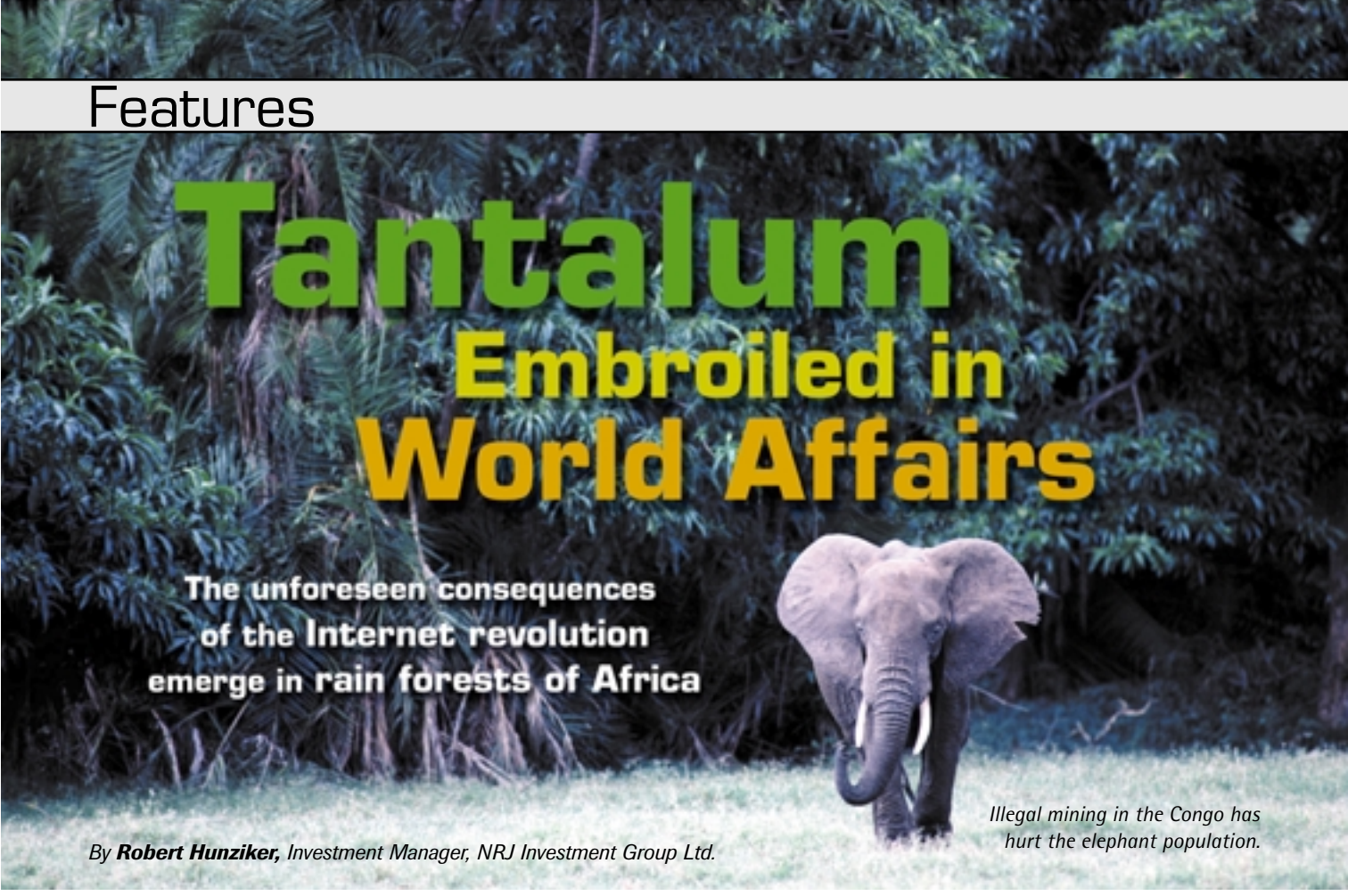
Tantalum
Embroiled in World Affairs

The unforeseen consequences of the Internet revolution emerge in rain forests of Africa

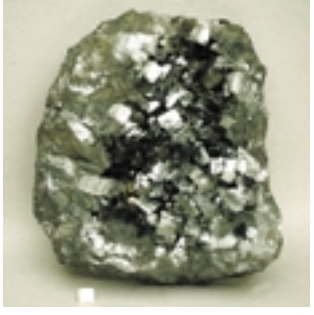


Illegal mining in the Congo has hurt the elephant population.

By **Robert Hunziker,** *Investment Manager, NRJ Investment Group Ltd.*

This year marks the 200th anniversary of the discovery of tantalum by Anders Gustav Ekeberg of Sweden using an ore sample from Kimito, Finland. He named it after King Tantalus of Phrygia, from Greek mythology, who was condemned to eternal frustration by standing up to his neck in water, which receded when he tried to drink it. Ekeberg thought this name was fitting because of the difficulty he had in isolating it. Modern-day tantalum has lived up to this sense of frustration, more so than Ekeberg could have ever imagined.

Two years ago, tantalum became a poster child for the slaughter of elephants and gorillas in some of the world's finest national parks in the Congo, close to the battlegrounds of what some have called Africa's first World War involving six nations and left over 2.5 million dead. Members of the United Nations received death threats when they conducted a major study on the effects of illegal mining of columbite-tantalite ore (called coltan) in the Congo.



Tantalite sample. Photo: Courtesy of the Smithsonian Institute.

The U.S. House of Representatives passed a resolution in September 2001 that banned the purchase of tantalum from the Congo. Tantalum's price skyrocketed to over $500/ pound, an increase of ten-fold within several months, in the face of distorted news stories about shortages. Slogans, like "Blood Tantalum" and "No Blood on my Mobile," became haunting symbols of the scramble for tantalum among major corporations that locked in astronomically high contract prices for future delivery of the rare metal from legitimate sources.

Tantalum was not a household name back then, but the events between 1999 and 2001 imprinted its name like never before in the minds of major worldwide manufacturers like Nokia and Ericsson. It touched the hearts and souls of everyone involved: human rights workers; teenage prostitutes; child laborers; environmentalists; journalists; and U.S. government officials. The war's ravages virtually wiped out the elephant population in the Kahuzi-Biega wildlife park in the Congo, a world-wide treasure lost possibly forever. Major corporations and small companies will not forget the mad scramble to secure raw tantalum resources to make cell phones and numerous kinds of electronics.

The information technology revolution hit full force in the late 1990s, and it seemed nobody could make enough cell phones and laptops to satisfy consumers. The Internet propelled everybody and every product to dizzying heights, and investors poured their savings dollars into a frenzied market that was, in reality, feeding on itself. Nobody who knew how to spell the word tantalum in 1998 and 1999 was prepared for the onslaught that was immediately ahead, and the bubble economy that would ensue. Tantalum became a part of this road-to-riches fantasy, and its bubble is still hissing.

The tantalum supply chain involves mining for tantalite ore in Australia, Africa, Brazil, China, Russia, Canada, and tin slag operations specifically in Thailand and Nigeria. Companies like H.C. Starck, Cabot Corp., and Ningxia NFM process the ore into tantalum powder and wire processors. Next, manufacturers like Kemet, AVX, and Vishay make capacitors. On top of the supply heap, original equipment manufacturers (OEMs) use tantalum to produce consumer and industrial products like cell phones, computer chips, stereos, VCRs, lenses, prosthetics, heat shields, auto engine components, airbag igniters, and turbine engine alloys.

Tantalum has been called "magical dust," and magical or not, it is certainly at the top of the list of efficient metals. It adds functions to circuits that other dielectrics cannot, and it has very high volumetric efficiency and reliability. Batteries last longer, and products are lighter when tantalum is used. Tantalum allows jet turbines to operate at higher temperatures, and its corrosion-resistant character, similar to glass, is ideal for chemical processing. It improves the refractive index of lenses to make them thinner, and it provides X-rays with a brighter image while reducing the radiation dosage to the patient. Tantalum powder is the ignition for air bags that prevent death by milliseconds. This alone may qualify it as "magical dust" to anybody who has lived through a head-on collision.

Tantalum's unique characteristics have embedded it into our rapidly changing world at an ever-faster pace. The major question today is, "what does the future hold, and will tantalum, once again, inflame passions for its possession to the point of skyrocketing prices and black-market trading that finance another war or rebellion in a developing country?"

Tantalum is also unique in that, contrary to most metals, its price has shown a long-term, upward trend. The Mineral Commodity Surveys, prepared by the U.S. Geological Survey, showed that the average price climbed 128% from 1955 to 1965 to $7.75/pound. It was up another 106% in the next 10 years. The pace slowed a bit, rising 42% to $22.75 in 1985. It was up again 22% in the next 10 years, and reached $39/lb in 2001, though anecdotal evidence showed even higher spot prices. Since 1955, tantalum jumped 1,047%, whereas copper rose 74% over the same time. This wide disparity in absolute price behavior suggests a chronic shortage of supply and a growing demand from new uses in the industrial economy.

Unlike other metals, like nickel and copper, tantalum is not traded in a central market. The trading market for tantalum is, essentially, a spot market where dealers around the world establish prices on a transaction-by-transaction basis. As the Internet bubble grew, the price fed on itself; companies double and triple ordered tantalum supplies. Speculators entered the market and captured free-flowing inventory in a complex supply chain that had no central market. They temporarily horded supply to drive prices ever higher, causing many companies to lock in high-priced, long-term contracts for tantalum.

By 2000, the tantalum market was in total disarray. The price had rocketed ten-fold to more than $550/pound. The boom in mobile phones, hardwired communications, Internet, and computers made double-digit growth an easy byword that was fed by easier money from Wall Street. Tantalum shipments peaked at 2,267 metric tons (mt), or five million pounds, in 2000, a record-breaking year. From 1992 to 2000, production of tantalum grew 242% or 17%/year. However, there was, in fact, a surplus of 1 billion capacitors in 1999 and 6 billion in 2000, after 26 billion capacitors already had been shipped. The supply chain really did not fail, and today there is sufficient capacity to meet a market growing at 20%/year until 2005. The hype of the times prevailed back in 1999 and 2000 by driving tantalum pricing substantially above its secular trend line, but hype tends to fail in the final analysis, as did the ridiculous price of tantalum.

Year	Tantalum Price	Percentage Change
1955	$3.40/lb.	NA
1965	$7.75/lb.	up 128%
1975	$16.00/lb.	up 106%
1985	$22.75/lb.	up 42%
1995	$27.75/lb	up 22%
2001	$39.00/lb.	up 41%

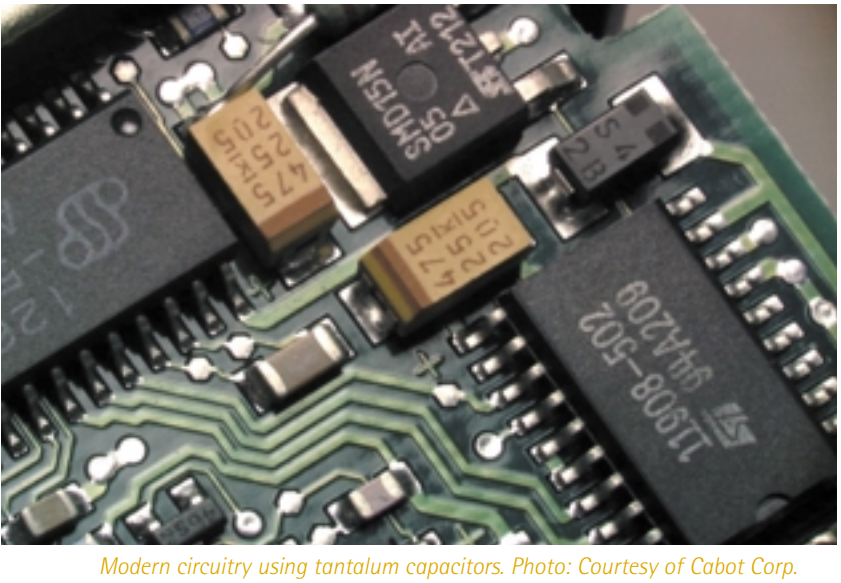
The events between 1999 and 2001 may have changed the landscape of the tantalum market and altered its foreseeable future, but in Africa, the outrageous tantalum price made the sale of coltan an easy source of untraceable income. The war in the Congo was partially financed by tantalum that rebels and others stole from one of the world's largest deposits, which devastated beyond repair agricultural land, native culture and lifestyles, and the Kahuzi-Biega National Park and Lkapi Wildlife Reserve. This was the wake-up call to the world. The scandal fit neatly into journalistic pieces with subtitles like: "How much do you want to offer per kilogram: Please find me at least $100,000, and I will deliver immediately." The substance for sale was not cocaine or opium. It was for coltan.

Today, tantalum's worldwide raw material reserves are 364,000 mt, or 79 million pounds, enough to supply the entire industry for 16 years, assuming demand does not increase above current usage parameters. The largest mines—Greenbushes and Wodgina—are in Western Australia and are owned by Sons of Gwalia, which is ramping up to 2.5 million pounds of annual production over the next three years. Total world production in 2000 was 3 million pounds. By 2003, worldwide mines will be capable of producing 5.5 million

pounds/year. There is an ample supply of tantalite ore. Tantalum is a refractory metal that is gray to bluish, hard, malleable, ductile, and silver white when polished.

The price spike tantalum experienced has opened up new exploration efforts around the world. Several explorationists have reported potential new deposits in Canada, Bolivia, Finland, Egypt, and Saudi Arabia. One of the largest potential deposits could come from Tertiary Minerals, having recently been granted exploration rights from Saudi Arabia to the potentially huge Ghurayyah deposit in the northwest part of the country. It is believed that it could exceed the known resources of Sons of Gwalia.

The U.S. government has classified tantalum as a strategic resource since the 1950s, and many believe any future deposits will garner considerable interests if located in stable geopolitical settings. In short, new deposits found in several African, Middle Eastern, and South American settings, most probably, will not create as much interest by users of ore as those discovered in stable North American and Australian settings. The industry basically works on the basis of long-term contracts whereby mining companies provide ore on contract to processors for a number of years. Hence, it is believed that a premium may be attached to politically stable resources. The recent experience in the Congo will most likely reaffirm this course of action.



Modern circuitry using tantalum capacitors. Photo: Courtesy of Cabot Corp.

Several exploration companies are active in North America, which currently has extremely limited resources. Commerce Resources is exploring the Verity and Fir properties in British Columbia, and Avalon Ventures is preparing a feasibility study for the Big Whopper pegmatite in Ontario. War Eagle Mining has reported encouraging results from the Northwest Territories. Recently, Chapleau Resources and Navigator Resources are evaluating the potential world-class Kougrok deposit in northern Alaska. The deposit, which also contains significant tin, appears to be underlain by enriched granites, and might provide a stable and nearby source of tantalum.

The Supply Chain Overreacts

The tantalum powder industry saw capacity grow beyond the needs of the marketplace. Since 2000, capacity has increased from 2.9 million pounds to 4.4 million pounds, though there is no direct evidence that any real shortage existed in 2000. The industry produced 3 million pounds in 2000, but demand was only for 2 million pounds. In fact, from 1999 to 2000, 2 million pounds of surplus was produced, enough for another year's demand. Today, capacity is high enough to produce enough powder until 2010.

Capacitor manufacturers also overreacted, and they have sufficient capacity to meet a market growing at 20%/year until 2005. Today, manufacturers can produce 29 billion capacitors/year.

The Brussels-based Tantalum-Niobium International Study Center (TIC) promptly responded to the tantalum situation and recommended stronger communications between all members of the supply chain. Miners and processors must exchange information; capacitor manufacturers need to explain their long-range plans to both ends of the chain; and OEMs should relate their plans to others in the chain. This commitment to communication is already bearing fruit. For example, H.C. Starck, one of the largest processors, is establishing links to the OEMs. Kemet Corp. recently announced new relationships with distributors, contract manufacturers, as well as with key OEM accounts. This orchestrated activity by TIC will be a key ingredient in the prevention of disruptive markets in tantalum. Thus, a smooth marketplace should continue to propel new developmental usage for tantalum without the fear of price spikes.

The tantalum debacle of 1999 and 2000 has also sparked new efforts to find alternatives to serve in place of tantalum. Both H.C. Stark and Cabot have R&D departments working with niobium, which is much more abundant and less costly. Advances in niobium will allow that dielectric to establish its own niche market, as well as a substitute for some tantalum designs. Tantalum, however, still has an overall edge in characteristics for the majority of applications. Kemet is conducting new efforts in high-frequency tantalum. Vishay Intertechnology is far along on development of solid niobium capacitors that can be used as drop-in replacements for tantalum capacitors. According to Glyndwr Smith, Vishay's senior vice president of marketing, "it looks like niobium will be a good backup for tantalum capacitors if we see the same high demands that we saw in 2000."

The trend toward miniaturization is accelerating, and passive components provide the right stuff to meet growing requirements for smaller footprints. The auto industry is looking harder at smaller packages as they cram more electronics into cars. According to the February 2002 report by Roskill Information Services, new markets for tantalum will maintain demand growth, with the demand for capacitors growing 9% to 10% each year through 2005. A number of new markets for tantalum capacitors are opening, including applications in autos, computer memory chips, and proces-

sors, which have the potential to be major tantalum consumers in the future.

Painful memories continue to haunt tantalum's recent past. Inventory corrections are still hitting those companies in the supply chain, but there are telltale signs, as suggested by TIC, that the inventories diminishing. The coltan trade in the Congo has slowed to a trickle, but the landscape has been ravaged, displacing agriculture, people, and world wildlife preserves. A permanent scar remains on the societies that allowed the rape and pillage of land, resources, and people. The world's highest officialdom became immersed in what was once described as "bloody tantalum," and these memories will linger.

The last stronghold of the eastern lowland gorillas was nearly wiped out, killed as a food source for the hungry rebels and coltan miners. The gorilla population was reduced to 1,000 from 8,000 so that somebody could gain a coltan profit to finance a war. Rather than calling for a ban on tantalum from the Congo, the Dian Fossey Gorilla Fund is attempting to work with local groups, industry leaders, and conflict resolution specialists to determine a win-win solution, saving the gorillas and improving conditions for peasant miners. The fund can be contacted at: www.gorillas.org.

Tantalum has had a very tumultuous 200-year history

Bolivian miners work a mineralized pegmatite. Photo: Courtesy of General Minerals.

However, it is still only a youngster in the big picture of high technology and our rapidly advancing future. Tantalum capacitors store more power in less space than any alternative, and that in itself will likely ensure its bright future.

For more information, contact Robert Hunziker at: NRJ Investment Group Ltd., Venice, Calif. 90291; Tel: +1.310. 821.9500; Fax: +1.310.822.9535; E-mail: rhunziker@attbi.com.