

Cobalt mineral ecology

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ABSTRACT

Minerals containing cobalt as an essential element display systematic trends in their diversity and distribution. We employ data for 66 approved Co mineral species (as tabulated by the official mineral list of the International Mineralogical Association, <http://rruff.info/ima>, as of 1 March 2016), representing 3554 mineral species-locality pairs (www.mindat.org and other sources, as of 1 March 2016). We find that cobalt-containing mineral species, for which 20% are known at only one locality and more than half are known from five or fewer localities, conform to a Large Number of Rare Events (LNRE) distribution. Our model predicts that at least 81 Co minerals exist in Earth's crust today, indicating that at least 15 species have yet to be discovered—a minimum estimate because it assumes that new minerals will be found only using the same methods as in the past. Numerous additional cobalt minerals likely await discovery using micro-analytical methods.

Primary Co minerals include 26 species, most of which are hydrothermally deposited chalcogenides. We identify 33 additional plausible as yet undiscovered primary cobalt chalcogenide minerals, including 28 phases with spinel, nickeline, pyrite, and marcasite structural topologies. All 40 secondary cobalt minerals are oxides, and 37 of these phases also incorporate hydrogen. We tabulate an additional 117 plausible secondary Co minerals that are related compositionally and/or structurally to known species. New cobalt minerals are likely to be discovered in specimens collected at the 10 most prolific Co localities, all of which are mining districts with hydrothermal Co mineralization and hosting at least 10 different primary and secondary Co species.

Keywords: Cobalt, mineral ecology, new minerals, statistical mineralogy, philosophy of mineralogy, rarity, accumulation curves, LNRE distributions