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The linkage between abuse to artisanal cobalt miners--including children--in the Democratic Republic of the Congo (DRC) and use of cobalt in advanced batteries has prompted global supply chain reviews, responsible sourcing initiatives, and research to remove cobalt from battery cathodes. However, no study has systematically evaluated how large of a role artisanal mining plays in world cobalt mine production. Doing so reveals artisanal supply trends and potential monitoring points for artisanal production to help provide more transparent cobalt supply chains. This study finds that artisanal cobalt mining"s share of world cobalt mining has generally decreased since 2008 and that most artisanal production was either processed in the DRC by Chinese firms or exported to China.

Keywords: artisanal cobalt mining, the Democratic Republic of the Congo, China, child labor, responsible sourcing

Methods and data used to estimate artisanal cobalt mine production in the Democratic Republic of the Congo (DRC): unknown methods for literature estimates in the left column, artisanal-production-A, also referred to as "nonindustrial production" in the middle column; artisanal-production-B, also referred to as "artisanal processing and imports (i.e., artisanal production)" in the right column.

The results for artisanal-production-B (also referred to as artisanal processing and imports) are presented in Fig. 3 A and B as the dotted lavender line. Like artisanal-production-A, artisanal-production-B peaks in 2005, 2010, 2015, and 2018, as well as bottoming out in 2013, 2016, and 2020. The annual trends for artisanal-production-B were similar to those of artisanal-production-A, with the sign of annual change (positive or negative) for artisanal-production-A and -B being the same for 17 of the 20 y (Dataset S11d). From 2000 through 2020, the average difference between artisanal-production-A and -B was 800 tpa (1%) with a minimum difference of zero (0%) and a maximum of 5,000 tpa (67%) (Dataset S11d).

In comparison, government estimates, as a percentage of total world and DRC production, peaked in 2004 at 12% and 35%, respectively. Government estimates then fell over time to 8% and 12% in 2019, which are the same percentages as artisanal-production-A and close to artisanal-production-B results of 10% and 15% in 2019. Industry estimates peaked at 17% and 30% in 2010 (as opposed to 10% and 18% for both artisanal-production-A and -B). In 2020, the average of industry estimates is 6% and 9%, equal to artisanal-production-A and like artisanal-production-B"s 7% and 10%. In other words, the trends and quantities of government and industry estimates were largely in line with the results for artisanal-production-A and -B.

Artisanal-production-A in the Democratic Republic of the Congo (DRC), unstacked dark purple area on the Left axis; processing of artisanal production into intermediate cobalt materials (i.e., artisanal processing) in the DRC, blue gray unstacked area, Left axis; and artisanal processing as a percentage of artisanal-production-A, light blue line on the Right axis.

China"s imports of cobalt ores/concentrates from the DRC (imports). Industrial Chinese cobalt ore/concentrate imports, stacked dark blue gray area; artisanal (i.e., nonindustrial) Chinese cobalt ore/concentrate imports, stacked light purple area; total Chinese cobalt ore/concentrate imports" share of world imports, light turquoise line on the Right axis; and artisanal imports" share of total Chinese imports from the DRC, rose line on the Right axis.