for the inhabitants and women as well as children have become more involved in the activity than ever just to sustain their daily needs (Figure 3A). Most of the respondents between 15-30 age groups constitute majority of the mining population in Batouri with a representative of 45% of the total mining population. The adult age group of 31-45 is less involved in the activity with only about 5% taking part. We were told that the reason for this less

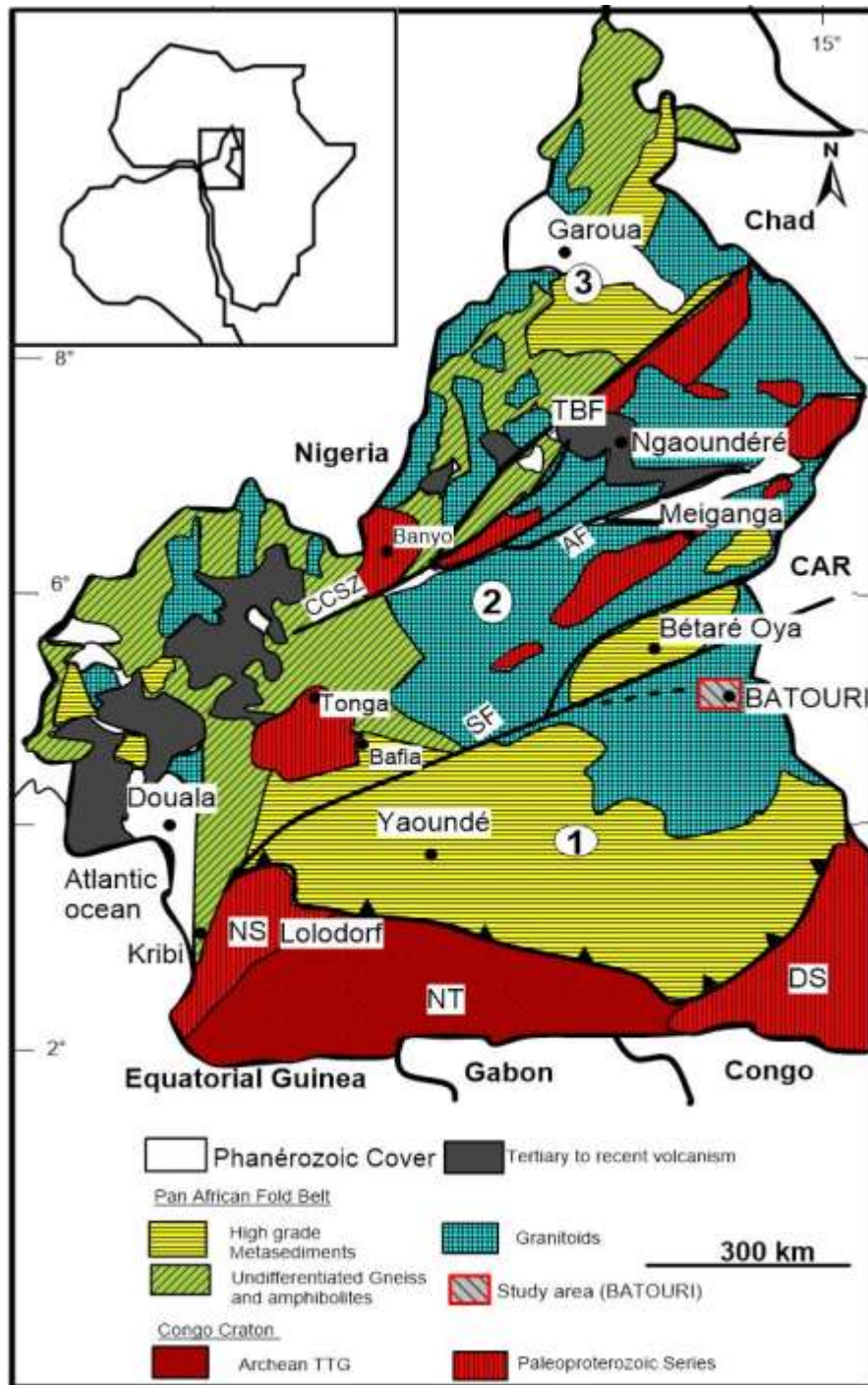


Figure 1. Geological map of Cameroon with the three main domains of the Pan African North-Equatorial fold belt (modified from Nzenti et al., 2006): (1) southern domain, (2) central domain, (3) northern domain. TBF, Tibati-Banyo Fault; CCSZ, Central Cameroon Shear Zone; SF, Sanaga Fault; AF, Adamaoua Fault; NT, Ntem complex; DS, Dja series; NS, Nyong series. Batouri area is marked by a red square.

involvement is because most of the men within the age group migrate to neighboring villages to start off businesses and new mining sites. Another interesting group interval is that of 46-60 age group who constitute

35% of the total mining population. Today women are actively involved in mining activities in all the stages from digging to panning the gold. In Batouri, female artisans constitute 35% out of the total mining population while the

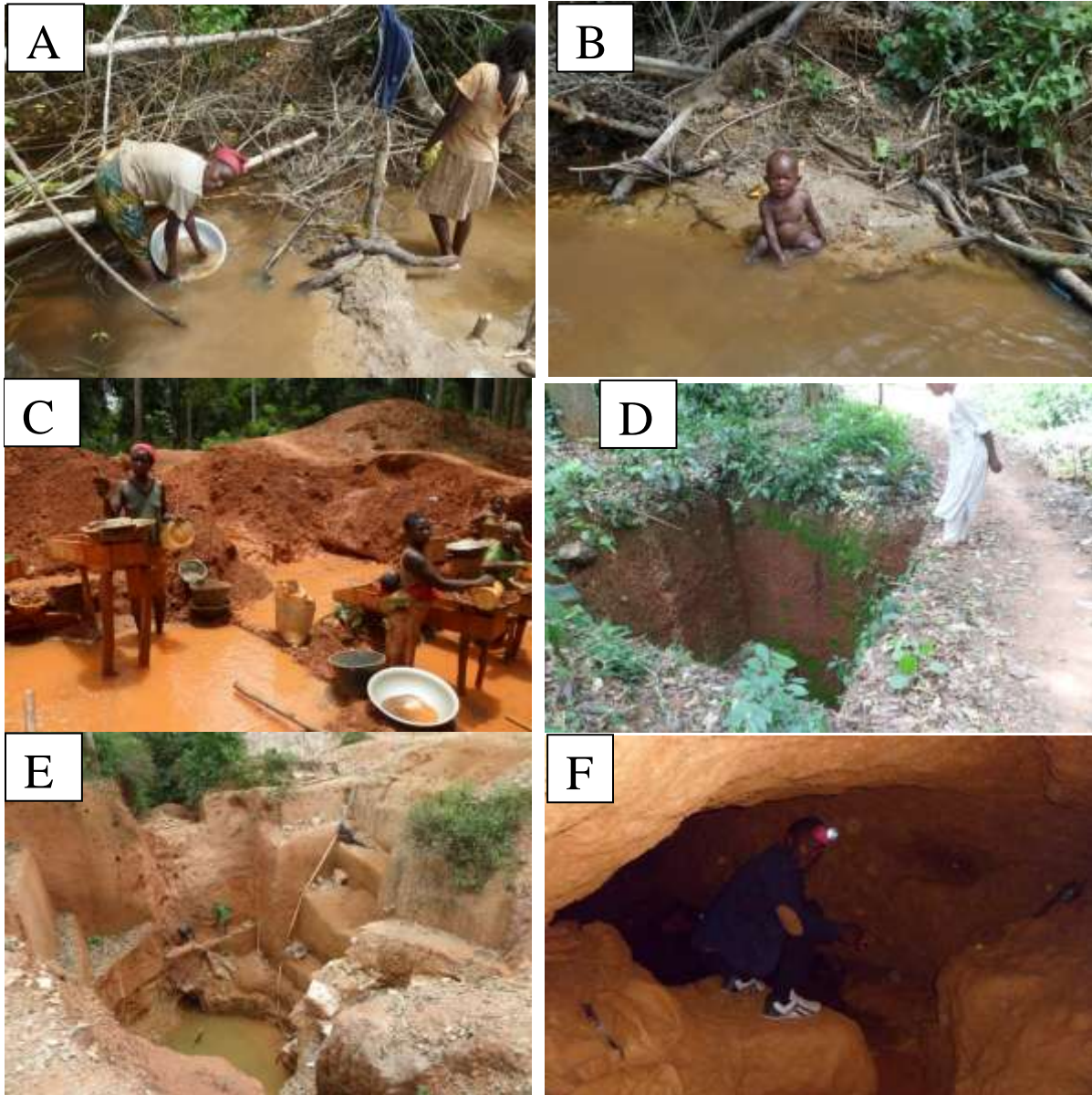


Figure 2. Field photographs of the artisanal gold mining field: A) Female artisans scooping sediments along a stream channel and panning for gold. B) Baby belonging to one of the female artisan assisting gold panning by his mother. C) Female artisans in a mining pit using washing table to recover gold. D) A 10 year's old abandoned pit in Mongonam. E) A 15 m deep pit at less than 50 cm from the main foot path in Batouri mining site. F) An underground tunnel of about 25 m long excavated in Mongonam in search for gold.

men constitute 65% (Figure 3B). The women are showing strong demand in the activity because it is from there they get their daily needs. There is no doubt that in the nearest future there will be more women involved in this artisanal mining activity than men. As concern education, most of the miners have attended some basic level of education even without obtaining the qualification (Figure 3C).

The present situation shows that youths are the majority of miners with basic level of education. Child

labor cases are also very rampant in the mining grounds. The children are considered as sources of labor and additional man power in the mining grounds. Most parents have withdrawn their children from school to help them in the mining activity. In the mining population young boys get married at a very early age. A total of 70 marriages were recorded with 5 widowed and no divorce cases noted from total respondents. Sixty five percent out of the total of hundred respondents were married with 5% widowed cases (Figure 3D). The 30% single cases were

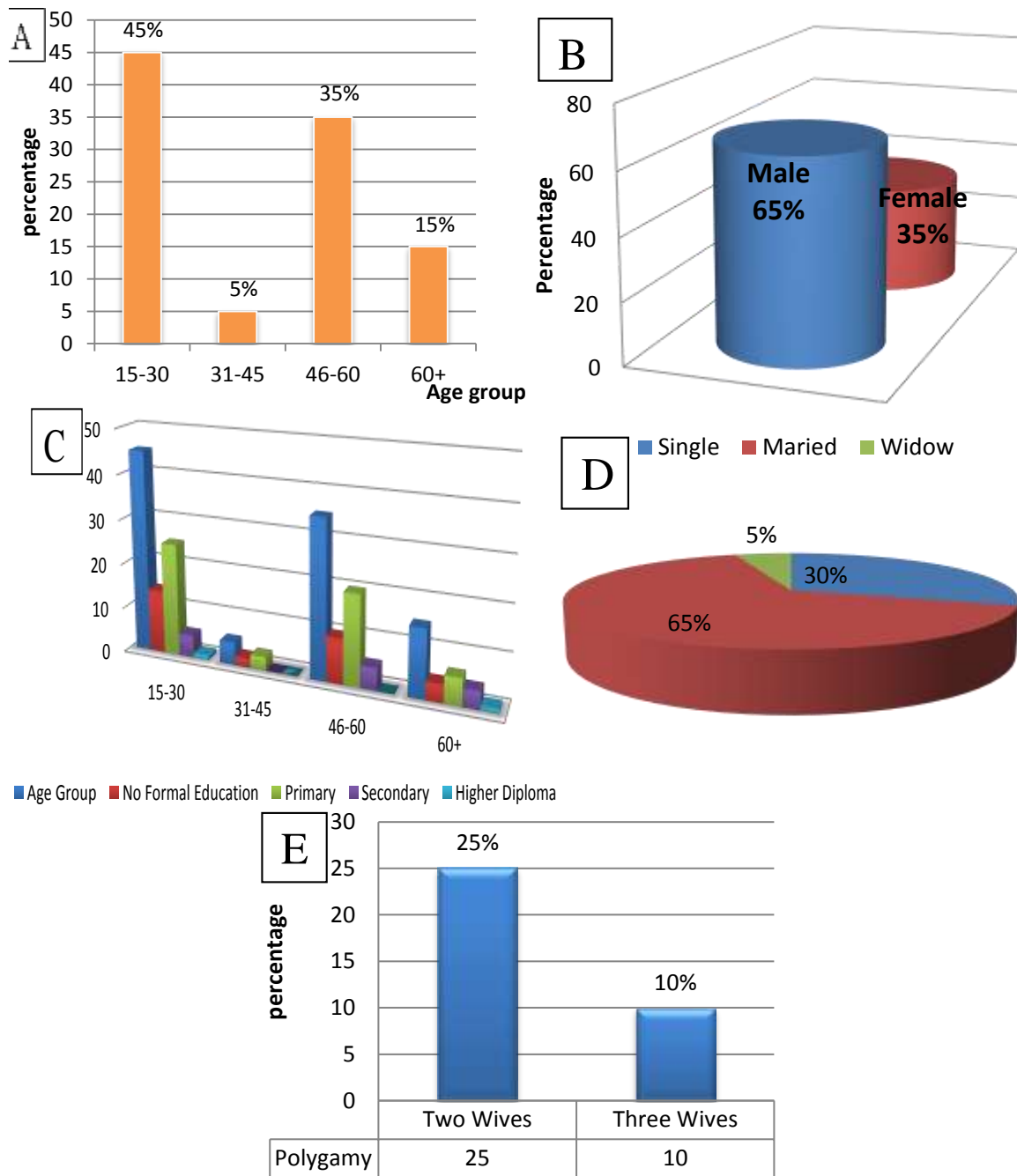


Figure 3. A) Age group of mining population, B) Gender ratio of miners, C) Education of miners D) Marital status of miners and E) Polygamy trend of miners.

mostly male youths below 22 years and some students on holidays who only came to join hands with their parents. The mining population of Batouri supports large families and the polygamy is a common phenomenon. To some polygamous household head, marrying more than one wife proves one's dignity in the community, and also strength of manhood. Twenty five percent (25%) of the total 35 households were married to two wives while 10% had above three wives (Figure 3E).

Socio-economic impact

The gold mining population of Batouri is diversified in their economic activities. Though gold mining is the primary occupation, the artisans practice alongside secondary activities such as agriculture, fishing, hunting, and other auxiliary services (Figure 4A). Most of the crops they plant here include plantains, cocoyam and maize. Since mining is also done along stream channels,

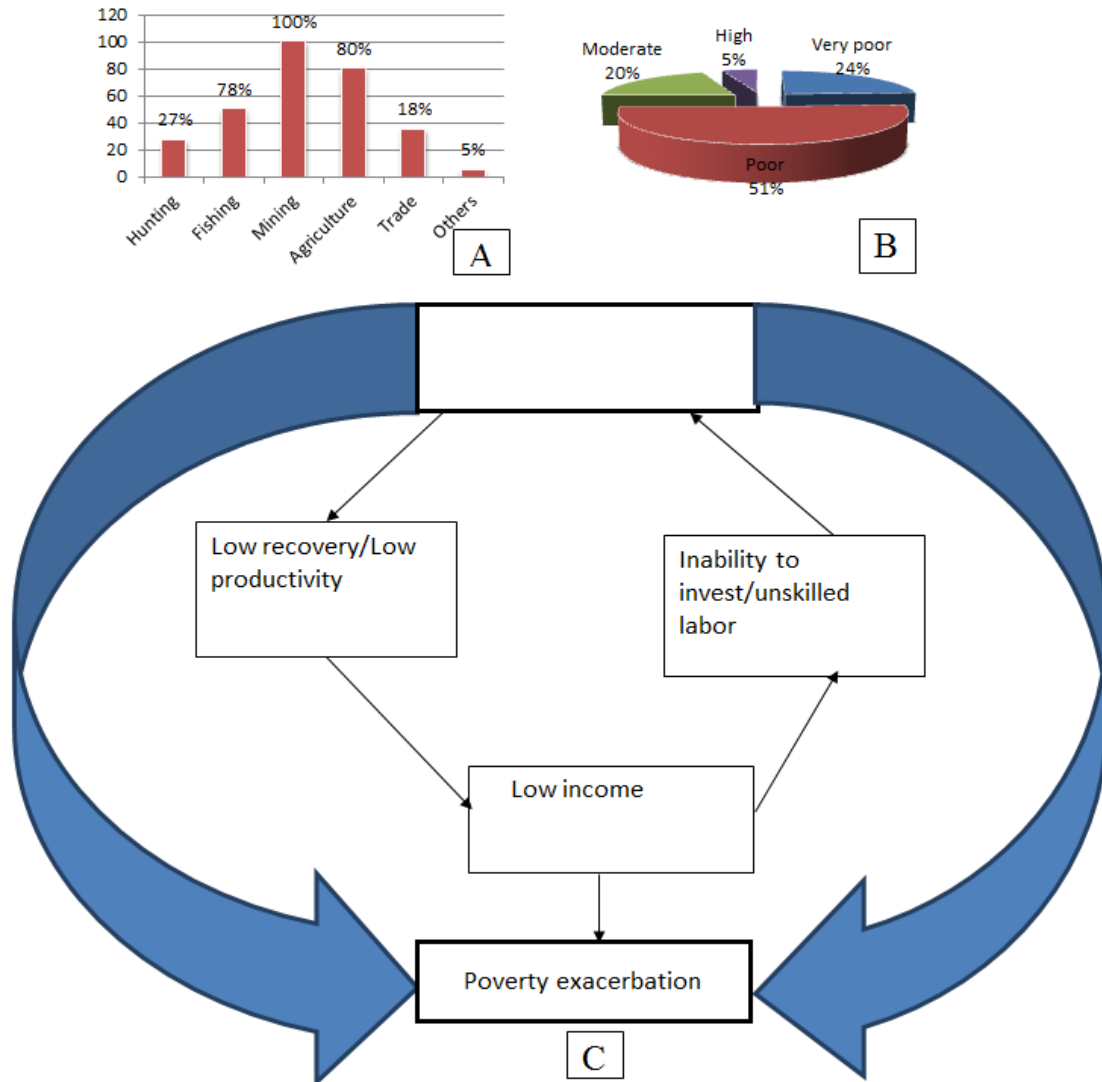


Figure 4. A) Socio-economic activities of the artisans, B) Standards of living of artisans, C) Artisanal gold mining poverty trap.

fishing is also common too. 78% of the miners are bound to practice fishing along the stream channel during mining. Other activities such as hunting (27%), petit trading (18%), brick moulding and huts construction are also carried out at small scales. However, this work further isolates negative socio-economic impact prevailing among the artisans that has contributed to a low standard of living observed to include: alcoholism, cigarette smoking, commercial sex, social conflicts on mining plots and diverse health challenges. With all these negative impact, coupled with the use of rudimentary tools, poverty cycles become clearly visible at household levels and this entails an adverse social implication on the mining community as a whole (Figure 4B, C). All of this boils down to poverty exacerbation in the mining camps; thus the vicious poverty cycle becomes well pronounced.

The health status of the miners in Batouri has greatly deteriorated due to intensive labor. Most of the tools used in mining are rudimentary and man power is much needed. This exposes the miners to high risk of injuries and numerous health problems such as skin rashes, cough, muscle pain, and heart problems. The community is littered with abandoned mining pits which are breathing grounds for mosquitoes making malaria becomes one of the most common ailments affecting the people. From the statistics obtained at the district health center in Batouri, it is very glaring that apart from the aforementioned ailments, water borne diseases and sexually transmitted infections (STIs) are very common and the number of infected cases has increased drastically over the past five years. There is bound to be falling standards in the living conditions of the mining population.

The parameter considered in bringing out this standard



Figure 5. A & B) Land degradation and deforestation caused by small scale mechanized gold mining in Kambele, C & D) stream pollution caused by artisanal gold mining in Mongonam, E) Air pollution produced by the grinding of quartz grains, F) A 30 years old abandoned pit.

of living is the minimum amount of money made by each artisan in a month and comparing it with the national minimum wage rate of Cameroon. It is worth noting that a majority of the artisans suffer from diverse health challenges and they become unable to go to work as such they are bound to have less income in a month hence low standard of living. This low standard of living is characterized by: the inability of the miner to have three square meals a day, living in deteriorated houses and the inability to provide basic needs to their children. Poverty line of the artisans is already above 50%, only about 5% of the total population enjoy absolute high standard of

living characterized by good living conditions, while 20% experiences moderate standard of living (Figure 4B).

Impact of mining on the environment in Batouri

Field observations and responses gathered reveal that the major environmental problems of artisanal gold mining in Batouri area are deforestation, land degradation, soil erosion and tailings dumped (Figure 5A, B). Other impacts include air pollution and stream water pollution (Figure 5C, D, E). Thirty-five (35%) of the

respondents said artisanal mining has no negative impacts on the environment. Sixty-five (65%) cited some few cases of negative impact such as land degradation and deforestation.

Concerning the natural environment the most outstanding impact noticed are vegetation clearance (deforestation), land degradation, air pollution, leaching of pollutants from tailings, and water pollution. These impacts concord with the findings of Tetsopgang et al. (2007), Trivedi (2001), Warhurst (2001), Corttrel et al. (2000), Hilson and Murck (2001), Awudu (2002) and Anane (2008). These diminish and destroy farming land thereby increasing the rate of food insecurity.

CONCLUSION AND RECOMMENDATIONS

This work was aimed at assessing the impacts of artisanal gold mining on the mining population and the environment in Batouri. The results obtained show that the greater proportions of the workers in the mining sector are youths with a representative of 45% of the total mining population as such mining brings about employment. Though some artisans make much money, but their standard of living remains poor because of mismanagement of the money.

The negative impact of artisanal mining on both the population and the environment include: High rate of school drop outs, poor hygienic conditions in the mining camps giving rise to diverse health challenges, high rate of prostitution which leads to the spread of STIs, deforestation which leads to loss of forest ecosystem, land degradation leading to loss of farming land, water pollution and air pollution. Some of the workers in the artisanal mining sector are ignorant of the negative effects of mining to the environment and this has contributed to poor management of the environment. Since Cameroon is a store house of mineral resources in the world, and coupled with the fact that these resources are constantly being extracted, there is a high need for the government to do the following in order to check the damage caused on the environment:

- i) Set up committees that will do a day to day follow up of mining companies to see if they are not deviating from the environmental protection laws.
- ii) Organize seminars during which the artisanal miners will be drilled on the negative effects of their activities on the environment and trained on doing sustainable mining.
- iii) Encourage the miners to educate their children right up to the level of the university since statistics have shown that most of the young miners are school drop outs.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

- Anane M (2008). Farmers resist Newmont operations in AjenuaBepo Forest. Public Agenda, March 31, 2008.
- Awudu GBK (2002). "The role of foreign direct investment (FDI) in the mining sector of Ghana and the environment", A Paper Presented at the Conference on Foreign Direct Investment and the Environment, OECD, Paris-France.
- Chebeu C, Ngo Nlend CD, Nzenti JP, Ganno S (2011). Neoproterozoic high-K calc-alkaline granitoids from Bapa-Batié, North Equatorial Fold Belt, Central Cameroon: petrogenesis and geodynamic significance. *The Open Geol. J.* 5:1-20.
- Suh EC, Lehmann B, Mafany GT (2006). Eology and geochemical aspects of lode Gold mineralization at Dimako-Mbosccoro, SE Cameroon. *Geochem. Expl. Environ. Anal.* 6:295-309.
- Djouka-Fonkwé ML, Schulz B, Schüssler U, Tchouankoué JP, Nzolang C 2008. Geochemistry of the Bafoussam Pan-African I- and S- type granitoids in western Cameroon. *J. Afr. Earth Sci.* 50:148-167.
- Hilson G, Murck B (2001). Progress towards Pollution prevention and waste minimization in the North American gold mining industry. *J. Cleaner Prod.* 9(5):405-415.
- Kouankap Nono GD, Nzenti JP, Suh CE, Ganno S (2010). Geochemistry of ferriferous, high-K calc-alkaline magmas from the Banefo-Mvoutsaha Massif (NE Bafoussam), Central Domain of the Pan-African Fold Belt, Cameroon. *The Open Geol. J.* 4:15-28.
- La Plaine P (1967). Indices minéreaux et ressources minérales du Cameroon. In bulletin de la direction des mines et de la géologie No. 5, République fédérale du Cameroon.
- Njiekak G, Dörr W, Tchouankoué JP, Zulauf G (2008). U-Pb zircon and microfabric data of (meta) granitoids of western Cameroon: constraints on the timing of pluton emplacement and deformation in the Pan-African belt of Central Africa. *Lithos* 102:460-477.
- Nzenti JP, Kapajika B, Wörner G, Lubala RT (2006). Synkinematic emplacement of granitoids in a Pan-African shear zone in Central Cameroon. *J. Afr. Earth Sci.* 45:74-86.
- Nzina Nchare A, Nzenti JP, TankoNjiosseu EL, Ganno S, Ngotué T (2010). Synkinematicferro-potassicmagmatism from the Mekwene-NjimafofireFoumban Massif, along the Foumban-Banyo shear zone in central domain of Cameroon Pan-African fold belt. *J. Geol. Mining Res.* 2(6):142-158.
- Penaye J, Hell JV (2013). Abandoned artisanal mining sites of Eastern Cameroon: environmental problems and Cameroon legislation: institute for geological and mining research. Yaounde, Cameroon.
- Tetsopgang S, Nzolang C, Kuepouo G (2007). Environmental and socio-economic assessment of an artisanal gold mine in BetareOya, East Cameroon. Internal report (CREPD) Yaounde, Cameroon.
- Trivedi RN (2001). A text book on environmental sciences. Published by J.L. Kumar for Anmol Publications Pvt Limited, New Delhi.
- Warhurst A (2001). Corporate citizenship and corporate social investment: drivers sector partnerships. *J. Corporate Citizenship* 1(1):57-73.



Journal of Geology and Mining Research

Related Journals Published by Academic Journals

- *African Journal of Pure and Applied Chemistry*
- *International Journal of Physical Sciences*
- *Journal of Geology and Mining Research*
- *Journal of Environmental Chemistry and Ecotoxicology*
- *Journal of Internet and Information Systems*
- *Journal of Oceanography and Marine Science*
- *Journal of Petroleum Technology and Alternative Fuels*

academicJournals