Foreign direct investment and poverty alleviation in Tanzania: a case of Bulyanhulu and Geita Gold Mines Limited in Kahama and Geita districts

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Environmental and health impacts of mining operations on local neighbourhoods

Overview

With each passing year, the environment in the mining areas is rapidly degrading and its economic value is diminishing. Agricultural lands were not directly degraded, but the decrease of total land available for farming has reduced arable land and shortened the fallow period. The traditional bush fallow system, which allowed for adequate recycling of nutrients and improved the productivity of subsequent planting cycles, cannot be practiced in Sukumaland any longer: there is not enough land and there are too many people (see Chapter 2). Large-scale mining operations continue to reduce vegetation in the area, pushing it to levels negative for biodiversity. The principle assets of the environment—land, water and air—have been severely affected by mining operations. It is questionable whether they can continue supporting adequate well-being and development of rural dwellers in mining neighbourhoods. This chapter considers the impact of mining on the physical environment, land and vegetation, air and water pollution. It also looks at the health impact on inhabitants of GGML and BGML neighbourhoods as well as more broadly the LVGB and its environment.

Degradation of land and vegetations

Considerable areas of land and vegetation in large-scale mining areas have been cleared to make room for mining operations. Surface mining operations in GGML have consumed considerably more land than in the underground mining taking place at BGML. It is estimated that at mine closure the mining companies would have consumed about 40-60% of their total land areas for activities such as siting mines, heap leach facilities, tailing storage facilities and open pits, mine camps, constructing roads and arranging resettlement for displaced communities. This has an adverse impact on land and vegetation, the major sources of livelihood for rural inhabitants of the area. According to the GGML's Annual Environmental Reports (2007; 2008), the company operates under a Special Mining Licence (SML 45/99), granted in June 1999, pursuant to Section 39 of the 1998 Mining Act. In total, the SML area covers 17,509 hectares of land. GGML has also been granted permission to mine in the Geita Forest Reserve (permit issued in October, 1999) by the Ministry of Natural Resources and Tourism, specifically the Forestry and Beekeeping Division. As more than 70% of the SML area falls under the Geita Forest Reserve, it clearly threatens the biodiversity in the area (Box 6.1). The Geita Forest Reserve is comprised of six forest reserves (Geita Hill, Rwamgasa, Usindakwe, Mienze, Ruande and Sinde Hill forest) home to several rare species. The total land area allocated under the SML and Prospecting License (PL) is 33,387.5 hectares (Table 6.1).

Box 6.1 Forest clearance for mining activities threatens biodiversity

…The villagers and GGM workers confirm regular sightings of wildlife in the area: lions, elephants, leopards, monkeys, antelopes and birds. The current pace of clearing forest land for mining activities is very high—around 78% of the forest has already been cleared—and threatens these rare species of fauna and flora with complete annihilation.

Source: Kapondya (2008).

Table 6.1 Land managed by GGML

License category	Estimated area
Land owned by the mine (SML)	17,509 ha
License enlargement requests (Geita Hill, Katoma and Nyamonge East Extension)	2,376.5 ha
Land owned under Prospecting License (PL)	13,502 ha
Total land managed (licensed area)	33, 387.5 ha

Source: GGML Annual Environmental Report 2007; 2008.

Land disturbance is monitored and managed through a Permit to Clear System and Disturbed Land Register. In 2007, 14 permits were issued, earmarking 296.94 ha land for clearing. The majority of permits were related to road construction and exploration activities. By early 2008 there were 2,977.7 hectares of disturbed land, from the 33,387 hectares total area (SML and prospect areas)—9% disturbance (Table 6.2).

Table 6.2 Areas occupied by different categories of disturbed land

Category	Estimated area
Open pits	308.25 ha
Waste rock dumps	741.30 ha
Tailings storage facility	289.20 ha
Infrastructure (housing, roads, offices, plant etc.)	1,642.24 ha
Total disturbed land	2,977.70 ha

Source: GGML Annual Environmental Report 2007; 2008.

Deforestation from surface mining has long-term effects, which persist even after the soil is replaced and tree are planted once the mine is decommissioned. The new species that will be introduced can potentially influence the composition of the top soil and subsequently determine soil fertility and the duration of fallow period for some crops. In addition to soil erosion due to destruction of surface vegetation, there is significant reduction in the available arable land and loss of habitat for birds and other animals (Box 6.1). Observations indicated that the tailing storage facility at GGML consumed 289.2 hectares arable land (Table 6.2). Given estimated maize yields per acre (1 acre = 0.404

hectares) of 5-14 bags (500–1,400 kg), this means the tailing dam has deprived farmers of at least 680,000 kg of maize per annum. The tailing storage facility, plant site and feed stockpile of GGML have endangered income and food security for 300 farmer households.

Water pollution

Mining operations are major sources of both surface and ground water pollution, and four major pollution problems have been observed in GGML and BGML mining areas. These include chemical pollution of ground water and streams—especially mercury and cyanide—and dewatering effects. Also other pollution, such as aid and noise, has been recorded.

Chemical pollution

Cyanide, mercury and other dangerous chemicals are used during ore processing, and they are major pollutants of surface and ground water. Chemical pollution can also occur through the misuse, mishandling and poor storage of explosives. Sulphur dioxide (SO_2) fumes emitted by mining operations are a source of extensive chemical pollution. In addition to chemical pollution, high levels of heavy metals can be fatal to human health and the environment, particularly aquatic life. For instance, Bitala (2008) revealed that heavy metal contamination in both soils and plants at Nyakabale village near GGML has increased beyond the permissible standard limits prescribed by the World Health Organisation (WHO). Table 6.3 shows the dangerously high levels of heavy metals (well above permissible standard levels in soils): chromium (Cr) exceeded by 60 times, silver (Ag) by 36 times, copper (Cu) by 182 times, zinc (Zn) by 42 times, mercury (Hg) by 6,060 times, lead (Pb) by 153 times, and cadmium (Cd) by 232 times (Fifield & Haines, 2000). Bitala (2008) also observed that heavy metal levels in plant samples taken from Nyakabale village were above permissible standard levels for plants (Table 6.4). The results indicated Cr levels 5,682 times above standard, Ag 480 times, Cu 420 times, Zn 40 times, Hg 9,067 times, Pb 927 times, and Cd 3 times above permissible standard levels (Fifield & Haines, 2000).

Table 6.3 Comparison of concentration of heavy metals at Nyakabale with standard concentrations in surface soils

Trace element	Observed* (mgkg-1)		Number of times above standard	Standard** (mgkg-1)	
	Range	Mean		Range	Mean
Cr	200.000-19,790.000	3,620.000	60	5.000-1,100.000	60.000
Ag	139.000-760.000	90.000	36	0.400-70.000	2.500
Cu	1,150.000-8,585.000	2,726.000	182	6.000-60.000	15.000
Zn	107.000-5,555.000	2,519.000	42	17.000-125.000	60.000
Hg	280.000-3,750.000	303.000	6,060	0.004-0.700	0.050
Pb	64.000-14,945.000	3,064.000	153	1.500-80.000	20.000
Cd	12.500-520.000	58.000	232	0.010-2.5000	0.250

Source: Bitala (2008) and **Fifield & Haines (2000).

Table 6.4 Comparison of concentration of heavy metals in sampled plants from Nyakabale with standard concentrations in plants

Trace element	Observed* (mgkg-1 dry weight)		Number of times above standard	Standard** (mgkg-1 dry weight)	
	Range	Mean		Range	Mean
Cr	1.000-6,380.000	1,136.314	5,682	0.020-0.200	0.200
Ag	1.500-144.000	72.750	480	0.009-1.500	0.150
Cu	18.500-5,120.000	2,097.571	420	1.000-12.000	5.000
Zn	110.000-4,105.000	1,185.814	40	12.000-60.000	30.000
Hg	1.000-270.000	90.667	9,067	0.001-0.040	0.010
Pb	325.000-7,695.000	927.043	927	0.300-10.000	1.000
Cd	1.400-4.200	2.800	3	0.020-0.500	0.100

*Bitala (2008) and **Fifield & Haines (2000).

The picture for heavy metal levels in BGML could not be established as there is no independent study of the pollution in this area. There have been extensive media reports, between May and July 2009, on severe toxic leakages from BGML's sister project in North Mara Gold Mine (NMGM) in Tarime (eastern part of LVGB) into the Teghite River—claiming 46 human lives and 200 dead livestock (Box 6.2). According to these media reports, NMGM is polluting the environment in the villages and water bodies that surround the project. The levels of heavy metals and cyanide in the water and sediments of the Teghite River are manyfold higher compared to the permissible standard levels (Fifield & Haines, 2000). For example, Ni was 260 times, Pb 168 times and Cr 14 times higher. These pollutants are said to originate from potential acid forming (PAF) waste rocks of NMGM's tailing dam (*The Guardian*, Thursday 9 July, 2009).

Box 6.2 Background to mass poisoning of North Mara villages

The human and animal tragedy in the area surrounding the North Mara Gold Mine began unfolding several years ago, when people living around the area started complaining about the effluents from the tailing dam released into the nearby Teghite River had serious health effects on nearby residents. The communities witnessed mass destruction of the environment—caused by mining activities. As the elders shared, 'there is a tailing pond whose liquid oozes and pollutes water sources, the grasses are burnt by corrosive fluid which flow from the tailing dam…while cattle are grazing within the unfenced upstream side of the tailing dam at Matongo Village. This is dangerous as both animals and humans may be at risk from improper tailing material containing cyanide and heavy metals'. Independent environmental experts indicated that heavy metal and cyanide levels around the North Mara Mine were higher than the permissible levels and were thus a threat to both flora and fauna. A report issued by the ward executive officer for Kibasuka, listed the names of persons that died in the ward since May 2009: 18 persons in Nyakunguru Village, 18 persons in Nyarwana, 10 persons in Weijita. Their deaths are blamed on contact with the contaminated water. In total, 46 persons (24 men and 19 women) perished, and 200 heads of cattle were lost.

Source: Thisday, Thursday 9 July 2009.

The accumulation of heavy metals in soil and water leads to increased bio-concentration and bio-accumulation in plants, fish, livestock and humans (through the food chain) (Cunningham & Saigo, 2001). Bio-concentration and bio-accumulation of heavy metals in plants, fish and livestock poses a health risk to humans, as they are at the end of the food chain (higher trophic level). Consumption of food and water polluted by heavy metals has been connected to many health problems that endanger human life, including wide range carcinogenic pathogens (skin, liver and kidneys); teratogenic effects; mutagenic effects as well as brain damage (Weitzel, 2006; Nicholas, 2004; Turkdogan *et al.*, 2003; WHO, 2001; WHO, 1996). In addition, intoxication from higher concentration of metals, such as cadmium and lead, may weaken the immune system, making the victims susceptible to diseases (Iyengar & Nair, 2000; WHO, 1996). The WHO's (1996) prescribed upper limits for safe dietary intake of trace elements for humans (65 kg body weight) are found in Table 6.5.

Table 6.5 The upper limits of safe dietary intake of trace elements

Trace element	(mgday-1 safe limit)***
Cr	0.250
As	0.139
Cu	12.000
Zn	45.000
Hg	0.046
Pb	0.232
Cd	0.065

Source: WHO, 1996 *** limit per 65 kg body weight.

Despite the fact that mine workers are provided with protective gear (e.g., masks, gloves, helmets, and safety boots), there are widely reported cases showing the detrimental effects from using cyanide and mercury in gold extraction. Kapondya (2008) noted the existence of water pollution, skin irritation and deaths of livestock that drank contaminated water (Boxes 6.3 and 6.4).

Box 6.3 Water pollution due to mining activities

As an elderly woman of Mtakuja village (Kabula, 58 years) attests,

> the water that comes from the remnant rocks is poisonous and cannot be used for domestic use and livestock…we are now told not to use even the rain water we collect on our rooftops because the dusts washed from the tops of our houses have traces of the remnant rocks…and when this water is taken and stored for a period of time it turns blackish/greenish…caution had been given not to use it…the water from these remnant rocks also trailed down to our local wells… when women go to fetch water they have to look if there are some dying frogs …for fear of poisons.

Box 6.4 Livestock deaths blamed on suspected cyanide poisoning of Mtakuja River

Mzee Majiyatamu Kufungulia (61 years old) from Nyakabale village shares his story:

> My sixteen cattle and two sheep died after drinking the suspected poison which has trailed down the river Mtakuja—this was in 2000. The GGML people are very clever…they rushed on the scene…took samples and paid 70,000 TZS per head of cattle and they buried them…but the results never been relayed back…people are eager to know the cause of death of animals and the chemical status of the river…I would have taken the samples myself but I did not know where to start and where to take them, so the GGML took charge of the process and promised to send the results to the community…which is not yet done…. I asked the GGML staff…and he answered cleverly that…'we are condemned to cause death of the animals so what did you expect us to do?' I now recognise they do have the results…so I am supposed to make follow up myself?

Dewatering effects

Mining operations have direct dewatering effects. In addition to consuming large quantities of water, mining operations also excavate large tracts of land and pile large mounds of earth along water courses, thus preventing sources of water from recharging from ground water sources. This ultimately may reverse the direction of the ground water flow and lead to active dewatering. Many boreholes and hand dug wells now provide less water or have completely dried up. As reported by a Geita District employee, 'mining activities have caused intense geo-morphology alterations such that water is now flowing from the points of intensive excavation closer to mining sites and boreholes in most human settlements have dried up, while seasonal rivers are flowing throughout a year'(focus group discussions, Geita District engineering staff, May 2008).

Air and noise pollution

Mining operations and mining support companies release particulate matter into the ambient air; pollution concerns are primarily focused on airborne particulate matter, black smoke emission, noise and vibration.

Airborne particulate matter

Airborne particulates are of major concern in mining neighbourhoods. These include sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO) and black smoke. They are usually produced by site clearance and construction, open pit drilling and blasting, loading and haulage, vehicular movements, ore and waste rock handling as well as heap leach crushing by large-scale mining companies. Others sources include fumes from the roasting of sulphide ores by assay laboratories and refining processes. The release of airborne particulate matter in the environment—particularly minute dust particles of less than 10 microns—is a big health threat to human and animals living close to large-scale mining operations, especially open-pit mines. High levels of exposure to all types of fine dust have potential to cause respiratory diseases and disorders, and can worsen chronic conditions, such as asthma and arthritis. The dust arising from gold mining operations has high silica content, known to cause silicosis and tuberculosis. Medical reports have confirmed increasing rates of tuberculosis, while silicosis has not yet been reported in either BGML or GGML (Table 6.9 and Figure 6.3e).

Dust deposits on vegetation make it unpalatable for both people and livestock. Observations revealed the consumption of green vegetables has fallen at both mining neighbourhoods among the households that have become aware of the deleterious effects of dust. This has severely reduced the nutrition value of their sustenance, especially pregnant women and children. The black smoke from burning fuel, fumes from assay laboratories and ore roasting at mines are additional sources of airborne pollutants.

The other particulate matter is sulphur dioxide (SO_2), which is produced by roasting sulphide ore by mines and assay laboratories, vehicle emissions and domestic energy sources (such as liquefied petroleum gas and kerosene). High concentration of SO_2 may lead to increased acid formation in the atmosphere, subsequently producing sulphuric acid (H_2SO_4) which in turn causes breathing difficulties and discomfort. According to Park (1987), toxicity levels between 0.5-1.0 g/l have no visible effect on health, but toxicity levels greater than 1.5 g/l can result in breathing difficulties and at 200 g/l and above can cause notable breathing discomfort. Some of the harmful effects of sulphuric acid include heart disorders, asthma, bronchitis, lung problems and other respiratory disorders.

Noise and vibration pollution

Common sources of noise and vibration in large-scale mining areas include mobile equipment as well as air blasts and vibration from blasting and other machinery. Noise—especially high pitched noise—is a health hazard (prolonged exposure injures the auditory system). It also causes structural damage to buildings (cracks), stress and discomfort. Further, noise can frighten animals and interfere with mating by suppressing their libido and causing abortions—thus shrinking both domesticated and wildlife populations. Observation confirmed widespread and deafening noises emanating from open-pit mines. Communities have lodged their complaints with the district council authorities, blaming the frequent blasting in the mines and the resulting ground vibrations for the considerable structural damages of their houses (e.g., walls cracking) (Photos 6.1 a & b). Documenting the impact on the residents of the area, medical reports indicated increasing frequencies of ear ailments in both BGML and GGML mining neighbourhoods (Figure 6.3b).

Photo 6.1 Structural damage due to increased mining operations: (a) Nyakabale (near GGML) and (b) Kakola (near BGML)

a b

Health impact

Mining accidents and increased rates of illness cause major adverse effects on the health of the population as a whole. The effects of some of the pollutants manifest themselves immediately (e.g., cyanide) but others (e.g., mercury) take a long time to become visible. According to medical reports from the district medical offices in Kahama and Geita as well as from respective regional offices in Shinyanga and Mwanza, common mining related diseases observed during the 2002-2006 period include but are not limited to vector borne diseases (e.g., malaria), respiratory tract diseases (especially pulmonary tuberculosis), skin diseases, eye diseases and physical injury to small-scale miners.

Malaria

Malaria is a major public health concern for all Tanzanians, especially for pregnant women and children under the age of five. It is the leading cause of morbidity and mortality among outpatient and inpatient admissions and accounts for up to 40% of all outpatient attendances (MOH, 2006). Many parts of the country, including the uplands, report malaria transmission throughout the year, although it is more common during and after the rainy season. Persons with insufficient immunity to malaria after previous exposure suffer the worst cases of the disease. Children under age of five are at highest risk, followed by pregnant women because their reduced natural immunity. Pregnant women are four times more likely to experience malaria related complications than non-pregnant women. Malaria also causes miscarriages, low birth weight, and neonatal mortality (Jameson, 1993).

Malaria is the cause of many societal and economic burdens, from school absenteeism to low productivity in workplace. In the short term, widespread malaria reduces agricultural production and other economic outputs; while in the long term, the cumulative effect may decrease national economic capacity and development. It is the leading cause of child and maternal mortality in the mining neighbourhoods, with average annual crude mortality rate of 399 per 100,000 in Geita and 348 per 100,000 in Kahama (national annual average is 141 per 100,000). Geita and Kahama districts recorded the highest incidence of malaria in terms of morbidity, with annual incidence of 553 per 1,000 in Geita and 524 per 1,000 in Kahama (national average stands at around 500 per 1,000). The inhabitants blamed the mining operations for the high incidence of malaria. The mining operations promote environmental modifications that favour malaria vector development (mosquitoes). The activities created open pits and altered the course of flowing water, thus producing bodies of stagnant water, which serve as perfect mosquito breeding sites. Also, large-scale mining companies had attracted large numbers of migrant workers, some of whom are carriers of malaria parasites. Not only do they themselves suffer under the infliction, but they also increase the risks of malaria epidemic breakouts.

HIV/AIDS

HIV prevalence is on the rise with each subsequent year, according to data extracted from voluntary counselling and testing (VCT) centres and from monthly blood donor reports. GGML and BGML have exceptionally high and rising HIV prevalence; in 2002 it was 8.1%, while in 2006 it increased to 18.3%. The prevalence rate in mining neighbourhoods is higher compared to national average of 8.8% recorded in 2008. The trend in terms of number of patients and percentages indicate an increasing pattern in both mining neighbourhoods (Table 6.6). GGML has much higher number of reported cases, as it is population is four to five times larger than BGML's (Figure 6.1).

Table 6.6 HIV/AIDS prevalence and new reported cases 2002-2006

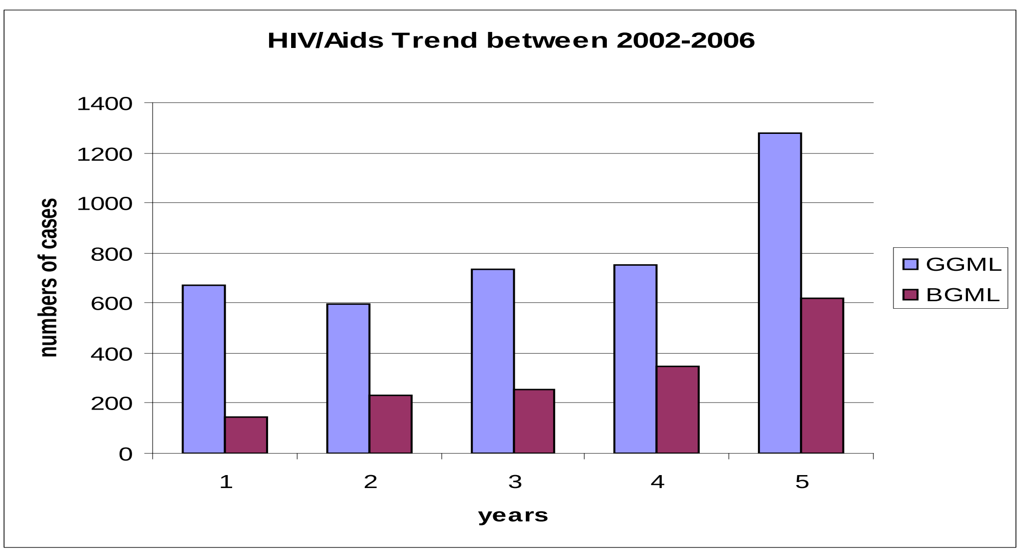
HIV / AIDS Prevalence (%)					
Years	2002	2003	2004	2005	2006
GGML	9.2	10.4	13.7	12.7	18.3
BGML	8.1	8.8	8.9	9.2	16.9
HIV/AIDS reported new cases (numbers)					
GGML	670	595	736	750	1,278
BGML	146	233	256	348	618

Source: District HIV/AIDS/STDs control implementation reports 2002-2006.

Sexually transmitted diseases (STDs)

Sexually transmitted diseases (STDs) are known to facilitate sexual transmission of HIV infection, and the control of STDs has been recognised as one of the key strategies for preventing HIV infection. The most commonly occurring STDs in mining neighbourhoods include genital discharge syndrome (GDS), genital ulcer discharge (GUD), pelvic inflammatory diseases (PID), syphilis, and urinary tract infections (UTI). Observations revealed an increase in STD cases in both mining neighbourhoods. Again, due to its larger population, GGML posts much higher numbers compared to BGML (Table 6.7 and Figure 6.2 a-d). The observed increases in STDs and HIV/AIDS prevalence can be attributed to two major factors: the high influx into the area of sexually active (15-45 years old) expatriates and local job seekers (*wasoteaji*), and the increased number of small-scale miners and entrepreneurs operating in the neighbourhood.

Figure 6.1 HIV/AIDS trend in mining neighbourhoods



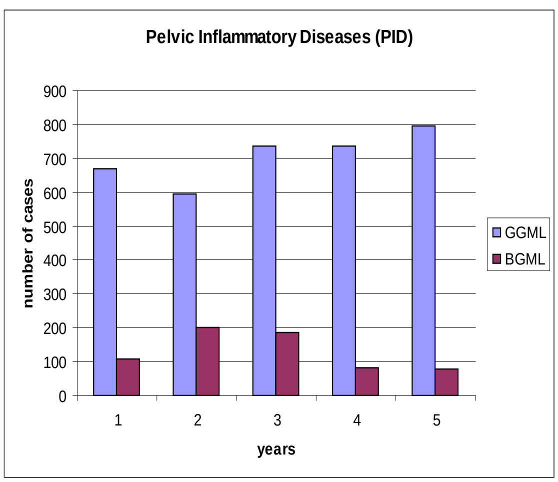
Note: Numbers 1, 2, 3, 4 & 5 on x-axis represent the years 2002, 2003, 2004, 2005 & 2006 respectively.

Table 6.7 Reported cases of STD infections 2002-2006

Genital ulcer discharges (GUD)					
Years	2002	2003	2004	2005	2006
GGML	1,230	1,312	1,256	4,014	3,334
BGML	47	40	22	95	68
Genital discharge syndrome (GDS)					
GGML	2,176	2,097	2,294	2,061	2,024
BGML	78	93	66	150	175
Pelvic inflammatory diseases (PID)					
GGML	670	595	736	737	795
BGML	106	201	185	83	79
Urinary tract infections (UTI)					
GGML	362	403	436	400	478
BGML	344	313	292	231	291

Source: District HIV/AIDS/STDs control implementation reports 2002-2006.

Figures 6.2 a-d STD trends in mining neighbourhoods



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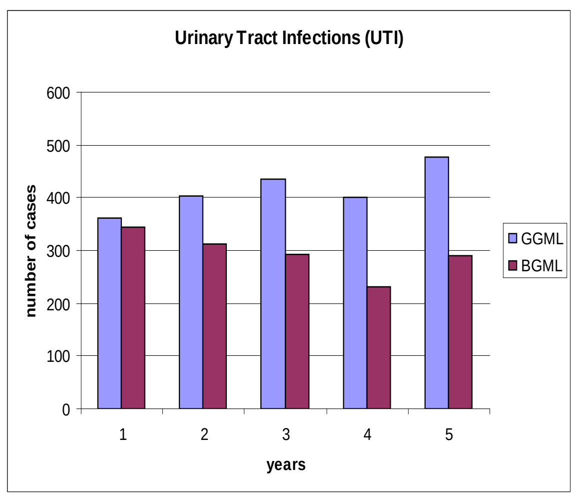

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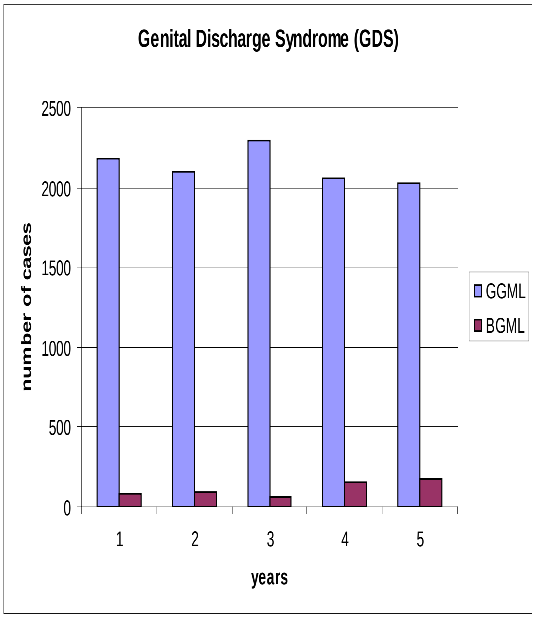

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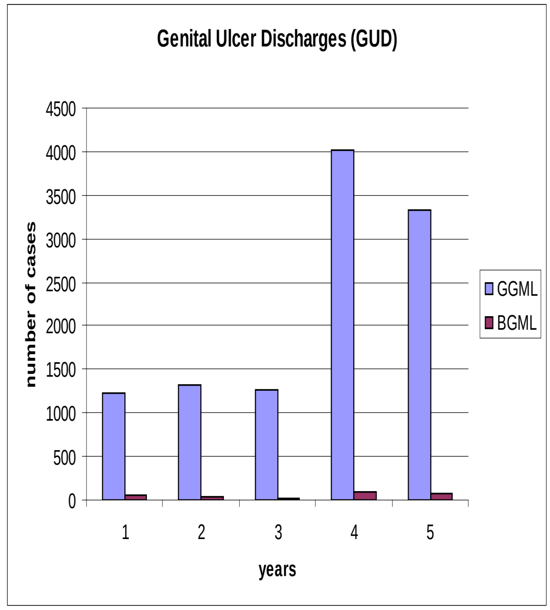

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Note: Numbers 1, 2, 3, 4 & 5 on x-axis represent the years 2002, 2003, 2004, 2005 & 2006 respectively.

Skin diseases

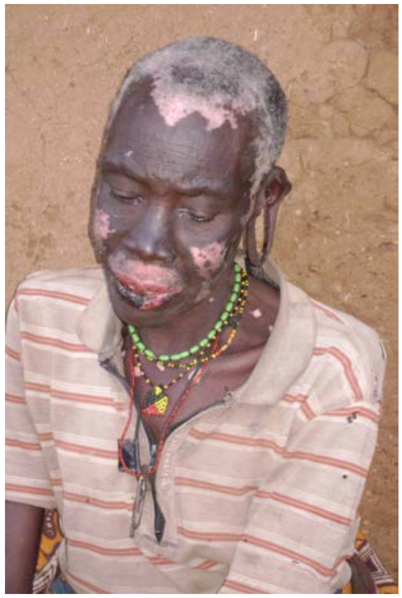
Skin rashes are very common, especially among children. The communities blame the rashes on allergic reactions to the stream and well waters, which they feel are very polluted from mining related chemicals. A photo taken from the neighbourhood of North Mara Gold Mine, one of the large-scale gold mines in the Lake Victoria Greenstone Belt, shows the appalling impact on the victim's skin (Photo 6.2).

Table 6.8 Reported cases of skin diseases 2002 - 2006

Years	2002	2003	2004	2005	2006
GGML	344	313	292	231	291
BGML	311	260	168	324	272

Source: District Health Department Implementation Reports 2002-2006.

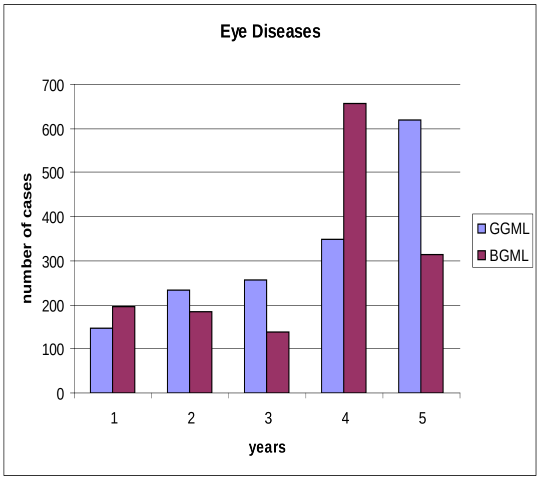
Photo 6.2 The human cost of gold and the deadly price to pay (as reported by *Thisday*, Friday, 26 June 2009)



Other diseases

Also other mining and pollution related diseases were reportedly on the rise. These include diarrhoea, asthma, ear diseases, eye diseases and tuberculosis (Table 6.9 and Figure 6.3 a-e). There has been increased reporting of diarrhoea in the area. Surface water run-off is most likely responsible for increased and widespread presence of mining related toxic substance in the area during the rainy season. Incidents of asthma, ear and eye diseases as well as tuberculosis are reported on the rise in mining neighbourhoods. The inhabitants complained that these are caused by dusts, chemical toxicity and the deafening sound from explosion blasts and machines.

Figures 6.3 a-e Diarrhoea, asthma, ear and eye diseases and tuberculosis trends in mining neighbourhoods



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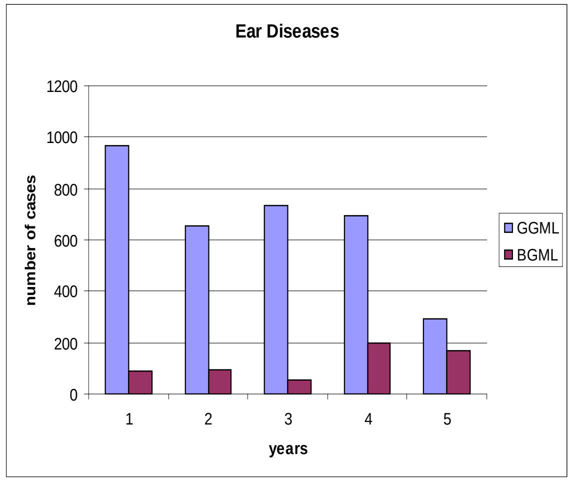

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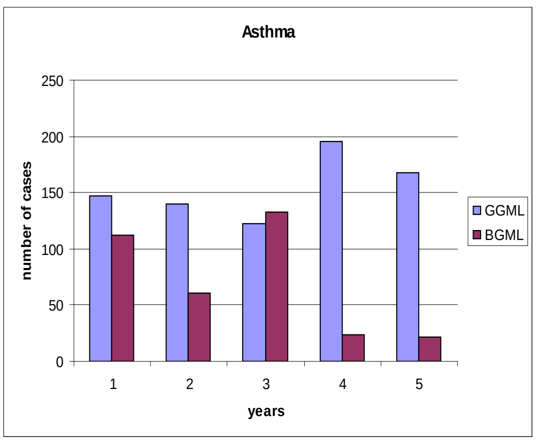

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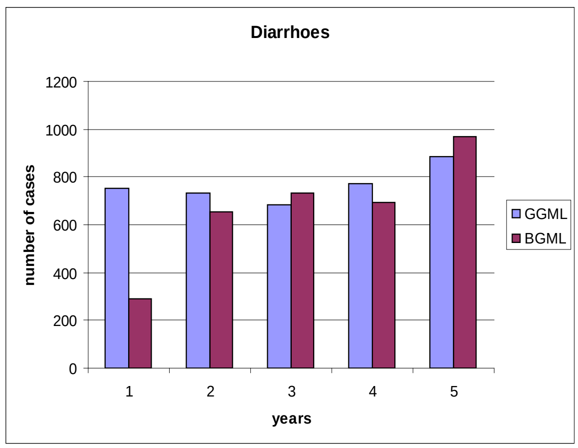

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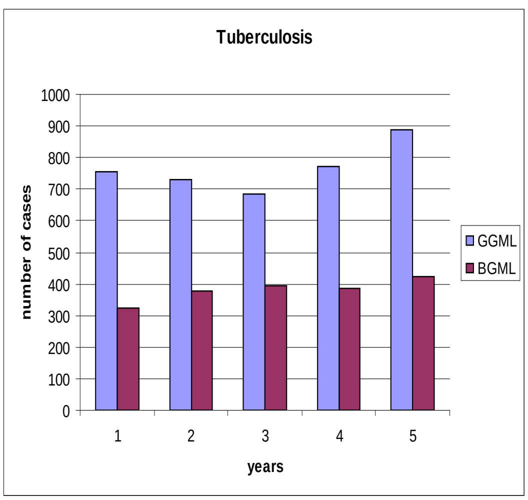

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Note: Numbers 1, 2, 3, 4 & 5 on x-axis represent the years 2002, 2003, 2004, 2005 & 2006 respectively.

Table 6.9 Reported cases of diarrhoea, asthma, ear and eye diseases, and tuberculosis 2002-2006

Diarrhoea					
Years	2002	2003	2004	2005	2006
GGML	754	732	686	771	886
BGML	291	656	732	692	969
Asthma					
GGML	147	140	122	195	168
BGML	112	61	133	24	22
Ear diseases					
GGML	969	656	732	692	291
BGML	90	95	55	198	170
Eye diseases					
GGML	146	233	256	348	618
BGML	196	184	138	656	314
Tuberculosis					
GGML	754	732	686	771	886
BGML	322	377	394	386	422

Source: District Health Department Implementation Reports 2002-2006.

Summary

Chapter 6 presented the environmental and health impacts of large-scale mining operations in the LVGB (with emphasis on GGML and BGML). It was demonstrated that surface mining has much bigger adverse environmental impact compared to underground mining: it is expected that an estimated 40-60% of mining land will be disturbed by the end of exploitation. This will severely threaten the biodiversity in the LVGB. Also, around 300 farmers were expelled from their land to pave way for mining operations. The resulting crop losses (estimated at 6,800 bags of maize per year) severely threaten the income and food security of these households. High concentrations of heavy metals—well above WHO prescribed safe levels—were noted at Nyakabale village and in the neighbourhoods of NMGM. Heavy metals are proven to greatly endanger the health of people, animals, plants and aquatic life. The heavy metals that have been documented include chromium, silver, copper, mercury, lead and calcium. So far 46 human lives have been lost due to heavy metal contamination. Also, 200 heads of cattle have perished near NMGM, and 16 heads of cattle and 2 sheep were found dead at Nyakabale village, both blamed on heavy metal contamination. Mining activities have caused intense geo-morphologic alterations, which have changed the underground water flows at points of intensive excavation. Due to these alterations, most boreholes near the mines have dried up. Consumption of green vegetables has dropped in mining neighbourhoods: people avoid them due to the large amount of air particle pollution sediments on the plants. This has negatively affected nutrition, especially of children and pregnant women. Communities have also lodged complaints with district authorities against the frequent blasting in the mines, because it causes considerable structural damages to their houses. The medical reports confirm increased incidents of ear disease and other diseases due to pollutants and accidents. Malaria, HIV/AIDS, UTI, tuberculosis, skin and eye diseases were in the spotlight. Looking at raw numbers, GGML has more reported incidents of diseases, which is expected as its total population is four to five times bigger than BGML's.