

1 History

The word is generally accepted as derived from the Greek via medieval German. Records of the name only go back to 1335 when it was applied to gnomes living in the mines in the Schneeberg Mountains in Germany. However, cobalt colouring of ceramics has been known for well over 2,000 years in Persia and Egypt so it must have had an unknown earlier name.

Cobalt occurred in the Schneeberg with silver and nickel and it was silver that was of interest then. When problems arose, they were blamed on the “Kobolds” – later it was found to be the cobalt ore that caused the problems – hence the name transference. Problems from nickel were blamed on a higher (or lower!) cause – and Nick to Nickel is a short step.

Colourings from oxides and silicates were the main use up to the 20th Century and even in 1916, total output was only 554 tonnes with 400 of it as oxides.

A Short History of Cobalt

BC 2250	Dating of Persian blue glass necklace (cobalt oxide)
BC 100	Dating of Portland Vase from Greece
AD 1470	Working of Schneeberg Saxony silver-cobalt deposits
AD 1520	“Saffre” colour by Peter Weidenhammer (Erzgebirge)
AD 1540	“Smalt” colour by Christian Schurrer (Bohemia)
AD 1651	Cobalt ores worked from oxide in Burma
AD 1705	Cobalt “invisible ink” invented by Walchim
AD 1735	Metallic cobalt isolated by G. Brandt (Sweden)
AD 1780	Cobalt proved as element by Bergman
AD 1802	Thenard chemistry of Cobalt
AD 1842	Cobalt electroplating by R. Bottger
AD 1864	New Caledonia cobalt ores discovered by Garnier
AD 1891	Cobalt in ground coat enamel frit (Claus)
AD 1897	Sabatier suggests use of cobalt as catalyst
AD 1901	Cobalt used as paint drier
AD 1903	Willet Miller names town in Ontario “COBALT”
AD 1905	Cobalt in Highspeed Steels
AD 1907	Haynes Stellite® patent 873745 (cobalt chrome) US
AD 1909	Tammann suggests cobalt-chrome for gas turbine
AD 1913	Haynes patent for cobalt-chrome-tungsten satellites
AD 1914	Cobalt discovered in Katanga, Zaire
AD 1914-1918	Hopcalite (cobalt) gas masks for carbon monoxide fumes
AD 1917	Cobalt magnet steels by K. Honda (Japan)
AD 1923	R. Schroter tungsten carbide patent 420689 (Germany)
AD 1930	Cobalt discovered at Rhokana, Zambia
AD 1933	Alnico magnets invented by GEC (USA) and Mishima (Japan)
AD 1934	Cobalt deficiency proved in sheep (Filer & Underwood)
AD 1936	First production of Alnico magnets in USA
AD 1936	Development of Vitallium by Austenal as a dental alloy
AD 1937	Cobalt isotopes 55, 56, 58 and 60 first produced
AD 1934-1937	Roelen cobalt catalysed synfuels and oxo processes (Ruhrchemie)
AD 1939-1946	Vitallium used in bucket for aircraft engine superchargers
AD 1948	Commercial use of cobalt oxo synthesis
AD 1948	Use of cobalt 60 radioactive isotope in radiography & therapy
AD 1948	Isolation of Vitamin B12
AD 1950	Libsch soft magnet iron-cobalt (Permendur)
AD 1953	Extensive use of cobalt for hydrodesulphurisation catalyst
AD 1954	Cobalt catalysis of xylenes (terephthalic acid synthesis)

AD 1957	Use of cobalt in magnetic particle recording
AD 1958	Cobalt 60 used in food and medical sterilisation
AD 1967	Strnat discovery of rare earth cobalt magnets
AD 1970	Commercial cobalt samarium magnets
AD 1975	Iwasaki & Takemura perpendicular recording with Co-Cr
AD 1980	Growth of Co-Cr alloys in prosthetics
AD 1991	Growth of catalyst, chemical market
AD 1994	Cobalt's use in Ni/Cd, Ni/MH and Li/Co batteries growing
AD 2001	Growth of catalysts, gas to liquid technology

Cobalt has been used to colour pottery and glass from at least 2600 BC and cobalt-containing glazes have been found in Egyptian tombs of that period. Chinese pottery from Tang (600-900 AD) and Ming dynasties (1350-1650 AD) also contained blue colours made from cobalt-containing minerals. The metal itself seems to have only been isolated in 1735 by G. Brandt, a Swedish scientist, and its metallic uses stem from Elwood Haynes' studies and patents in the early 1900's. The Co-Cr alloys, and superalloys in general, which caused the great leap in cobalt use are of course still in use as are the Alnico series of magnets invented in the 1930's.

Cobalt sources have changed over its history, from Norway, Sweden, Hungary and Germany (Saxony) to a dependence on the African Copper Belt in the 1970's and 1980's. In the last decade, sources have diversified with increasing amounts coming from nickel ores in Australia.

The present situation is changing again. In percentage terms, the origin of the cobalt being refined now is:

New Caledonia	5.0%
Australia	10.5%
Africa – Copperbelt	31.9%
Africa – Others	12.9%
Canada	10.9%
China	3.6%
Cuba	9.5%
Russia	12.1%
Others	<u>3.7%</u>
Total	100% (refined Co in 2001 ± 41,000 tonnes)

These figures are of necessity for guidance only. The likelihood is that the trend towards Australia, Cuba and the Pacific will increase as new nickel production becomes viable. One cannot however now ignore Canada with the possibility of growth through Voisey's Bay.

As usual, in most cases, cobalt is a by-product. The balance is swinging towards nickel as the main product, but although refined production in Africa had declined in recent years, the amount of cobalt produced as a by-product of Africa copper ores/slugs is still substantial. The current split is 50% nickel, 45% copper and 5% primary cobalt.