"Extraordinary…I hope policymakers on every continent will read this book."
—ADAM HOCHSCHILD, author of *King Leopold's Ghost*

COBALT RED

HOW THE BLOOD OF THE CONGO POWERS OUR LIVES

SIDDHARTH KARA

WINNER OF THE FREDERICK DOUGLASS BOOK PRIZE

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For my daughter

List of Acronyms

CDM Congo DongFang Mining
CMKK Coopérative Minière Maadini kwa Kilimo
CMOC China Molybdenum Company
COMAKAT Coopérative Minière et Artisanale du Katanga
COMIAKOL Coopérative Minière Artisanale de Kolwezi
COMIKU Coopérative Minière KUPANGA
COMMUS La Compagnie Minière de Musonoie Global SAS
FARDC Forces Armées de la République Démocratique du Congo
Gécamines La Générale des Carrières et des Mines
IDAK Investissements Durables au Katanga
KCC Kamoto Copper Company
KICO Kipushi Corporation
MIKAS La Minière de Kasombo
MUMI Mutanda Mining Sarl
SAESSCAM Service d'Assistance et d'Encadrement du Small-Scale Mining
SAEMAPE Service d'Assistance et d'Encadrement de L'Exploitation Minière Artisanale et à Petit Echelle
SICOMINES Sino-Congolaise des Mines
TFM Tenke Fungurume Mining
UMHK Union Minière du Haut-Katanga
ZEA Zone d'Exploitation Artisanale

Nyama tembo kula hawezi kumaliza.
("You never finish eating the meat of an elephant.")

—*Congolese saying*

Introduction

> Such then was the main task: to convince the world that thgis Congo horror was not only and unquestionably a fact; but that it was not accidental or temporary, or capable of internal cure … To demonstrate that it was at once a survival and a revival of the slave-mind at work, of the slave-trade in being.
>
> —E. D. Morel, *History of the Congo Reform Movement,* 1914

THE SOLDIERS ARE WILD and wide-eyed as they point their weapons at the villagers trying to enter the mining area at Kamilombe. Although they are desperate to reach their loved ones just a stone's throw away, the villagers are denied access. What has happened here must not be seen. There can be no record or evidence, only the haunting memories of those who stood at this place where hope was lost. My guide urges me to stay at the periphery; the situation is too unpredictable. From the fringes, it is difficult to see the details of the accident. The craterous landscape is obscured by a leaden haze that refuses the entry of light. Distant hills appear only as the vague silhouette of a lumbering beast.

I move closer to investigate, treading carefully into the boiling crowd. I catch sight of a body in the dirt. It is a child, lying motionless within a storm of dust and despair. I try to make out the features of his face, but they elude me. Around the lifeless body, the ocher gravel has been stained in dark shades of red, like burnt umber or rusted metal. Until this moment, I thought that the ground in the Congo took its vermillion hue from the copper in the dirt, but now I cannot help but wonder whether the earth here is red because of all the blood that has spilled upon it.

I inch toward the cordon to see the child more clearly. Tensions between the soldiers and villagers escalate to the brink of riot. A soldier shouts angrily and waves his gun at me. I've drifted too close and lingered too long. I take one final look toward the child. I can see his face now, locked in a terminal expression of dread. That is the lasting image I take from the Congo—the heart of Africa reduced to the bloodstained corpse of a child, who died solely because he was digging for cobalt.

★ ★ ★

There is a frenzy taking place in the Democratic Republic of the Congo, a manic race to extract as much cobalt as quickly as possible. This rare, silvery metal is an essential component to almost every lithium-ion rechargeable battery made today. It is also used in a wide array of emerging low-carbon innovations that are critical to the achievement of climate sustainability goals. The Katanga region in the southeastern corner of the Congo holds more reserves of cobalt than the rest of the planet combined. The region is also brimming with other valuable metals, including copper, iron, zinc, tin, nickel, manganese, germanium, tantalum, tungsten, uranium, gold, silver, and lithium. The deposits were always there, resting dormant for eons before foreign economies made the dirt valuable. Industrial innovations sparked demand for one metal after another, and somehow they all happened to be in Katanga. The remainder of the Congo is similarly bursting with natural resources. Foreign powers have penetrated every inch of this nation to extract its rich supplies of ivory, palm oil, diamonds, timber, rubber … and to make slaves of its people. Few nations are blessed with a more diverse abundance of resource riches than the Congo. No country in the world has been more severely exploited.

The scramble for cobalt is reminiscent of King Leopold II's infamous plunder of the Congo's ivory and rubber during his brutal reign as king sovereign of the Congo Free State from 1885 to 1908. Those familiar with Leopold's regime may reasonably point out that there is little equivalency between the atrocities that took place during his time and the harms taking place today. To be sure, the loss of life during Leopold's control of the Congo is estimated to be as high as thirteen million people, a sum equal to half the population of the colony at the time. Today, the loss of life caused either directly by mining accidents or indirectly by toxic exposure and environmental contamination in the mining provinces would likely be a few thousand per year. One must acknowledge, however, the following crucial fact—for centuries, enslaving Africans was the nature of colonialism. In the modern era, slavery has been universally rejected and basic human rights are deemed *erga omnes* and *jus cogens* in international law. The ongoing exploitation of the poorest people of the Congo by the rich and powerful invalidates the purported moral foundation of contemporary civilization and drags humanity back to a time when the people of Africa were valued only by their replacement cost. The implications of this moral reversion, which is itself a form of violence, stretch far beyond central Africa across the entire global south, where a vast subclass of humanity

continues to eke out a subhuman existence in slave-like conditions at the bottom of the global economic order. Less has changed since colonial times than we might care to admit.

The harsh realities of cobalt mining in the Congo are an inconvenience to every stakeholder in the chain. No company wants to concede that the rechargeable batteries used to power smartphones, tablets, laptops, and electric vehicles contain cobalt mined by peasants and children in hazardous conditions. In public disclosures and press releases, the corporations perched atop the cobalt chain typically cite their commitments to international human rights norms, zero-tolerance policies on child labor, and adherence to the highest standards of supply chain due diligence. Here are a few examples:[1]

> Apple works to protect the environment and to safeguard the well-being of the millions of people touched by our supply chain, from the mining level to the facilities where products are assembled … As of December 31, 2021, we found that all identified smelters and refiners in our supply chain participated in or completed a third party audit that met Apple's requirements for the responsible sourcing of minerals.

> Samsung has a zero-tolerance policy against child labor as prohibited by international standards and relevant national laws and regulations in all stages of its global operations.

> While Tesla's responsible sourcing practices apply to all materials and supply chain partners, we recognize the conditions associated with select artisanal mining (ASM) of cobalt in the DRC. To assure the cobalt in Tesla's supply chain is ethically sourced, we have implemented targeted due diligence procedures for cobalt sourcing.

> For Daimler, respect for human rights is a fundamental aspect of responsible corporate governance … We want our products to contain only raw materials and other materials that have been mined and produced without violating human rights and environmental standards.

> Glencore plc is committed to preventing the occurrence of modern slavery and human trafficking in our operations and supply chains … We do not tolerate child labour, any form of forced, compulsory or bonded labour, human trafficking or any other form of slavery and actively seek to identify and eliminate them from our supply chains.

As scrutiny over the conditions under which cobalt is mined has increased, stakeholders have formulated international coalitions to help ensure that their supply chains are clean. The two leading coalitions are the Responsible Minerals Initiative (RMI) and the Global Battery Alliance (GBA). The RMI promotes the responsible sourcing of minerals in accordance with the UN Guiding Principles for Business and Human Rights. Part of the RMI's platform includes a Responsible Minerals Assurance Process that purports to support independent, third-party assessments of cobalt supply chains and to monitor cobalt mining sites in the DRC for child labor. The GBA promotes safe working conditions in the mining of raw materials for rechargeable batteries. The GBA has developed a Cobalt Action Partnership to "immediately and urgently eliminate child and forced labour from the cobalt value chain"[2] through on-ground monitoring and third-party assessments.

In all my time in the Congo, I never saw or heard of any activities linked to either of these coalitions, let alone anything that resembled corporate commitments to international human rights standards, third-party audits, or zero-tolerance policies on forced and child labor. On the contrary, across twenty-one years of research into slavery and child labor, I have never seen more extreme predation for profit than I witnessed at the bottom of global cobalt supply chains. The titanic companies that sell products containing Congolese cobalt are worth trillions, yet the people who dig their cobalt out of the ground eke out a base existence characterized by extreme poverty and immense suffering. They exist at the edge of human life in an environment that is treated like a toxic dumping ground by foreign mining companies. Millions of trees have been clear-cut, dozens of villages razed, rivers and air polluted, and arable land destroyed. Our daily lives are powered by a human and environmental catastrophe in the Congo.

★ ★ ★

Although the scale of destruction caused by cobalt mining in the name of renewable energy is without contemporary parallel, the contradictory nature of mining is nothing new. Some of the most transformative advancements in human civilization would not have been possible without gouging the earth for minerals and metals. The revolution began around seven thousand years ago when people first applied fire to mined materials. Metals were melted and formed into objects used for commerce, adornment, and weapons. Tin was discovered five thousand years ago and mixed with copper to make bronze, the first alloy harder than its constituent metals. The Bronze Age was born, and the advent of metalworking

sparked rapid advancements in human civilization. Bronze was used to fashion weapons, agricultural tools, and coins. The first forms of writing developed, the wheel was invented, and urban civilization evolved. It was also during the Bronze Age that cobalt was first used to color pottery. During the Iron Age, iron ore was mined and smelted into steel, which was used to fashion more powerful tools and weapons. Armies were built and empires were forged. During the early Middle Ages, Europeans created the first mining concessions. Governments offered commercial entities the rights to mine minerals from a parcel of land in exchange for a portion of revenues, a system that continues to this day.

Mining technology leaped forward during the late Middle Ages when miners started using black powder from China to blow up large rocks. The influx of mineral wealth from the New World, especially gold, financed much of the Renaissance, leading to the Industrial Revolution, which gave birth to the modern mining industry. Coal mining powered industrialization, and with it came a troubled history of environmental contamination, degradation of air quality, and exacerbation of climate change. The Industrial Revolution spurred further improvements in mining equipment—mechanical drills increased the efficiency of mining hard rock, and manual loading and hauling were replaced by electric conveyors, mine cars, and heavy-duty vehicles. These and other technological advancements allowed mining companies to dig deeper and more extensively than ever before.

By the late twentieth century, mining contributed to almost every aspect of modern life. Steel was used for buildings, homes, bridges, ships, trains, vehicles, and planes. Aluminum, tin, nickel, and other metals were used in thousands of industrial and consumer applications. Copper was used for electrical wiring and circuitry, military ordnance, and industrial machinery. Petroleum derivatives gave us plastics. Advancements in agricultural productivity would not have been possible without machinery from mined materials. Although today's trillion-dollar global mining industry is dominated by coal, iron, bauxite, phosphate, gypsum, and copper, the so-called strategic and rare earth elements used in modern technology devices and renewable forms of energy are rapidly growing in economic and geopolitical importance. Many of these strategic minerals can be found in central Africa, chief among them cobalt.

Throughout much of history, mining operations relied on the exploitation of slaves and poor laborers to excavate ore from dirt. The downtrodden were forced to dig in hazardous conditions with little regard to their safety and for little to no compensation. Today, these laborers are assigned the quaint term *artisanal miners,*

and they toil in a shadowy substrate of the global mining industry called *artisanal and small-scale mining* (ASM). Do not be fooled by the word *artisanal* into thinking that ASM involves pleasant mining activities conducted by skilled artisans. Artisanal miners use rudimentary tools and work in hazardous conditions to extract dozens of minerals and precious stones in more than eighty countries across the global south. Because ASM is almost entirely informal, artisanal miners rarely have formal agreements for wages and working conditions. There are usually no avenues to seek assistance for injuries or redress for abuse. Artisanal miners are almost always paid paltry wages on a piece-rate basis and must assume all risks of injury, illness, or death.

Although ASM is fraught with hazardous conditions, the sector has been growing rapidly. There are roughly forty-five million people around the world directly involved in ASM, which represents an astonishing 90 percent of the world's total mining workforce. Despite the many advancements in machinery and techniques, the formal mining industry relies heavily on the hard labor of artisanal miners to boost production at minimal expense. The contributions from ASM are substantial, including 26 percent of the global supply of tantalum, 25 percent of tin and gold, 20 percent of diamonds, 80 percent of sapphires, and up to 30 percent of cobalt.[3]

★ ★ ★

To uncover the realities of cobalt mining in the Congo, I journeyed into the heart of the country's two mining provinces—Haut-Katanga and Lualaba. I formed well-reasoned plans on how I would conduct my investigations, but few plans survive first contact with the Congo. Conditions were adversarial at every turn, including aggressive security forces, intense surveillance, the remoteness of many mining areas, distrust of outsiders, and the sheer scale of hundreds of thousands of people engaged in the feverish excavation of cobalt in medieval conditions. The journey into the mining provinces was at times a jarring time warp. The most advanced consumer electronic devices and electric vehicles in the world rely on a substance that is excavated by the blistered hands of peasants using picks, shovels, and rebar. Labor is valued by the penny, life hardly at all. There are many episodes in the history of the Congo that are bloodier than what is happening in the mining sector today, but none of these episodes ever involved so much suffering for so much profit linked so indispensably to the lives of billions of people around the world.

The field research for this book was conducted during trips to the Congo's mining provinces in 2018, 2019, and 2021. Travel during 2020 was not possible

due to the COVID-19 pandemic. As the pandemic wreaked havoc across the globe, its impact on the destitute people mining for cobalt remains largely unassessed. When industrial mines went into lockdown for extended periods during 2020 and 2021, demand for cobalt did not graciously hibernate. It only grew as people across the world relied more than ever on their rechargeable devices to continue working or attending school from home. The increased demand for cobalt pressured hundreds of thousands of Congolese peasants who could not survive without the dollar or two they earned each day to clamber into the ditches and tunnels, unprotected, to keep the cobalt flowing. COVID-19 spread rapidly in the artisanal mines of the Congo, where mask wearing and social distancing were impossible. The sick and dead infected by the disease were never counted, adding an unknown number to the industry's bleak tally.

To obtain the testimonies included in this book, I devoted as much time as possible listening to the stories of those living and working in the mining provinces. Some spoke for themselves; others spoke for the dead. I followed institutional review board (IRB) protocols for human subject research during all my interviews with artisanal miners and other informants. These protocols are designed to protect sources from negative consequences for participating in research and include securing informed consent prior to conducting an interview, not recording any personal identifying information, and ensuring that any written or typed notes always remained in my possession. These procedures are especially important in the Congo, where the dangers of speaking to outsiders cannot be overstated. Most artisanal miners and their family members did not want to speak with me for fear of violent reprisals.

My investigations in the DRC were only made possible with the assistance of several guides and translators who were trusted in local communities. These guides assisted me in gaining access to scores of mining sites, as well as the people who toiled at them. Every one of the guides who worked with me did so at considerable personal risk. The Congolese government has historically gone to great lengths to obscure conditions in the mining provinces. Anyone seeking to expose the realities, such as journalists, NGO workers, researchers, or foreign news media, is heavily monitored during their stay. The Congolese military and other security forces are omnipresent in mining areas, making access to mining sites dangerous and at times impossible. Perceived troublemakers can be arrested, tortured, or worse. Out of an abundance of caution, I have used pseudonyms for my guides and the brave individuals whose testimonies are included in this book. I have also limited any personal descriptions or information that could be used to

identify these individuals, as such information would place them and their families in jeopardy.

★ ★ ★

The severity of harm being caused by cobalt mining is sadly not a new experience for the people of the Congo. Centuries of European slave trading beginning in the early 1500s caused irreparable injury to the native population, culminating in colonization by King Leopold II, who set the table for the exploitation that continues to this day. The descriptions of Leopold's regime remain disturbingly applicable to the modern Congo.

Joseph Conrad immortalized the evil of Leopold's Congo Free State in *Heart of Darkness* (1899) with four words—"The horror! The horror!" He subsequently described the Congo Free State as the "vilest scramble for loot that ever disfigured the history of human conscience" and a land in which "ruthless, systematic cruelty towards the blacks is the basis of administration." The year after *Heart of Darkness* was published, the first known person to walk the length of Africa from the Cape to Cairo, E. S. Grogan, described Leopold's territory as a "vampire growth." In *The Casement Report* (1904), Roger Casement, British consul to the Congo Free State, described the colony as a "veritable hell on earth." Casement's indefatigable ally in bringing an end to Leopold's regime, E. D. Morel, wrote that the Congo Free State was "a perfected system of oppression, accompanied by unimaginable barbarities and responsible for the vast destruction of human life."[4]

Every one of these descriptions equally conveys conditions in the cobalt mining provinces today. Spend a short time watching the filth-caked children of the Katanga region scrounge at the earth for cobalt, and you would be unable to determine whether they were working for the benefit of Leopold or a tech company.

Although the people of the Congo have suffered through centuries of exploitation, there was a moment—a fleeting flash of light at the dawn of independence in 1960—when the direction of the nation could have drastically shifted. The country's first democratically elected prime minister, Patrice Lumumba, offered the nation a glimpse of a future in which the Congolese people could determine their own fates, use the nation's resources for the benefit of the masses, and reject the interference of foreign powers that sought to continue exploiting the country's resources. It was a bold, anti-colonial vision that could have altered the course of history in the Congo and across Africa. In short order, Belgium, the United Nations, the United States, and the neocolonial interests they

represented rejected Lumumba's vision, conspired to assassinate him, and propped up a violent dictator, Joseph Mobutu, in his place. For thirty-two years, Mobutu supported the Western agenda, kept Katanga's minerals flowing in their direction, and enriched himself just as egregiously as the colonizers who came before him.

Of all the tragedies that have afflicted the Congo, perhaps the greatest of all is the fact that the suffering taking place in the mining provinces today is entirely preventable. But why fix a problem if no one thinks it exists? Most people do not know what is happening in the cobalt mines of the Congo, because the realities are hidden behind numerous layers of multinational supply chains that serve to erode accountability. By the time one traces the chain from the child slogging in the cobalt mine to the rechargeable gadgets and cars sold to consumers around the world, the links have been misdirected beyond recognition, like a con man running a shell game.

This system of obfuscating the severity of exploitation of poor people of color at the bottom of global supply chains goes back centuries. Few people sitting for breakfast in England in the 1700s knew that their tea was sweetened by sugar harvested under brutal conditions by African slaves toiling in the West Indies. The slaves remained far removed from the British breakfast table until a band of abolitionists placed the true picture of slavery directly in front of the English people. Stakeholders fought to maintain the system. They told the British public not to trust what they were told. They espoused the great humanity of the slave trade—Africans were not suffering, they were being "saved" from the savagery of the dark continent. They argued that Africans worked in pleasing conditions on the islands. When those arguments failed, the slavers claimed they made changes that remedied the offenses taking place on the plantations. After all, who was going to go all the way to the West Indies and prove otherwise, and even if they did, who would believe them?

The truth, however, was this—but for the demand for sugar and the immense profits accrued through the sale of it, the entire slavery-for-sugar economy would not have existed. Furthermore, the inevitable outcome of stripping humans of their dignity, security, wages, and freedom can only be a system that results in the complete dehumanization of the people exploited at the bottom of the chain.

Today's tech barons will tell you a similar tale about cobalt. They will tell you that they uphold international human rights norms and that *their* particular supply chains are clean. They will assure you that conditions are not as bad as they seem and that they are bringing commerce, wages, education, and development to the poorest people of Africa ("saving" them). They will also assure you that they have

implemented changes to remedy the problems on the ground, at least at the mines from which they say they buy cobalt. After all, who is going to go all the way to the Congo and prove otherwise, and even if they did, who would believe them?

The truth, however, is this—but for their demand for cobalt and the immense profits they accrue through the sale of smartphones, tablets, laptops, and electric vehicles, the entire blood-for-cobalt economy would not exist. Furthermore, the inevitable outcome of a lawless scramble for cobalt in an impoverished and war-torn country can only be the complete dehumanization of the people exploited at the bottom of the chain.

So much time has passed; so little has changed.

Although conditions for the Congo's cobalt miners remain exceedingly bleak, there is nevertheless cause to be hopeful. Awareness of their plight is growing and, with it, hope that their voices will no longer call out into an abyss but into the hearts of the people at the other end of the chain, who are able to see at last that the blood-caked corpse of that child lying in the dirt is one of their own.

1

“Unspeakable Richness”

> It is in every aspect an enormous and atrocious lie in action. If it were not rather appalling the cool completeness would be amusing.
>
> —Joseph Conrad, letter to Roger Casement, December 17, 1903

WE ARE ALL AWARE of just how much today’s world depends on fossil fuels. Oil, coal, and natural gas are extracted in every corner of the globe, beneath oceans, deserts, mountains, and land. Imagine for a moment if almost three-fourths of all fossil fuel beneath the earth’s surface was instead extracted from a single patch of earth roughly four hundred by one hundred kilometers in size. Imagine that within this patch of earth, approximately half the oil was located in and around a single city and that the deposits were shallow enough for anyone to access with a shovel. This would surely be the most indispensable city in the world. Massive drilling companies would flock to it to stake their claims on the riches. So too would the local population from miles around. Violence would erupt to secure control of valuable territory. Preservation of the environment would become an afterthought. Regional governance would be marred by corruption. Profits would be asymmetrically distributed, with powerful stakeholders at the top of the chain accruing the most benefit while the local inhabitants languished. This is the exact situation taking place today with a crucial mineral that will be as important to our future as fossil fuels have been to our past. The mineral is cobalt, and the city is Kolwezi.

Kolwezi is tucked in the hazy hills of the southeastern corner of the Democratic Republic of the Congo. Although most people have never heard of Kolwezi, billions of people could not conduct their daily lives without this city. The batteries in almost every smartphone, tablet, laptop, and electric vehicle made today cannot recharge without Kolwezi. The cobalt found in the dirt here provides maximum stability and energy density to rechargeable batteries, allowing them to

hold more charge and operate safely for longer periods. Remove cobalt from the battery, and you will have to plug in your smartphone or electric vehicle much more often, and before long, the batteries may very well catch on fire. There is no known deposit of cobalt-containing ore anywhere in the world that is larger, more accessible, and higher grade than the cobalt under Kolwezi.

Cobalt is typically found in nature bound to copper, and the copper-cobalt deposits in the Congo stretch in varying degrees of density and grade along a four-hundred-kilometer crescent from Kolwezi to northern Zambia, forming an area called the Central African Copper Belt. The Copper Belt is a metallogenic wonder that contains vast mineral riches, including 10 percent of the world's copper and about half the world's cobalt reserves. In 2021, a total of 111,750 tons of cobalt representing 72 percent of the global supply was mined in the DRC, a contribution that is expected to increase as demand from consumer-facing technology companies and electric vehicle manufacturers grows each year.[1] One might reasonably expect Kolwezi to be a boom town in which fortunes are made by intrepid prospectors. Nothing could be further from the truth. Kolwezi, like the rest of the Congolese Copper Belt, is a land scarred by the mad scramble to feed cobalt up the chain into the hands of consumers across the globe. The scale of destruction is enormous, and the magnitude of suffering is incalculable. Kolwezi is the new heart of darkness, a tormented heir to those Congolese atrocities that came before —colonization, wars, and generations of slavery.

The first European to cross the heart of the African continent in a single trip from east to west, British lieutenant Verney Lovett Cameron, ominously wrote this about the Congo in *The Times* on January 7, 1876:

> The interior is mostly a magnificent and healthy country of unspeakable richness. I have a small specimen of good coal; other minerals such as gold, copper, iron and silver are abundant, and I am confident that with a wise and liberal (not lavish) expenditure of capital, one of the greatest systems of inland navigation in the world might be utilized, and from 30 months to 36 months begin to repay any enterprising capitalist that might take the matter in hand.[2]

Within a decade of Cameron's missive, "enterprising capitalists" began pillaging the "unspeakable richness" of the Congo. The great Congo River and its capillary-like tributaries provided a built-in system of navigation for Europeans making their way into the heart of Africa, as well as a means by which to transport valuable resources from the interior back to the Atlantic coast. No one knew at the outset that the Congo would prove to be home to some of the largest supplies of

almost every resource the world desired, often at the time of new inventions or industrial developments—ivory for piano keys, crucifixes, false teeth, and carvings (1880s), rubber for car and bicycle tires (1890s), palm oil for soap (1900s+), copper, tin, zinc, silver, and nickel for industrialization (1910+), diamonds and gold for riches (always), uranium for nuclear bombs (1945), tantalum and tungsten for microprocessors (2000s+), and cobalt for rechargeable batteries (2012+). The developments that sparked demand for each resource attracted a new wave of treasure seekers. At no point in their history have the Congolese people benefited in any meaningful way from the monetization of their country's resources. Rather, they have often served as a slave labor force for the extraction of those resources at minimum cost and maximum suffering.

The rapacious appetite for cobalt is a direct result of today's device-driven economy combined with the global transition from fossil fuels to renewable sources of energy. Automakers are rapidly increasing production of electric vehicles in tandem with governmental efforts to reduce carbon emissions emerging from the Paris Agreement on climate change in 2015. These commitments were amplified during the COP26 meetings in 2021. The battery packs in electric vehicles require up to ten kilograms of refined cobalt each, more than one thousand times the amount required for a smartphone battery. As a result, demand for cobalt is expected to grow by almost 500 percent from 2018 to 2050,[3] and there is no known place on earth to find that amount of cobalt other than the DRC.

Cobalt mining in towns like Kolwezi takes place at the bottom of complex supply chains that unfurl like a kraken into some of the richest and most powerful companies in the world. Apple, Samsung, Google, Microsoft, Dell, LTC, Huawei, Tesla, Ford, General Motors, BMW, and Daimler-Chrysler are just some of the companies that buy some, most, or all their cobalt from the DRC, by way of battery manufacturers and cobalt refiners based in China, Japan, South Korea, Finland, and Belgium. None of these companies claims to tolerate the hostile conditions under which cobalt is mined in the Congo, but neither they nor anyone else are undertaking sufficient efforts to ameliorate these conditions. In fact, no one seems to accept responsibility at all for the negative consequences of cobalt mining in the Congo—not the Congolese government, not foreign mining companies, not battery manufacturers, and certainly not mega-cap tech and car companies. Accountability vanishes like morning mist in the Katangan hills as it travels through the opaque supply chains that connect stone to phone and car.

The flow of minerals and money is further obscured by a web of shady connections between foreign mining companies and Congolese political leaders,

some of whom have become scandalously rich auctioning the country's mining concessions while tens of millions of Congolese people suffer extreme poverty, food insecurity, and civil strife. There was not a single peaceful transfer of power in the Congo from 1960, when Patrice Lumumba was elected to be the nation's first prime minister, until 2019, when Félix Tshisekedi was elected. In the interim, the country was subjected to one violent coup after another, first with Joseph Mobutu, who ruled the Congo from 1965 to 1997, followed by Laurent-Désiré Kabila's reign from 1997 to 2001, followed by his son Joseph Kabila from 2001 to 2019. I use the words *rule* and *reign* because Mobutu and the Kabilas ran the country like despots, enriching themselves on the nation's mineral resources while leaving their people to languish.

As of 2022, there is no such thing as a clean supply chain of cobalt from the Congo. All cobalt sourced from the DRC is tainted by various degrees of abuse, including slavery, child labor, forced labor, debt bondage, human trafficking, hazardous and toxic working conditions, pathetic wages, injury and death, and incalculable environmental harm. Although there are bad actors at every link in the chain, the chain would not exist were it not for the substantial demand for cobalt created by the companies at the top. It is there, and only there, where solutions must begin. Those solutions will only have meaning if the fictions promulgated by corporate stakeholders about the conditions under which cobalt is mined in the Congo are replaced by the realities experienced by the miners themselves.

To understand these realities, we must first lay a bit of groundwork in this chapter on the Congo and the cobalt mining supply chain. Our journey will then begin in an old colonial mining town called Lubumbashi. From there, a single road traverses the mining provinces deeper into the heart of cobalt territory. As we follow this road, the conditions of cobalt mining will be revealed with each passing mile through the firsthand accounts of the children, women, and men who dig for cobalt, as well as my own reporting on the mineral traders, government officials, multinational corporations, and other stakeholders that profit from their work. Nearing the center of cobalt mining in Kolwezi, we will encounter testimonies of a darker truth, one that cannot be fathomed. I saw it for myself on September 21, 2019, at a place called Kamilombe. I will take you there, just as I took the journey, down the only road that leads to the truth.

THE HEART OF AFRICA

Occupying the entire heart of the African continent, the Democratic Republic of the Congo is an extraordinary land teeming with nature. Wild forests, rugged mountains, broad savannas, and raging rivers fill the land. The nation is bordered to the north by the Central African Republic, to the northeast by South Sudan, to the east by Uganda, Rwanda, Burundi, and Tanzania, to the south and southeast by Zambia, to the southwest by Angola, and to the west by the Republic of the Congo and a sliver of coastline where the Congo River empties into the Atlantic. Imagine a giant ball of clay pinched at two ends—southwest from Kinshasa to the ocean, and southeast in a terrestrial peninsula that traces the Copper Belt. The upper two-thirds of the country is dressed in tropical rain forest, second in size only to the Amazon and home to the largest population of great apes in the world. South of the forest, plateaus slope downward into sprawling savannas. The rugged peaks of the Rwenzori Range stand guard along the northeastern border adjacent to the Rift Valley and the great lakes of Africa. The equator transects the top third of the Congo, and when it is the rainy season on one side of the equator, it is the dry season on the other. As a result, it is always raining somewhere in the Congo, and the country has the highest frequency of thunderstorms in the world.

The major cities of the DRC include the frenetic capital, Kinshasa, located near the southwestern edge of the country along the banks of the Congo River. It is one of Africa's fastest-growing megacities and home to more than seventeen million "Kinois." Mbuji-Mayi is capital of Kasai-Orientale Province, situated in the south-central part of the country and home to the largest diamond deposit in the world. The capital of Tshopo Province, Kisangani, is located near numerous gold mines and serves as a trading hub in the heart of the Congo River. Perched at the southern end of Lake Kivu, Goma is the main city on the dangerous border with Rwanda, where coffee, tea, and other agricultural products are grown. Roughly 2,300 kilometers southeast of Kinshasa at the opposite end of the country is Lubumbashi, capital of Haut-Katanga Province and administrative head of the mining provinces. Kolwezi is the capital of the adjacent province of Lualaba at the other end of the Copper Belt. Aside from Lubumbashi and Kolwezi, none of the aforementioned cities are connected by road or rail.

The soul of the Congo is its extraordinary river. It is the deepest river in the world, and through its system of tributaries, it drains a region the size of India. The crescent shape of the Congo River makes it the only one in the world that crosses the equator twice. By the time the river reaches the Atlantic, it empties with so much force that it clouds the ocean with sediment for a hundred kilometers offshore. The source of the Congo River was the final great mystery of African

geography, and the drive by European explorers to solve this mystery tragically altered the fate of the Congo and made possible all the suffering taking place in the mining provinces today.

For most of its history, the southeastern corner of the DRC was called Katanga. The region was annexed into the Congo Free State by King Leopold in 1891 before its vast mineral riches were fully evident. Katanga has always been an outlier in the DRC. The people in Katanga largely see themselves as Katangans first and Congolese second. Crucially, Katangan leaders never fully subscribed to the premise that their mineral riches should be shared with the nation. Prior to Congolese independence, the Belgians established extensive mining operations in Katanga, and they also made every effort to keep control of the region after independence by orchestrating the secession of the province followed by the assassination of Prime Minister Lumumba. With so much money at stake, control of Katanga has always been a bloody affair.

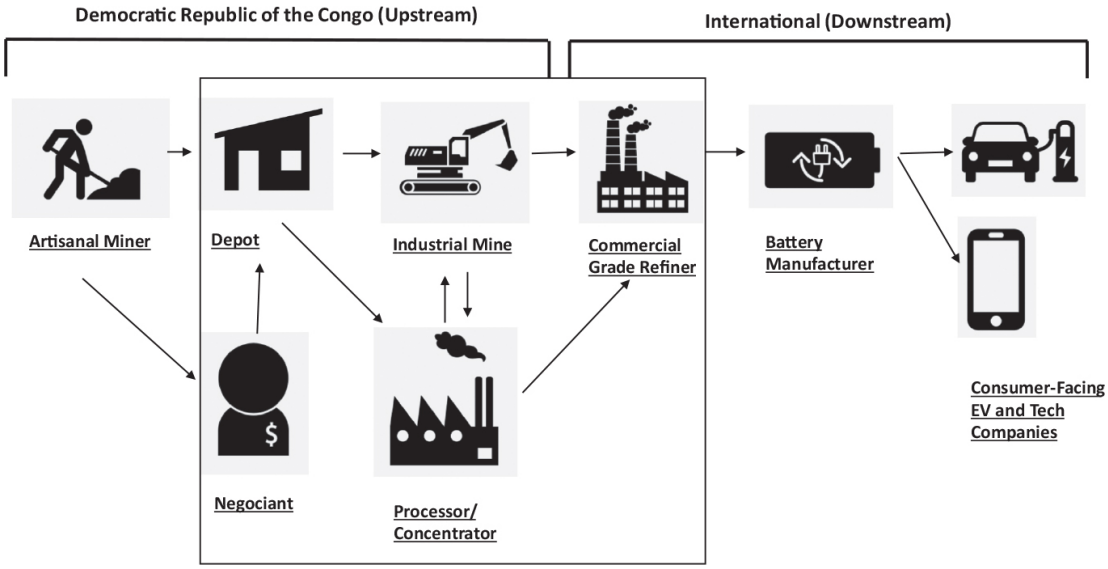
Although the copious mineral riches of Katanga could easily fund numerous programs to improve child education, alleviate child mortality, upgrade sanitation and public health, and expand electrification for the Congolese people, most of the mineral wealth flows out of the country. Despite being home to trillions of dollars in untapped mineral deposits, the DRC's entire national budget in 2021 was a scant $7.2 billion, similar to the state of Idaho, which has one-fiftieth the population. The DRC ranks 175 out of 189 on the United Nations Human Development Index. More than three-fourths of the population live below the poverty line, one-third suffer from food insecurity, life expectancy is only 60.7 years, child mortality ranks eleventh worst in the world, access to clean drinking water is only 26 percent, and electrification is only 9 percent. Education is supposed to be funded by the state until eighteen years of age, but schools and teachers are under-supported and forced to charge fees of five or six dollars per month to cover expenses, a sum that millions of people in the DRC cannot afford. Consequently, countless children are compelled to work to support their families, especially in the mining provinces. Despite helping to generate untold riches for major technology and car companies, most artisanal cobalt miners earn paltry incomes between one or two dollars per day.

FROM TOXIC PIT TO SHINY SHOWROOM

The global cobalt supply chain is the mechanism that transforms the dollar-a-day wages of the Congo's artisanal miners into multibillion-dollar quarterly profits at the top of the chain. Although the two ends of the chain could not be more disconnected in terms of human and economic valuation, they are nevertheless linked through a complicated set of formal and informal relationships. The nexus of these links resides in a shadow economy at the bottom of the mining industry that flows inevitably into the formal supply chain. This merging of informal with formal, artisanal with industrial, is the most important aspect of the cobalt supply chain to understand. It is, despite claims to the contrary, all but impossible to isolate artisanal cobalt from industrial production.

Opposite is a rough sketch of what the global cobalt supply chain looks like. The links inside the box indicate points in which cobalt from various sources can be mixed.

Artisanal miners occupy the base of the chain. Known locally as *creuseurs* ("diggers"), they use rudimentary tools to dig in pits, trenches, and tunnels to find an ore called heterogenite, which contains copper, nickel, cobalt, and sometimes uranium. The Congo's artisanal mining sector is regulated by a government agency called SAEMAPE, which until 2017 was called SAESSCAM.[4] SAEMAPE has designated fewer than one hundred sites across the Copper Belt in which artisanal mining is authorized to take place, called Zones d'Exploitation Artisanale (ZEAs). The small number of ZEAs is woefully insufficient to accommodate the hundreds of thousands of people who try to earn a living by digging for cobalt. As a result, artisanal miners dig in hundreds of unauthorized mining areas spread across the Copper Belt. Many of these sites are located right next to industrial mining operations since the diggers know there is likely to be valuable ore under the ground. Artisanal mining also takes place directly on many industrial mining sites, even though it is forbidden under Congolese law.



Artisanal cobalt feeds into the formal supply chain via an informal ecosystem of *négociants* (traders) and *comptoirs* (depots), also known as *maisons d'achat* (buying houses). These are the fuzzy linkages that serve to launder minerals from artisanal sources into the formal supply chain. *Négociants* are independent operators who work in and around artisanal sites to purchase cobalt from artisanal miners. They are almost all young Congolese males, and they either pay a fixed price per sack or offer a split of the sales price to the depots. Once the *négociants* have loaded their hauls onto motorbikes and pickup trucks, they transport the ore to the depots for sale. In some of the larger artisanal mining areas, there are depots located on-site, in which case artisanal miners can sell directly to them.

Depots and buying houses are usually small shacks that advertise with telltale pink tarps and painted names, such as $1,000,000 Depot or Cuivre-Cobalt, or just with a number (555) or the name of the owner (Boss Xi). There are hundreds of depots scattered around Haut-Katanga and Lualaba Provinces. There is no scrutiny at any depots as to the source or conditions under which the ore being purchased was mined. After the depots purchase ore from *négociants* or artisanal miners, they sell their supply to industrial mining companies and processing facilities. From this point forward, it is impossible to isolate artisanal from industrial production. Although Congolese law stipulates that mineral depots should be registered and operated only by Congolese nationals, almost all depots in Haut-Katanga and Lualaba Provinces are operated by Chinese buyers. Artisanal production accounts for up to 30 percent of all cobalt mined in the DRC, although the number could be

even higher, as there is no accurate way to disaggregate artisanal from industrial production.

The formal segment of the supply chain begins with the massive industrial copper-cobalt mines that span the Copper Belt. Some of the mines, such as Tenke Fungurume and Mutanda, are as big as a European capital. The industrial mining operations in the DRC are typically structured as joint ventures between the state-owned mining company, Gécamines, and a foreign mining company. As of my last ground count in November 2021, there were nineteen major industrial copper-cobalt mining complexes operating in Haut-Katanga and Lualaba Provinces, fifteen of which were owned or financed by Chinese mining companies. Most of the Chinese-owned mining sites I visited were secured either by a military force called the FARDC or the elite Republican Guard. Other industrial sites and many informal mining areas are guarded by any array of armed units, including the Congolese National Police, the mining police, private military contractors, and informal militias. These armed security forces are devoted to two tasks: keep prying eyes out, and keep minerals secure.

Prior to export from the DRC, cobalt-containing ores must undergo a preliminary processing stage during which the cobalt is separated from other metals in the ore. Some of this processing takes place at industrial sites, and some of it takes place at dedicated processors in Kolwezi, Likasi, and Lubumbashi. The preliminary processing typically yields either crude cobalt hydroxide or cobalt concentrate. These semi-refined forms of cobalt are loaded onto trucks and driven to seaports in Dar es Salaam and Durban for export to commercial-grade refiners, most of which are in China. In 2021, China produced 75 percent of the world's refined cobalt. The largest single refiner was Huayou Cobalt with a market share of 22 percent.[5] Huayou owns Congo DongFang Mining, one of the largest copper-cobalt mining companies operating in the DRC. The vertical integration of Chinese companies across the cobalt supply chain has accelerated in recent years, solidifying the country's dominance over the rechargeable battery industry. Although it would seem advantageous for the DRC to refine cobalt to commercial-grade form and control more of the value chain, a senior official at Gécamines explained, "In Congo, we do not have sufficient electricity capacity to refine cobalt."

Fully refined cobalt is combined with other metals to make cathodes—the positively charged part of a battery. The largest lithium-ion battery manufacturers in the world are CATL and BYD in China; LG Energy Solution, Samsung SDI, and SK Innovation in South Korea; and Panasonic in Japan. In 2021, these six

companies produced 86 percent of the world's lithium-ion rechargeable batteries, with CATL alone holding a one-third global share.[6] Most of the cobalt in these batteries originated in the Congo.

COBALT AND THE COPPER BELT

For much of human history, cobalt was little more than a color. As far back as the Persian Empire and the Ming dynasty, cobalt was used to create blue pigments in art and pottery. In the modern era, the element has accrued a range of industrial functions. Cobalt is used in the manufacture of superalloys for turbines and jet engines; as a catalyst for cleaner fuels; in carbides used to make cutting tools; in materials used for dental and bone surgeries; in chemotherapies; and in the cathodes of rechargeable batteries. Given its wide range of uses, the European Union has designated cobalt to be one of twenty "critical" metals and minerals, and the United States has designated cobalt to be a "strategic mineral." Initiatives to secure reliable supplies of refined cobalt that bypass China's current monopoly have become matters of considerable geopolitical importance to the U.S. and the EU.

By virtue of geographic fluke, the Central African Copper Belt holds roughly half of the world's cobalt reserves at an estimated 3.5 million tons.[7] Although geographic fluke may be responsible for the massive reserves of cobalt in the Copper Belt, the artisanal mining crisis in the DRC would not be possible unless there were substantial deposits of cobalt at depths shallow enough to be accessible by a shovel. According to Central African geology expert Murray Hitzman, the reason the copper-cobalt deposits in the Copper Belt are so shallow is because they are uniquely found in "sediment hosted stratiform deposits." This type of deposit indicates that the cobalt-containing ores occur in discrete layers of sedimentary rocks that were initially laid down in water. Such deposits are the only ones with the potential to be pushed upward to the surface by tectonic activity, thereby making them accessible to artisanal miners. The Central African Copper Belt happens to be located on the western shoulder of one of the most spectacular examples in the world of this tectonic activity—the East African Rift.

The East African Rift is a 6,500-kilometer fracture in the earth's surface that stretches from Jordan to Mozambique; it is caused by three plates pulling apart from each other—the Nubian plate, the Somalian plate, and the Arabian plate. Beginning around 800 million years ago, tectonic activity in the rift caused ocean

water to enter an enclosed basin in the Copper Belt region. Most of the ocean water evaporated, but some of the saline fluids circulated into the sediments within the basin and stripped metals from them, including copper and cobalt. At some point between 650 and 500 million years ago, the salt layers began to move upward due to tectonic action, forming salt diapirs—domed rock formations in which a core of rock moves upward by several kilometers to pierce the earth's surface. A similar process took place along the Gulf Coast of the United States, which made numerous oil and gas fields accessible to drilling.

As a result of the ocean water deposits and subsequent tectonic action, copper-cobalt ores across the Copper Belt are found both at great depths and near the surface. At depths below the level of a fluctuating water table, the copper and cobalt are combined with sulfur in the mineral carrollite, which is the primary source of industrially mined cobalt in the Congo. Closer to the surface, water combines with sulfur to create sulfuric acid, causing ores to "rust." This weathering turns a sulfide into an oxide. Oxidized cobalt forms cobalt hydroxide in the mineral heterogenite. According to Hitzman, "The cobalt-hydroxide ore bodies in Katanga are unique. They form blocks that can be tens of meters to several kilometers in length floating like raisins in a cake." Artisanal miners dig tunnels up to sixty meters deep to find these "raisins" of heterogenite. One of the largest known deposits of cobalt raisins is beneath a neighborhood of Kolwezi called Kasulo, a madhouse of tunnel digging that is unlike any place on earth.

DARK SIDE OF THE EV REVOLUTION

That cobalt is found in massive, shallow, high-grade deposits in the DRC illuminates the supply side of the equation playing out in the country's mining provinces. The demand side is driven by the fact that cobalt is used in almost every lithium-ion rechargeable battery in the world. Development of lithium-ion batteries dates to the 1970s at Exxon, during the time of the OPEC oil embargo, when alternate energy sources were being explored. Sony produced the first commercial-scale lithium-ion batteries in the early 1990s, at which time they were used primarily for small-scale consumer electronics. The lithium-ion battery market received its first upward demand shock with the smartphone and tablet revolutions. Apple introduced the iPhone in 2007, and Android smartphones were launched in 2008. Since that time, billions of smartphones have been sold, and each one of them requires a few grams of refined cobalt in their batteries. A

similar eruption of gadgets took place in the tablet market. Apple launched the iPad in 2010, followed soon after by Samsung's Galaxy Tab. Billions of tablets have since been sold, each of which requires up to thirty grams of cobalt in the battery. Add in laptops, e-scooters, e-bikes, and other rechargeable consumer electronic devices, and the aggregate amount of cobalt needed from all devices, save those with four or more tires, adds up to tens of thousands of tons each year.

The EV market, however, is where cobalt demand has really exploded. The first rechargeable electric vehicle was invented in 1880s, but it was not until the early 1900s that electric vehicles were being produced on a commercial scale. By 1910, around 30 percent of vehicles in the United States were propelled by electric engines. Had the trend continued, we would all be living on a cleaner, cooler planet. Instead, internal combustion engines came to dominate the next century of the automobile industry. There are several developments cited for the shift to gasoline-powered vehicles. First, the U.S. government invested heavily to expand road infrastructure beginning with the Federal Aid Road Act of 1916. Driving across the nation required greater ranges than could be achieved by EV technology at the time. In addition, the discovery of large oil reserves in Texas, California, and Oklahoma made internal combustion–powered cars much cheaper to operate.

Electric vehicles were relegated to a niche market until the push for renewable sources of energy beginning in 2010 led to an electric vehicle renaissance. This renaissance shifted into overdrive after the Paris Agreement in 2015, in which 195 nations agreed to a shared goal of keeping the increase in global average temperatures to less than 2°C from preindustrial levels. To achieve this goal, CO2 emissions must be reduced by at least 40 percent below 2015 levels by 2040. Since about one-fourth of CO2 emissions are created by vehicles with internal combustion engines, the expansion of battery-powered transportation provides the only solution.

In 2010, there were only 17,000 electric vehicles on the road in the entire world. By 2021, that number had skyrocketed to 16 million. Meeting the ambitions of the Paris Agreement would require at least 100 million total electric vehicles in use by 2030. An even more ambitious EV30@30 Campaign was launched in 2017 with the goal of accelerating the deployment of electric vehicles, targeting a 30 percent market share for electric vehicles sales by 2030. The EV30@30 target would require a global stock of 230 million EVs by 2030, a fourteen-fold increase over 2021 numbers.[8] EV sales could end up being even greater, as twenty-four nations pledged at COP26 to eliminate the sale of gas-powered vehicles entirely by 2040. Millions of tons of cobalt will be needed, which will continue to push

hundreds of thousands of Congolese women, men, and children into hazardous pits and tunnels to help meet demand.

WHY DO LITHIUM-ION BATTERIES NEED COBALT?

To achieve mass adoption of electric vehicles at the levels projected will require that EV batteries become cheaper and are able to achieve longer ranges between charges. Prices of lithium-ion battery packs have steadily decreased as EV manufacturers seek to achieve cost parity with internal combustion vehicles. Measured in price per kilowatt-hour, the production cost of lithium-ion battery packs has fallen 89 percent from $1,200/kWh in 2010 to $132/kWh in 2021. Production costs are projected to reach the all-important mark of $100/kWh by 2024, at which point EVs will achieve cost parity with gas-powered cars.[9] Equally important to cost in accelerating EV adoption is the range the car can travel between charges. To increase range, batteries require higher energy densities, and only lithium-ion chemistries using cobalt cathodes are currently able to deliver maximum energy density while maintaining thermal stability. To understand why requires a brief review of how batteries work.

Batteries provide portable sources of electrical energy by rebalancing a chemical imbalance between a cathode (positive electrode) and an anode (negative electrode). The cathode and anode are separated by a chemical barrier called an electrolyte. When the cathode and anode are connected to a device, this creates a circuit, which results in a chemical reaction that generates positive ions and negative electrons at the anode. An opposite reaction takes place at the cathode. Nature always seeks balance, so the positive ions and negative electrons in the anode travel to the cathode, but they take different paths to reach their destinations. The ions flow directly through the electrolyte to the cathode, whereas the electrons flow through the external circuit to the cathode. The electrons are unable to travel through the electrolyte because its chemical nature acts as a barrier and forces them to pass through the outer circuit / device. This flow of electrons creates the energy that powers the device. As a battery generates electrical power, the chemicals inside it are gradually “used up.” A rechargeable battery, on the other hand, is one that allows a change in the direction of flow of electrons and ions using another power source that pushes everything back to the starting point.

Different materials have different abilities to release, attract, and store electrons and ions, and this is where lithium and cobalt enter the picture.

Lithium-based chemistries became the dominant form for rechargeable batteries because lithium is the lightest metal in the world, which has obvious benefits for consumer technology and electric vehicle applications. Cobalt is used in the cathodes of lithium-ion batteries because it possesses a unique electron configuration that allows the battery to remain stable at higher energy densities throughout repeated charge-discharge cycles. Higher energy density means the battery can hold more charge, which is critical to maximize the driving range of an electric vehicle between charges.

The three primary types of lithium-ion rechargeable batteries used today are lithium cobalt oxide (LCO), lithium nickel manganese cobalt oxide (L-NMC), and lithium nickel cobalt aluminum oxide (L-NCA). Lithium accounts for only 7 percent of the materials used in each type of battery, whereas cobalt can be as high as 60 percent.[10] Each battery chemistry has its strengths and weaknesses.

LCO batteries provide high energy density, which allows them to store more power per weight of battery. This quality makes them ideal for use in consumer electronic devices such as mobile phones, tablets, and laptops. The tradeoff is that LCO batteries have shorter life spans and deliver a lower amount of power, qualities that make them unsuitable for use in electric vehicles.

L-NMC batteries are used in most electric vehicles, except for Tesla, which uses L-NCA batteries. Since 2015, the trend with these batteries has been to reduce cobalt reliance by moving toward higher ratios of nickel.[11] Nickel has lower thermal stability than cobalt, so the higher the ratio of nickel used, the lower the battery's stability and safety.

The limited supply and high cost of cobalt has not gone unnoticed by the EV industry. Battery researchers are working on alternative designs that can minimize or eliminate reliance on cobalt. At present, most cobalt-free alternatives have significant disadvantages relating to energy density, thermal stability, manufacturing costs, and longevity. Many of them are also a decade or more away from commercial-scale production.

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For the foreseeable future, there will be no avoiding cobalt from the Congo, which means there will be no avoiding the devastation that cobalt mining causes the people and environment of the mining provinces of the DRC. Even after battery designers find a way to eliminate cobalt from rechargeable batteries without

sacrificing performance or safety, the misery of the Congolese people will not end. There will surely be another prize slumbering in the dirt that will be made valuable by the global economy. Such has been the curse of the Congo for generations. Unspeakable riches have brought the people of the Congo little other than unspeakable pain.

More than a century ago, E. D. Morel described the Congo Free State as "a gigantic slave-farm reeking with cruelty."[12] Cobalt mining is the slave farm perfected—the cost of labor has been nullified through the degradation of Africans at the bottom of an economic chain that purports to exonerate all participants of accountability through a shrewd scheme of obfuscation adorned with hypocritical proclamations about the preservation of human rights. It is a system of absolute exploitation for absolute profit. Cobalt mining is the latest in a long history of "enormous and atrocious" lies that have tormented the people of the Congo.

The truth, as ever, waits to be revealed.