

THE DISASTROUS CONSEQUENCES OF HEAP LEACHING AND MARINE DISCHARGES IN GOLD MINING

Introduction

1. Gold mines cause ever larger environmental problems; it is high time today's practices of international companies extracting gold from the earth be questioned. This was the key message stated in articles published by the *New York Times* recently. The American daily is not known to easily espouse criticisms of multinational enterprises. Yet the reports on gold mining published in the daily in October last were truly alarming. According to the newspaper - the tailings which mining companies produce are ever growing in size, and the technique which today is being employed to extract gold from the ore is judged too risky to be acceptable (1). The high profile indictment of gold mining practices by the *New York Times* constitutes a very welcome occasion to discuss gold mining and its environmental costs, and to assess their implications for policymaking and for economic theory.

2. An initial observation regarding contemporary gold mining is that the raw material extracted from the earth is predominantly used towards manufacturing luxury consumer items. In the past, gold served a crucial function as means of payment, and was employed as general equivalent, i.e. to facilitate the exchange of commodities on the capitalist market. Today, gold continues being held by central banks to back up their monetary policies, i.e. as reserve currency. However, the chief function of gold these days is rather to serve as raw material towards production of ornaments. According to data published in the mid-1990s, 85 percent of all new gold extracted from the earth was then employed to make jewelry. (2) This confirms that the environmental problems caused by gold mining cannot be considered as inevitable, as the necessary by-effects of humanity's struggle for survival. They can easily be done away with, if only consumption patterns be changed.

3. Further, the sector of gold mining is deemed to be an attractive destination for investment capital. In a study published in 1996, the well known British expert on mining and environment, Roger Moody, argued that the sector of gold mining is one of the most lucrative, profitable of all mining sectors. According to Moody's data, the worldwide extraction and production of gold in the year 1992 amounted to 3,573 tonnes. Three years later the amount had further increased to 3,642 tonnes. (3) And the attraction of gold mining as field of investment has not diminished since. According to recent newspaper reports, the price-level of gold now is higher than it has been in 17 years, i.e. 500 Dollars per ounce (4). In consequence, the powerful companies dominating the sector – companies such as Newmont, Barrick Gold and Placer Dome – are likely to continue being interested in gold extraction in the future, and will do so at great risks to our natural environment.

4. Before elaborating on today's environmental costs of gold extraction, let's look briefly at the question of capital concentration in the sector. Not all gold ore is extracted by large multinationals; informal gold digging undertaken by small artisans as is well known too plays a role in the sector (5). Yet artisanal gold mining is clearly secondary to large scale mining controlled by powerful companies. According to Moody's figures, in 1991 about *twenty* companies were responsible for *two-thirds* of all extraction and production of gold in the

world. Moreover, almost half of this share of gold production was controlled by the two largest mining companies alone (6). This does not mean that artisanal gold mining is entirely insignificant – in countries like Brazil and Congo (DRC) many thousands of people continue to take part in the gold rush, digging feverishly for gold. Yet the dominance over the sector by large corporations using the very most ‘modern’ technology for extraction, is unmistakably large and continues to grow. (7)

Process of Heap Leaching with Cyanide-Mixture

5. To understand fully what environmental disasters are being wrought by contemporary gold mining, we need to discuss the new technique that has been applied since the late seventies to extract gold through leaching from the ore. In this technique, large amounts of ore are simultaneously sprayed with a liquid mixture, which contains both water and cyanide. The choice of the given technique is based on the fact that only ores with microscopically small amounts of gold can be dug from the earth today. All ores with a large percentage of gold have long ago been appropriated. The spraying of gold ore with cyanide solution is seen by multinational companies as the very most suitable method, - as the method which from a cost point of view is most effective towards processing gold ore that is low grade. Yet the environmental and health risks of the method are enormously large. Cyanide is one of the very most toxic substances on earth, and for this reason is also used to commit suicide. The use of the cyanide solution also results in new toxic waste, containing mercury and arsenic. Mercury laced effluents can cause brain damages and severe tremors in humans, and ground water that is polluted with arsenic can result in skin diseases.

6. As mentioned, one further problems with the technique of leaching is that it results in gigantic mountains of waste. In order to obtain small amounts of gold the ore, as said, needs to be leached with the cyanide solution. This process emanates in huge mountains of tailings that are polluted and huge quantities of earth need to be moved. Besides, the cyanide solution needs to be stored after usage. According to the *New York Times* reports, mine workers in order to gather just *one ounce* of gold need to dig up no less than *30 tonnes* of ore (8). The quantity of earth that must be moved is equally large, at times amounting to 100 ton for just one ounce of gold! (9) Thus, the sector of gold mining illustrates a problem which is common to many mining sector today. Mines where high grade ores of minerals and metals can be extracted are gradually being exhausted. Thus, reliance on low grade ores is increasing day by day, meaning that ever larger quantities of tailings are being created in order to obtain minor quantities of minerals.

7. A further problem relates to the storage of the cyanide-solution after its usage in heap leaching. In order to storage the effluents, companies create special ponds and lakes. Yet this waste storage can easily result in leaks. According to UN data, over a period of 15 years, from 1985 till 2000, a dozen reservoirs with cyanide solution, previously used for the spraying of gold ore, have leaked, with poisonous waste flowing into rivers and their tributaries. The environmental consequences of these accidents have been dramatic.(10) The very most serious of accidents has occurred in Romania, in 2000. Here, some 100 thousand cubic meter of effluents were released into the river system of the Danube, after the dam of a pond containing the poisonous cyanide solution had burst. Some 100 tons of fish reportedly died, and the cyanide plume generated by the accident travelled a distance of 1500 kilometres, up to the Black sea area (11). Earlier, in 1995, three million cubic meters of cyanide tainted water had poured into the Essequibo river in the South American country of Guyana, after a tailings

dam separating cyanide effluents from the river had fissured (12). Guayana's government was forced to declare the mining area a disaster zone.

New Method for the Disposal of Waste

8. Aside from applying a novel technique for the leaching of gold from the ore, mining companies in the gold mining sector – like companies in other mining sectors – have also taken to a new method for the disposal of tailings. In the past huge amounts of tailings used to be discharged into rivers and river systems – a methodology which did not just result in environmental *problems*, but in environmental *disasters* as well. Thus, the Ok Tedi copper and gold mine erected in mountainous areas of Papua New Guinea in 1989, has been discharging 80 thousand tonnes of tailings into the Ok Tedi/Fly river system per day. The results were massive losses of fish: according to some reports, as much as 90 percent of all fish downstream the rivers died. It is also estimated that vegetation over an area of 900 km² will ultimately be affected. (13) Another disastrous gold mining project is the Grassberg mine in West Papua, controlled by the Freeport/Rio Tinto company. In 1999, the mine released 200 thousand tonnes of tailings into the Ajikwa river per day, i.e. two-and-a-half times as much as the amount released by the Ok Tedi gold-copper mine. (14)

9. Towards the end of the 1980s, spokespersons of mining companies started admitting publicly that the discharge of tailings into rivers, and the storage of tailings in lakes and ponds, is damaging to our natural environment. One of the factors inducing companies to rethink their methods of waste disposal, was the uprising of the population of Bougainville island in 1988, staged in reaction to environmental problems caused by a copper mine. Here, in Bougainville, whole rivers got clogged due to the release of tailings into the river water. The flood plains of the delta downstream the rivers too got polluted in consequence of the mining waste. (15) The people's uprising started when the mining company refused to address people's grievances, in particular the demand by landowners of the delta that they be compensated for the pollution of land from the tailings. Since the late 1980s, an increasing number of multinational companies has opted in favour of a new method for the disposal of waste, i.e. the release of the fluid tailings via long pipelines towards the bottom of the sea. According to Roger Moody, this method, called STD (Submarine Tailings Disposal), is much used by companies operating in countries around the Pacific.

10. A report distributed by Moody's research centre *Nostramo Research* in 2000 extensively discussed the risks associated with this new method of waste storage. Moody amongst others questioned the 'evangelical' way one professor Ellis propagates the storage of tailings polluted through the use of chemicals at the bottom of the sea. The scientist Ellis approves of environmental damages, and supports the destruction of marine life, without carefully weighing the precise effects of marine disposal for biological species which inhabit the deep seas. Ellis is also charged with having poorly tested his own views: he had backed up his views with few practical experiments. (16) Moody's own report lists a whole series of mines where STD has resulted in environmental problems. The Misima gold mine, which has been employing STD since 1989, releases up to 22 thousand tonnes of tailings into the Solomon sea per day, at a depth of 112 meters. A huge area of some 20 km² has meanwhile been covered with a waste carpet, erasing all forms of life. In another case, the company running the Minahasa gold mine in Indonesia has constructed a long pipeline for the transport of tailings towards the sea at Ratatotok. Fishermen here have reported they have suffered a 70 percent reduction in their fish catch. (17)

Conclusion

11. We now need to consider the policy implications, and the theoretical implications of the above story regarding the newest method for production of gold and for the storage of tailings from gold mines. As to policy-implications: multinationals running the gold mines defend their choice in favour of continuation of mining with the argument that their mining projects result in jobs. Yet the negative economic and environmental consequences of modern gold mining are so overwhelmingly large that continuation of this form of mining appears to be highly irresponsible. As stated in the introduction to this article, gold primarily serves as raw material for the manufacturing of jewelries and other ornaments. In order to gather minor quantities of gold huge quantities of earth need to be moved. The process of heap leaching employed to extract the gold from the ore is highly damaging for human health and the environment, and it results both in poisonous effluents that need to be stored, and in ever larger quantities of polluted tailings which are released into the seas and oceans via questionable methods of disposal. The question is whether humanity can afford causing so much environmental damage as by-effect of the production of luxury goods.

12. Furthermore, the story regarding contemporary gold mining has implications for economic theory as well. Both classical economic theory and its radical offshoot, Marxian economics, share the view that all industrial production results in *surplus value*, - in new commodities for market sale containing more value than the value embodied in commodities which an entrepreneur buys when initiating his production. Both classical and Marxian theory held that commodities contain two forms of value, namely *use value* and *exchange value*. Both theories ignored the value which is embodied in animal species and in inorganic materials that are *not* employed by human actors within the context of the capitalist mode of production. Both theories credited workers who through their labour contribute to production of new commodities, with being the creators of value, arguing that all surplus value is the result of human labour. And although these theories, more particularly Marxist theory, have helped back up the social struggles which industrial workers since the nineteenth century have waged for recognition of their labour, - both currents of economic thought have failed to theorise the negative environmental consequences of modern capitalist production.

13. Two concepts which did not exist in classical and Marxian theory, yet are crucial towards analysing the environmental consequences of contemporary gold mining, and of extraction in other mining sectors, are: the concepts of *negative use value* and of *non-commodity waste*. The first concept, that of negative use value, is suitable towards analysing the health and environmental effects of heap leaching. According to traditional thinking, - all industrial technologies are essentially 'productive', they serve towards the enlargement of human welfare, as long as control is in the right hands. Yet the heap leaching of gold ores with cyanide solution does not just result in a raw material with a certain value, but results in huge environmental and health problems as well. The risks connected with these and other new methods of extraction and production can only be measured well, if we are ready to admit that capitalist production technologies and end products do not just possess use values, but do often possess negative use values as well (18).

14. Secondly – we also need to revise the traditional conceptualisation regarding the outcome of capitalist production processes. Modern mining of metal ores, including the mining of gold ore, does not just result in valuable raw materials, but also in ever larger quantities of waste, - i.e. in waste as a by-product of extraction and production processes. According to the above-mentioned mining expert Roger Moody, metal mines alone do annually discharge some 15

billion tonnes of polluted tailings worldwide, which figure needs to be multiplied, once other types of mining waste - such as the tailings from coal mines - are included (19). Moreover, the need to reflect on non-commodity waste is becoming ever more pressing, in view of the fact that multinational companies have developed new methods for the processing of low grade ores. Thus the new method of heap leaching employed in contemporary gold mining emanates in a new type of waste, the cyanide solution, and also results in massive quantities of effluent tailings which, frequently, are discharged via pipelines into the sea. An updated version of Marxian theory may help to bring out that the surplus value created via the mining and processing of gold, is less significant than the environmental damages and economic costs caused by the waste of gold mining (20).

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- (2) Roger Moody, *The Lure of Gold – How Golden is the Future* (PANOS Media Briefing, No.19, May, 1996);
- (3) *ibid*;
- (4) Jane Perlez and Kirk Johnson, 'Behind Gold's Glitter: Torn Lands and Pointed Questions' (*New York Times*, October 24, 2005b); also Bram Vermeulen, 'Het is Alles Goud Wat er Blinkt' (*NRC-Handelsblad*, December 3, 2005);
- (5) see eg. Stefano Liberti, 'Trafic d'Or Entre le Congo et l'Ouganda' (*Le Monde Diplomatique*, Paris, France, December, 2005, p.14-15);
- (6) Roger Moody (1996), *op.cit.*;
- (7) see also the recent news regarding attempts by Barrick Gold, the third largest gold mining company in the world, to take over Placer Dome, the world's fifth largest gold mining enterprise – printed in the Dutch daily *NRC Handelsblad*, 'Consolidatie Goudsector. Vijandig Bod Barrick op Placer Dome' (*NRC-Handelsblad*, November 1, 2005);
- (8) Jane Perlez and Kirk Johnson (2005b), *op.cit.*;
- (9) Clive Ponting, *A Green History of the World. The Environment and the Collapse of Great Civilisations* (Penguin Books, London, United Kingdom, 1993), p.328; Ponting mentions the example of copper ore in particular;
- (10) according to UNEP (United National Environmental Program) – see Jane Perlez and Kirk Johnson (2005a);
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- (12) Roger Moody (1996), *op.cit.*;
- (13) Nostromo Research, *Into the Unknown regions: the Hazards of STD* (Down to Earth/Minewatch Asia Pacific, July/November 2000);
- (14) *ibid*;
- (15) *ibid*;
- (16) *ibid*;
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- (18) see Peter Custers, 'Marxism and the Concept of Negative Use Value' (*Frontier Weekly*, Calcutta, India, Vol.38, No11-14, October 2-29, 2005, p.92);
- (19) Nostromo Research (2000), *op.cit.*; on the amount of toxic waste which is released by metal mines, see also the press release, 'Most Toxic Industry in America Blocks Public Right to Know How Much Corporations Pollute in U.S.' (www.earthworksaction.org/);
- (20) for a theoretical discussion regarding waste in the nuclear production chain – see the chapters 2-9 of my study '*Questioning Globalized Militarism. Nuclear and Military Production and Critical Economic Theory*' (to be published in 2006).