

BLAINE HARDEN

The Dirt in the New Machine

FROM *The New York Times Magazine*

BEFORE YOU MAKE another call on that cell phone, take a moment, close your eyes, and reflect on all you've done for Mama Doudou, queen of the rain-forest whores.

Thanks to dollars that you and millions like you have spent on cell phones and Sony PlayStations, Mama Doudou had a knockout spring season in a mining camp called Kuwait, deep in central Africa. Kuwait — a name suggesting big money from below ground — was one of twenty illegal mines hacked in the past year out of the Okapi Faunal Reserve, a protected area in the Ituri rain forest of eastern Congo. The reserve is named after a reclusive, big-eared relative of the giraffe that is found only in Congo. Along with about four thousand okapi, the reserve is home to a rich assemblage of monkeys (thirteen species), an estimated ten thousand forest elephants, and about the same number of Mbuti people, often called pygmies, who live by hunting, gathering, and trading.

Mama Doudou, though, didn't mess with wildlife or pygmies. She sold overpriced bread in the mining camp and negotiated terms of endearment among three hundred miners and thirty-seven prostitutes. For a miner to secure the affections of a prostitute, he had to bring Mama Doudou some of the precious ore he was digging up in the reserve: a gritty, superheavy mud called coltan.

Coltan is abundant and relatively easy to find in eastern Congo. All a miner has to do is chop down great swaths of the forest, gouge SUV-size holes in streambeds with pick and shovel, and spend days up to his crotch in muck while sloshing water around in a plastic

washtub until coltan settles to the bottom. (Coltan is three times heavier than iron, slightly lighter than gold.) If he is strong and relentless and the digging is good, a miner can produce a kilogram a day. Earlier this year, that was worth eighty dollars — a remarkable bounty in a region where most people live on twenty cents a day.

Coltan is the muck-caked counterpoint to the brainier-than-thou, environmentally friendly image of the high-tech economy. The wireless world would grind to a halt without it. Coltan, once it is refined in American and European factories, becomes tantalum, a metallic element that is a superb conductor of electricity, highly resistant to heat. Tantalum powder is a vital ingredient in the manufacture of capacitors, the electronic components that control the flow of current inside miniature circuit boards. Capacitors made of tantalum can be found inside almost every laptop, pager, personal digital assistant, and cell phone.

Mama Doudou, who is forty-five, is formally known as Doudou Wangonda, but she is called Mama because in the rain forest she is widely respected. She told me she doesn't understand what "rich white people" do with coltan. But she's exceptionally well versed in how much they pay for it. Late last year, exploding demand for tantalum powder created a temporary worldwide shortage, which contributed to Sony's difficulties in getting its new PlayStation 2 into American stores, as well as to a tenfold price increase on the world tantalum market. Mama Doudou abandoned her position as a traditional chief and joined thousands of people who walked into the Ituri forest hoping to get rich quick.

When the price of coltan was soaring, Mama Doudou made an absolute killing. First, she sold bread to miners at a scandalous price. She made as much as \$800 worth of coltan for every \$50 in cash that she spent on baking supplies. Then she used what she called her "natural leadership abilities" to win election as president of the camp prostitutes, most of whom were poorly educated, town-bred women in their late teens. As president, Mama Doudou collected — and turned over to the owner of the mine — a variety of fees and fines related to the mating habits of miners and their women.

The normal arrangement in the camp was for a miner, after forking over a kilo of coltan to Mama Doudou, to pair off with one woman for the duration of their respective stays in the forest. The

miner's "temporary wife" would cook his food, haul his water, and share his bed in a shack made of sticks and leaves. In return, he would give her enough coltan to keep her in cosmetics, clothes, and beer. If a miner decided that he wanted a prettier young woman to haul his water, he had to pay Mama Doudou another kilo of coltan.

"This is called the infringement fee," she explained.

Likewise, if a woman decided, as many did, to dump one miner in favor of another who happened to be a better producer of coltan, then she, too, had to pay Mama Doudou a kilo of coltan.

"This also is called the infringement fee," she said.

Frequent swapping of "temporary wives" in an equatorial forest where hygiene was problematic and condoms all but nonexistent led to an explosion of gonorrhea.

"There was too much sofisi," Mama Doudou said, using the Swahili word for the disease. Soon half the people in Kuwait had it. Antibiotics that could knock down gonorrhea were on sale in the camp for a tomato tin of coltan (worth about \$27). They sold exceptionally well.

Mama Doudou's business ventures were part of a squalid encounter between the global high-tech economy and one of the world's most thoroughly ruined countries.

Congo — always too well endowed with natural resources and too weakly governed for its own good — is a nation in name only. The Democratic Republic of the Congo is in the late stages of a political malady that students of modern Africa call "failed state syndrome." Roads, schools, and medical clinics barely exist. Malnutrition and poverty have brought back diseases, like sleeping sickness, that had been under control. The World Health Organization recently estimated that the monthly toll of "avoidable deaths" in Congo was 72,800.

The eastern half of the country, with about 20 million residents, has no real government and no laws except the ever-changing rules imposed by invading armies from Rwanda and Uganda and roving bands of well-armed predators.

A scalding report that was presented this spring to the United Nations Security Council said that coltan perpetuates Congo's civil war. The report, based on a six-month investigation by an expert panel, said the war "has become mainly about access, control, and trade" of minerals, the most important being coltan. The one thing

that unites the warring parties, according to the report, is a keen interest in making money off coltan.

"Because of its lucrative nature," the report said, the war "has created a 'win-win' situation for all belligerents. Adversaries and enemies are at times partners in business, get weapons from the same dealers, and use the same intermediaries. Business has superseded security concerns."

Environmental groups have added emotional fuel to the accusations in the UN report by cataloguing the devastation that the coltan trade has brought to Congo's wildlife. About ten thousand miners and traders have overrun Kahuzi-Biega National Park, according to a report released in May by a coalition of environmental groups. Before the civil war, the park was home to about eight thousand eastern lowland gorillas. That number may have since been reduced to fewer than one thousand, the report estimated, because miners and others in the forest are far from food supplies and must rely on bush meat. Apes are killed for food or killed in traps set for other animals. If something is not done to stop mining and poaching, the report said, the eastern lowland gorilla "will become the first great ape to be driven to extinction — a victim of war, human greed, and high technology."

While coltan extraction has taken advantage of Congo's ruin, it did not cause it. That has taken more than 110 years of misrule, during which Congo has attracted a string of shady suitors.

The most malign of the courtships began in the late nineteenth century, when agents of King Leopold II of the Belgians started stripping central Africa of ivory and rubber. To enforce production quotas on the locals, Leopold's agents chopped off their hands, noses, and ears. Before the king was forced to trade away the hugely profitable colony in 1908, an estimated five million to eight million Congolese were killed.

In the 1960s, the Americans waded in. To fight Communism and secure access to cobalt and copper, the Central Intelligence Agency helped bring about the assassination of Congo's first democratically elected prime minister, Patrice Lumumba. That was followed by three decades of White House coddling of his successor, Mobutu Sese Seku, Africa's most famous billionaire dictator, who set a poisoned table for the chaos that followed his eventual overthrow in 1997.

Since then, Congo has been locked in a sprawling and numb-

ingly complicated civil war that by some estimates has become the deadliest conflict in the history of independent Africa. The war has caused the deaths of 2.5 million people over the past two and a half years in eastern Congo alone, according to a recent report by the International Rescue Committee, a New York-based aid agency, which described the emergency in Congo as "perhaps worse than any to unfold in Africa in recent decades."

The coltan story seemed clear when I flew to Congo early this summer. Globalization was causing havoc in a desperate country. For the sake of our electronic toys, guerrillas were getting rich, gorillas were getting slaughtered, and the local people were getting paid next to nothing to ruin their country's environment. Traveling inside Congo, however, I found clarity on the question of coltan to be as scarce as paved roads, functioning schools, or sober soldiers.

What muddied up the story, first of all, was the curiously egalitarian quality of coltan mining. Just about anyone with a shovel and a strong back can dig it up. It's easier to find and more plentiful than diamonds, which have created their own blood frenzy in Africa. It has injected hundreds of millions of dollars into an economy that had virtually ceased to function. True, much of that money has been creamed off by warlords and profiteers, and very little of it has been redistributed in social services. Some, though, has filtered down to miners, middlemen, and merchants.

To discover the importance of coltan's trickle-down effect (and to meet Mama Doudou), I first had to take a spine-mashing, thirteen-hour ride on the back of a Yamaha trail bike over a mud track that used to be the main east-west highway across northern Congo.

The road I traveled is all but impassable to motorized vehicles, excepting a trail bike driven by someone who knows how to negotiate mammoth mudholes, many of which are deeper and longer than a New York City garbage truck, as well as when to bribe drunken rogue soldiers and when to run from them.

Riding through the reserve, I was menaced by a Congolese soldier, a member of the Front for the Liberation of Congo, a poorly disciplined rebel group supported by the Ugandan Army. He demanded my boots, explaining that he didn't have boots. He demanded money, explaining that he had none. He pointed his AK-47 at my stomach. Gunning the Yamaha, my driver sped away be-

fore the soldier, who was stumble-down drunk, could react. This encounter, my driver later explained, was normal.

In Epulu, a village that is the administrative center of the Okapi reserve, I spent an afternoon with a coltan miner named Munako Bangazuna, a quiet, wary man who stood only four feet six inches tall. Early this year, Bangazuna enjoyed what he called "my richest period." In a mine inside the Okapi reserve, he dug about a kilo of coltan a day, he said. Working seven days a week, he made more than \$2,000 a month for two months in a row — a fortune in the forest.

He is twenty-six and married with children. Mining allowed him to provide his family with food and consumer goods he never dreamed he'd be able to afford. Besides food, he bought a bicycle, a radio, a foam mattress, cooking pots, dishes, and clothes for himself, his wife, and his kids.

Bangazuna does not claim to have spent his money wisely. The mining camp where he lived was called Boma Libala, a phrase that means "kill the marriage." It was the largest and, by reputation, nastiest mining camp in the reserve, with three thousand miners and several hundred prostitutes.

"I lost a lot of my money on prostitution and also on Primus," said Bangazuna, referring to a brand of Congolese beer. His wife cooked for him in Boma Libala, he said, during the time he was drinking lots of beer and spending most of his money on prostitutes. "I was lucky," he said. "She did not divorce me."

Bangazuna was hardly alone in his bad behavior. One coltan moment that particularly nauseates authorities occurred this spring in Epulu, when a drunken miner and a seminaked prostitute fornicated in broad daylight on the lawn of the primary school, in front of village children.

Like several miners I interviewed in the reserve, a territory controlled by the Ugandan military and its rebel allies, Bangazuna was compelled to give up a slice of his coltan diggings to an extortion racket run by Ugandan soldiers.

"In the morning, when you get up, the Ugandans hand you a pack of cigarettes, and they give you two bottles of beer," said Bangazuna, explaining his daily routine. "In the evening, when you finish digging, you have to pay them back with coltan. It was very expensive. One bottle of beer cost me two spoons of coltan" —

about eight dollars — and cigarettes were one spoon. If you refuse to pay or if you don't have coltan, they beat you and threaten to shoot you."

When I talked to Bangazuna, he was broke. He had spent all the money he'd earned digging coltan. He also happened to be under arrest. Game wardens (whose expenses are paid partly by donations from several American zoos) had caught him digging coltan in the reserve after he'd been warned not to do so.

When the wardens let him go, Bangazuna confided, he planned to dig more coltan.

This spring, the price of coltan crashed, falling from \$80 a kilo in March to \$8 in June. As cell phone sales slumped and the Nasdaq shrank, demand for coltan from companies like Nokia, Ericsson, and Motorola fell precipitously. Suddenly, a Congolese coltan miner had to dig coltan all day simply to afford to eat in a mining camp, and he had to dig for three or four days to find enough coltan to pay for the drugs that would clear up a case of sofsi.

At the Kuwait mine, everything came unglued. The prostitutes, then the merchants, then the miners and, finally, Mama Doudou herself abandoned the mine and walked out of the rain forest.

A few days before game wardens burned it to the ground, I visited another mine in the Okapi reserve. It was more accessible than Kuwait and, unlike the infamous but shut-down Boma Libala camp, where Bangazuna had squandered so much of his money, it still had a few working miners.

To get to Tuko-Tu camp, I walked for about two hours on a well-trod trail beneath a high canopy of trees. They shrouded the rain forest in permanent shadow. It rained hard as I walked, and the dark, soggy forest was threaded with filigrees of mist.

For all its gloom, the forest was about as primeval as a rest stop on the New Jersey Turnpike. Every half hour or so, two or three giggly women, seemingly dressed for a party in glistening lipstick and gaudy dresses, smelling of strong perfume, would materialize out of the dank greenery. Their bare feet were caked with mud; they carried their shoes. They were prostitutes from Tuko-Tu, and they were walking out to buy bread and beer in a village on the main road.

On both sides of the footpath, a towering mainstay of the forest was dying for the sake of coltan. The eko, one of three giant trees

that form the rain forest's canopy, has a durable, waterproof bark. Miners strip off a long girdle of the bark to make a trough into which they shovel coltan-bearing mud, which is then flushed with water. Stripping bark has killed thousands of eko trees in the reserve, which greatly upsets the local pygmies. They rely on the tree, whose flowers attract bees, as depots for gathering honey.

The mining camp squatted in a clearing hacked out of the forest. It was a jumble of stick huts with roofs made from forest leaves. Most of the huts were empty. The camp was down to 57 residents, from a high of 320 when coltan was at \$80 a kilo. Out in front of the huts, a few toddlers stood stoically in the mud as bored young mothers picked lice from their hair. Ugandan soldiers used to come here, I was told, to force miners to buy beer and cigarettes. But they had stopped coming in May, when the price of coltan began to fizzle. There were still miners, of course, but they were out digging, deeper in the forest.

So I walked on, following a streambed. After about an hour and a half of walking, the streambed suddenly disappeared. A bombing range took its place — or what looked like a bombing range. Craters, hundreds of them, many ten feet deep, all of them partly filled with muck, marched on for miles through the forest — until they ended in a cluster of about twenty-five miners. With shovels, picks, and plastic washtubs, they were creating more craters in the streambed.

Jean Pierre Asikima, forty-three, was among them. He gave up digging gold two months earlier, he said, to come into the forest in search of coltan. But the digging was poor, the price was low, and he said he was losing weight in the forest.

"I have come too late, and soon I will quit," he said, standing in a crater he had dug, waist-deep in muddy water that was the color of chicken gravy.

Still, Asikima worked with a fury. With mud and gravel from his crater, he built a seven-foot-high mound. Then he shoveled and scraped the mud into an eko-bark trough, while another miner, a sixteen-year-old who said his name was Dragon, went to work with a blue plastic washtub, pouring several hundred tubs full of water through the makeshift sluice.

After about an hour, a glittering black stain had gathered at the foot of the trough. It was an ounce or so of coltan, the fruit of five

hours of digging and washing. Asikima said it was not enough to buy a tin of rice for dinner. As he began to dig another crater, I asked him about his life in the forest. He said he despised it.

"If I had another job," he said, "I would not come here. But there are no other jobs. When this mine closes, I will go and find another one."

He is not alone. Although the price has crashed, many coltan-bearing regions of eastern Congo remain thick with miners, merchants, and prostitutes. In a country with a twenty-cents-a-day living standard, the chance of earning a few dollars from coltan is still a powerful enough reason to live in the bush and shovel muck, sell bread, and risk sofi.

To halt war profiteering and the destruction of wildlife, the report to the UN Security Council called for an embargo on the export of coltan and other natural resources from Uganda and Rwanda.

Although the embargo has yet to be imposed by the Security Council, European and American companies that profit from the coltan trade have been scurrying to avoid bad publicity. Pictures of dead gorillas and of environmental ruin in Congo's national parks have been particularly effective in triggering alarm among companies that pride themselves on their environmental images.

Sabena, the Belgian airline named in the report for hauling Congolese coltan to Europe, announced in June that it will no longer carry the ore. Nokia and Motorola are among several major mobile-phone makers that have publicly demanded that their suppliers stop using ore mined illegally in Congo. And so it has gone down the supply chain. The world's largest maker of tantalum capacitors, Kemet, in Greenville, South Carolina, has asked its suppliers to certify that ore does not come from Congo or bordering countries, including Uganda and Rwanda. Cabot Corporation, a Boston-based company that is the world's second-largest processor of tantalum powder, announced this spring that it "deplores all unlawful and immoral activities" connected with coltan mined in Congo and declared that it will not buy any ore from that part of the world.

The high moral ground that companies have been quick to stake out has the added attraction of being profit-neutral, at least for the moment. The tantalum market is glutted because of declining de-

mand in the slumping technology sector. As important, there has been a sharp increase in production by a giant Australian mining company, called Sons of Gwalia, which now produces half the world's supply.

In the immediate future, it looks as though less and less of the world's tantalum will come from Congo's coltan mines. And as the UN sees it, this will be a very good thing. Its report concluded, "The only loser in this huge business venture is the Congolese people."

But inside what's left of Congo, a wide array of influential people (who are not combatants in the war and are not getting rich from coltan) make a persuasive case that these demands are naive and could well produce disastrous consequences. They argue that in a collapsed state where the likelihood of constructive Western intervention is next to nil, there simply are no easy fixes.

"For local people who are trying to make a bit of money out of coltan, how can an embargo possibly help?" asked Aloys Tegera, who directs the Pole Institute, a nongovernmental social-research institute in Goma, in eastern Congo. Tegera is well aware of coltan's destructive side: he is the lead author of a study on the severe social impact of coltan mining, which describes how teachers have been lured to the mines from the country's few functioning classrooms and explains why teenage girls have turned to prostitution.

"Coltan fuels the war; nobody can deny that," said Tegera. "That is why we maybe will never get peace. But civilians, especially those who are organized, also are getting some money from this."

He and many others find it more than slightly insulting that in a country where millions are hungry and coltan is helping to feed some of them, a de facto embargo is gathering steam among high-tech companies apparently worried less about human beings than about the public-relations downside of dead gorillas. And, like many other Congolese, he declines to become morally riled up about foreign domination.

"Of course, the Rwandans are pillaging us," he said. "But they are not the first to do it and they are no worse than the others. King Leopold did it. The Belgians did it. Mobutu and the Americans did it. The most sorrowful thing I have to live with is that we are incapable of coming up with an elite that can run things with Congolese interests in mind."

Terese Hart, an American botanist who helped create the Okapi Faunal Reserve and has worked there since the early 1980s, supports neither an embargo on coltan nor a quick pullout of Ugandan forces from northeast Congo.

"The world wants to intervene from a distance and pull the strings on the puppet," said Hart, who works for the Wildlife Conservation Society. "The problem is that the strings are not connected to anything. When outsiders struggle to find solutions for Congo, they often assume there is some kind of government. There is no government. There is nothing."

As for coltan mining, Hart said it is silly for the outside world to try to squeeze one of the few ways for poor people to make a bit of money.

"Outside the reserve, I think that coltan mining is the lesser evil of the types of exploitation that occur when there is no government," Hart said. "I prefer mining to logging. Cutting timber in the rain forest is part of an irreversible ecological process. I don't think coltan mining does as much permanent damage. The miner will not get much, but at least he will continue to live."

Among the Congolese I spoke to about coltan, the consensus was that they could not risk the simple solutions that outsiders had prescribed. Struggling to survive in a failed state, they saw no straightforward answers, no moral high ground. For them, the only thing worse than mining coltan is not mining it.

What progress there is in eastern Congo tends to be slow, small-scale, and subject to sudden reversal.

The World Health Organization has succeeded in working with rebel groups to vaccinate most children for polio, but it says seven of ten children have not received any other vaccines in the past decade. Western donors are distributing some medicines, seeds, and tools, but three-quarters of the population still has no access to basic health care.

When progress is being made, it often involves the mixed blessing of coltan. In eastern Congo, two mining entrepreneurs, Edouard Mwangachuchu, a Congolese Tutsi, and his American partner, Robert Sussman, a physician from Baltimore, are struggling to build a legitimate business in an illegitimate state.

They run a company that even their competitors say treats miners fairly. It supplies shovels and picks to about a thousand men

who operate as independent contractors in mines located far from national parks, protected forests, and endangered gorillas.

The land belongs to Mwangachuchu, whose herds were slaughtered in 1995, as the Mobutu era was sputtering to an end. Desperate to shore up popular support, Mobutu encouraged Congolese in the east to attack the ethnic Tutsi minority. A mob pulled Mwangachuchu, then a financial adviser to the provincial government in Goma, out of his Suzuki jeep on his way to work. They choked him with his necktie, ripped off his clothes, and dumped him at the Rwandan border. Crowds later stoned and shot at his house.

Mwangachuchu, his wife, and their six children were granted political asylum in the United States in 1996, and they rented a house in Laurel, Maryland. Two years later, homesick and bored with his job at a Carvel ice cream plant, Mwangachuchu returned home for a visit.

Civil war was raging. His cattle farm had been destroyed, his herds gone, his buildings burned. But he still owned the land, which he had long known was rich in coltan. In 1999, a year after his first trip home, he heard that there was money to be made mining it. All he needed was a partner, someone with a bit of money.

Robert Sussman, fifty-five, sold his medical practice in Baltimore in the early 1990s. Comfortably well off, he began a second career as a mining-camp doctor in remote countries, including Myanmar and Congo. Intrigued by mining, he began thinking of going into the business himself. He met Mwangachuchu in a Goma hotel in 1998, and they became partners the following year, as the price of coltan began to go up.

Sussman and Mwangachuchu say they are investing in Congo for the long term. They believe they can operate profitably despite the recent slump in coltan prices and despite the fact that their mines are still periodically fought over by roving bands of armed men. The partners say they have laid the foundation for a solid business.

"We are proud of what we are doing in Congo," Sussman told me. "We want the world to understand that if it's done right, coltan can be good for this country."

Sussman and Mwangachuchu, of course, are also in it for the money. High coltan prices last year gave them an unexpected windfall. Sussman said they sold twenty-two metric tons of coltan, which

earned them about \$7.5 million — before they paid their many bills.

Since then, they have bought about twenty-five more tons of coltan from miners in the field — ore that they have not been able to sell.

Last year, Sussman and Mwangachuchu shipped their ore to Europe on Sabena airlines. That airline now refuses their business, and they are scrambling to find another shipper. They fear that a corporate embargo could cripple their business and idle miners who have come to depend on them.

“We don’t understand why they are doing this,” Mwangachuchu told me. “The Congolese have a right to make business in their own country.”

ROBERT M. HAZEN

Life's Rocky Start

FROM *Scientific American*

NO ONE KNOWS how life arose on the desolate young earth, but one thing is certain: life's origin was a chemical event. Once the earth formed 4.5 billion years ago, asteroid impacts periodically shattered and sterilized the planet's surface for another half a billion years. And yet, within a few hundred million years of that hellish age, microscopic life appeared in abundance. Sometime in the interim, the first living entity must have been crafted from air, water, and rock.

Of those three raw materials, the atmosphere and oceans have long enjoyed the starring roles in origins-of-life scenarios. But rocks, and the minerals of which they are made, have been called on only as bit players or simply as props. Scientists are now realizing that such limited casting is a mistake. Indeed, a recent flurry of fascinating experiments is revealing that minerals play a crucial part in the basic chemical reactions from which life must have arisen.

The first act of life's origin story must have introduced collections of carbon-based molecules that could make copies of themselves. Achieving even this nascent step in evolution entailed a sequence of chemical transformations, each of which added a level of structure and complexity to a group of organic molecules. The most abundant carbon-based compounds available on the ancient earth were gases with only one atom of carbon per molecule, namely, carbon dioxide, carbon monoxide, and methane. But the essential building blocks of living organisms — energy-rich sugars, membrane-forming lipids, and complex amino acids — may include more than a dozen carbon atoms per molecule. Many of