## Discovery of the Bygoo Iin

## Deposit

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## Wagga Tin Belt Regional Setting

- The Wagga Tin Belt contains numerous tin occurrences
- The biggest is the Ardlethan deposit with an endowment of more than 70,000 tonnes* of tin
- Bygoo is located in the Ardlethan Tin Field, 7 km north of the Ardlethan Mine
* See Thomson ASX announcement of 14 Nov 2016


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## Wagga Tin Belt Granite Chemistry

- Ardlethan Granite and Wilgaroon Granite - highly evolved geochemistry among the Wagga Tin Granites
- Both S-type granites with high Rb, low Sr, TiO2; similar tin chemistry also
- Thomson acquired Wilgaroon in 2012 - only one previous hole, 1996; 1km outboard of granite - 250m of tin-tungsten alteration and veins - including best assays of $2.5 \% \mathrm{Sn}, 1.4 \% \mathrm{~W}$, $0.2 \mathrm{~g} / \mathrm{t} \mathrm{Au}$.


After Blevin and Chappell, Economic Geology 1995

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## Ardlethan Tin Field

- Acquired by Thomson in 2015
- The Bygoo area is 7 km north of Ardlethan
- Ardlethan is the biggest tin deposit in NSW with ore mined plus deposits remaining at 15 million tonnes at $\mathbf{0 . 5 \%}$ Sn for 72,500 tonnes of tin*
- Associated with the intrusion of the Ardlethan Granite
- Multiple hard-rock tin occurrences on eastern granite contact

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## Ardlethan Tin Field



## Ardlethan Tin Field - North

- Plan of more than 200 historic workings north of Ardlethan Mines
- Multiple clusters arrayed along the eastern edge of the Ardlethan Granite
- Recorded production mainly from two areas - the "Big Bygoo" (inc. Temora, Lone Hand) - 10,600 tons at 2.0\% Sn for 200 tons of tin metal
- and "Little Bygoo" (Dumbrells, Smiths etc) - 26,000 tons at $1.0 \%$ for 260 tons of tin
- Most historic workings were shut by 1946.
- Ardlethan produced about 6000 tons of tin metal in the same period.


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- Ardlethan Mine commenced under Aberfoyle in 1964
- Aberfoyle's first regional exploration was soil sampling 1965-1968
- No anomalies worth following up
- Magnum took over; exploring the Big Bygoo cluster from 1970 to 1972 (EL 345) and then 1978 to 1982
- Extensive shallow RAB drilling
- 15 Percussion (most vertical)
- 2 angled Diamond


## Ardlethan Tin Field - Bvgoo Area



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- Magnum RAB drilling
- Very few deeper than $15 m$
- Best results in deeper percussion and diamond:
- Temora (4 holes) - 6.1m at
$\mathbf{2 . 1 \% ~ S n ~ f r o m ~ 4 1 m ~ a n d ~ 2 . 1 m ~}$

Temora (4 holes) - 6.1m at
2.1\% Sn from 41m and $\mathbf{2 . 1 m}$ at $1.3 \%$ from 51 m

- Leviathan (1 hole) - 3.1m at 0.7\% from 47m


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## Ardlethan Tin Field - Bygoo Area

- After Magnum stopped work in 1972 the mine (Ardlethan Tin NL) recommenced in 1973 until 1977
- Shallow auger work first
- Alluvial anomalies outlined
- Then moved to percussion drilling of selected areas...



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## Ardlethan Tin Field - Bygoo Area

- Regional exploration from Ardlethan Mine
- Percussion drilling - mainly around the mine (minor anomalies at Carrolls, Browns Knob, Fordes Gossan and Stouts)
- Major program at "Little Bygoo" (Dumbrells)
- Interpreted "Contact Greisen" at the roof of the east dipping Ardlethan Granite



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- Regional exploration from Ardlethan Mine
- Major program at "Little Bygoo" (Dumbrells)
- Interpreted "Contact Greisen" at the roof of the east dipping Ardlethan Granite
- Estimated 1.5 million tonnes at 0.2 to $0.3 \% \mathrm{Sn}$ (EL 647 Final report DIGS GS1977/093)


## Ardlethan Tin Field - Bygoo Area



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## Metallogenic Model

- Possible deposit types
- Breccia Pipe (Ardlethan)
- Greisen / Vein (Bygoo)
- Contact Greisen also present at Bygoo
- Skarn (not seen)


Source: Possible tin deposits diagram from Dr Phillip L. Blevin, Geological Survey of NSW

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## Bygoo Model - Pipe or Dome?

- Model for Thomson's Bygoo
Exploration
- Smiths 1939 diagrams pipe shape intrusion with tin "rind" or "carapace"



## Bygoo Discovery hole

- Model for Thomson's Bygoo Exploration
- Angled holes - different directions
- Hole 10 made the discovery with 13 m at 1\% Sn



## thomson <br> Bygoo North Drilling



- Drilling at Bygoo North. Easy access.
- Prospective area covered by soil (and crops currently).


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- Early holes were nearly all vertical
- Poorly oriented to discover steeply dipping greisen zones
- Some holes subparallel to nearby greisens
- Thomson's BNRC10 intercepted 13m at $1.0 \% \mathrm{Sn}$ (true width ~ $4 m$ ) in this example


## Bygoo - angled drilling



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## Bygoo - angled drilling

- In some cases the vertical holes appeared to intersect a marginal alteration zone to the mineralised greisen
- Thomson's BNRC11 intercepted 35 m at 2.1\% Sn (true width $\sim 10 \mathrm{~m}$ ) in this example
- The early hole P308 had a tourmaline-rich alteration zone with 33.5 m at $0.3 \%$ Sn



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## Bygoo Mineralogy

- Clean Cassiterite
- Bygoo North petrology: Hole 11
- Cassiterite crystals size up to 3 mm (average in sample 0.5 mm )
- Cassiterite crystals are zoned, with alternating patches of iron-rich and iron-poor compositions
- Overall:
- Quartz~75\%
- Topaz ~10-15\%
- Cassiterite $\sim 5-8 \%$


Photo 1.9 mm across

- Tourmaline < ~2\%


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## Bygoo North Long Section



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## Bygoo North Greisens and Potential



## thomson <br> Bygoo Exploration Target

- Exploration Target of 0.9 to 1.4 million tonnes at 0.8 to $1.4 \% \mathrm{Sn}(7,200$ to 20,100 tonnes of contained tin)
- Grade estimate:
- average grade in mineralised zones is $1.4 \% \mathrm{Sn}$
- 182 metre splits in Thomson drilling previously reported - 9 drill holes over 100 m
- Cut-off $0.2 \%$ Sn, internal waste up to $3 m$, maximum grade $11.1 \%$
- Grade range for target - 0.8\% (median) to 1.4\% (average)
- Bygoo North true width estimates previously reported:
- range from $4-10 \mathrm{~m}$, average 7 m ; use 5 to 8 m for exploration target
- Bygoo North strike extent drilled to date 100m; potential to triple to 300 m
- Bygoo North dip extent drilled to date 40 m ; potential to double to 80 m
- Potential for repeats - Bygoo South plus structures seen in magnetics (two at least discounted to half the size of Bygoo North)
- 2.5 specific gravity applied to estimate tonnage from volume - SG of granite, rhyolite
- Further drilling is planned to test the validity of the exploration target, potentially to estimate a JORC compliant mineral resource, and is expected to be completed by the end of 2016.
- Note: the potential quantity and grade is conceptual in nature, there has been insufficient exploration to estimate a Mineral Resource and it is uncertain if further exploration will result in the estimation of a Mineral Resource.


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- At least four high-grade greisens identified so far
- True widths 4 to 10 m
- Depth is measured vertically from surface to the top of the intercept

| Hole | Intercept | Depth* | Greisen |
| :---: | :---: | :---: | :---: |
| BNRC003 | 17 m at $0.9 \% \mathrm{Sn}$ | 103 | Bygoo North NW-SE |
| BNRC004 | 5 m at $1.3 \% \mathrm{Sn}$ | 113 | Bygoo North NW-SE |
| BNRC010 | 13 m at $1.0 \% \mathrm{Sn}$ | 58 | Bygoo North Dumbrells |
| BNRC011 | 35 m at $2.1 \% \mathrm{Sn}$ | 38 | Bygoo North Dumbrells |
| BNRC013 | 11 m at $1.4 \% \mathrm{Sn}$ | 76 | Bygoo North Dumbrells |
| BNRC013 | 10 m at $2.0 \% \mathrm{Sn}$ | 108 | Bygoo North NW-SE |
| BNRC018 | 4 m at $2.4 \% \mathrm{Sn}$ | 82 | Bygoo North NW-SE |
| BNRC019 | 8 m at $1.7 \% \mathrm{Sn}$ | 101 | Bygoo North NW-SE |
| BNRC019 | 9 m at 0.7\% Sn | 119 | Bygoo North NW-SE |
| BNRC020 | 11 m at $2.1 \% \mathrm{Sn}$ | 67 | Bygoo North Dumbrells |
| BNRC021 | 8 m at $1.3 \% \mathrm{Sn}$ | 52 | Bygoo South |
| BNRC028 | 4 m at $1.4 \% \mathrm{Sn}$ | 36 | Bygoo South |
| BNRC031 | 20 m at $0.9 \% \mathrm{Sn}$ | 35 | Bygoo South |
| BNRC033 | 9 m at $1.6 \% \mathrm{Sn}$ | 50 | Bygoo North Dumbrells |
| BNRC033 | 8 m at $1.4 \% \mathrm{Sn}$ | 68 | Bygoo North Dumbrells |
| BNRC035 | 7 m at 1.3\% Sn | 19 | Bygoo South |
| BNRC038 | 8 m at $1.2 \% \mathrm{Sn}$ | 13 | Bygoo Far North |
| BNRC039 | 6 m at $0.8 \% \mathrm{Sn}$ | 72 | Bygoo North Dumbrells |
| BNRC040 | 19 m at $1.0 \% \mathrm{Sn}$ | 43 | Bygoo North Dumbrells |

Bygoo Intercepts

## Project Benchmarking

- Initial drilling results already include significant high grade tin intercepts close to surface


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## Thomson's Tin Prospects

| Rank | Project | Prospect | Current Status |
| :---: | :---: | :---: | :---: |
| 1 | Wagga Belt | Bygoo North | Exploration target 7,200 to 21,000 tonnes of tin at 0.8-1.4\% Sn * |
| 2 | Wagga <br> Belt | Ardlethan Tin Field | Multiple hard-rock tin prospects on EL8260 require testing e.g. Bald Hill, Big Bygoo |
| 3 | Wagga <br> Belt | Mt Paynter | JORC Resource**: 245,000 tons at 0.5\% W and 0.3\% Sn plus further potential |
| 4 | Wagga Belt | Wilgaroon | Drill target defined: Ardlethan model |
| 5 | Wagga <br> Belt | Gibsonvale | Potential to find source for alluvial tin ( 7,000 tons produced \{Cluff Resources\}) |
| 6 | New England | Basin One | Exploration target* : 1.8 to 4.9 million tonnes with grades of between $0.1 \%-0.2 \% \mathrm{Sn}$ and $0.25 \%-0.5 \% \mathrm{Cu}$ (between 1,800 and 10,000 tonnes of Sn and between 4,500 and 24,000 tonnes of Cu ) |
| 8 | Thomson | Thomson Fold Belt (Cuttaburra B) | Up to $0.8 \%$ tin and $0.6 \%$ tungsten intersected in a large intrusionrelated mineralised hydrothermal system |

[^2]
## Further Afield - Bald Hill

- 10km south of Ardlethan Mine
- On the eastern edge of the Ardlethan Granite
- Multiple historical tin workings
- Limited drilling
(1978-1983) delineated alluvial resource* - 2.5 million tonnes at $0.05 \% \mathrm{Sn}$ (1,300 tons)
- Hard rock source lightly tested: "undiscovered"


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- 400km north of Bygoo
- VTEM image with
magnetic contours
- EM Low under magnetic high indicates possible granite extension with mineralised potential
- One hole by Straits - DD9601. 263m of Sn W anomalism at
edge of EM low, 800 m east of $\mathbf{2 6 3 m}$ of Sn W anomalism at
edge of EM low, 800 m east of granite contact
- Intercept: 263m at 433 ppm Sn, 225 ppm $W$ from 319m including: 3 m at $1.1 \% \mathrm{Sn}$ at 322 m and 1 m at $1.4 \% \mathrm{~W}$ at 321m.
- Target - Granite boundary or in EM Low


## Tin Prospect - Wilgaroon



## Mt Jacob - Tin skarn at Basin One

Tin - copper skarn. CRAE estimated 5 million tonnes at $0.17 \% \mathrm{Sn}(8,500 \text { tonnes of } \mathrm{Sn})^{*}$

- Note tin is present as Cassiterite ( $300^{\circ}$ to $500^{\circ}$ - meaning the granite is close and shallow)* Final report on EL 1176 on NSW DIGS as GS1983_121.R00009789


## Tin Prospect - Mt Paynter.

Small JORC based on drilling and underground access. Potential to expand. 245,000 tons at 0.5\% W, 0.3\% Sn - ASX release of 30 September 2015



[^0]:    * See Mines and Wines 2017 paper and Thomson ASX release Nov 16. Does not include low grade stockpiles

[^1]:    Source: Terra Studio, * all jurisdictions except DRC

[^2]:    * The potential quantity and grade is conceptual in nature, there has been insufficient exploration to estimate a Mineral Resource and it is uncertain if further exploration will result in the estimation of a Mineral Resource. Details of the Basin One Exploration Target were released by Thomson in its quarterly report for December 2013.
    ** Details of the Mt Paynter Mineral Resource were released in the September 2015 quarterly report.

[^3]:    *This historic resource is not JORC: Details presented in Thomson quarterly for September 2016, based on Shell reports from 1978-1983

