

Zambia's Copperbelt Area and Copper Mining: A Review

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Abstract

Zambia's economy is fueled by copper production, which is one of the country's most important industries. In terms of copper output, Zambia has around five large open-pit mines and eight significant underground mines. Zambia's Government owns a stake in some of these businesses. This article examines the economic, social, technological, and environmental ramifications of copper mining in the Copperbelt area of Zambia.

Keywords

Copperbelt, Copper, Mining, Economy, Environment

1. Introduction

The Copperbelt is a region in Africa that straddles Zambia and the Democratic Republic of Congo. As shown in **Figure 1**, the Zambia Copperbelt is in the Northern part of the country. The main industry in the region is copper mining (Fraser & Larmer, 2010).

The Copperbelt refers to the mining regions of Zambia's Copperbelt Province (especially Ndola, Kitwe, Chingola, Luanshya, and Mufulira) and the Congo's Haut-Katanga and Lualaba provinces (particularly Lubumbashi, Kolwezi, and Likasi) (Frederiksen, 2013). In other cases, the word *Copperbelt* may be used to completely exclude the Congo. Copperbelt was established as a province immediately after Zambia gained independence in 1964, and was formerly known as a western province (Butler, 2008). President Kenneth Kaunda, the country's founding father, changed the name to Copperbelt in 1969. Both Katanga and the Copperbelt were known as Ilamba or Lambaland at the time of immigration. Mineral richness abounds in both provinces.

Copperbelt Province owes its existence to the copper and cobalt mining industries, which began in the late 1920s in Luanshya District with the opening of the first commercial mine (Munene, 2019). In the Copperbelt region, the direct and indirect employment of the majority of the population has as its main source the mines of Copper because of the long history of the latter. Zambia’s economy is primarily reliant on copper mining, which generates over 70% of the country’s revenue (Chipili, 2019).

The two biggest copper mining companies in the Copperbelt are Mopani Copper Mines (MCM) and Konkola Copper Mines (KCM). These mines serve as a gauge for the mining industries and, by implication, the Zambian economy’s health. The Copperbelt is the country’s major contributor to GDP, with mining accounting for 90% of the total (Money, 2019). Smaller Copperbelt mines such as Lubambe Copper Mine, Chibuluma Mines, NFC Africa Mining, CNMC Luanshya, Chambishi Copper Smelting Company, Sino-Metals, and Chambishi Metals also add to Zambia’s copper output.

The production of copper in the Copperbelt area has environmental impacts and the government needs to remedy this. This present study presents a brief review of copper mining in the Copperbelt region with attention to economic, social, technical, and environmental aspects.



Figure 1. Map showing Copperbelt in Zambia (adapted from One Planet Nations Online).

2. Geological Structure

Copperbelt area includes the Neoproterozoic Katanga Supergroup, which includes deposits of Cu-Co and many other metals Cu, Pb, Zn, U, Au, Fe and other metals (Master, Rainaud, Armstrong, Phillips, & Robb, 2005). Cu ore has a 3 wt% average grade, whereas Co ore has a 0.18 wt% average grade (Kribek, Majer, Vladimir, Veselovsky, & Nyambe, 2010). The Katanga Supergroup encompasses a considerable chunk of the Copperbelt (Sillitoe, Perello, & Garcia, 2010). These are meta-sedimentary rocks that were metamorphosed and distorted as part of the Lufilian Arc, which runs northwest to the east (Ondra, Bohdan, Mihaljevic, Majer, Veselovsky, Vencelides et al., 2011). Deposits of copper-cobalt are mostly found in the Zambia Copperbelt area, while comparable copper mineralization can be found in the province of North-Western at non-higher grade (Sillitoe, Perello, Creaser, Wilton, & Wilson, 2017). As shown in Figure 2, Lufilian Arc's Central African Copperbelt is clogged with Cu-Co deposits.

The Katanga Supergroup's copper deposits are concentrated in the Lower Roan Subgroup (Jackson, Warin, Woad, & Hudec, 2003). As a result, mining is mostly done in the Lower Roan Formation, where the ore composition is dominated by pyrite (FeS_2), chalcopyrite (CuFeS_2), bornite (Cu_5FeS_4), chalcocite

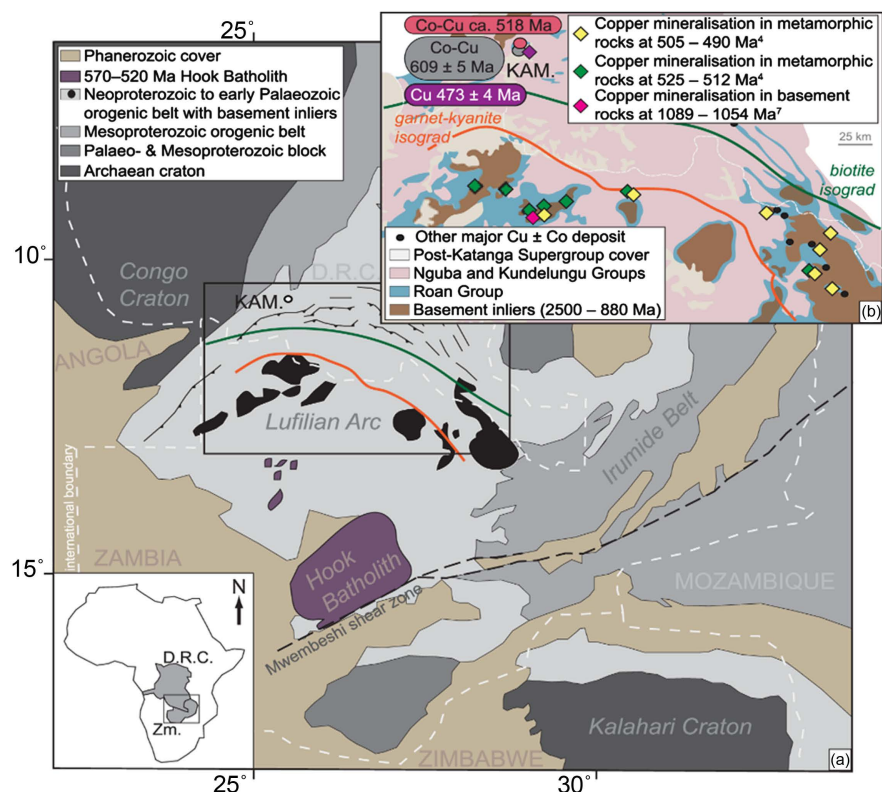


Figure 2. (a) The Lufilian Arc and Hook batholiths are located in Zambia and the Democratic Republic of Congo in relation to the Archaean Kalahari and Congo cratons, as well as Mesoproterozoic orogenic belts. (b) Deposits of copper-cobalt (Cu-Co) in Lufilian Arc's Central African Copperbelt (adapted from Saintilan, Selby, Creaser, & Dewaele, 2018).

(Cu₂S), digenite (Cu₉S₅), linnaeite (Co₃S₄), and carrolite (Cu(CoNi)₂S₄) (Kampunzu, Cailteux, Kamona, Intiomale, & Melcher, 2009).

3. Historical Context

Period of post-colonization

In 1928, Zambia opened its first commercial copper mine (Francis, 1971). The Rhodesian Selection Trust (RST) had ownership of this mine. Copper was produced on a modest scale at Kansanshi and Bwana Mkubwa mines as early as 1908 and 1911, respectively (Sikamo, Mwanza, & Mweemba, 2016). Two private mining companies, Rhodesian Select Trust (RST) and Anglo American Corporation (AAC), operated in Northern Rhodesia (now Zambia) between 1928 and 1969. Anglo American Corporation and AAC were the subsidiaries of two international enterprises (Robert, 1966).

Period following independence

After Zambia's independence in 1964, the country's development was inspired by rapid growth in the copper sector in the late 1960s and early 1970s due to favorable world copper prices (Roan Consolidated Mines Public Relations Department, 1978). Despite the increase in copper prices, workers were unsatisfied since the majority of workers were on short-term contracts (casual labor), and short-term workers are not represented by unions and are thus vulnerable to precariousness (Ferguson, 1999).

Mining nationalization era

As a result, the government stated its plan to purchase shares in mining enterprises during the Mulungushi economic reforms of 1968 (Roberts, 1982). This was part of the "Zambian Economic Revolution", a series of changes (Nziramasanga, 1973). The Matero reforms were introduced by the government in 1969 and resulted in the government owning 51% of the mining corporations (Jane, 1983). In 1970, the Zambia Industrial Mining Corporation (ZIMCO) took over the two mining businesses, renaming them RST and Nchanga Consolidated Copper Mines (NCCM) (Fraser, Alastair, & Lungu, 2015). It was in 1973 that the Zambian government ended the purchase of shares in mining companies; the shares purchased were around 51% (Sardanis, 2011). In 1982, there was the merger of RST and Nchanga Consolidated Copper Mines (NCCM), and there was the creation of Zambia Consolidated Copper mines Limited (ZCCM), with 60.3% of the shares being owned by Zambia's government and AAC the remainder (Simutanyi, 2008).

Financial crisis and copper mines' re-privatization

In the course of their duty to keep employees peaceful during the nationalization process, miners have taken on a variety of social services (Mususa, 2012). The mines have not only looked after their employees, but have also provided services to the entire community in mining townships (Lungu, 2008), and the country has seen unprecedented investments in the development of new schools, hospitals, and roads in such a short period of time. Following the petroleum

crises of 1974 and 1979, the price of gold began to fall, and the Zambian economy began to suffer (Burdette, 1984). Apart from the drop in copper prices, the sector has faced a slew of issues, including a lack of investment, overstaffing, and obsolete equipment, with production costs soaring that underground mines progressed to deeper levels, what made that in 1994, the Republic of Zambia was among the thirty poorest countries in the world (World Bank Group, 2016). The government privatized the mines in 2000 and kept only a minority shareholding through ZCCM (Larmer, 2016).

4. Mining Methods and Copper Production

Sublevel Open Stopping is the most prevalent underground mining method, and many other methods are merely variants of Sublevel Open Stopping (Brown, 2015). Mainly, there are three mines that use Subvel Open Stopping method, two mines that use Subvel Caving method and four methods which are Vertical Crater Retreat, Cut and Fill, Room and Pillar, and Mechanized Continuous Retreat are used in one mine each (Global Business Report, 2014).

Generally, there is no safer and more efficient method than the other methods. Not all mines adapt the same safer and more efficient method. The type of mining method used is determined by the type of resource being extracted, the location of the deposit beneath or on the earth's surface, and the capacity of each method to extract the resource profitably. Each mining method also has varying levels of safety and environmental impact (Koehler, 1980).

Copper output peaked at 750,000 tonnes in 1969, the same year that nationalization talks began to heat up. Production had declined marginally to 700,000 tonnes by time nationalization was finalized in 1973. This was due to the fact that as soon as nationalization considerations began, investment in the mining industry began to decline. Production continued to decline after nationalization, and by the year 2000, production had decreased to 250,000 tonnes after 24 years of nationalization (John, 2001). As shown in Figure 3, Copper production over the decade from the 2010 to 2019 has been good with an average of over 700,000 tonnes. As Figure 3 shows, compared to 2010, copper production was low in 2009. This was generally due to the global financial crisis of 2008.

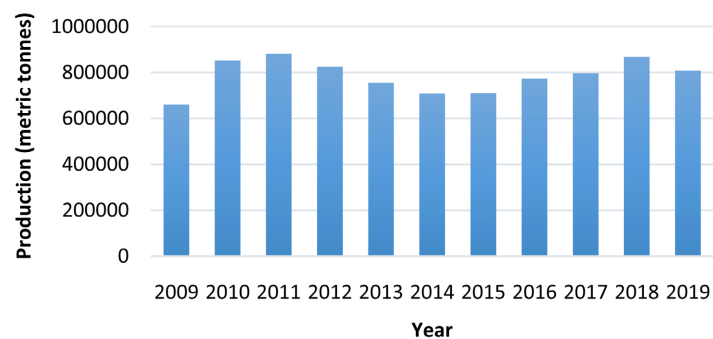


Figure 3. Production of copper in Copperbelt Province from 2009 to 2019 (Zambia Extrative Industries Transparency Initiative Annual Report, 2019).

5. Environment Affected by Mining

In the Copperbelt, the geotechnical integrity of rubbish dumps is a major source of environmental concern (Copper Environmental Project, 2002). Acid Mine Drainage occurs when mineral waste covers more than 12,000 hectares of land. Air pollution from SO₂ emissions, soil contamination, surface water pollution and siltation in the Kafue River and metal deposition in vegetables, fruit, and fish are among the other negative effects (Joanna, 2014). The Government of Republic of Zambia, on the other hand, is implementing several mitigating steps to solve these environmental issues through an entity called the Zambia Environmental Management Agency (ZEMA) (Pesa, 2021).

6. Conclusion

According to a study conducted by African Forum and Network on Debt and Development (AFRODAD) in 2016, Copper exports from the Copperbelt area represented a minimum of 27% of PIB and a maximum of 34% of PIB between 2010 and 2015 (AFRODAD, 2016). Since the post-independence era, numerous studies have shown that the growth of Zambia's GDP has shifted in direct proportion to changes in copper prices and most of Zambia's copper comes from the Copperbelt area, which means that mining activities in Copperbelt area are of vital importance to the Zambia economy. Statistical studies show that copper is expected to remain the main export of the Republic of Zambia for a long time and therefore the Copperbelt will remain the region that houses the heart of the Zambian economy.

In order to solve the environmental problem, mining companies, before starting their activities, should present an environmental management plan to be approved by the government. In the course of their activities, all mines should be accountable for their environmental conservation work and the government should monitor it carefully. Mining companies should use durable equipment and reduce the impact of waste on the environment by using proper waste disposal techniques. They should also fill in the local ecosystem as much as possible, making the area livable and allowing it to regain its shape after the mine closes.

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Conflicts of Interest

There are no conflicts of interest declared by the author.

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