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ARTISANAL MINING IN MOOK, RED SEA HILLS, NE SUDAN

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Abstract

Gold mining has been recorded in Sudan since the time of Pharoah. But there has been an increase in mining activities during the last decade. Therefore a fresh look into the mining activities was taken up.Fifteen kilometers from Portsudan, the capital of Red Sea State, lies Mook area where the present study was carried out. This is the place where vat panning, ore crushing, ore panning with mercury amalgamation, milling of ore, and burning of amalgamate gold takes place. This involves hundreds of workers in the process of procuring gold.An attempt has been made to study this strategic area and the environmental implications it has on the mine workers.

Keywords: Artisanal mining; crushing milling of ore.

INTRODUCTION

The Red Sea Hills region is located in the North East Sudan which is bounded by the Nile in the west, the Red Sea in the east, the Egyptian borders in the north and the Eritrean heights in the south. During the time of Pharoah (Klemm, Klemm and Murr 2001) a lot of gold mining took place leaving behind milled quartz, pottery, graves and houses of miners. (Johnson Paul 1999). The mining continued till the most of the high grade gold was exploited. (Johnson Paul 1999)

During the last decade, technology increased where GPX devices can locate even a small amount of gold, deep inside the quartz veins. Hence a large number of artisanal mining sites have cropped up creating job opportunities for many who are under poverty line, who in turn are risking their health to mine for gold.

The Red Hills area has very little vegetation. It has arid to semi arid type of climate with less rainfall during June to September. It is also thinly populated. Clusters of people live as separate communities in small villages and small settlements. They mostly belong to tribes such as Biga Hadhandawa, Kukrieb, Amarar, Bisharin and Beni Amir. For most of them, mining is their livelihood even if it endangers their health.

The mining activity is carried out along the Red Sea coast which is a flat strip with a width ranging from 24 km to 56 Km (Figure 1 and Figure 2).

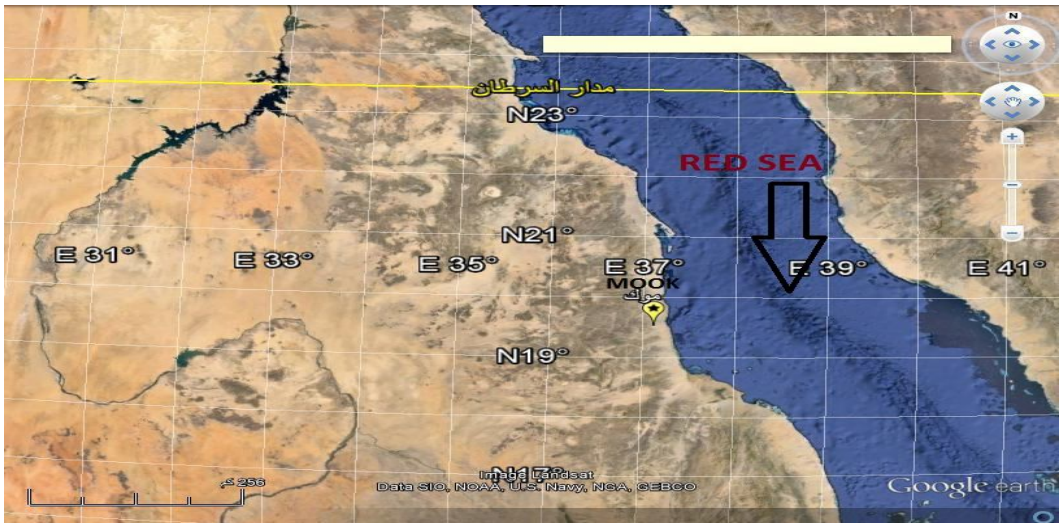

Fig. 1: Satellite image of Mook area

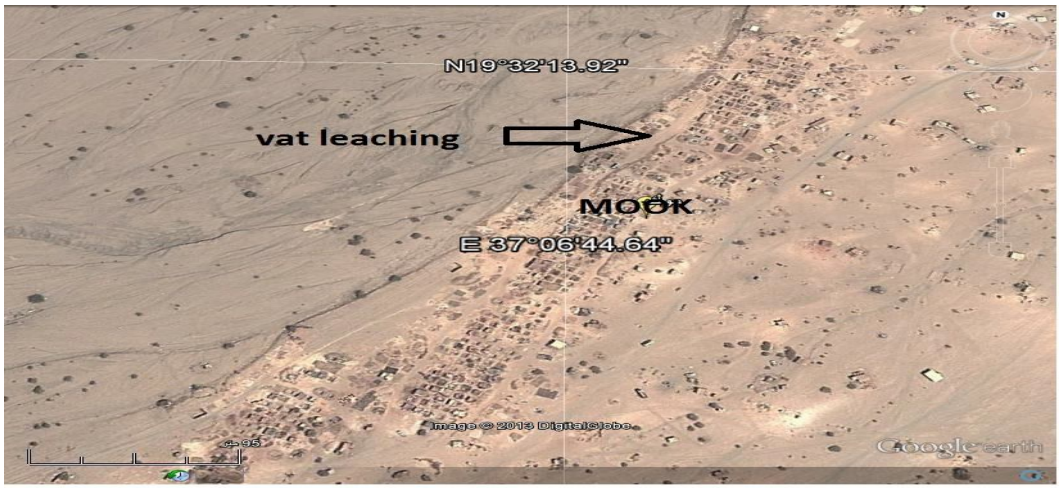

Fig. 2: Satellite image of Mook

GEOLOGY OF THE AREA

The stratigraphic classification of NE Sudan has been studied by Gass (1955), Ruxton (1956), Gabert et al (1960), Kabesh (1962) and Vail (1979). Their classifications are shown in Table1.

Table 1: Stratigraphic subdivisions of the Red Sea Hills

Gass (1955)	**Ruxton (1956)**	**Gabert et al 1960**	**Kabesh (1962)**	**Vail (1979)**
Asotteriba volcanic				
(dykes) younger granite	(acid,basic,sills and dykes) Red granie	(dykes) Younger granite	(dykes) Younger granite	(dykes) Youngerigneous activity (Gabbro granite,syenite) Central volcanics Group(homogar) Acid volcanics)
	Injection granite		Grey granite	
	Awat series (acid volcanics,sedi ments)	Awat series (acid volcanics, sediments)	Awat series (acid volcanics, sediments)	
				Green schist Assemblage Serpentinites Batholithic Granitoids Greenschist assemblage (meta volcincs,sediment andUltra basics
Basic intrusive Gabbroo troctonite pyroxenite	Basic inrtusives	Basic intrusives	gabbros	
Batholithic granite (Assimilation granite)		Batholithic granite	Diorites and Epidiorites	
Oyo series (metasediments intermediate-acid volcanics)	Nafirdeib series (basic and intermediate Volcanics, sediments)	Nafirdeib series Salala series (Intermediate volcanics sediments)	Nafirdeib series (intermediate volcanics sediments)	
Granite gneiss (+schists,volcan ics)	Primitive series Basic dyke Swarms (acid gneisses, schists)	Kashebib series (para gneisses)	Gneisses (Para and ortho - gneisses)	Meta sedimentary group
				Grey gneiss group

Kashebib Series

Kashebib Series is oldest unit in the Red SeaHills Region of Sudan. It is made up of para gneisses, schists, amphibolites, quartzites and migmatites of middle Proterozoic age to lower Proetrozoic –Archaean (Rasvalyayev&Shakhov, 1978).

The Kashebib series is referred to as granitic gneiss by Gass (1955),para and orthogneiss by Kabesh (1962) and considered to be of medium to high grade metamorphic facies mainly found in Sasa plain near Gebeit Elmaadin, near Hayia and in the west of Port Sudan correlated with Haffafit series (Egypt) and Hali group (Saudi Arabia) (Almond et.al.,1979).

Nafirdieb Series

The term Nafirdieb series was adopted for the first time by Ruxton (1956) while the same series had been referred to as Oyo series by Gass (1955). Later on itwas referred to as Greenschist Assemblage by Vail (1979).

Nafirdieb series units unlike Kashebib are widespread. They occupy most of the Red Sea Hills Region lying unconformable on Kashebib series. They consist of volcano - sedimentary sequences of basalt, andesite, dacite, rhyodacite, rhyolite with associated pyroclastic rocks, volcanoclastic gray-wackes, conglomerates,grits, limestones and mudstones.

The Nafirdeib sequences were subjected to low grade metamorphism of green schist facies and they were intrude by grantic batholiths. Nefirdieb series are correlated with Attalla series of Egypt and Baish group of Saudi Arabia (Ahmed et al., 1979).

Awat Series

Awat, Asoteriba and Homogar series lie unconformable on Nafirdeib series and the batholithic granites (Rexton, 1956); Ahmed et. al., 1979). It consists of volcano - sedimentary sequences mainly of dacites, rhyolites with acid pyrolastics, ignimbrites, mudstones, siltstones and conglomerates (Ruxton,1956). From the field observations, it is noticed that Awat series units are slightly or not deformed and the volcanic sequences are more acidic than those of Nafirdieb series (Embletion et al., 1983).

Artisanal Mining

According to Vercoutter (1959), there were 74 ore deposits of gold and 2 silver deposits in Sudan. But since most of the pure gold has been exploited, only remnants of small veins are left behind. Therefore artisanal mining helps the people make a living. With modern technology, search for unexplored veins is carried out or search for placer deposits in streams is done regularly.

To explore veins, GPX instrument is used to detect traces of gold left behind. After detecting the vein an unscientific hole is made following the quartz veins underground (fig 3). The traces of gold are extracted by crushing using jackhammer or hand hammer. The weathered portion of the vein is easy to break but as the miner tries to crush the rock deeper inside it becomes extremely difficult. The method followed is to burn plastic deep inside the hole for two or three days. That creates toxic fumes which are harmful. A long pipe is inserted inside the hole and air is pushed inside with the hope of air replacing the harmful gases. After the vein is exploited, crushing and milling is carried out. Milling is done with the help of a hammer mill which creates fine dust which fill the air (Figure 4). The next process is the panning method which is carried out in small vats of 4 X 4 meters and 0.5 meter depth (Figure 5). Since the quantity of gold is small, mercury is added to segregate the gold (Figure 6). Finally the artisanal miner takes the mercury with bare hands and burns the mercury gold mixture. The mercury evaporates and the gold is left behind (Figure7).

DISCUSSION AND CONCLUSION

During the field study in the year 2013, 642 vats for panning were present. In most of the vats two or three persons are employed, numbering 1640. There were 123 crushers on site. For each crusher two persons are employed to give a total of 246. Indirectly some more persons get employed by transporting goods and people, by opening eateries and tea stalls.

The advantages are few. The per capita income has increased. The Government of Sudan is also benefited. Job opportunities have increased. The disadvantages are many. Firstly the health impact is major problem. There is danger to life in underground mining. Inhaling of toxic gases in the mine, inhaling the fine dust during milling, the inhaling of mercury fumes all of these cause severe lung impairment. Secondly the social aspect is also a problem. Lot of infighting among the people, schools closed to enable both the teacher and taught to earn more, and an increase in unchecked crime. Increase in child labor has become a major issue. Thirdly the environmental impact is immense. Decrease in agriculture is turning the area barren, water and land is polluted. Big holes left in the area which sometimes collapses which endangers animals. Dumping of waste has changed the area into a desert (Figure8).

RECOMMENDATIONS

Making the people aware about the hazards of artisanal mining (Figure9). Training the miners in safety methods will go a long way in creating a clean environment. Train them to use physical separation techniques like shaking table and sluice box instead of harmful mercury.

Fig. 3: Unscientific hole of mining

Fig. 4: Hummer milling and dust

Fig. 5: Vat Panning

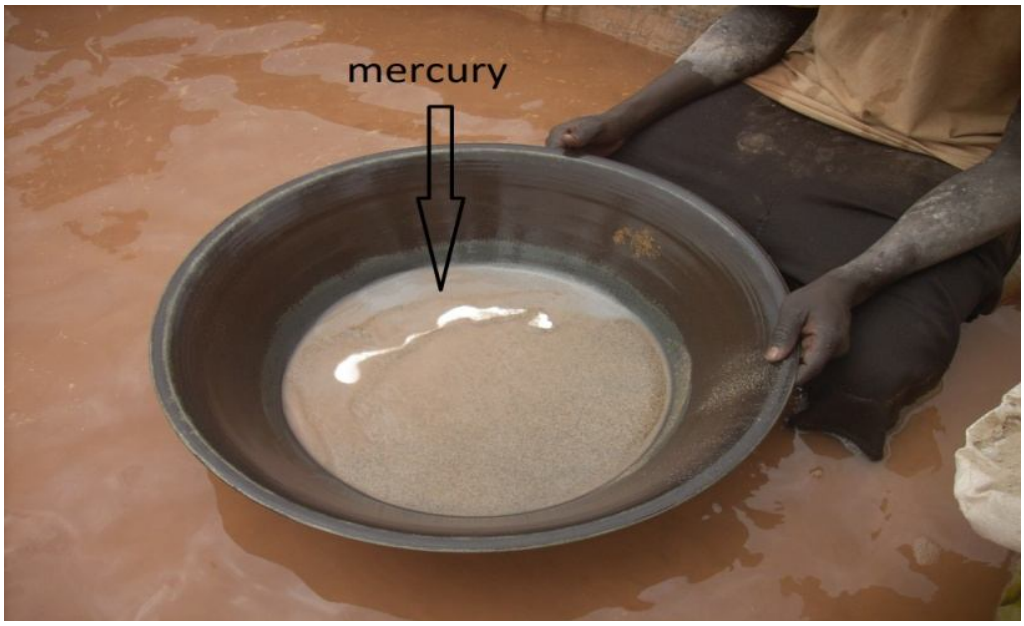

Fig.6: Mercury is added to Amalgamationthe Gold

Fig. 7: The mercury evaporates and the gold is left

Fig.8: Dumping of Waste

Fig. 9: Workshop done by Geological Research Authority of Sudan, Portsudan branch

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