Global Cu, Ni and Co resources: Changing trends and endowments and implications for the future of the global mining industry

Corresponding author: Simon M Jowitt, Monash University, simon.jowitt@monash.edu

Co-authors:
Gavin M Mudd, Monash University, gavin.mudd@monash.edu

The long-term availability of mineral resources underpins human society, technology and economic activity, and secure supplies of primary production-dominated metals, such as Cu, and metals such as Co that are recovered as by- or co-products, are vital to modern life. Here, we present a detailed overview of global Cu, Ni and Co resources classified by mineral deposit type; these metals contribute to infrastructure, technology and lifestyles, but have significantly different production histories and current resource distributions. Production of all three metals increased throughout the 20th century, but this production was more than matched by increases in Cu, Ni and Co resources-reserves driven by exploration success, increasing technological capacity, growing markets and demands, as well as geological factors such as exploitation of lower grade but much larger deposits and economies of scale.

Global Cu production is dominated by primary production, and the 730 mining and mineral exploration projects within our Cu database yield a minimum total amount of global Cu resources of ~1,800 Mt Cu, with a further 80.4 Mt Cu of potentially less robustly reported resources in China. The vast majority of global Cu resources are hosted by porphyry deposits, especially in Chile, with Cu porphyry deposits containing some 10 times more Cu than any other mineral deposit type.

Our Ni database contains 296.2 Mt Ni resources within 253 sulfide (118.0 Mt Ni) and 224 laterite (178.1 Mt Ni) projects. A further 3.38 Mt Ni in China yields a global total of 299.6 Mt Ni, indicating that global Ni resources are dominated by laterite deposits (59.5%). Although Ni is a primary metal within the vast majority of these deposits, the importance of co-/by-product Ni is exemplified by the PGE deposits of the Bushveld Complex, which, if amalgamated, yield a single resource that dominates global Ni resources, with 28,884 kt contained co- or by-product Ni.

Cobalt is a critical metal that is generally produced as a byproduct and is used with increasing frequency in modern technology. The dominantly by-product nature of Co means that uncertainties exist in Co grades and recovery rates; given this, we classified our total recoverable Co resource data into high, medium and low quality categories, depending on factors such as whether statutory resource reporting codes were used during resource reporting. A minimum of 26.8 Mt Co is present in current global Co resources, with 15.2, 5.6 and 6.0 Mt Co in high, medium and low quality resources, respectively. ~15.9 Mt of this Co is recoverable, with ~10.7, ~2.6 and ~2.6 Mt Co recoverable in high, medium and low quality resources, respectively. This robust methodology can be applied to other companion (and often critical) metals, such as In, Re, and Se, all of which are increasingly important for modern-day life.

These data indicate that there are abundant Cu, Ni and Co resources already identified that can meet growing global demands for decades to come – the primary factors that govern whether a given project is developed (or not) are geometallurgical, social, economic and environmental in nature.