

COBALT MINERALISATION IN CORNWALL – A NEW DISCOVERY AT PORTHTOWAN



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Although cobalt mineralisation has been noted in Cornwall and Devon in the mining literature, there are limited details of its production and paragenesis; detailed mineral studies of cobalt are almost non-existent. This paper describes in detail previously unrecorded cobalt mineralisation discovered at Porthtowan, Cornwall, in the vicinity of old workings which are part of the Wheal Lushington group of mines, immediately west of the village. A small number of massive sulphide/gangue samples (taken from a larger sample suite) were chosen to be as representative as possible. Analysis was carried out using a QEMSCAN® automated mineral SEM-EDS system, which found that samples contained up to 50% cobaltite, along with chalcopyrite, bornite, galena, sphalerite, acanthite, erythrite, matildite, chlorargyrite and other primary and secondary mineral species. This assemblage is typical of a sub-type of crosscourse mineralisation, with secondary species a result of significant weathering and supergene alteration, complicated by seawater infiltration due to the coastal location. While the number of samples is limited, the detail of the mineralogical assemblage is significant, as it is the first time such an assemblage has been subjected to this level of scientific scrutiny in Cornwall.

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INTRODUCTION

Cobalt, atomic number 27, is a brittle, hard, silvery grey transition metal with an average crustal abundance of 26.6 ppm, occurring in nature as a series of sulphides and arsenides (and secondary species), in close association with silver, nickel and copper. Cobalt was first isolated in 1739 by Georg Brandt (<http://www.rsc.org/periodic-table/element/27/cobalt>) and is a dense metal (8.86 g/cm³) with a high melting point (1495°C) and ferromagnetic properties. It is used chiefly in the production of high-strength and heat-resistant alloys as well as in magnets, battery cathodes (with lithium), jewellery (alloyed with platinum) and medical implants. Its compounds have wide ranging uses as colourants and catalysts.

Cobalt does not occur naturally in native form, although it does form the very rare alloy wairauite (CoFe) found at one locality in New Zealand. It is known as an essential component in 59 mineral species (Mindat.org, 2017), the majority of which are sulphides, arsenides and secondary arsenates. The most common species, including those found in this study, are: cobaltite (CoAsS), skutterudite (CoAs₃), safflorite (CoAs₂) and, the secondary arsenate, erythrite (Co₃(AsO₄)·8H₂O). Cobalt has a strong affinity for nickel, silver and arsenic and compounds of these elements often form in close paragenetic association with cobalt species.

COBALT IN CORNWALL

Cobalt is a minor product of the Cornubian Orefield, with a total mined production (mostly from the mid-late 18th Century and early 19th Century; records of which are very incomplete) of a few hundred tons (Dines, 1956). In some cases it was mined in conjunction with nickel and bismuth ores and Alderton (1993) gives a combined production of 500 tons for these three metals, although the real figure is likely to be higher.

Cobalt mineral species were recognised in around thirty Cornish mines (Borlase, 1758; Pryce, 1778; Dines, 1956; Collins, 1912, 1892; Tindle, 2008; Le Boutillier, 1996, 2003). Cobaltite has been confirmed from Fowey Consols, St Blazey and South Terras Mine, St Stephen-in-Brannel. Earlier references to cobaltite at Dolcoath Mine, Wherry Mine and Botallack Mine, now appear to be dubious and are likely describing skutterudite (Tindle, 2008). Cobaltite was found as a minor constituent in the 3ABC Pegmatite Zone on the 360 fathom level of South Crofty Mine at Pool (Le Boutillier, 2003). Skutterudite is known from Botallack Mine; Levant Mine; Geevor Mine; Wherry Mine, Penzance; Hawkes Point Mine, St Ives; Wheal Herland, Gwinear (associated, in a crosscourse, with native silver and silver sulphides; Hamilton Jenkin, 1963a); Roscrow United Mine, Ponsanooth; Wheal Sparnon and Pednandrea Mine, Redruth; East Pool Mine, Illogan; Dolcoath Mine, Camborne (associated with U, Co, Ni-bearing crosscourses cutting Main Lode close to