

## Essential Minerals for the Green Revolution – 5 Cobalt Mined by children

A UK Government report estimates that the conversion of the UK vehicle fleet from internal combustion engines to battery electric vehicles will require “an estimated 207,900 tonnes of cobalt”. The demand for cobalt in general could be up to 10 times greater by 2050 compared with 2015.



Cobalt minerals extracted by hand from a shallow mine in Africa (Photo courtesy of AdobeStock\_562501968)

What is cobalt? Cobalt (Co) is a chemical element with an atomic number 27. Cobalt is only found in the Earth's crust chemically combined with other elements such as copper and nickel although small deposits can be found in iron meteorites. To obtain the hard lustrous, silver metal element it needs to be extracted from metal ores where it is a by-product of the smelting process.

Where does cobalt come from?

The table shows the top ten countries for the mining of cobalt minerals like the one in the photograph above (Source, USGS).

Country	Mine production in 2022, tonnes	Reserves, tonnes
Australia	5,900	1,500,000
Canada	3,900	220,000
DR Congo	130,000	4,000,000
Cuba	3,800	500,000
Indonesia	10,000	600,000
Madagascar	3,000	100,000
Papua New Guinea	3,000	47,000
Philippines	3,800	260,000
Russia	8,900	250,000
Turkey	2,700	36,000

The Democratic Republic of the Congo (DRC) has about 4 million tonnes of cobalt reserves, but China has only about 140,000 tonnes. Total world reserves of cobalt are estimated at about 8 million tonnes. What percentage of world cobalt reserves are held by a) the DRC? (about 50%), b) China

(about 1.75%). China is the world's main producer of refined cobalt, most of which it uses to make batteries, so China has to import most of its raw cobalt minerals.

Most of the cobalt in the DR Congo is extracted as a by-product of large scale copper and nickel mining, in the south of the country, from mines mostly owned by companies in China. However, about 20% of the cobalt minerals are mined on a very small scale, known as 'artisanal mining'. Each tiny mine produces small quantities of cobalt minerals which are sold at trading posts and then smelted to produce low grade cobalt. This is mostly shipped to China for refining into high grade cobalt, of which about 80% is used in manufacturing car batteries.

The problem is that many of these artisanal mines employ children as young as 4 or 5 years old, and around 40,000 children are involved, earning an average of only 6 US cents a day.

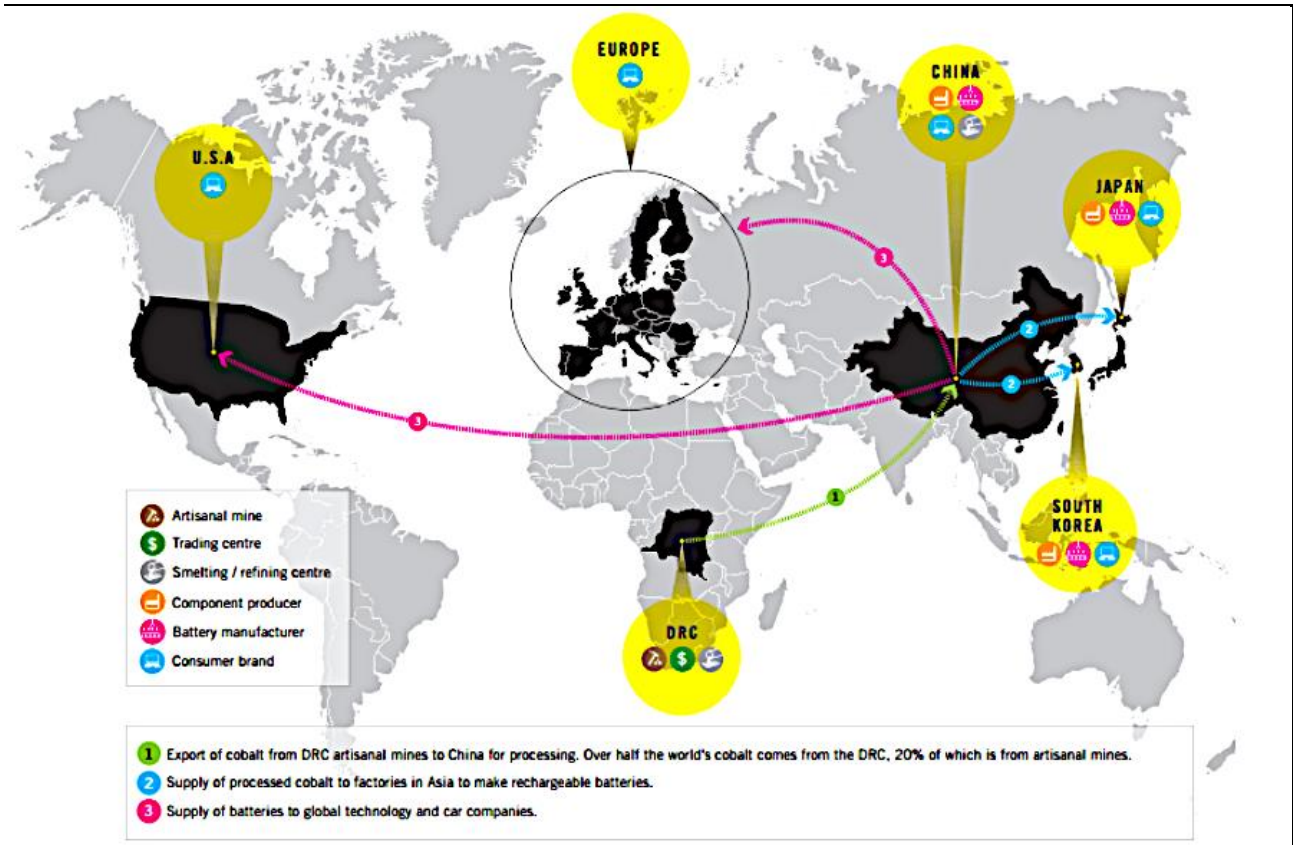
Children in DRC are often trafficked and exploited because of their small size, so that they can work in confined spaces, some even using their bare hands. A Roman Catholic priest who has investigated the conditions stated, “They work seven days a week and more than 12 hours a day,” Using tools like hammers, chisels, and spades, their working conditions are like that of slavery, he said. Injuries are common, and for those who are hurt or become sick, the lack of medical care means “the majority will die due to various untreated illnesses”.



A child miner in the DR Congo (Photo courtesy of AdobeStock\_559919334)

Find another photograph of some of these child miners from one of the websites listed below and draw a sketch of the scene. As you do so, imagine how you would try to cope if one of those children was you. What might be the impact on the families if their children were stopped from earning money in the mines?

Look at the map of the trade of artisanal-mined cobalt. Could your family electric car have cobalt in it, which was mined by children? List the stages of the route by which this could have happened.



The main trade in artisanal-mined cobalt [[Another Troubling Report of Cobalt Mining in DRC \(infocongo.org\)](http://infocongo.org)]

Are there other alternatives?

- Can we obtain enough cobalt by recycling scrap equipment? (*No. There is insufficient cobalt in circulation, although recycling should be encouraged as much as possible.*)
- Can alternative materials be used in place of cobalt? (*Scientists are working to reduce the need for cobalt, although some alternatives, such as manganese and nickel, are less efficient or more costly. Whatever metals are used, they all have to be mined from the*

*ground somewhere, but hopefully not by child labour.*

- Large quantities of cobalt minerals are found lying on the beds of the deep oceans across the world. Should mining companies be allowed to extract them – at least children could not be used for such purposes! (*So far, mining of the sea bed has not been allowed, since the deep ocean floor does not belong to anybody, and mining could destroy the delicate ecosystems, but this could change in the future.*)

## The back up

**Title:** Essential Minerals for the Green Revolution – 5 Cobalt

**Subtitle:** Mined by children

**Topic:** Raising awareness of the main trade in cobalt and the use of child labour in cobalt mines in the main producing country

**Age range of pupils:** 12 years and above

**Time needed to complete activity:** 30 minutes or more, depending on plotting graphs and using pictures from the web.

**Pupil learning outcomes:** Pupils can:

- explain why so much more cobalt is needed as new technologies are employed to counter the rise in carbon emissions;
- evaluate different possible sources of cobalt;

- explain why there is no alternative to mining to meet current and future demands for cobalt;
- Explain the problems of child labour in artisanal mining.

**Context:** This activity could be used in a lesson on the need to identify and exploit cobalt minerals in vital applications in many different fields, especially lithium-ion batteries. Worldwide demand for cobalt and related metals is rising rapidly as new technologies are embraced.

**Following up the activity:**

- Use the figures in the table on page 1 to plot a bar graph showing the mine production of each country onto a world map. Site the base of each bar on its own country.
- Pupils should be encouraged to research the problems of child labour in dangerous artisanal mines, from the point of view of the children themselves and for wider implications in the economy of the DR Congo.

**Underlying principles:**

- Worldwide demand for cobalt is increasing rapidly with the growth of new technologies.
- Existing technologies also require more cobalt as world population increases.
- Some cobalt can be recycled, but there is insufficient in circulation to be able to supply rapidly growing needs.
- Development of large-scale cobalt mines in African countries mostly depends on investment from other countries, e.g. China.
- Demand from China encourages small scale artisanal mining linked to local trading posts.
- Mining of natural cobalt minerals can cause emissions and water pollution which are harmful to both human health and the environment.

**Thinking skill development:**

Establishing the worldwide demand for cobalt and the need to extend the mining of it involves construction. Metacognition is involved when the plight of children involved in artisanal mining is discussed. Applying thinking to new contexts is a bridging skill.

**Resource list:**

- access to the table and graphics above
- an atlas, or the electronic equivalent per group of pupils

**Useful links:** For up to date statistics about cobalt production see [Cobalt \(usgs.gov\)](https://www.usgs.gov). The following websites are typical of those which seek to expose the use of child labour and contain graphic images of children at work: [Another Troubling Report of Cobalt Mining in DRC \(infocongo.org\)](https://www.infocongo.org)  
[Congo, child labour and your electric car \(humantraffickingsearch.org\)](https://www.humantraffickingsearch.org)  
<https://www.catholicnewsagency.com/news/253539/here-s-what-pope-francis-said-about-exploitative-mining-in-the-congo>

**Source:** Written by Peter Kennett of the Earthlearningidea team. Thanks to Ben Lepley of SLR Consulting Ltd for advice.

Note: This activity was as accurate as possible in summer 2023. Rapid developments are taking place in the technology of low and renewable energy.

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## Essential Minerals for the Green Revolution

Earthlearningidea has compiled a series of activities on the minerals which are essential if modern technology is to be able to reduce the World's carbon footprint. Some are regarded as "critical" minerals and many of them are relatively "new" in terms of needing to be exploited.

This table will be updated as fresh activities are added.

All titles begin with: Essential Minerals for the Green Revolution...

<b>Mineral</b>	<b>Title</b>
<a href="#">Lithium</a>	1 Lithium: an element which is pulling more than its weight in the world
<a href="#">Copper</a>	2 Copper: an element for which the demand is increasing rapidly
<a href="#">Rare Earths</a>	3 Rare Earth Elements: vital components in modern technology
<a href="#">Graphite</a>	4 Graphite: from a pencil to the electric car!
<a href="#">Cobalt</a>	5 Cobalt: mined by children
<a href="#">Tin, Tungsten, Tantalum</a>	6 "The Three Ts": Tin, Tungsten and Tantalum
<a href="#">Gold</a>	7 Gold: an essential mineral - or is it?
<a href="#">Critical minerals</a>	8 Critical Minerals: Essential mineral - critical mineral: what is the difference?