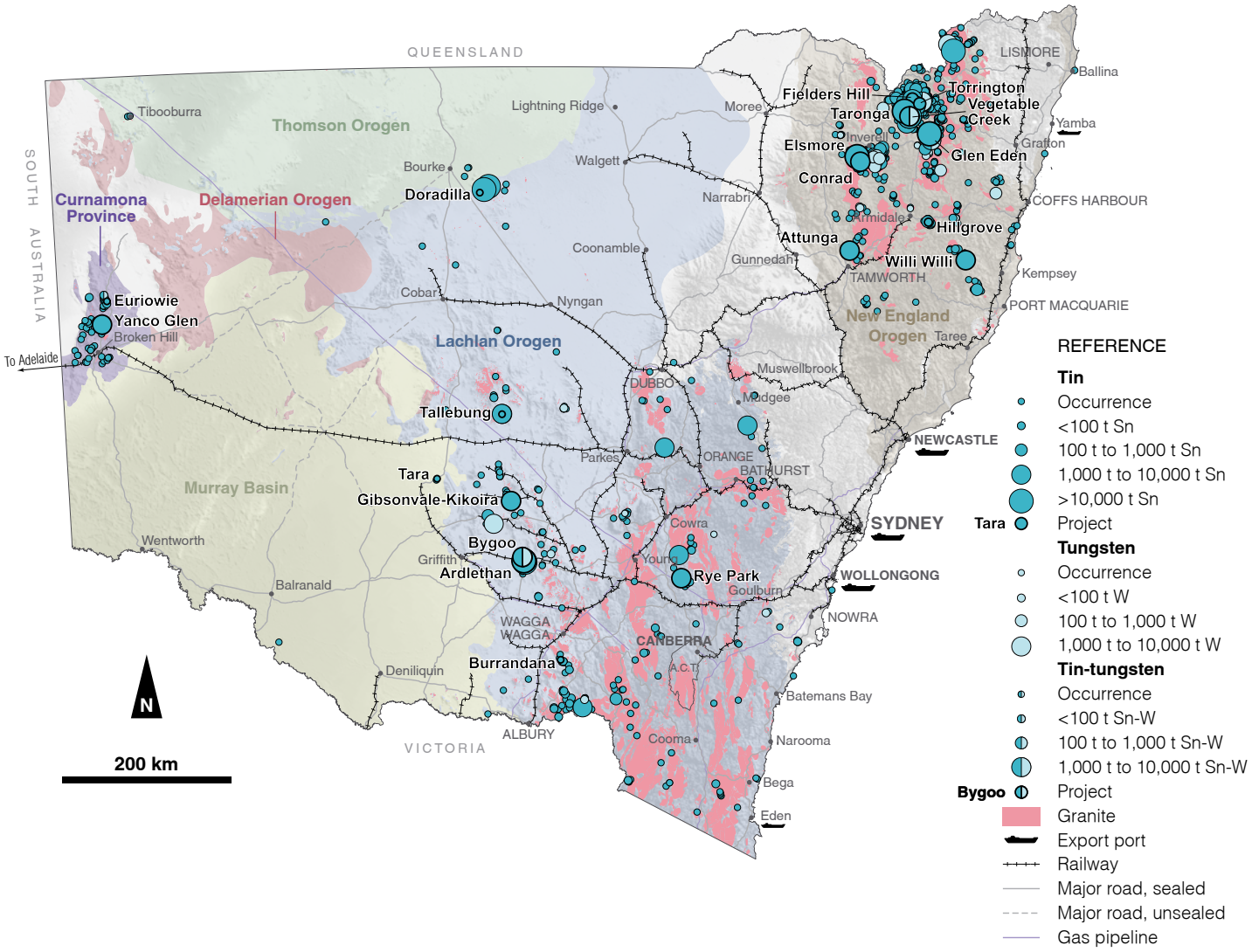
Tin and tungsten

Opportunities in New South Wales, Australia

DECEMBER 2021



Overview

- New South Wales (NSW) has a tin endowment (current resources and past production) exceeding 445,000 t and tungsten endowment exceeding 35,900 t.
- Tin and tungsten are either the principal commodities or a significant credit in a diverse range of deposits.
- Tungsten occurs both as wolframite-dominated deposits in tin-dominated districts or as scheelite-dominated skarns.
- Many deposits have not been subjected to modern exploration techniques or explored at depth, providing excellent opportunities for the development of existing resources and new discoveries.

Deposit types

Tin and tungsten mineralisation are comprised of a diverse range of deposit styles. Most deposit styles have a close spatial and genetic relationship to the apical regions of granitoid plutons. Deposit styles include pegmatite and magmatic segregations within granitoids and adjacent wallrocks, greisens, stockworks, scheelite skarns and replacement orebodies (both proximal and distal types) and tourmaline-bearing breccia pipes.

Tin deposit types in NSW:

- alluvial (Vegetable Creek)
- stockwork & greisen (Taronga, Emmaville)
- skarn (Doradilla, Willi Willi)
- breccia pipe (Ardlethan)
- pegmatite (Euriowie, Yanco Glen).

NSW GOVERNMENT

Tungsten deposit types in NSW:

- skarn (Attunga, Rye Park)
- vein (Tallebung)
- greisen (Torrington).

Regional geological criteria

- Areas of known Sn–W mineralisation
- Highly fractionated, felsic granites with intermediate to reduced oxidation states
- Batholiths only now being unroofed or still shallowly buried
- Occurs as skarns, Sn–W veins in New England and Lachlan orogens
- Pegmatites around Broken Hill.

Mineralisation features

Sn ± W mineralisation is invariably associated with the upper parts of felsic and fractionated granitoid plutons and, with cupolas and ridges on the tops of batholiths, where exsolved magmatic fluids have evolved, been focussed, and/or ponded. Greisen bodies in the roof zone of granites or beneath internal contacts within granite; transgressive veins, stratabound replacements. Metal zonation (down temperature) may be W > Sn > base metals. Cassiterite may occur as infill or replacement. Gangue: quartz, mica, feldspars, tourmaline, topaz.

Prospective terranes

- Granites of Siluro-Devonian, Carboniferous and Permo-Triassic age; batholith only now being unroofed or still shallowly buried.
- Replacement deposits, massive greisens, porphyry-style stockworks. Replacement deposits generally have the highest grades, whereas greisens and stockworks potentially offer the largest tonnages.
- Tin as cassiterite – mineralogically simple ores, and Sn dominant metal with possibly W and Ag.
- Tungsten as wolframite and scheelite with minor commodities including Sn and topaz (silexite).
- Prospective Sn–W areas may also contain rare earth elements, such as Y, In, Ta and Nb.

New England Orogen

- Most historical tin production (~250,000 t) was from alluvial deposits including 80,000 t from the Emmaville district (Torrington, Great Brittan, Fielders Hill).
- Significant potential hardrock tin resources remain in major historical mineral fields (Taronga, Elsmore, Glen Eden).
- Good potential for buried high-level granite systems in or under tin deposits that are associated with I-type granites. Some of these intrusions may contain heavy rare earth elements.
- Hillgrove Au-Sb-W district are hosted in late Palaeozoic polydeformed, hornfelsed metasediments and Permo-Carboniferous granitoids. Significant tungsten in the form of scheelite.
- Hardrock styles include veins (single, sheeted, stockwork), disseminations, pipes and greisens.
- Some W and Sn deposits occurring in and close to the margins of some granite bodies (i.e. Mole Granite, Gilgai Granite, and Ruby Creek Granite). Potential exists for deposits located under contemporaneous volcanics, similar to the Tingha–Gilgai district.

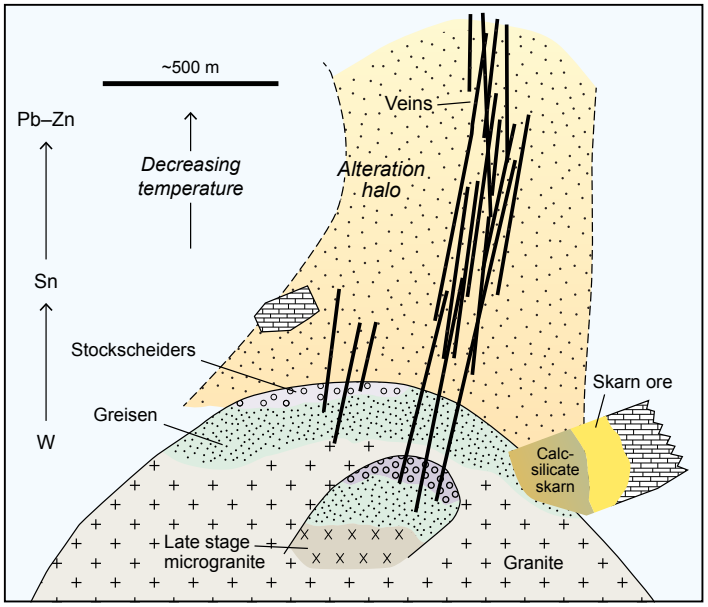
Silexite with wolframite, Fielders Hill, New England Orogen.

Lachlan Orogen

- Host to numerous occurrences of Sn and W. Significant historical alluvial production.
- Tin and tungsten are mainly associated with S-type granites and minor I-types.
- Wagga Tin Belt is highly prospective and contains hardrock Sn ± W deposits associated with fractionated, reduced granitoids, e.g. granitoids of the Koetong Supersuite that are associated with many deposits including Ardlethan.
- Significant potential hardrock resources remain: veins (Kikoira), breccias (Ardlethan Tin mine), greisens, carbonate replacement/skarn (Doradilla).
- Good potential for buried systems under cover (e.g. Burrandana, Tara prospect).

Curnamona Craton

Pegmatites are widespread in the Broken Hill region. Some are highly fractionated and include the famous Be- and Li-bearing pegmatites. Around Euriowie they are associated with Sn and Ta.



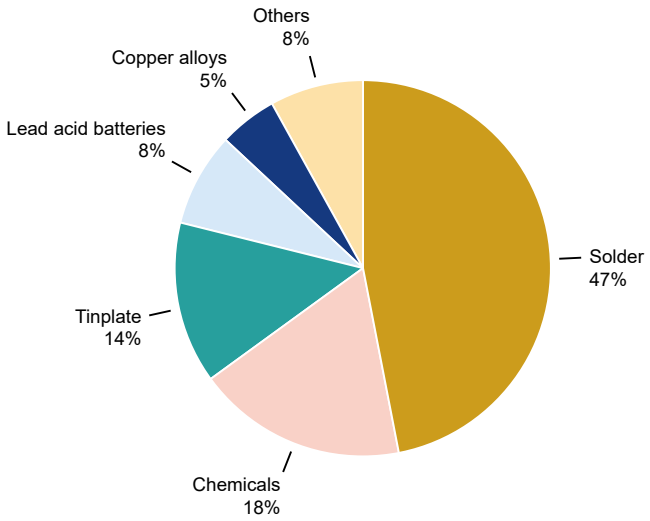
Schematic model of a typical greisen–stockwork–skarn Sn–W-base-metal system (modified after Blevin 2017).

Summary of significant tin and tungsten resources in NSW

Project name Deposit type	**Current resources and reserves (JORC)**	**Contained tin ('000 t)**	**Contained tungsten ('000 t)**
Ardlethan Breccia pipe	Tailings: (indicated & inferred) 10.7 Mt @ 0.20% Sn Waste Material: (inferred) 21.3 Mt @ 0.09% Sn Hardrock underground: (indicated & inferred) 5.5 Mt @ 0.45% Sn	67	–
Attunga Skarn	(inferred) 1.29 Mt @ 0.61% WO_3, 0.05% Mo	–	6
Conrad Vein & greisen	(indicated & inferred) 3.3 Mt @ 1.22% Pb, 0.62% Zn, 86 g/t Au, 0.17% Sn, 0.11% Cu	6	–
Doradilla Skarn	(inferred) 4.630 Mt @ 0.25% Sn	13	–
Glen Eden Breccia	(indicated) 30 Mt @ 0.08% WO_3, 0.04% SnO_2, 0.10% MoS_2	–	9
Taronga Sheeted vein system	Northern Zone: (indicated & inferred) 27.0 Mt @ 0.15% Sn Southern Zone: (indicated & inferred) 9.3 Mt @ 0.19% Sn	57	–
White Rock (Rye Park) Skarn	(inferred) 0.26 Mt @ 0.7% WO_3, 0.15% SnO_2	–	1
Yanco Glen Pegmatite	(inferred) 0.83 Mt @ 0.17% WO_3	–	3

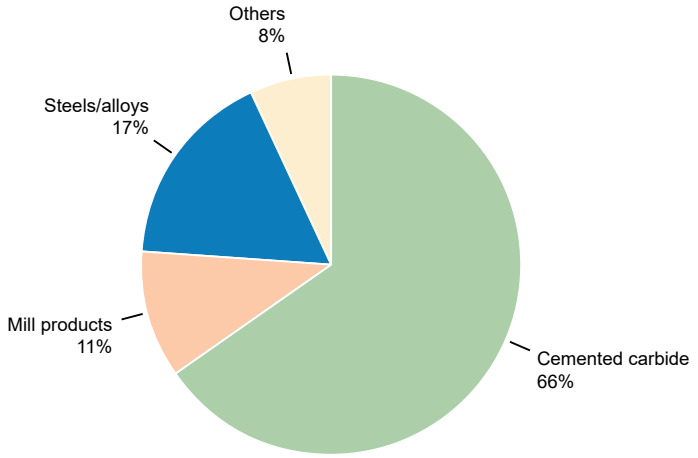
Conrad shaft, New England Orogen.

Global tin uses (2017)



Source: https://www.internationaltin.org/

Global tungsten uses (2017)



Source: https://www.itia.info/

Tin with cassiterite, North Brittan, New England Orogen.

Tin stockwork, Great Brittan, New England Orogen.

Contact: mra.info@geoscience.nsw.gov.au | +61 2 4063 6500