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The Cost of Gold | 30 Tons an Ounce

Behind Gold's Glitter: Torn Lands and Pointed Questions

By JANE PERLEZ and KIRK JOHNSON

There has always been an element of madness to gold's allure.

For thousands of years, something in the eternally lustrous metal has driven people to the outer edges of desire - to have it and hoard it, to kill or conquer for it, to possess it like a lover.

In the early 1500's, King Ferdinand of Spain laid down the priorities as his conquistadors set out for the New World. "Get gold," he told them, "Humanely if possible, but at all costs, get gold."

In that long and tortuous history, gold has now arrived at a new moment of opportunity and peril.

The price of gold is higher than it has been in 17 years - pushing $500 an ounce. But much of the gold left to be mined is microscopic and is being wrung from the earth at enormous environmental cost, often in some of the poorest corners of the world.

And unlike past gold manias, from the time of the pharoahs to the forty-niners, this one has little to do with girding empires, economies or currencies. It is almost all about the soaring demand for jewelry, which consumes 80 percent or more of the gold mined today.

The extravagance of the moment is provoking a storm among environmental groups and communities near the mines, and forcing even some at Tiffany & Company and the world's largest mining companies to confront uncomfortable questions about the real costs of mining gold.

"The biggest challenge we face is the absence of a set of clearly defined, broadly accepted standards for environmentally and socially responsible mining," said Tiffany's chairman, Michael Kowalski. He took out a full-page advertisement last year urging miners to make "urgently needed" reforms.

Consider a ring. For that one ounce of gold, miners dig up and haul away 30 tons of rock and sprinkle it with diluted cyanide, which separates the gold from the rock. Before they are through, miners at some of the largest mines move a half million tons of earth a day, pile it in mounds that can rival the Great Pyramids, and drizzle the ore with the poisonous solution for years.

The scars of open-pit mining on this scale endure.

A months-long examination by The New York Times, including tours of gold mines in the American West, Latin America, Africa and Europe, provided a rare look inside an insular industry with a troubled environmental legacy and an uncertain future.

Some metal mines, including gold mines, have become the near-equivalent of nuclear waste dumps that must be tended in perpetuity. Hard-rock mining generates more toxic waste than any other industry in the United States, according to the Environmental Protection Agency. The agency estimated last year that the cost of cleaning up metal mines could reach $54 billion.

A recent report from the Government Accountability Office chastised the agency and said legal loopholes, corporate shells and weak federal oversight had compounded the costs and increased the chances that mining companies could walk away without paying for cleanups and pass the bill to taxpayers.

"Mining problems weren't considered a very high priority" in past decades, Thomas P. Dunne, the agency's acting assistant administrator for solid waste and emergency response, said in an interview. "But they are a concern now."

With the costs and scrutiny of mining on the rise in rich countries, where the best ores have been depleted, 70 percent of gold is now mined in developing countries like Guatemala and Ghana. It is there, miners and critics agree, that the real battle over gold's future is being waged.

Gold companies say they are bringing good jobs, tighter environmental rules and time-tested technologies to their new frontiers. With the help of the World Bank, they have opened huge mines promising development. Governments have welcomed the investment.

But environmental groups say companies are mining in ways that would never be tolerated in wealthier nations, such as dumping tons of waste into rivers, bays and oceans. People who live closest to the mines say they see too few of mining's benefits and bear too much of its burden. In Guatemala and Peru, people have mounted protests to push miners out. Other communities are taking companies to court.

This month a Philippine province sued the world's fifth-largest gold company, Canada-based Placer Dome, charging that it had ruined a river, bay and coral reef by dumping enough waste to fill a convoy of trucks that would circle the globe three times.

Placer Dome, which also runs three major mines in Nevada, answered by saying that it had "contained the problem" and already spent $70 million in remediation and another $1.5 million in compensation.

Some in the industry have paused to consider whether it is worth the cost - to the environment, their bottom line or their reputations - to mine gold, which generates more waste per ounce than any other metal and yet has few industrial uses.

The world's biggest mining company, Australia-based BHP Billiton, sold its profitable Ok Tedi mine in Papua New Guinea in 2001 after having destroyed more than 2,400 acres of rainforest. Upon leaving, the company said the mine was "not compatible with our environmental values."

After tough lessons, other companies, like Newmont Mining, the world's largest gold producer, are paying for more schools and housing, trying harder to ease social problems around its mines.

"I don't think any of our members want to be associated with a bad operation - notwithstanding it would hurt their ability to open new facilities," said Carol L. Raulston, spokeswoman for the National Mining Association. "News goes around the world quickly now and there is no place to hide."

Critics say corporate miners have been cloistered from scrutiny because of their anonymity to consumers, unlike, say, oil companies, which also extract resources but hang their name over the pump.

Last year the mine watchdog group Earthworks began a "No Dirty Gold" campaign, marching protesters in front of fashionable Fifth Avenue storefronts, trying to change gold mining by lobbying gold consumers.

"They just said to ask where the gold was coming from and whether it caused social or environmental damage," said Michael E. Conroy, senior lecturer and research scholar at the Yale University School of Forestry and Environmental Studies. "The repercussions in the mining media were huge - some said it was all lies, but retailers began to realize what their vulnerability was."

Mr. Kowalski, Tiffany's chairman, has tried to stay ahead of the controversy. He has broken new ground by buying Tiffany's gold from a mine in Utah that does not use cyanide.

But the largest sellers of gold are not luxury outlets like his, but rather Wal-Mart stores, and even Mr. Kowalski, a trustee of the Wildlife Conservation Society, hesitated to call any gold entirely "clean."

Asia's Insatiable Appetite

Amrita Raj, a 25-year-old bride, was shopping for her wedding trousseau on a recent Saturday in New Delhi. There was a "wedding set" to be bought that day, with its requisite gold necklace, matching earrings and two sets of bangles.

For the sake of family honor, the new in-laws would have to receive gold gifts as well - a "light set" for the mother-in-law, plus a gold ring or a watch for the bridegroom, and earrings for a sister-in-law.

"Without gold, it's not a wedding - at least not for Indians," Ms. Raj said.

For thousands of years, gold has lent itself to ceremony and celebration. But now old ways have met new prosperity. The newly moneyed consumers who line the malls of Shanghai and the bazaars of Mumbai sent jewelry sales shooting to a record $38 billion this year, according to the World Gold Council, the industry trade group.

Over the last year, sales surged 11 percent in China and 47 percent in India, a country of a billion people whose seemingly insatiable appetite for gold - for jewelry, temples and dowries - has traditionally made it gold's largest consumer.

That kind of demand leads many in and out of the industry to argue that gold's value is cultural and should not be questioned. The desire to hoard gold is not limited to households in India or the Middle East, either.

The United States, the world's second-largest consumer of gold, is also the world's largest holder of gold reserves. The government has 8,134 tons secured in vaults, about $122 billion worth. The Federal Reserve and other major central banks renewed an agreement last year to severely restrict sales from their reserves, offering, in effect, a price support to gold.

That price is not simply a matter of supply and demand, but of market psychology. Gold is bought by anxious investors when the dollar is weak and the economy uncertain. That is a big reason for gold's high price today.

For miners that price determines virtually everything - where gold is mined, how much is mined, and how tiny are the flecks worth going after.

"You can mine gold ore at a lower grade than any other metal," said Mike Wireman, a mine specialist at the Denver office of the E.P.A. "That means big open pits. But it must also be easy and cheap to be profitable, and that means cyanide."

That kind of massive operation can be seen at Yanacocha, a sprawling mine in northern Peru run by Newmont. In a region of pastures and peasants, the rolling green hills have been carved into sandy-colored mesas, looking more like the American West than the Andean highlands.

Mountains have been systematically blasted, carted off by groaning trucks the size of houses and restacked into ziggurats of chunky ore. These new man-made mountains are lined with irrigation hoses that silently trickle millions of gallons of cyanide solution over the rock for years. The cyanide dissolves the gold so it can be separated and smelted.

At sites like Yanacocha, one ounce of gold is sprinkled in 30 tons of ore. But to get at that ore, many more tons of earth have to be moved, then left as waste. At some mines in Nevada, 100 tons or more of earth have to be excavated for a single ounce of gold, said Ann Maest, a geochemist who consults on mining issues.

Mining companies say they are meeting a demand and that this kind of gold mining, called cyanide heap leaching, is as good a use of the land as any, or better.

Cyanide is not the only option. But it is considered the most cost-effective way to retrieve microscopic bits of "invisible gold." Profit margins are too thin, miners say, and the gold left in the world too scarce to mine it any other way.

"The heap is cheaper," said Shannon W. Dunlap, an environmental manager with Placer Dome. "Our ore wouldn't work without the heap."

But much of those masses of disturbed rock, exposed to the rain and air for the first time, are also the source of mining's multibillion-dollar environmental time bomb. Sulfides in that rock will react with oxygen, making sulfuric acid.

That acid pollutes and it also frees heavy metals like cadmium, lead and mercury, which are harmful to people and fish even at low concentrations. The chain reaction can go on for centuries.

Many industry officials, reluctant to utter the word pollution, protest that much of what they leave behind is not waste at all but ground-up rock. The best-run mines reclaim land along the way, they say, "capping" the rock piles with soil and using lime to try to forestall acid generation.

But stopping pollution forever is difficult. Even rock piles that are capped, in an attempt to keep out air and rain, can release pollutants, particularly in wet climates.

Cyanide can present long-term problems, too. Most scientists agree that cyanide decomposes in sunlight and is not dangerous if greatly diluted. But a study by the United States Geological Survey in 2000 said that cyanide can convert to other toxic forms and persist, particularly in cold climates.

And just as cyanide dissolves gold out of the rock, it releases harmful metals, too.

There have also been significant accidents involving cyanide. From 1985 to 2000, more than a dozen reservoirs containing cyanide-laden mine waste collapsed, the United Nations Environment Program reported.

The most severe disaster occurred in Romania in 2000, when mine waste spilled into a tributary of the Danube River, killing more than a thousand tons of fish and issuing a plume of cyanide that reached 1,600 miles to the Black Sea.

That spill led to calls for the gold industry to improve its handling of cyanide. After five years of discussion, the industry unveiled a new code this month. It sets standards for transporting and storing cyanide and calls on companies to submit to inspections by a new industry body.

But the cyanide code is voluntary and not enforced by government. And Glenn Miller, a professor of environmental science at the University of Nevada, says it does not adequately deal with one of mining's most important, unattended questions: What happens when the mine closes?

A Rocky Mountain Disaster

One answer can be found in a rural, rugged area of northeastern Montana called the Little Rocky Mountains.

There, Dale Ployhar often comes to the high bare slopes around the abandoned Zortman-Landusky gold mine to plant pine seedlings on a silent hillside that has been reclaimed by little more than grasses.

"I bring lodgepole seeds and scatter them around, hoping they'll come back," he said, looking out over the tiny town of Zortman, population 50.

Zortman-Landusky was the first large-scale, open-pit cyanide operation in the United States when it opened in 1979. The imprint it left on the environment, psyche and politics of Montana continues today.

What happened there - a cacophonous, multilayered disaster involving bankruptcy, bad science, environmental havoc and regulatory gaps - foreshadowed the risky road that gold has taken in the years since, mining experts, government regulators and environmentalists say.

"There's a lot of bitterness left," said Mr. Ployhar, 65, a heavy equipment operator, whose son bought some of the mine lands at a bankruptcy auction four years ago.

Some mining experts say that Zortman-Landusky - a combination of two open pits near Zortman and the neighboring village of Landusky - offered a steep learning curve on how chemical mining worked, and didn't.

Others say that overly ambitious production schedules by the mine's owner, Pegasus Gold, based in Canada, were to blame. A bonus package of more than $5 million for top executives, announced after the company filed for bankruptcy protection in 1998, did not help.

Mining with cyanide can be tricky even in the best conditions. At Zortman, the company made the mistake of building their cyanide heaps atop rock that turned acidic. The cyanide and the acid mixed in a toxic cocktail that seeped from the mounds.

Mining stopped in 1996, and company officials insisted in their public comments over the next year that they wanted to be responsible corporate citizens and stay to clean up the property. But the price of gold was falling, then below $280 an ounce, and Pegasus closed its doors.

"This became one of the worst cases in Montana," said Wayne E. Jepson, manager of the Zortman project at the Montana Department of Environmental Quality. "But even as late as 1990, one of the last studies for Landusky predicted no acid in any significant amounts."

Environmental risks from hard-rock mines often turn out to be understated and underreported, according to two recent studies.

Robert Repetto, an economist at the University of Colorado, examined 10 mines in the United States and abroad run by publicly traded companies. All but one, he wrote in a June report, had failed to fully disclose "risks and liabilities" to investors.

The environmental group Earthworks examined 22 mines for a report it will publish in November. Almost all of them had water problems, leading it to conclude that "water quality impacts are almost always underestimated" before mining begins.

"The combination of the regulatory approach and the science is what creates inaccurate predictions," said James R. Kuipers, a consultant and former mining engineer, one of the authors of the study.

At Zortman-Landusky, the state wrote the environmental impact study itself, based primarily on information from the company, Mr. Kuipers said.

Montana and other big mining states still often depend on mining companies for much of the scientific data about environmental impact, or the money to pay for the studies, state and federal regulators say, mainly because government agencies generally lack the resources to do expensive, in-depth research themselves.

Some mine regulators defend the practice, saying that having scientific data supplied by companies with a financial interest in the outcome is not necessarily bad if the review is stringent.

"What is important to make the system work is that state and federal agencies have the wherewithal and expertise to look at the information," said Mr. Wireman of the Denver E.P.A. office.

But one lesson of Zortman is that good information is sometimes ignored.

In the early 1990's, an E.P.A. consultant and former mining engineer, Orville Kiehn, warned in a memo to his bosses that not enough money was being set aside by the mine for water treatment.

Mr. Kiehn's opinion, vindicated today, went nowhere. The environmental agency had little legal authority then - and no more today - to protect the public from an operating mine except by filing a lawsuit, as it did in 1995 after Pegasus had already violated federal clean water standards.

The company settled the suit in 1996 and agreed to pay $32.3 million mostly to upgrade and expand water treatment.

At the time, state officials rejected the idea of squeezing Pegasus to put up more money. This spring, Montana's legislature created a special fund for water treatment to make up for it, for the next 120 years, at a cost of more than $19 million.

Washington is also coming to grips with the failure to plan for the cost of mining. The Government Accountability Office, the investigative arm of Congress, sharply criticized the E.P.A. in August for not requiring metal mines to provide assurances that they can pay for cleanups, a failure that it said had exposed taxpayers to potentially billions of dollars in liabilities.

For Montana, the Zortman experience was chilling. In 1998, as the catastrophe was making headlines across the state, voters approved the nation's first statewide ban on cyanide mining, halting any new gold projects. They renewed the ban last year.

Profit and Poverty

Today gold companies are striking out to remote corners of the globe led by a powerful guide: the World Bank.

The bank, the pre-eminent institution for alleviating world poverty, has argued that multinational mining companies would bring investment, as well as roads, schools and jobs, to countries with little else to offer than their natural resources. For the bank, which tries to draw private investment to underdeveloped lands, the logic was simple.

"We invest to help reduce poverty and help improve people's lives," said Rashad-Rudolf Kaldany, head of oil, gas and mining at the bank's profit-making arm, the International Finance Corporation.

The bank has worked both ends of the equation. At its urging, more than 100 cash-strapped governments have agreed to cut taxes and royalties to lure big mining companies, said James Otto, an adjunct professor at the University of Denver law school.

At the same time, the bank put up money for or insured more than 30 gold-mining projects, looking for profits.

Though mining was a small part of the bank's portfolio, it was not without controversy as accidents mounted. In one of the worst disasters, in 1995, a mine in Guyana insured by the bank spilled more than 790,000 gallons of cyanide-laced mine waste into a tributary of the Essequibo River, the country's main water source.

By 2001, the World Bank president, James D. Wolfensohn, imposed a two-year moratorium on mining investments and ordered a review of its involvement in the industry.

Emil Salim, a former minister of environment of Indonesia, led the study. "I said, up to now the International Finance Corporation was only listening to business," he said in an interview in Jakarta. "I said, so now let's give some voice to civil society."

Mr. Salim recommended reducing the use of cyanide, banning the disposal of waste in rivers and oceans, and giving communities veto power over mining company plans.

But the industry complained. And developing country governments said they liked the bank's loans to gold mines. In the end, the bank settled on more modest goals.

It pledged to make environmental impact statements understandable to villagers and to back only projects with broad community support. It also urged governments to spend mining companies' taxes and royalties in the communities near the mines.

But critics and environmental groups say the bank demands little from the mining companies in return for its money and its seal of approval.

The bank's guidelines for arsenic in drinking water are less stringent than those of the World Health Organization, and mercury contamination levels are more lenient than those permitted by the E.P.A., said Andrea Durbin, a consultant to nongovernmental groups pressing for tougher standards.

The International Finance Corporation is drafting new guidelines that will clarify what it expects from miners, said Rachel Kyte, its director of environment and social development.

But the draft rules give mining companies even more latitude, said Manish Bapna, the executive director of the Bank Information Center, a group that monitors the bank. They will make it easier for companies to evict indigenous people and to mine in some of the globe's most treasured habitats, he said.

Despite the World Bank's two-year review, little has changed, said Robert Goodland, a former director of environment at the bank who was an adviser on the study. "The bank insists on business as usual," he said.

Resistance in Guatemala

The first piece of new mining business the bank invested in after its review can be found today in the humid, green hills of western Guatemala.

Bishop Alvaro Ramazzini, a big burly man who mixes politics and religion with ease, doesn't understand why the World Bank lent $45 million to a rich multinational company for a gold mine in his impoverished region of Mayan farmers.

"Why not spend the money directly to help the people?" he asked.

Sprawled across a deep wooded valley, a new mine built by Glamis Gold, a Canadian company, was chosen by the World Bank last year as a new model for how gold mining could help poor people.

But the mine has faced protest at every turn.

At the June 2004 board meeting of the International Finance Corporation, there was considerable skepticism about its $45 million loan to Glamis.

Members questioned why a $261 million project was creating only 160 long-term jobs and giving money to a "well capitalized" company like Glamis at all, according to minutes of the meeting provided to The Times by a nongovernmental group opposed to the project.

Others were worried that the I.F.C. was relying too heavily on information from Glamis about the potential for pollution.

The World Bank had pledged to back only mines with broad local support. But on the ground in Guatemala, opposition boiled over last December.

Angry farmers set up a roadblock to stop trailers carrying huge grinding machines for the mine. After 40 days, and battles between police and protesters, the equipment had to be escorted by soldiers.

To persuade the villagers of the mine's benefits, Glamis flew 19 planeloads of farmers to a mine it runs in Honduras.

But the villagers of Sipicapa still wanted their voices heard. On a cool Saturday morning in June, more than 2,600 men and women dressed in their weekend best, with children in tow, crowded into the community's yards, churches and verandas to vote in a nonbinding referendum.

"We are already regretting that our forefathers allowed the Spaniards to buy our land for trinkets and mirrors," said Fructuoso López Pérez, a local mayor. "So we should vote so our children will thank us for doing right."

At that, a church full of local people raised their hands in a unanimous show of opposition to the mine.

Much of the peasants' fury was informed by Robert E. Moran, an American hydrogeologist, who was asked by Madre Selva, a Guatemalan nongovernmental organization, to visit the mine and review its environmental impact statement.

Mr. Moran, who was on the advisory board of the bank's mining study, found it badly lacking. It did not address the "very large quantities of water" the mine would use, or give basic information on the "massive volumes" of waste the mine would produce, he said.

Tim Miller, vice president of Central American operations for Glamis, said the environmental impact statement had been a "working document."

In Guatemala City, the Vice Minister of Mining, Jorge Antonio García Chiu, defended approval of the mine, saying it followed four months of consultation.

Mr. Kaldany, the I.F.C. official, said the investment and the environmental impact statement were both sound. "We are a bank," he said. "We go on the basis of a business development project. Then, as well, the bank asks: Are we needed? Are we adding any value?"

Glamis had already spent $1.3 million on social programs in the villages as part of the bank's requirements, Mr. Kaldany said.

At the mine, the grinding and churning of new machinery being tested already echoes across the valley. Production could begin as early as November.

Mr. Miller, of Glamis, said the mine was a winner for the people, and his company. In fact, he said, Glamis didn't need the bank, the bank came to Glamis.

Bank officials "were anxious to make some investments" in the region, he said. The company is expecting to gross $1 billion over the life of the mine, with profits of $200 to $300 million.

"That's a return of about 25 to 30 percent," he said.

Ghana: The Social Costs

The men of Binsre on Ghana's ancient Gold Coast carry on their own hunt for gold. Nearly naked, their arms and legs slathered in gray ooze, they sift through the muck in a large pit, using buckets and hard hats, looking for any last scrap.

So far industrial mining has not lived up to its promise for these men and their families. They are illegal miners who find work not inside the highly mechanized mines of Ghana's first-world investors, but on the fringes, scavenging the waste left behind by AngloGold Ashanti, the world's second-largest gold company, based in South Africa.

Six miners have died in the last several years, most of them overcome by fumes when waste from the mine gushed into the pit, said Hannah Owusu-Koranteng, an advocate for the illegal miners. The mine tried to keep the men out.

"We used to use dogs," said AngloGold Ashanti's chief financial officer, Kwaku Akosah-Bempah. "Then they said we were using dogs to bite them." So the mine stopped using the dogs and the men returned.

In the nearby village of Sanso, a few men said they had lost their land to the mine. Now they carve shafts into a mountain of waste rock, where they haul, hammer, chip and sift.

"You wake up one day and you realize your farm is destroyed," said Assemblyman Benjamin Annan, a local politician. "They say they will compensate but it takes one or two years. So people are compelled to go to illegal mining, the way our ancestors did."

Industrial-size shaft mining has existed in Ghana for 100 years, but with the price of gold soaring, more companies are arriving now, this time bringing open-pit cyanide mines. The investment has been greeted warmly by the government.

Newmont is set to spend a billion dollars on a new mine next year and on a second mine - in one of the badly deforested country's last remaining forest preserves - in 2007.

The World Bank is here, too, preparing to lend the company $75 million. Together, the bank and Newmont say, they aim to show how social development and gold mining can be married.

Newmont compensated the farmers who were moved off their land. It is offering training for new jobs, like growing edible snails and making soap. It built new concrete and tin-roofed houses to replace homes made of mud.

But the mine will create just 450 full-time jobs. More than 8,000 people will be displaced.

"The house is O.K.," said Gyinabu Ali, 35, a divorced mother of five children, who recently moved into her gaily painted two-room house, with a toilet out back, that overlooks several dozen similar units resembling a poor man's Levittown. "I miss my land where I could grow my own food."

Near the mine of Newmont's competitor, AngloGold Ashanti, in Obuasi, only half of the homes have an indoor bathroom, and 20 percent have running water. With the exception of the brick villas of the company executives, Obuasi today looks like a vast and squalid shanty town.

The chief financial officer, Mr. Akosah-Bempah, said he was offended by the poor conditions. Most of the company's taxes and royalties had stayed in the capital, he said, leaving the ramshackle town bereft of the benefits of gold mining.

"Sometimes we feel embarrassed by going to Obuasi," he said. "Not enough has gone back into the community."

Somini Sengupta contributed reporting from New Delhi for this article.

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The Cost of Gold | Treasure of Yanacocha

Tangled Strands in Fight Over Peru Gold Mine

By JANE PERLEZ and LOWELL BERGMAN

SAN CERILLO, Peru - The Rev. Marco Arana drove his beige pickup over the curves of a dirt road 13,000 feet high in the Andes. Spread out below lay the Yanacocha gold mine, an American-run operation of mammoth open pits and towering heaps of cyanide-laced ore. Ahead loomed the pristine green of untouched hills.

Then, an unmistakable sign that this land, too, may soon be devoured: Policemen with black masks and automatic rifles guarding workers exploring ground that the mine's owner, Newmont Mining Corporation, has deemed the next best hope.

"This is the Roman peace the company has with the people: They put in an army and say we have peace," said Father Arana as he surveyed the land where gold lies beneath the surface like tiny beads on a string.

Yanacocha is Newmont's prize possession, the most productive gold mine in the world. But if history holds one lesson, it is that where there is gold, there is conflict, and the more gold, the more conflict.

Newmont, which has pulled more than 19 million ounces of gold from these gently sloping Peruvian hills - over $7 billion worth - believes that they hold several million ounces more. But where Newmont sees a new reserve of wealth - to keep Yanacocha profitable and to stay ahead of its competitors - the local farmers and cattle grazers see sacred mountains, cradles of the water that sustains their highland lives.

The armed guards are here because of what happened in the fall of 2004 at a nearby mountain called Cerro Quilish. For two weeks, fearing that the company's plans to expand Yanacocha would mean Quilish's desecration and destruction, thousands of local people laid siege to the mine. Women and children were arrested, tear gas was thrown, the wounded hospitalized after clashes with the police.

In the end, the world's No. 1 gold-mining company backed down. Father Arana, who runs a local group formed to challenge the mine, helped negotiate the terms of surrender. Newmont withdrew its drilling equipment from Quilish - and the promised reserves from its books. Now, in large part because of the loss of Quilish, the company says production at Yanacocha may fall 35 percent or more in two years.

The forced retreat, a culmination of years of distrust between the peasants and the mine, was a chastening blow for an industry in the midst of a boom. It underscored the environmental and social costs of the technologies needed to extract the ever-more-valuable ore from modern mines. And it showed how a rising global backlash against those costs was forcing mining companies to negotiate what has come to be known as "social license" if that boom was to go on.

But the history of Yanacocha, pieced together in a six-month examination by The New York Times and the PBS television program "FrontlineWorld," is also an excursion into the moral ambiguities that often attend when a first-world company does business in a third-world land.

Gold miners say they have no choice but to go where the ore is; they cannot choose the governments they deal with. Yanacocha shows how one company maneuvered in a country, Peru, dominated by a secret web of power under a corrupt autocracy.

Newmont gained undisputed control of Yanacocha in 2000 after years of back-room legal wrangling. Behind the scenes, Newmont and its adversaries - a French company and its Australian ally - reached into the upper levels of the American, French and Peruvian governments, employing a cast of former and active intelligence officials, including Peru's ruthless secret police chief, Vladimiro Montesinos.

Much of that arm-twisting has been dragged into the light, in secret recordings by the spy chief. The tapes, apparently intended to blackmail and manipulate Peru's powerbrokers, surfaced in 2000 and led to the downfall of Mr. Montesinos and the president he served, Alberto K. Fujimori.

The tapes captured everything from plotting to fix elections to shopping bags of money being unloaded for payoffs in Mr. Montesinos's office at the Peruvian National Intelligence Agency.

They captured Newmont's maneuverings, too. In one audio recording, the No. 3 Newmont executive at the time, Lawrence T. Kurlander, is heard offering to do a favor for Mr. Montesinos.

"Now you have a friend for life," Mr. Kurlander tells the spy chief.

"You have a friend for life also," Mr. Montesinos replies.

Last year, a Justice Department investigation into whether Newmont's victory resulted from bribing foreign officials was dropped after the Peruvian government failed to cooperate fully and the statute of limitations expired, according to law enforcement officials familiar with the case. The Peruvian government investigated the Yanacocha affair without bringing charges.

Mr. Kurlander has agreed to speak out publicly about his meeting for the first time. He says he regrets seeking out Mr. Montesinos, now in jail charged with everything from corruption to gun running and drug trafficking. But Mr. Kurlander and Newmont are adamant that no bribes were paid, nothing illicit done, at least not by them or their allies.

"Everybody involved on the American side, in the American government, that went to see him or spoke to him, asked for a level playing field," said Mr. Kurlander, who retired in 2002. "Not a single person asked for him to influence the outcome of the case."

Newmont's senior executives declined repeated requests for interviews for this article, though they did allow Times reporters to make an extensive visit to the Yanacocha mine. But in a written statement, Newmont said of its legal battle for the mine, "We are satisfied that the company complied in all respects with applicable laws."

Whatever the past environmental problems, Newmont says Yanacocha now meets all Peruvian and international standards. And the company says it is committed to gaining and maintaining the approval of the community.

Still, to many of the local people, the continuing struggle for Yanacocha evokes a tale of treachery nearly any Peruvian school child can recite.

In 1532, the Spanish conquistador Francisco Pizarro captured the last Inca emperor, Atahualpa, in Cajamarca, the provincial capital 28 miles from Yanacocha. The young Inca, a god to his people, was held for months while he scrambled to amass a ransom: enough gold to fill a room as high as his arm could reach.

He turned over his gold, expecting to be freed. But Pizarro killed him anyway.

Living on Water

At first, people here saw possibility in the mine. Yanacocha - "black lake" in the indigenous Quechua tongue - sits in one of the poorest agricultural regions of Peru.

"When Yanacocha began its operations, we would only hear about how everyone was happy," Father Arana said. "The mine was going to bring jobs, improve roads." No one thought much, he said, about the inevitable collisions.

The collisions began almost immediately.

In the Andean peasants' universe, water is the heart of the land. The people depend on it - for their animals, for drinking, for bathing. Community life is organized around it.

But the mine lives on water, too. The bits of gold here, so small they are called "invisible gold," can be mined profitably only by blasting mountains, then culling the gold with vast quantities of cyanide diluted with similarly vast quantities of water.

It was not long before the peasants began to complain. Streams and canals were drying up, they said. They were filled with murky sediment. The water smelled foul.

But on the ledger books, Yanacocha was a fast success.

The mine had started with 1.3 million ounces of reserves in the ground. Within a year, it claimed over 3 million. It was the biggest foreign investment in Peru.

"Everywhere we drilled and looked, there was gold," said Len Harris, Yanacocha's first general manager.

Dueling Companies

Celebration soon gave way to strife.

A year before, a partnership had been formed to develop the mine: Newmont; a Peruvian partner, Buenaventura; and a French government-owned company, Bureau de Recherches Géologiques et Minières (BRGM). No partner had a controlling interest. The World Bank's investment arm, the International Finance Corporation, later took a 5 percent stake, hoping to promote development in a country plagued by economic chaos and roiled by a Maoist insurgent group, Shining Path.

With the mine expanding and the guerrilla leader captured, BRGM announced plans to sell a large part of its increasingly valuable stake to an Australia-based company, Normandy Poseidon. Newmont, considering the involvement of another major mining company unacceptable, sued, arguing that the partnership agreement gave it and Buenaventura first right of refusal on any sale.

Twice, Peruvian courts agreed. Then, in September of 1997, the Peruvian Supreme Court issued a startling ruling, agreeing to review a case Newmont thought it had definitively won. Stunned and suspicious, the company called in Mr. Kurlander.

Mr. Kurlander, then 56, had spent most of his life in government, as a prosecutor and as chief criminal-justice adviser to Gov. Mario M. Cuomo in New York. He later moved to corporate work and was recruited by Newmont in 1994. He had no experience in mining, but in an industry known for its rough edges, he became a top Newmont executive, valued for his political contacts and easy ability to walk between the halls of government and the corporate suite.

On his arrival in Peru, Mr. Kurlander says, he was told by Newmont's lawyers and security chief that the French were "behaving inappropriately in the litigation."

"The mere fact that they were doing this," he said in an interview, "was unseemly at best and corrupt at worst."

Newmont, he said, was at a distinct disadvantage: the Foreign Corrupt Practices Act forbids American companies to pay anything of value to a foreign official in exchange for a "result." By contrast, in 1997, most European countries, France included, did not prohibit paying bribes.

The French ambassador to Peru at the time, Antoine Blanca, said in an interview that no one connected to the embassy had ever offered bribes or otherwise acted improperly.

Still, what emerges from documents and interviews with participants is a picture of three years of increasing pressure and intimated threats by Normandy and the government of France.

In the Peruvian press, the French ambassador insinuated corruption of the judiciary; French government emissaries suggested to Peruvian officials that there would be consequences if Newmont was awarded the disputed shares.

Normandy recruited Patrick Maugein, a well-connected French businessman. By phone, fax and letter, Mr. Maugein placed Newmont and Buenaventura on notice that the dispute had become a "matter of state"; the French, he warned, "had every intention of fighting it to the bitter end." Mr. Maugein had ties to the French president, Jacques Chirac, and soon Mr. Chirac wrote to President Fujimori, urging a Supreme Court review and his personal intervention.

Mr. Maugein declined to be interviewed for this article, but in a letter wrote that any allegations of illicit activity "come from people who have been paid to make them."

From Lima, in the days after the Supreme Court agreed to take the case, Mr. Kurlander headed to Washington to enlist help on the American side. By the end of October 1997, Stuart E. Eizenstat, under secretary of state for economic affairs, wrote Peru's prime minister to press for "a fair and impartial hearing," according to documents released under the Freedom of Information Act.

"A politically tainted decision would adversely affect U.S. investment in Peru," he wrote

On Jan. 5, 1998, Peru's Supreme Court came back with a preliminary decision; 3 to 2 for the French, one vote shy of victory.

As the Peruvians prepared to assign two more judges to the case, Mr. Kurlander says, he and Buenaventura's chief, Alberto Benavides, appealed to Mr. Fujimori.

Soon after, Mr. Kurlander said, the president's office sent word about the man to see.

Spy Chief's Favor Bank

Vladimiro Montesinos's titles never matched his stature. Officially, he was "counselor" to Mr. Fujimori and de facto head of the National Intelligence Service. In reality, he was the second-most-powerful man in Peru - "Rasputin, Darth Vadar, Torquemada and Cardinal Richelieu" rolled into one, according to an American Army intelligence report.

The National Intelligence Service was also on the payroll of the C.I.A., which gave Mr. Montesinos a million dollars a year for his supposed help in combating the narcotics trade, according to former C.I.A. officials who approved the payments.

This was the man Mr. Kurlander headed to see alone on Feb. 26, 1998. While he says he knew that Mr. Montesinos was "an extremely bad man," he maintains that the extent of the government's corruption and human rights abuses were not well known at the time. There was, however, one case he was aware of.

Not long before, the Fujimori government had seized the television station of a Peruvian-Israeli businessman, Baruch Ivcher, after it began broadcasting reports tying the intelligence chief to drug trafficking and corruption. Mr. Kurlander knew that publicity about the case was threatening to become a headache for Peru's government.

As the secret tape rolls, Mr. Montesinos says he is aware of Mr. Kurlander's problems and is "very glad to do whatever I can for you."

Mr. Kurlander describes his own links to the intelligence community and how he has enlisted "friends" - two former C.I.A. officials - to assist him, because the French side "has been acting quite strangely."

Their conversation is interpreted by Grace Riggs, a lawyer and former lover of the spy chief who had a child with him.

Soon Mr. Kurlander raises the Ivcher case. Mr. Montesinos assures him that the pursuit of Mr. Ivcher is not an anti-Semitic "persecution," and Mr. Kurlander offers to help by lobbying his fellow Jews in the United States and abroad.

"Tell him I going to help him with the voting," Mr. Montesinos directs his translator. He is well aware of the "tricky practices of the French government," he says, making a joke about "The French Connection."

The reference, in English, gets the men laughing. Soon spy chief and executive are pledging friendship for life.

The spy chief then proceeds to discuss with another man, who has never been identified, the lawyers and judges who may need to be influenced. The conversation is in Spanish, which Ms. Riggs does not translate.

Finally, she tells Mr. Kurlander that because he helps Mr. Montesinos "without expecting anything in return," the spy chef "wants to do the same thing for you."

"I appreciate that," Mr. Kurlander replies.

"Amor con amor se paga," Mr. Montesinos exclaims.

Love is repaid with love.

Washington Is Heard From

Still, Mr. Kurlander says, he had doubts. In the following weeks, "nothing happened," he said. "I was very worried that we were lost." In fact, the channel between Mr. Montesinos and the Americans was open and bustling.

Peter Romero, then assistant secretary of state for Western Hemisphere affairs, acknowledged in an interview that he had twice called Mr. Montesinos to show that the case was being "monitored" in Washington.

"He seemed to be a nice enough fellow," he recalled.

The "compelling reason" to get involved, he said, came from Peruvian and American Embassy officials who confirmed the direct involvement of President Chirac and others at the top of the French government.

"We wanted to ensure that that was neutralized," Mr. Romero said.

Two and a half years later, Mr. Romero left government and was hired by Mr. Kurlander as a consultant on Peru for Newmont, where he remained for 18 months.

On April 14, six weeks after the Montesinos-Kurlander meeting, the video cameras were rolling for a visit from the C.I.A. station chief, Don Arabian.

As the meeting nears its end, Mr. Montesinos says he has been collecting information on the French attempt to influence the case and will not let them use "extortion, blackmail and other gangster" methods.

"I'm not working with the telephones, but we will if necessary," Mr. Montesinos says, an apparent reference to wiretapping. "We'll sort out the technical support." The men laugh.

Mr. Arabian, who recently retired, declined a request for an interview.

On May 8, the sixth Supreme Court justice voted in favor of Newmont and Buenaventura. With the vote deadlocked, 3-3, the court administrator appointed a final judge, Jaime Beltrán Quiroga. He was summoned the next day by Mr. Montesinos.

A videotape shows the justice settled on the couch as Mr. Montesinos talks about how, as a lawyer he, too, would normally "keep a distance" from events. But "in these cases," he says, "one has to intervene directly."

Mr. Montesinos avoids direct pressure - "as if we are imposing on you" - but reminds the judge that the case is a matter of national interest: the United States is a key guarantor of coming deliberations over Peru's border conflict with Ecuador.

There is no discussion of payoffs, but the spy chief does question the judge about his professional ambitions. The men reminisce.

"Well, doctor, you have a friend here," Judge Beltrán says.

"My dear, Jaime, then, a pleasure to see you, brother," Mr. Montesinos replies, assuring his guest that he will soon be transferred to Peru's Constitutional Court.

Judge Beltrán's vote was announced two weeks later: Newmont and Buenaventura were awarded BRGM's share - at the purchase price set in 1993: $109.7 million.

When the final transfer was negotiated a year later, the stake was valued at more than five times that.

Today Mr. Kurlander says that whatever his reservations at the time about meeting Mr. Montesinos, he went ahead because nearly everyone told him, "If the French were to be stopped, he was the only one in Peru who would dare to do it."

The transcript is "terribly unfair," Mr. Kurlander says, and leaves out a number of his statements that all he wanted was a "level playing field."

Mr. Kurlander's name has been attached to the meeting and his reputation harmed, he says, though he insists the meeting was no secret. He says his Newmont superiors and his partners in the Benavides family were thoroughly briefed.

"It was my government who recommended - strongly - that we speak with him," Mr. Kurlander said at his home outside Denver. "Tell me what my option is at that point. Do I lay down and just fold, fold up and go home? Or do I fight for what I think is right and fair and just?"

In an interview at his Lima offices, Mr. Benavides, now Buenaventura's chief executive, insisted, "We didn't know what Mr. Kurlander was doing," and added that he did not learn about the Montesinos meeting until the tape was made public several years later.

The Mercury Spill

At Yanacocha, year after year, the mine's geologists had kept striking gold. And with every ton of earth sifted, it became ever clearer that the mine had not just ripped up the landscape; it had remade the social architecture, too.

There were growing class divisions, between the many campesinos who had received well-paying jobs - Yanacocha would eventually employ as many as 2,200 people, two-thirds locals, full time, and up to 6,000 on shorter-term contracts - and the tens of thousands more who had not. People migrating to the region in pursuit of work brought overcrowding and rising crime.

In June 2000, a truck contracted to carry canisters of mercury, a byproduct of mining, spilled 330 pounds of the poisonous metal over 25 miles of road around Choropampa, 53 miles from the mine.

The villagers believed that the mercury was mixed with gold. They scooped it up. Some took it home to cook on their stoves. A World Bank report later said the mine delayed reporting the accident to the national authorities and initially played down its seriousness to the bank.

In the end, the Peruvian government fined the mine $500,000; the company says it has paid $18 million more. A class-action suit has been filed against Newmont in Denver, charging that more than 1,000 people were harmed, some for life.

The extent of that damage has been in dispute from the start. Even so, the spill left deep psychic scars. It became common mythology that mercury had killed newborn babies and caused cancer and other diseases, Dante Vera, a former Peruvian Interior Ministry official hired in 2004 as an adviser to Newmont, wrote in a report to company executives.

At Newmont, it was becoming increasingly clear that the social turmoil was a business problem. The spill, Mr. Kurlander said in a speech a year later, "served as a wake-up call for us."

Soon, he was headed back to Peru, to lead an environmental audit of the mine.

Newmont kept the audit's results within the company, never acknowledging them publicly - either to its shareholders or to the local people. Mr. Kurlander found "a high level of mistrust" of the mine.

But the 44 findings of Mr. Kurlander's audit, which was given to The Times, also confirmed many of the villagers' specific complaints: that fish were disappearing and that lakes, streams and canals were being contaminated, at least one with cyanide.

One stream, Quebrada Honda, had 13 fish per kilometer in 1997, but none by 2000, the audit said. Thousand of tons of rock not processed for gold recovery were generating dangerous acidic runoffs.

In a letter after the audit, Mr. Kurlander says that as the mine expanded, "we eliminated many environmental safeguards that were in the construction and environmental management plans." In all, he wrote to Newmont's new chief executive, Wayne Murdy, the findings were so serious that they could jeopardize the mine's continued operation and leave senior executives subject to "criminal prosecution and imprisonment."

Mr. Kurlander's tough words came on the heels of another memo to Mr. Murdy about the spill: On Jan. 18, 2001, Mr. Kurlander recommended that all the top executives, including himself and his boss, take cuts in their bonuses, of 50 to 100 percent, and that the punishment be made public. Mr. Kurlander singled out the company's environmental team, saying that despite public pledges, Newmont had failed to adhere to American environmental standards.

To his disappointment, Mr. Kurlander said, some bonuses were indeed reduced, but without public notice and much more modestly than he had recommended.

In a letter to Mr. Kurlander three years later, Mr. Murdy said the company had learned from the accident and the audit. Newmont, he said, spent $100 million to fix the environmental problems, including $50 million for a water-treatment plant and $20 million on two dams to prevent sediment from clogging streams and canals. Mercury is now shipped inside triple-sealed, stainless-steel containers and escorted by a convoy of cars.

To Mr. Kurlander, the spill showed the folly of a company ignoring the people, particularly the people most set against the mine. In a memo, he warned that with the mine sunk so low in the peasants' esteem, Newmont would never be able to mine Quilish.

"We have come to this because we have been in denial," he wrote. "We have not heeded the voices of those most intimate with our mine - those who live and work nearby."

It was less than a year after the audit that he retired.

The Peasants Protest

The protests began not long after people began seeing the drilling machines up on the cone-shaped hill above Cajamarca.

Quilish had long been on Newmont's drawing boards. Last year, Newmont mined three million ounces at Yanacocha, its most profitable single source of gold. But the more it pulls from the ground, the more it must replace to remain No. 1.

Back in 2000, the local government had passed an ordinance declaring Quilish and its watershed a protected natural reserve. But Newmont had persuaded a Peruvian court that it had the right to mine because it had acquired the concession years before. In August 2004, the machines moved in.

To many people, that was the final betrayal, said Mr. Vera, the former Newmont consultant. He quit this summer, saying his advice had been ignored.

On Sept. 2, deploying boulders, vehicles, anything they could find, hundreds of campesinos blockaded the narrow mountain road that runs from Cajamarca to the mine.

Several hundred armed officers, including 150 special operations police officers from Lima, were sent in to guard the mine.

The first day was the most violent; protesters were arrested, many of them women and old people, according to Father Arana's colleague, Jorge Camacho. At times during the siege, the police used tear gas. One man was shot in the leg. The company kept the gold coming out of Yanacocha, but only by helicoptering the workers in.

On Sept. 15, there was a regionwide strike, with street demonstrations in Cajamarca. The message, on one of the blizzard of placards in town, was: "Listen Yanacocha. Cajamarca is to be respected."

The protests were organized by the peasants themselves, Mr. Camacho and others say. But the 43-year-old Father Arana, son of teachers from Cajamarca, had been nurturing the movement for many years, even before he founded his group, Grufides, in the late 1990's. (These days, it receives financial assistance from Oxfam.)

The campesinos call him Father Marco, and he is a devoted adherent of liberation theology and its doctrine of social activism for the poor.

He is not the easiest of men. Last spring, he met Newmont's chief, Mr. Murdy, on the sidelines of the company's annual general meeting in Denver. As the priest recalls it, Mr. Murdy tried to be conciliatory, saying he lived by his mother's motto: "We are given one mouth but two ears to listen with." Father Marco says he rebuffed the overture, replying, "In the Bible, there is a saying about some people have eyes that don't see and ears that don't hear."

As the siege ran on at Yanacocha, the priest became a key negotiator between Newmont, the peasants and the Ministry of Mines. It was not long after the demonstrations in Cajamarca that the company surrendered. The machines came down from Quilish. At Newmont's request, the ministry withdrew its permit, too.

What remains up on the mountain is a symbolic wall of mud and straw that the campesinos built to keep the miners at bay.

More Gold Needed

Standing down at Quilish, with its 3.8 million ounces of reserves, has only intensified the need for new reserves.

"The pressure feels like you're laying track and knowing there's a locomotive right behind you," said the mine's exploration manager, Lewis Teal.

So Newmont is looking elsewhere, in the highlands near San Cerillo, where the jade-green lagoons and peaty grasses act as a store of water for the peasants below.

Many people there worry about the effects of a new mine. Which is why, after Quilish, Newmont is paying for the Peruvian police units protecting the drilling team, said the mine's manager, Brant Hinze.

Even so, Mr. Hinze said, leaving Quilish was the right thing to do. "The thing that the company did - both Newmont and Buenaventura - is listen to the communities, and they said this is something we want you to stay away from," he said.

Newmont's Peruvian partner, Mr. Benavides, argued that exploration of Quilish had not been abandoned, simply suspended.

"We have the concession, and we have the land," he said. He added: "I do not understand what social license means. I expect a license from the authorities, from the minister of mines. I expect a license from the regional government. I don't expect a license from the whole community."

Still, the idea of social license is at the heart of the agreement that ended the siege: If Newmont hopes ever to mine Quilish, it first must win the community's consent.

So to promote Yanacocha's well-being and expansion, Mr. Hinze has become the kind of mine manager he never imagined being. He says he had asked for the job running Yanacocha because of its sheer scale - "it's big, it's profitable," is how he puts it. Fifty years old, silver-haired and steely eyed, 6 foot 3 and 255 pounds, he is a man of scale himself. His idea of recreation, he says, is riding his Harley or swimming with hammerhead sharks.

Now, he says, he spends 70 to 80 percent of his working time on social issues. On a recent day, he ate roasted guinea pig at a lunch with a peasant group. A few days later, he attended a ceremony celebrating a gift of $500,000 for a new road around San Cerillo.

"Modern mining can coexist with cattle, agriculture and tourism," he told one gathering. "Today we begin a new history for communities around here."

Newmont says that it paid $180 million in taxes to Peru's government last year, and that under a new law, half was returned to the Cajamarca region. But to its frustration, the company says, the local government has largely been unable to use the money to benefit the people - and most of the people here remain achingly poor.

So the company, albeit ambivalently, has become something of a surrogate government. It is contributing money for schools and clinics and building some small water treatment plants in the villages. In all, the company says it will spend nearly $20 million this year on social programs.

Water remains a divisive issue: Father Arana and his allies argue that a new, every-three-weeks testing protocol is insufficiently independent. The peasants continue to complain.

But company and local officials say there have been no environmental accidents at Yanacocha in more than two years, and the mine says it manages its water to ensure there is enough for the community.

But the biggest issue is the one looming over every modern industrial gold mine: What happens when the ore that lured the miners here is gone?

Over 13 years, Newmont has moved mountains for gold - 30 tons of rock and earth for every ounce. By the time it is through, the company will have dug up a billion tons of earth. Much of it will be laced with acids and heavy metals.

Three years ago, after Newmont acknowledged that 36,700 fish were missing from a river contaminated by the mine, the World Bank hired an American geochemist, Ann Maest, to study the streams and canals flowing from the mine.

In the short term, she concluded, the water was safe for human use. But long term, she said in an interview, the company's own tests show that all the components are in place for the huge piles of rock to leak acids that will pollute surface and groundwater.

The only preventive, she said, would be "perpetual treatment."

Mr. Hinze, who was recently appointed head of Newmont's North American operations, insists that the company's plan for closing the mine will take care of long-term treatment and cleanup.

"We plan on being here a very long time," he said.

Newmont has yet to put aside money for long-term treatment, though it says it will comply with a Peruvian government requirement due to take effect in 2007. But to pay for cleanups, the company needs to keep profits high. To keep profits high, it needs to keep finding and mining more gold. Yet increasingly, the unmovable reality is that to keep mining more gold, it has to make peace with the people who will be here long after the miners leave.

Mr. Hinze and Newmont insist that that can - in fact, must - be done, even if some people may never be won over. "There will always be a level of mistrust," he said. "Unfortunately, we can't please everyone."

Mr. Vera, the former Newmont consultant, is not so confident. He says he sometimes thinks that the clash between the mine and the peasants is so fundamental as to be beyond even the best intentions.

"Mining negatively affects the Andean cosmic vision of the unity of nature," he said. "The conflict cannot be settled with money. Mining generates resentments that are difficult to heal."

Marlena Telvick and Natasha Del Toro contributed reporting for this article.

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Questions on the Cost of Gold

Jane Perlez and Kirk Johnson answer questions from readers on their series examining gold mining around the world.

Q. I had a question about your stat that it takes 30 tons of dirt for one ounce of gold. I do not understand how gold companies can make a profit on the less than $ 500 you receive for an ounce of gold. It does not make sense, especially when you consider that the payment comes years after you made an up-front investment for equipment, fuel, land and labor to mine and move up to 100 tons of rock, then leach it and finally refine the ounce of gold. Can you explain?

Kirk Johnson: That in many ways, is the central question of gold mining: Are all the costs being properly added up, or is the industry premised on tax breaks and/or defrayed costs that might have to be borne by governments and taxpayers.

The broader answer to your question, however, is summed up in the world "volume." Mining one $500 ounce would never make sense given the huge capital investment. But if there's a million ounces in the ground, given the mechanized operations and relatively small labor force required, the profit will come by just moving enough rock.

It's all about the almost unimaginable scale. A typical truck of the size being used in the open pit mines can carry about 300 tons of ore. One tire on these vehicles is about as big as a standard passenger car and costs $50,000. At one mine I visited, 200 such loads can be brought up every 24 hours.

Q. I wonder how many children work in the gold mines and under what kind of conditions.

Jane Perlez: In the mines we visited -- in Peru, Romania and Ghana -- we did not see any children. However, we were mostly in highly mechanized large scale mines. In most of these mines, the workers are almost entirely men, although in some places there are women truck drivers. The work is largely industrial: driving heavy machinery, etc.

We have heard of children working in very rough conditions in gold mines in Congo, but did not visit there so cannot confirm it. It's useful to remember that 20 percent of all gold mining is done by artisanal miners -- these are not companies, but people who use very labor intensive methods to extract ore from river beds, or waste rock left from mines. Sometimes, they work with their hands in tight, dark shafts dug deep in the ground.

Q. Do you have any information about where or how to buy jewelry in an environmentally and socially responsible way?

Johnson: I don't think there are any guarantees out there right now, even if a company said it was selling only environmentally or socially responsible jewelry, because the standard of what "responsible" or "sustainable" mining means has not been agreed upon by the industry. Some people are optimistic there might be a standard in the next few years, others less so. One place you might look at that claims to sell jewelry made only from recycled gold -- I can't vouch for it and have no financial interest -- is called greenkarat.com.

Q. How many companies like the Newmont Mining Corporation have you experienced from your years around the world, and do you see any real changes of attitudes from the Newmonts?

Perlez: I usually do not cover big corporations so I have to say I have not come up close with many of them. Each one is different. But I think it is interesting to note the effort by a mining company called BHP Billiton to sell a gold and copper mine in Papua New Guinea because of the environmental damage. Soon after that, BHP Billiton said they would not dispose of mine waste into rivers or into the oceans.

Q. I was wondering why the Western Shoshone Indians weren't even mentioned in your article when nearly 2/3 of the state is the second largest gold producing place in the world? And why was there no mention of the Summitville disaster in Colorado?

Johnson: Trying to cover an immense global topic like gold mining, even with 5,000 words at one's disposal, inevitably requires choices about the examples to site and the weight to give them. We will, however, be doing a subsequent article in this series that will focus more closely on the United States and The West.

Q. What is the least environmentally damaging metal to mine?

Johnson: The metal itself is less important than the geology of the rock in which it is found, and the type of mine that is dug to retrieve it. Copper and gold, in particular, are both often found in conjunction with sulfide rock that can produce acid and in turn release metal contaminants. Underground mines, whatever the metal, are also easier to manage for their environmental impact because the mined area is more compact and it's easier to seal or entomb areas that might become a problem.

Q. how does cyanide heap mining work? How is the gold-containing cyanide solution collected after being drizzled onto the rock heap?

Johnson: The sodium cyanide solution essentially dissolves the gold in the rock. At the bottom of the heap leach pad, this gold-bearing solution is then piped to a separating plant where either zinc or activated carbon is added to release the gold from the chemical bond.

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The Cost of Gold | The Hidden Payroll

Below a Mountain of Wealth, a River of Waste

By JANE PERLEZ and RAYMOND BONNER

JAKARTA, Indonesia - The closest most people will ever get to remote Papua, or the operations of Freeport-McMoRan, is a computer tour using Google Earth to swoop down over the rain forests and glacier-capped mountains where the American company mines the world's largest gold reserve.

With a few taps on a keyboard, satellite images quickly reveal the deepening spiral that Freeport has bored out of its Grasberg mine as it pursues a virtually bottomless store of gold hidden inside. They also show a spreading soot-colored bruise of almost a billion tons of mine waste that the New Orleans-based company has dumped directly into a jungle river of what had been one of the world's last untouched landscapes.

What is far harder to discern is the intricate web of political and military ties that have helped shield Freeport from the rising pressures that other gold miners have faced to clean up their practices. Only lightly touched by a scant regulatory regime, and cloaked in the protection of the military, Freeport has managed to maintain a nearly impenetrable redoubt on the easternmost Indonesian province as it taps one of the country's richest assets.

Months of investigation by The New York Times revealed a level of contacts and financial support to the military not fully disclosed by Freeport, despite years of requests by shareholders concerned about potential violations of American laws and the company's relations with a military whose human rights record is so blighted that the United States severed ties for a dozen years until November.

Company records obtained by The Times show that from 1998 through 2004, Freeport gave military and police generals, colonels, majors and captains, and military units, nearly $20 million. Individual commanders received tens of thousands of dollars, in one case up to $150,000, according to the documents. They were provided by an individual close to Freeport and confirmed as authentic by current and former employees.

Freeport said in a written response to The Times that it had "taken appropriate steps" in accordance with

American and Indonesian laws to provide a secure working environment for its more than 18,000 employees and contract workers.

"There is no alternative to our reliance on the Indonesian military and police in this regard," the company said. "The need for this security, the support provided for such security, and the procedures governing such support, as well as decisions regarding our relationships with the Indonesian government and its security institutions, are ordinary business activities."

While mining and natural resource companies sometimes contribute to the costs to foreign governments in securing their operations, payments to individual officers raise questions of bribes, said several people interviewed by The Times, including a former Indonesian attorney general, who said it was illegal under Indonesian law for officers to accept direct payments.

The Times's investigation also found that, according to one current and two former company officials who helped set up a covert program, Freeport intercepted e-mail messages to spy on its environmental opponents. Freeport declined to comment.

More than 30 current and former Freeport employees and consultants were interviewed over the past several months for this article. Very few would speak for attribution, saying they feared the company's retribution.

Freeport's support of the military is one measure of its extraordinary working environment. In the 1960's, when Freeport entered Papua, its explorers were among the very first outsiders ever encountered by local tribesmen swathed only in penis gourds and armed with bows and arrows.

Since then, Freeport has built what amounts to an entirely new society and economy, all of its own making. Where nary a road existed, Freeport, with the help of the San Francisco-based construction company Bechtel, built virtually every stitch of infrastructure over impossible terrain in engineering feats that it boasts are unparalleled on the planet.

That history, Papua's extreme remoteness and the company's long ties to the Indonesian government have given Freeport exceptional sway over a 21st-century version of the old company town, built on a scale unique even by the standards of modern mega-mining.

"If any operation like this was put forward now, it wouldn't be allowed," said Witoro Soelarno, a senior investigator at the Department of Energy and Mineral Resources, who has visited the mine many times. "But now the operation exists, and many people depend on it."

For years, to secure Freeport's domain, James R. Moffett, a Louisiana-born geologist who is the company chairman, assiduously courted Indonesia's longtime dictator, President Suharto, and his cronies, having Freeport pay for their vacations and some of their children's college education, and cutting them in on deals that made them rich, current and former employees said.

It was a marriage of mutual convenience. As Freeport prospered into a company with $2.3 billion in revenues, it also became among the biggest - in some years the biggest - source of revenue for the government. It remains so.

Freeport says that it provided Indonesia with $33 billion in direct and indirect benefits from 1992 to 2004, almost 2 percent of the country's gross domestic product. With gold prices hitting a 25-year high of $540 an ounce this month, the company estimates it will pay the government $1 billion this year.

With Suharto's ouster in 1998, after 30 years of unchallenged power, Freeport's special place was left vulnerable. But its importance to Indonesia's treasury and its carefully cultivated cocoon of support have helped secure it against challenges from local people, environmental groups, and even the country's own Environment Ministry.

Letters and other documents provided to The Times by government officials showed that the Environment Ministry repeatedly warned the company since 1997 that Freeport was breaching environmental laws. They also reveal the ministry's deep frustration.

At one point last year, a ministry scientist wrote that the mine's production was so huge, and regulatory tools so weak, that it was like "painting on clouds" to persuade Freeport to comply with the ministry's requests to reduce environmental damage.

That frustration stems from an operation that, by Freeport's own estimates, will generate an estimated six billion tons of waste before it is through - more than twice as much earth as was excavated for the Panama Canal.

Much of that waste has already been dumped in the mountains surrounding the mine or down a system of rivers that descends steeply onto the island's low-lying wetlands, close to Lorentz National Park, a pristine rain forest that has been granted special status by the United Nations.

A multimillion-dollar 2002 study by an American consulting company, Parametrix, paid for by Freeport and its joint venture partner, Rio Tinto, and not previously made public, noted that the rivers upstream and the wetlands inundated with waste were now "unsuitable for aquatic life." The report was made available to The Times by the Environment Ministry.

Freeport says it strives to mitigate the environmental effect of its mine, while also maximizing the benefits to its shareholders. The Times made repeated requests to Freeport and to the Indonesian government to visit the mine and its surrounding area, which requires special permission for journalists. All were turned down.

Freeport refused to make any official available for an interview and would respond to questions only in writing. A cover letter signed by its legal counsel, Stanley S. Arkin, said that Grasberg is a copper mine, with the gold retrieved as a byproduct, and that many journalists had visited the mine before the government tightened its rules in the 1990's. "Freeport has nothing to hide," Mr. Arkin wrote.

Indeed, at Grasberg, Freeport-McMoRan Copper & Gold mines the world's third-largest copper deposit. The mine also has proven reserves of 46 million ounces of gold, according to the company's 2004 annual report. This year, Mining International, a trade journal, called Freeport's gold mine the biggest in the world.

Social Tensions Erupt

Since Suharto's ouster, Freeport employees say, Mr. Moffett's motto has been "no tall trees," a call to keep as low a profile as possible, for a company that operates on an almost unimaginable scale.

But even before then, the new world that Freeport created was growing smaller. By the mid-1990's, with production in full swing, and the expanding impact of Grasberg's operations ever more apparent, Freeport was beset on all sides.

Environmental groups, able to coordinate more effectively with the Internet, made Freeport a target. Local tribes were more and more restless at seeing little benefit for themselves as vast riches were extracted from their lands. And some military commanders in Papua saw Grasberg's increasing value as ripe for the plucking.

To fortify itself, Freeport, working hand in hand with Indonesian military intelligence officers, began monitoring the e-mail messages and telephone conversations of its environmental opponents, said an employee who worked on the program and read the e-mail messages.

The company also set up its own system to intercept e-mail messages, according to former and current employees, by establishing a bogus environmental group of its own, which asked people to register online with a password. As is often the case, many who registered used the same password for their own messages, which then allowed the company to tap in.

Freeport's lawyers were nervous, a person who was at the company at the time said, but decided that nothing prohibited the company legally from reading e-mail messages abroad.

Social tensions around the mine, meanwhile, were fast growing, as was Papua's population. Papua, mostly animist and Christian after long years of missionary work, is distinct in many ways from the rest of Indonesia, the world's largest Muslim country.

Almost from Indonesia's independence, the province had rumblings of a separatist movement. Throughout Indonesia the military, a deeply nationalist institution, finances itself by setting up legal enterprises like shopping centers and hotels, or illicit ones, like logging. In Papua, the Grasberg mine became a chance for the military not only to profit but also to deepen its presence in a province where it had barely a toehold before Freeport arrived.

For many years Freeport maintained its own security force, while the Indonesian military battled a weak, low-level insurgency. But slowly their security needs became entwined.

"Where Freeport really took it on the chin is the military who came in had no vehicles, and they would commandeer a Freeport bus or a Freeport driver," said the Rev. David B. Lowry, an Episcopalminister hired by Mr. Moffett to oversee social programs. "We had no policies at that time."

No investigation directly linked Freeport to human rights violations, but increasingly Papuans associated it with the abuses of Indonesian military units, in some cases using company facilities.

An Australian anthropologist, Chris Ballard, who worked for Freeport, and Abigail Abrash, an American human rights campaigner, estimated that 160 people had been killed by the military between 1975 and 1997 in the mine area and its surroundings.

Finally, in March 1996, long-simmering anger at the company erupted in rioting when anti-mine sentiment among different groups coalesced into what was perhaps the biggest threat to the company to this day.

The mine and its mill were shut down for three days. Rioters destroyed $3 million of equipment and ransacked offices.

The company intercepted e-mail messages that, according to two persons who read them at the time, suggested that certain military units, the community and environmental groups were working together.

One e-mail exchange, between a community leader and the head of an environmental group, was filled with tactical military intelligence, according to a person who read the messages. In another exchange, an environmental leader urged the group's members to pull out because the demonstrations had turned violent.

Freeport told The Times that local leaders later met with company officials and said "they had provoked the disturbances as a means of expressing their aspiration to receive greater benefits from our operations."

In recent interviews, current and former Freeport officials recalled how they were stunned when, among those rioting, they saw men with military haircuts, combat boots and walkie-talkies. They seemed to be directing the rioters, at one point, to a Freeport laboratory, which they ransacked.

It was not long before a worried Mr. Moffett flew out to Indonesia in the company jet.

Freeport refused to comment on the meeting that followed. But a company official who was there recounted that Mr. Moffett met with a group of senior Indonesian military officers at the Sheraton Hotel in the lowland town of Timika, near the mine. The all-powerful Gen. Prabowo Subianto, son-in-law of President Suharto and commander of the Indonesian Special Forces, presided.

"Mr. Moffett, to protect you, to protect your company, you have to help the military here," General Prabowo began, according to the company employee who was present.

Mr. Moffett is said to have replied: "Just tell me what I need to do."

The Cost of Security

Each military service drew up its wish list, current and former company employees said.

In short order, Freeport spent $35 million on military infrastructure - barracks, headquarters, mess halls, roads - and it also gave the commanders 70 Land Rovers and Land Cruisers, which were replaced every few years. Everybody got something, even the Navy and Air Force.

The company had already hired a former C.I.A. operative, and on his recommendation, it now approached a military attaché at the American Embassy in Jakarta, and persuaded him to join the company, according to former and current employees. Two more former American military officers were hired, and a special department, called the Emergency Planning Operation, was set up to handle the company's new relationship with the Indonesian military.

The new department began making direct monthly payments to Indonesian military commanders, while the Security Risk Management office handled the payments to the police, according to company documents and current and former employees.

"They signed a pact with the devil," said an American who was part of Freeport's security operations at the time, and who agreed with the company's decision.

Freeport gave the military and the police in Papua at least $20 million from 1998 to May 2004, according to company documents. In interviews, current and former employees said that at least an additional $10 million was also paid during those years.

Seven years of accounting records were provided to The Times by an individual close to the company. Additional records for three years were provided by Global Witness, a nongovernment organization, which released a report last July, "Paying for Protection," about Freeport's relations with the Indonesian military.

Diarmid O'Sullivan, who works for Global Witness in London, criticized the payments. It may be necessary for a company to help governments with security, he said, but "they should give the money through the proper channels, in a transparent way."

Freeport told The Times, "Our books and records are transparent and accurately reflect the support that we provide."

That support, the company said in its responses, included "mitigating living costs," as well as "infrastructure, catered food and dining hall costs, housing, fuel, travel, vehicle repairs, allowances to cover incidental and administrative costs, and community assistance programs conducted by the military and police."

The company said all of its expenditures were subject to a budget review process.

The records received by The Times showed payments to individual military officers listed under things like "food cost," "administrative services" and "monthly supplement."

Current and former employees said the accounting categories did not reflect what the money was actually used for, and that it was likely that much of the money went into the officers' pockets. The commanders who received the money did not have to sign receipts, current and former employees said.

Asked if there was a reason Freeport would give money directly to military officers, Father Lowry, who retired in March 2004, but remained a consultant to Freeport until June, said, "I can't think of a good one."

The records show that the largest recipient was the commander of the troops in the Freeport area, Lt. Col. Togap F. Gultom.

During six months in 2001, he was given just under $100,000 for "food costs," according to the company records, and more than $150,000 the following year. Freeport gave at least 10 other commanders a total of more than $350,000 for "food costs" in 2002, according to the records.

Colonel Gultom declined to be interviewed.

Those payments were made to individual officers, current and former employees said, even though since the riots Freeport had allowed soldiers to eat in the company's mess and had trucked food to more distant military kitchens. "Three meals a day, seven days a week," a former official said.

Freeport also gave commanders commercial airplane tickets for themselves and their wives and children. Generals flew first or business class and lower ranking officers flew economy, said Brig. Gen. Ramizan Tarigan, who received $14,000 worth of tickets in 2002 for himself and his family.

General Tarigan, who held a senior police post, said that police officers were allowed to accept airplane tickets because their pay was so low - as a general, his base salary was roughly $400 a month - but that it was in violation of police regulations to receive cash payments.

In April 2002, the company gave the senior commander of forces in Papua, Maj. Gen. Mahidin Simbolon, more than $64,000, for what was described in Freeport's books as "fund for military project plan 2002." Eight months later, in December, he was given more than $67,000 for a "humanitarian civic action project." The payments were first reported by Global Witness.

General Simbolon, who is now inspector general of the Indonesian Army, declined requests to be interviewed.

A former Freeport employee who was involved in making those payments said the company could not be certain how much of the money General Simbolon actually spent on those projects.

Unsolved Killings

By 2003, following the Enron scandal and passage of the Sarbanes-Oxley Act, which imposed more rigid accounting practices on companies, Freeport began making payments to military and police units instead of individual officers, according to records and current and former employees.

The company paid police units in Papua slightly under $1 million in 2003, according to the records, listed under items like "monthly supplement payment," "administrative costs" and "administrative support."

Freeport told The Times that "company policies take into account the potential for human rights abuses in determining what types of assistance to provide."

According to the records received by The Times, the police Mobile Brigade, a paramilitary force often cited by the State Department for its brutality, received more than $200,000 in 2003.

In its 2003 annual human rights report, the State Department said soldiers from the Mobile Brigade "continued to commit numerous serious human rights violations, including extrajudicial killings, torture, rape, and arbitrary detention." It cited no specific incidents from Papua.

There was another reason for extra care by the company.

In August 2002, three teachers employed by Freeport, including two Americans, were killed in an ambush on a company road patrolled by the military that Freeport had paid to protect its employees. Three years later, the F.B.I. is still investigating and the reasons for the killings have not been determined. Freeport said that it could not comment on the investigation.

The United States indicted a Papuan, Anthonius Wamang, in 2004. But it has yet to receive the full cooperation of the military, several American officials said.

Freeport employees and American officials said the killings could have been part of a turf war between the military and the police, each of which wanted access to Freeport payments.

An initial report by the Indonesian police pointed to the Indonesia military, and some Freeport and Bush administration officials have said they suspect some level of military involvement.

The police report suggested that the motivation was that Freeport was threatening to cut its support to soldiers. Soldiers assigned to Papua have "high expectations," the report said, but recently, "their perks, such as vehicles, telephones, etc., were reduced."

Questions of Accountability

Freeport has resisted nearly any detailed disclosure of its payments to the military, saying they are legal and even required under Indonesian law.

Marsillam Simanjuntak, who was minister of justice and later attorney general in one of the first governments after the fall of President Suharto, said it was a violation of Indonesian law for soldiers or police officers to accept payments from a company. "Of course, it's illegal," he said.

But many companies do it, he said. The better question to ask, he said, was, "Is it allowed by the laws of the United States?"

This year, the New York City pension funds submitted a shareholder resolution asking Freeport to review its policy on paying the police and military. They argued that it could violate the Foreign Corrupt Practices Act, which forbids American companies from paying bribes to foreign officials. Freeport opposed the resolution.

In 2002, the funds submitted a similar resolution demanding that Freeport disclose how much it was paying to the military. Freeport kept it off the ballot.

In later filings with the Securities and Exchange Commission, Freeport reported that it had paid the military a total of $4.7 million in 2001, and $5.6 million in 2002. The company did not indicate whether the money was paid into commanders' personal accounts, or what the money was used for.

Freeport, in its responses, said it was complying with the Voluntary Principles on Security and Human Rights, a set of guidelines drawn up by the State Department. They recognize that natural resource companies "may be required or expected to contribute to, or otherwise reimburse, the costs of protecting company facilities."

The principles do not address the question of direct payments to individual officers. Nor do they require companies to account for the payments.

Freeport has also said that the payments were required under its Contract of Work, its basic agreement with the government of Indonesia, first signed in 1967 and updated in 1991.

The company declined to provide a copy of the contracts to The Times. A copy of each was provided by Denise Leith, author of "The Politics of Power: Freeport in Suharto's Indonesia." They contained no language requiring payments to the military.

S. Prakash Sethi, head of the International Center for Corporate Accountability, which recently concluded a report on Freeport's development policies in Papua, said that the company had told him that it made "in-kind" contributions to the military, for housing and food, but that he had not been given access to accounting records.

Any direct payments to military officers would be illegal, said Mr. Sethi, an expert on business ethics and corporate social responsibility and a professor at Baruch College. "It's corruption," he said. "It's bribery."

Mine Waste in the Rivers

All the while Freeport sealed its relations with the military, the country's fledgling environment ministry could do little but watch as waste from the mine piled up.

This year Freeport told the Indonesian government that the waste rock in the highlands, 900 feet deep in places, now covers about three square miles.

Down below, nearly 90 square miles of wetlands, once one of the richest freshwater habitats in the world, are virtually buried in mine waste, called tailings, with levels of copper and sediment so high that almost all fish have disappeared, according to environment ministry documents.

The waste, the consistency and color of wet cement, belts down the rivers, and inundates and smothers all in its path, said Russell Dodt, an Australian civil engineer who managed the waste on the wetlands for 10 years until 2004 for Freeport.

About a third of the waste has moved into the coastal estuary, an essential breeding ground for fish, and much of that "was ripped out to sea by the falling tide that acted like a big vacuum cleaner," he said.

But no government, even in Indonesia's new democratic era, has dared encroach on Freeport's prerogatives. The strongest challenge came in 2000, when a feisty politician, Sonny Keraf, who was sympathetic to the Papuans, was appointed environment minister.

Again, Mr. Moffett flew out to Jakarta.

Mr. Keraf initially refused to see the Freeport boss, but eventually agreed, and on the day kept him waiting for an hour and a half. "He came in so arrogant," Mr. Keraf recalled of the meeting in a recent interview, "sitting with his legs crossed."

Freeport refused to comment on the meeting. The American ambassador to Indonesia at the time, Robert Gelbard, said in an interview: "It was a terrible meeting."

Mr. Keraf said that Mr. Moffett had said that his company had never polluted. "I told him that he should spend the money he spent on paying off people not to talk about the mine to properly dispose of the waste," Mr. Keraf said.

Behind the scenes, Mr. Keraf kept up the pressure, angered that the company was using the rivers, forest and wetlands for its mine waste, a process allowed during the Suharto years.

An internal ministry memorandum from 2000 said the mine waste had killed all life in the rivers, and said that this violated the criminal section of the 1997 environmental law.

In January 2001, Mr. Keraf wrote to the coordinating minister for economic affairs, arguing that Freeport should be forced to pay compensation for the rivers, forests and fish that its operations had destroyed.

Six months later, one of his deputies, Masnellyarti Hilman, wrote to Freeport, saying a special environmental commission had recommended that the company stop using the river as a waste chute, and instead build a system of pipes.

She also told Freeport to build sturdier dam-like walls to replace the less solid levees that it used to contain the waste on the wetlands. That practice has continued.

Freeport says that local and regional governments have approved its waste management plans, and that the central government has approved its environmental impact statement and other monitoring plans.

But in a blistering July 2001 letter, Mr. Keraf took the governor of Papua to task for granting Freeport a permit in 1996 to use the rivers for its waste. The governor, Mr. Keraf said, had no authority to grant permits more lenient than the provisions of national laws.

Despite all these efforts, nothing happened. Mr. Keraf was unable to secure the support of other government agencies or his superiors in the cabinet.

In August 2001, a new government came to power, and a less aggressive minister, Nabiel Makarim, replaced Mr. Keraf. At first, he, too, talked publicly of setting stricter limits on Freeport. Soon his efforts petered out.

The Environment Ministry has begun trying to put teeth into its rules where it can. It brought a criminal suit against the world's largest gold company, Newmont Mining Corporation, for alleged pollution, including a charge of not having a permit for disposing of mine waste into the sea. Newmont has fought the charges vigorously.

But in the case of Freeport, the ministry has had no traction. Freeport still does not hold a permit from the national government to dispose of mine waste, as required by the 1999 hazardous waste regulations, according to Rasio Ridho Sani, assistant deputy for toxic waste management at the ministry. Mr. Arkin, Freeport's counsel, said that the company cooperated well with the environment ministry and that Freeport would not otherwise comment.

"Freeport says their waste is not hazardous waste," Mr. Rasio said. "We cannot say it is not hazardous waste." He said his division and Freeport were now in negotiations on how to resolve the permit question.

'A Massive Die-Off'

The environment ministry was not the first to challenge Freeport over how it has disposed of its waste in Papua.

The Overseas Private Investment Corporation, a United States government agency that insures American corporations for political risk in uncertain corners of the world, revoked Freeport's insurance policy in October 1995.

It was a landmark decision, the first time that the agency had cut off insurance to any American company for environmental or human rights concerns.

In doing so, two environmental experts, Harvey Himberg, an official at the agency, and David Nelson, a consultant, after visiting the mine for several days, issued a report critical of Freeport's operations, especially the huge amounts of waste it had sent into rivers, something that would not be allowed in the United States.

The company went to court to block the report from being made public, and only a redacted version was later released. A person who thought it should be made public provided an uncensored copy to The Times.

Freeport says the report reached "inaccurate conclusions." The company says it has considered a full range of alternatives for managing and disposing of its waste, instead of using the river, and settled on the best one.

A storage area would not be large enough and would require a tall dam in a region of heavy rainfalls and earthquakes, it said. A waste pipeline, rather than the river, would be too costly, prone to landslides and floods.

To the American auditors, such arguments were not convincing.

Freeport "characterizes engineered alternatives as having the highest potential for catastrophic failure when the project otherwise takes credit for legendary feats," the audit noted, like the pipelines more than 60 miles long down the mountains to carry fuel and copper and gold slurry.

At the time, the waste was jumping the riverbanks, "resulting in a massive die-off of vegetation," the report said.

The company threatened to take the agency to court over the cancellation of its insurance. After protracted negotiations, the policy was reinstated for a few months, as a face-saving gesture to Mr. Moffett, according to the head of the agency then, Ruth Harkin. It was not renewed.

Today, many of the same problems persist, but on a much larger scale. A perpetual worry is where to put all the mine's waste - accumulating at a rate of some 700,000 tons a day.

The danger is that the waste rock atop the mountain will trickle out acids into the honeycomb of caverns and caves beneath the mine in a wet climate that gets up to 12 feet of rain a year, say environmental experts who have worked at the mine.

Stuart Miller, an Australian geochemist who manages Freeport's waste rock, said at a mining conference in 2003 that the first acid runoffs began in 1993.

The company can curb much of it today, he said, by blending in the mountain's abundant limestone with the potentially acid producing rock, which is also plentiful. Freeport also says that the company collects the acid runoff and neutralizes it.

But before 2004, the report obtained by The Times by Parametrix, the consulting company who did the study for Freeport, said that the mine had "an excess of acid-generating material."

A geologist who worked at the mine, who declined to be identified because of fear of jeopardizing future employment, said acids were already flowing into the groundwater. Bright green-colored springs could be seen spouting several miles away, he said, a tell-tale sign that the acids had leached out copper. "That meant the acid water traveled a long way," he said.

Freeport says that the springs are "located several miles from our operations in the Lorentz World Heritage site and are not associated with our operations."

The geologist agreed that the springs probably were in the Lorentz park, and said this showed that acids and copper from the mine were affecting the park, considered a world treasure for its ecological diversity.

In the lowlands, the levees needed to contain the waste will eventually reach more than 70 feet high in some places, the company says.

Freeport says that the tailings are not toxic and that the river it uses for its waste meets Indonesian and American drinking water standards for dissolved metals. The coastal estuary, it says, is a "functioning ecosystem."

The Parametrix report shows copper levels in surface waters high enough to kill sensitive aquatic life in a short time, said Ann Maest, a geochemist who consults on mining issues. The report showed that nearly half of the sediment samples in parts of the coastal estuary were toxic to the sensitive aquatic organisms at the bottom of the food chain, she said.

The amount of sediment presents another problem. Too many suspended solids in water can smother aquatic life. Indonesian law says they should not exceed 400 milligrams per liter.

Freeport's waste contained 37,500 milligrams as the river entered the lowlands, according to an environment ministry's field report in 2004, and 7,500 milligrams as the river entered the Arafura Sea.

Freeport would not comment on the measurements. The company says it spent $30 million on environmental programs in 2004, and planted 50,000 mangrove seedlings last year as part of its reclamation efforts. It says cash crops can be grown on the waste with the addition of nutrients, and has begun demonstration projects.

An Uneasy Coexistence

If the accumulating waste is the despair of critics, for Freeport it signals expanding production. To keep its mine running, the company has increasingly had to play caretaker for the world that it has created.

After the 1996 riots, Freeport began dedicating 1 percent of revenues annually to a development fund for Papua to pay for schools, medical services, roads - whatever the people wanted.

The company built clinics and two hospitals. Other services include programs to control malaria and AIDS and a "recognition" fund for the Kamoro and Amungme tribes of several million dollars which, among other things, gives them shares in the company as part of a compensation package for the lands Freeport is using.

By the end of 2004, Freeport had spent $152 million on the community development fund, the company said.

Mr. Sethi, of the Center for Corporate Accountability, commended Freeport for commissioning the report on the company's development programs, saying that it was the first mining company to do so.

The report, which was released in October, concluded that the company had successfully introduced a human rights training program for its employees and had doubled the number of Papuan employees by 2001. The company was poised to double the number of Papuans in the work force again by 2006, the audit said.

Still, Thom Beanal, the Amungme tribal leader, says the combined weight of the Indonesian government and Freeport has left his people in bad shape. Yes, he said, the company had provided electricity, schools and hospitals, but the infrastructure was built mainly for the benefit of Freeport.

Mr. Beanal, 57, a vocal supporter of independence for Papua, has fought the company from outside and inside. In 2000, he decided that harmony was the better path, and joined the company's advisory board.

In November, he and other Amungme and Komoro tribesmen met with Mr. Moffett at the Sheraton Hotel in Timika. In an interview in Jakarta not long afterward, Mr. Beanal said he told Mr. Moffett that the flood of money from the community fund was ruining people's lives.

When the company arrived, he noted, there were several hundred people in the lowland village of Timika. Now it is home to more than 100,000 in a Wild West atmosphere of too much alcohol, shootouts between soldiers and the police, AIDS and prostitution, protected by the military.

Still more soldiers are on the way. Having negotiated an end to a separatist insurrection this year in another province, Aceh, the government is redeploying soldiers to Papua in a move to defeat the growing enthusiasm for independence, once and for all, and to watch over the province with the world's biggest gold mine. Freeport says its gold ore has 35 years to go.

Mr. Beanal said he was increasingly impatient with the presence of the soldiers and the mine. "We never feel secure there," he said. "What are they guarding? We don't know. Ask Moffett, it's his company."

Evelyn Rusli contributed reporting for this article.

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