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22. Ethical Section:

22.1 So What's Wrong with Gold Mining Anyway?

Most of the debates around ethical gold feature aspects of gold mining. In order to develop a personal position on the issue it is important to understand in what ways gold mining can be dangerous or destructive. This article is a glossary of the main terms, hopefully providing enough contextual information to explain their relevance to the issues.

Hard-Rock Mining involves digging a metal rich ore out of rock. A hard-rock mine (with or without the seven dwarves) is probably the image that comes to mind when most people hear the word 'mine'. The ore is usually found as seams (also called veins or reefs) that run through hard igneous or metamorphic host rocks. The seams themselves are usually a mixture of quartz and metal compounds. The miners aim to remove as little of the useless and hard host rock as feasible, so a hard-rock mine mostly consists of tunnels excavated as the miners followed the seams. It is, however usually necessary to also dig access, drainage and ventilation tunnels through the host rock to make the mine workable. Ores dug from hard-rock mines can be very rich in gold, but need to be broken up almost to powder as the first stage of processing.

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Gold panning

Open Cast Mining is, in principle, a much simpler method of extraction; dig a big hole and take everything out. In practice, the gold bearing layer is usually beneath other material that needs to be removed first. In mining parlance this is called the overburden and can include layers of rock, gravel, or topsoil. Open cast mines can operate at staggering scales, using enormous, specially constructed excavators and trucks. Open cast mining is the approach taken when the gold is dispersed throughout a softer sedimentary rock, or the gold-bearing layer is relatively close to the surface, as is the case with many placer deposits.

Placer Gold is gold that has already been weathered out of rock and deposited in alluvial gravels. This is the gold found in the beds of rivers and streams. It can also be found in the sands and gravels left where rivers used to flow. Placer Gold is predominantly nuggets, grains or dust of gold metal, which are extracted by sifting the gravel. Placer mining can be highly industrialised or simple operations. The low-tech approach is using a gold pan or rocker box, but placer gold can also be extracted using giant industrial gold dredges. As gold is much heavier than rock, it drops quicker whenever the gravel is disturbed, so the highest concentration of gold occurs where the gravel meets the bedrock. In Alaska deep gravel deposits were initially mined by digging tunnels through the lowest levels of the

Alaskan gold dredge

gravel, but later by removing and processing all the gravel with a gold dredge.

For economic reasons the preliminary stages of processing gold ores are usually undertaken close to the mine. These processes bring additional potential hazards. Gold does not react with many other materials, so the techniques commonly used to extract other metals cannot be applied. But gold will form an amalgam with mercury and forms a soluble compound with solutions of cyanide. Both these materials are being used today to process gold ores in different circumstances.

Mercury has been used in gold mining since classical times. The liquid metal is mixed with the crushed ore and on contact the gold and mercury form a pasty amalgam. The mercury can be turned into a vapour by heating, leaving the gold behind.

Gold sluices in Alaska.

Mercury was commonly used in industrial mining until the mid 20th century when the tragic consequences of handling mercury and environmental mercury pollution became obvious. Liquid mercury can be easily adsorbed through the skin, and mercury vapour is adsorbed through the lungs. Mercury left in the environment usually forms the metallo-organic compound methyl-mercury that contaminates river beds and soils for decades. This stable compound is easily ingested by animals. Mercury is a cumulative toxin that damages the nerves, eventually causing disability and death. An additional symptom is heightened emotional states. Hatters used mercury to prepare furs, and mercury poisoning is thought to have led to their erratic behaviour and the phrase 'mad as a hatter'.

Cyanide solutions were first used to commercially extract gold during the late 19th century, in a process called cyanidation. The process extracts more gold from ores than mercury, so introducing cyanidation made mines more productive and enabled mine owners to extract more gold from their discarded mine waste (called tailings). Unlike mercury or methyl-mercury, cyanide breaks down fairly quickly in air or water to form safe compounds. But cyanide itself is very toxic. Absorbing cyanide solutions though the skin or breathing cyanide gas is usually fatal unless quick remedial treatment is given. Cyanide is used industrially in the heap-leach process, where a weak (though still dangerous) cyanide solution is trickled through heaped piles of particulate ore. The gold is leached out as gold cyanate solution that is collected, and then the gold precipitated and filtered out. The most environmentally damaging events associated with cyanidation have been accidental spills of cyanide solutions due to human error or using poor, faulty or inefficient equipment. Once a leaked cyanide solution drains into a river system it kills all fauna it comes in contact with and deoxygenates the water as it breaks down.

Water is an essential requirement for some methods of extraction and processing. Wet sieving processes such as dredging need enormous quantities of water, as does heap leaching. Hydraulicking - using water cannons to dislodge overburden and gold-bearing gravels and sands – is an even more water-hungry process (in Roman Britain

a similar process, deluging, which denuded whole hillsides, was used to mine Welsh gold). In regions with low rainfall, such as the Upper Andes, new mining activity can further exacerbate pressure on water supplies.

Ground Disturbance is an inevitable consequence of all mining, but different processes give varying results. Tunnelling is less damaging than open cast mining in this respect, as less material is being moved and the surface is far less disturbed. The high waste to gold ratio commonly quoted by campaigners is heavily influenced by the inclusion of industrial scale open cast mine tailings. When discussing ground disturbance it is important to recognise competing perceptions and prejudices regarding the ground being disturbed. Land can be valued for its fertility or agricultural productivity (through most of history mountains and deserts were regarded as useless wastelands). Other viewpoints include aesthetic considerations. In the West we commonly see great rivers or mountains as embodiments of the Romantic untouched wilderness or sublime power of nature. Ironically, though Prince Charles once described it as the last wilderness in England, the landscape of Dartmoor National Park is largely the consequence of hundreds of years of placer and hard rock tin mining. Alternatively, for many cultures specific geological features are valued for their religious or cosmological significance, but Western derived systems of legislation do not readily respond to this type of relationship, which contravenes the notion of land as individual property. In all cases, which locations are considered untouchable is a consequence of judgements made and continually revised by people, not imposed by some external, eternally stable value system. As the recent removal and swift re-imposition of sanctions on drilling new oil wells in the Gulf of Mexico show, what is considered acceptable activity is the consequence of material events and social reactions, played out against a backdrop of competing long-term social pressures.

Whilst fertility has always been recognised when visually obvious, it is only recently that the physical extent of some ecological networks have become understood, and the crucial roles played by small and sometimes visually uninspiring locations, such as mud flats or marshes. In Alaska, gold-bearing stream beds are also, in many cases, the spawning grounds for Pacific Salmon. As placer gold is intimately bound up with watercourses the ecological consequences of its extraction are inevitably problematic. Downstream pollution from extraction chemicals and environmental degradation from silting, as well as the increased flood risk from deforestation, need to be recognised as potential hazards.

Acid Drainage is an additional potential hazard found with hard-rock mining. Though hard rock mining produces less tailings, these rocks, and the walls of the mine tunnels, have had no previous contact with air or water. Once exposed minerals in the rock sometimes start to react and decompose, producing acid solutions. Rainwater trickling through heaps of tailings wash out the acids, polluting the surrounding environment. If an abandoned mine floods the contaminated water from the tunnels starts to drain into water courses. Acid drainage is not an inevitable consequence of hard-rock mining, but if it occurs the reactions and resulting pollution can continue for

Ouro Preto gold mine

decades, or even centuries, after the mine is closed. The decomposition reactions are impossible to stop and very expensive to mitigate. The situation is aggravated by its timing. Acid drainage usually develops after a mine is closed so seeking redress or compensation is more difficult than with pollution from an operating mine.

> "The issues that gold mining raises are not uniform across the spectrum of activity."

The issues that gold mining raises are not uniform across the spectrum of activity. Small and usually rudimentary operations, called artisanal and small-scale mining (or ASM for short), suffer primarily from the desperate personal circumstances of miners and a lack of access to resources and technical knowledge. Gold is far easier to process, transport and sell than most other minerals, making gold mining using rudimentary (but hazardous) technology a realistic proposition. In many cases the miners' plight is aggravated by antipathy or active exploitation by more powerful factions, including in some cases state officials or even government leaders. The more marginal ASM communities are, the more attempts at regulation or education become compromised. Established or "traditional" practice, no matter how personally or environmentally damaging, is preferred to safer new processes promoted by outsiders.

In a sense the term "small-scale" is a misnomer. In aggregate ASM is an enormous phenomenon and according to observers the number of ASM miners has exploded over the past two decades. Deteriorating financial conditions in developing countries have made gold mining more enticing and less controllable. As well as long-standing mining communities, ASM includes increasing numbers of new recruits previously employed in other economic sectors or administrations. Despite artisan mining being declared illegal in Zimbabwe, the country's economic collapse has led to an unprecedented expansion in the number of socially marginal gold mining camps. This is not a new phenomenon. The 19th century Californian and Klondike Gold Rushes were both partially fuelled by severe international economic slumps. Between 1897 and 1898 around 100,000 prospectors stampeded from around the world to the Klondike, but within two years enthusiasm waned and many returned home. In contrast contemporary ASM activity is more localised and established. In Ghana in 1995 ASM participation was estimated at 30,000. By 2003 it was assumed to be 200,000 and still rising. Tanzania is more extreme, rising 450% from 100,000 in the early 1990s to 550,000 in 2003. Worryingly, as in the Klondike over a century ago, in both countries the use of mercury for gold extraction is ubiquitous.

In contrast, large-scale industrial operations generate different problems. Publicly listed companies are driven by economic imperatives, expected to maximise profit, and rely heavily on leveraged finance. Such companies are by nature impersonal: neither inherently bad nor good. Accusations of immorality are severely misguided as they are in fact amoral, merely reflections of the dominant social perspectives of their host society. Historically issues have been raised regarding their responsibilities to their own employees and local communities, what constitutes an acceptable level of environmental degradation and the extent and type of mitigation they should provide to counterbalance the damage caused by mining. I will be concentrating on these issues in more depth in the next article, as well as looking at the issues of local communities affected by mining, and some of the initiatives started to help those worst affected.

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This is the second in a series of articles written especially for benchpeg. To read the first article for benchpeg by Peter Oakley please refer to issue 162 of the benchpeg newsletter.
benchpeg produced an ethical edition of the newsletter in 2008 and aimed to give an overview of the ethical issues within the jewellery industry. For any comments or feedback on the series, or to request the 2008 ethical issue please email:
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