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The African Copperbelt, which stretches some 500 km in length, roughly following the northwest–southeast border between the Democratic Republic of Congo (DRC) and Zambia, contains more than 10% of the world's known copper deposits, and hosts the highest concentration of industrial activity in sub-Saharan Africa outside of South Africa.

In 1867, Scottish missionary and explorer David Livingstone first described the smelting of ore into copper ingots by people living in the Katanga area, who had known and worked the deposits for centuries. Formal exploitation in the DRC (then Belgian Congo) began when the railway line reached Elizabethville (now Lubumbashi) in 1910, under Union Minière du Haut-Katanga (which was nationalized in 1967 as Gécamines, La Générale des Carrières et des Mines). During the early 1930s, this was the largest copper-producing company in the world. Commercial copper mining in Zambia started in 1909 at Broken Hill, Northern Rhodesia (now Kabwe, Zambia). However, exploitation of these ores has long been one of the most complicated geopolitical and economic questions of the region, not only because of colonial (and later nationalistic) rivalries, but also because of the energy-intensive requirements of smelters—pyrometallurgical processing then being the only known technology for treating copper ores.

The first hydrometallurgical operation, comprising leaching and direct electrowinning, started up at Jadotville (now Likasi) in 1929, producing 30 kt/a of copper cathode. This technology could be economically operated at smaller scale, with a lower energy requirement, and in a less technically demanding environment than the traditional pyrometallurgy route. The Luilu operation started in 1960, with leaching and electrowinning for 150 kt/a copper production, as well as producing cobalt metal. Hydrometallurgical processing of copper oxide ores took a major step forward when the inclusion of a solvent extraction step prior to electrowinning was proven at the Tailings Leach Plant (now Konkola Copper) in Zambia in the 1970s. This technology allowed much higher cathode purity to be obtained than could be achieved by pyrometallurgical processes at that time.

Much of the latter part of the 20th century was characterized by rises and falls of the copper price, nationalization and denationalization of the mining industry in both countries, brutal civil wars, assassinations, abrupt changes of governments, many decades of political and economic instability and corruption, and the DRC falling to rank among the poorest countries in the world. Some stability was finally restored to the region in the early 2000s, prompting a cautious return of investment and industrial activity.

In the past 15 years, the DRC has experienced a huge resurgence of activity, with an impressive proportion of the capital spending, project development, operational expansions, and metal value production in the Southern African mining industry now located in this region. The geology and mineralogy of the deposits differ significantly from those in other major copper-producing regions of the world, the ores often having very high grades as well as the presence of cobalt. Both mining and metallurgy present some unique difficulties, not only technical, but also with respect to logistics, supply chain, and legislative issues; however, the region is blessed with large resources of oxide ores, mainly at relatively shallow depths, and a young, ambitious, and eager-to-learn workforce.

The high-grade oxide ores have enabled relatively rapid construction, commissioning, and ramp-up of numerous Copperbelt hydrometallurgical operations in the past decade to produce London Metal Exchange Grade A copper cathode. There are now nearly fifty production sites in the DRC, where copper cathode output has grown from almost zero in 2008 to 1.77 Mt in 2022, and is anticipated to exceed 2.50 Mt by 2025. More than 70% of the world's recent new projects are in the DRC, accounting for more than 90% of new copper cathode capacity. Earlier this year, the DRC overtook Chile as the leading global producer of hydrometallurgical copper.

Pyrometallurgical production has not been abandoned, however: Ivanhoe Mining is planning the first new smelter in several decades to treat concentrate at the giant Kamoa–Kakula project in the DRC, which is ranked as the world's largest high-grade copper deposit. Zambian processing has traditionally also focused heavily on pyrometallurgical routes.

Journal Comment *(continued)*

The DRC also produces almost 70% of the world's cobalt. In the 1960s, the highest-quality cobalt cathode in the world was produced at the Luilu plant near Kolwezi (now Kamoto Copper), which hosted engineers from Japan and the USA who came to learn from the African operations. Today, cobalt production from this region has become highly emotive and politicized: some 20% of the country's supply is sourced from artisanal miners (estimated to exceed 100 000 in the Kolwezi area alone), often working in highly dangerous conditions and employing child labour. Cobalt is an essential component in many formulations of lithium-ion battery cathodes, considered critical to a low-carbon future; however, the precarious nature of the supply chain is driving technological development towards elimination of cobalt from these batteries. Cooperation and good faith between governments, legislators, multinational mining companies operating in the region, and labour are required to ensure that this window of opportunity for cobalt is not missed.

Despite ongoing difficult environments in the Copperbelt mining industry, industrial investment in this region is accelerating, mainly driven by Chinese-owned companies. To supply energy and electrification requirements to meet global decarbonization and sustainability goals, demand for copper is predicted to increase by some 20% by 2030; estimated cobalt demand is somewhat lower. As a major producer of these critical and strategic metals, the African Copperbelt is now slowly positioning to regain some of its former glory as a technical leader and major player on the world mining stage.

Sources

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