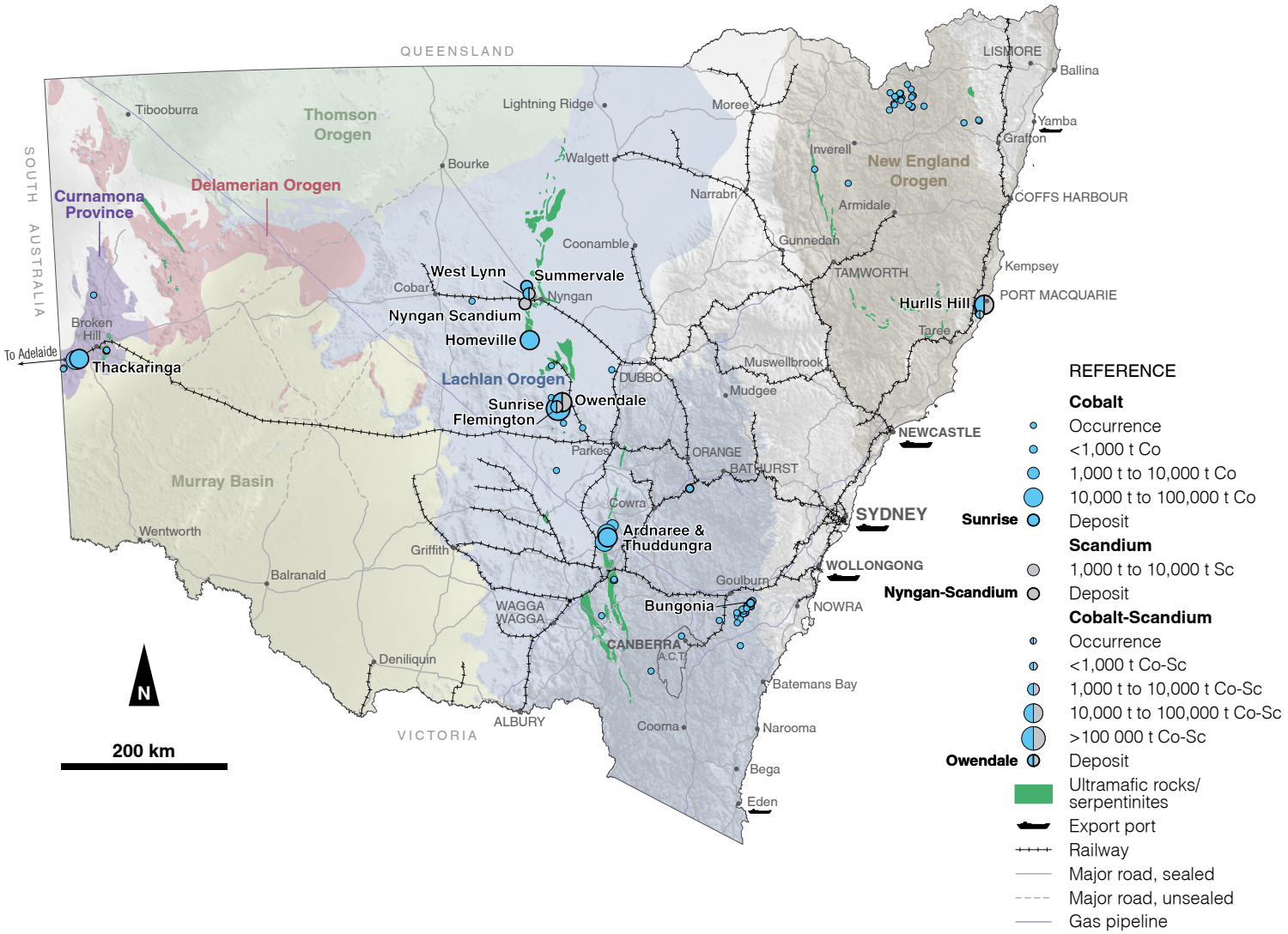
Cobalt and scandium

Opportunities in New South Wales, Australia

DECEMBER 2021



Overview

- New South Wales (NSW) has excellent investment opportunities for cobalt and scandium, which are critical specialty metals with high supply risk.
- NSW hosts the world's sole scandium-only resource.
- Cobalt and scandium are key 'tech metals' that can add value to nickel and base-metal projects.

Cobalt

Cobalt is a hard and lustrous metal and is mainly recovered as a by-product of smelting copper, zinc and nickel. About 36,000 t or 29% of world cobalt production in 2015 was for batteries.

Cobalt demand is increasing for lithium-ion batteries for electric vehicles, various other rechargeable devices, and for super alloys.

Scandium

Lightweight scandium super alloys are used for aerospace and new high-tech applications, given their excellent strength and corrosion resistant properties.

Recent global consumption is 10–15 t per year, mainly from recycling of military airframes and as a by-product of processing residual ore stockpiles and tailings (source — USGS).

Geological setting

Cobalt occurs naturally as the arsenide $Co(As_2)$, known as smaltite or speiss cobalt; as cobalt sulfarsenide CoAsS, known as cobaltite or cobalt glance; glaucodot (Co,Fe)AsS; and as hydrated arsenate ($Co(AsO_4)_2.8H_2O$), known as erythrite or cobalt bloom.

NSW GOVERNMENT

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Project highlights

Deposit name	Current resources and reserves	Contained cobalt (t)	Contained scandium (t)
Ardnaree & Thuddungra	(indicated) 3.2 Mt @ 0.67% Ni, 0.04% Co	46,330	–
	(inferred) 90.1 Mt @ 0.63% Ni, 0.05% Co	–	–
Flemington	(measured, indicated & inferred) 2.7 Mt @ 0.101% Co, 403 ppm Sc, 2,423 ppm Ni	2,727	1,090
Homeville (Collerina)	(indicated & inferred) 17.9 Mt @ 0.89% Ni, 0.06% Co	10,740	–
Hurlls Hill	(inferred) 10.8 Mt @ 0.66% Ni, 0.010% Co & 41 ppm Sc	10,765	441
Nyngan scandium	(proved & probable) 1.4 Mt @ 409 ppm Sc	–	–
	(measured & indicated) 16.9 Mt @ 235 ppm Sc	–	3,972
Owendale – Red Heart	(measured, indicated & inferred) 35.6 Mt @ 405 ppm Sc, 0.28 g/t Pt, 0.10% Ni, 0.06% Co	20,500	22,000
Sunrise	(measured, indicated & inferred) 101 Mt @ 0.59% Ni, 0.13% Co	132,000	–
	(measured, indicated & inferred) 45.7 Mt @ 421 ppm Sc	–	19,222
	(proved & probable) 147.4 Mt @ 0.092% Co, 0.56% Ni, 53 ppm Sc	–	–
Thackaringa (Big Hill, Pyrite Hill & Railway)	(global resource) 123 Mt @ 0.066% Co (probable) 71.8 Mt @ 0.071% Co	81,180	–
West Lynn & Summervale	(inferred) 21.3 Mt @ 0.84% Ni, 0.05% Co, 20% Fe, 2.4% Al	10,650	–

World resources

Cobalt occurs in sediment-hosted stratiform copper deposits in Congo (Kinshasa) and Zambia. Cobalt and scandium commonly occur in lateritic deposits, mainly developed over orthomagmatic sulfide deposits and ultramafic and mafic rocks in Australia, Canada, Russia, and the United States. In laterite, they are adsorbed into clay minerals — e.g. Ni-Co asbolite $(Ni,Co)_{2-x}Mn^{4+}(O,OH)_4.nH_2O$.

Cobalt is extracted by several processes including flotation, reduction, roasting, with electro-winning being the final stage.

NSW occurrences

Cobalt has been produced as a by-product of smelting of base-metal ore at Broken Hill, manganiferous grits near Bungonia and has been produced from laterites near Carcoar and Port Macquarie. Extensive deep weathering during the 'Tertiary' period (Paleogene–Neogene) formed numerous laterite-hosted deposits.

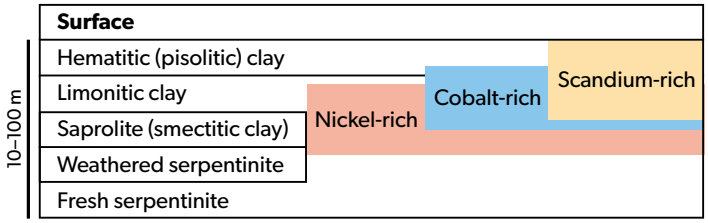
NSW hosts over 338,000 t of cobalt.

Exploration opportunities

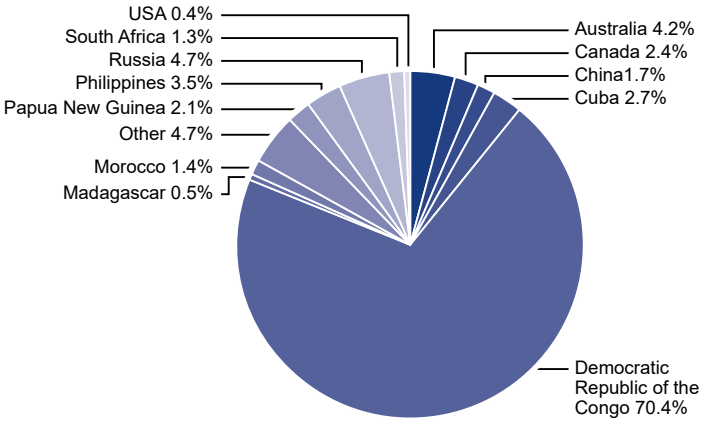
Many prospective areas in NSW await systematic exploration for cobalt and scandium. They include:

- nickel–cobalt laterites developed over the Owendale–Syerston, Tout and Alaskan-type Fifield igneous complexes in the central Lachlan Orogen
- deeply weathered serpentinites such as the Great Serpentinite Belt (e.g. Port Macquarie deposits), the Coolac Serpentinite Belt and Jindalee Group (Thuddungra)
- ultramafic rock sequences under shallow cover
- residual manganese–cobalt rich 'grits' of Tertiary age near Bungonia, 160 km southwest of Sydney.

Tertiary laterite development



Global cobalt production (2020)



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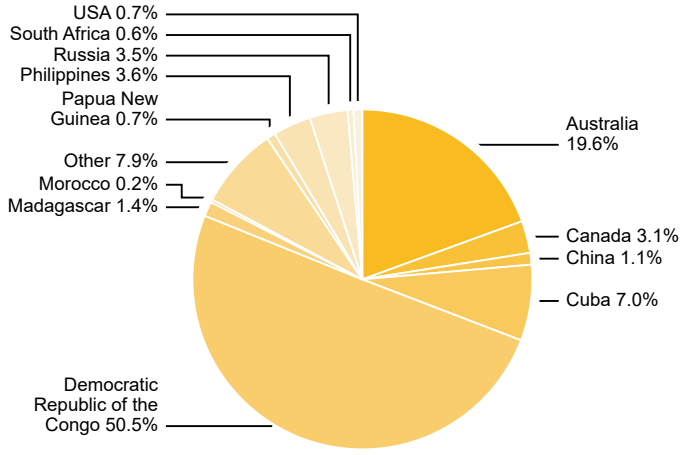
Global cobalt reserves (2020)



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