

Mines and Wines 2022 Bowdens Epithermal Silver Deposit: Recent knowledge advancements & Machine Learning cogitations

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# Bowdens Project Team



BOWD

# Deposit Setting: Regional Geology

- Northeastern limb of the Lachlan Orocline.
- Ordovician through to Carboniferous age basement.
- Work demonstrates the eastern limb of the Macquarie Arc has the potential for discovery on significant mineralisation.
- Extensional type intermediate sulphidation Ag-Pb-Zn(+Au).





### **Project Overview: Development**

- Final submission process complete for Independent Planning Commission determination in second half 2022.
- Development of an open cut mine.
- Processing on site of up to 2.0 million tonnes of ore per year.
- Approximately 53 million ounces of silver will be produced over the life of the mine with zinc and lead as a by-product.
- Conventional flotation circuit with two concentrate products:
  - Silver-lead concentrates by road/rail to Port Pirie, S.A.;
  - Zinc concentrates by road or road/rail to Botany or Newcastle for shipping.
- Project life of 23 years (mine life of 16 years).

SILVER



#### Deposit Setting: Local Geology

- Rylstone Volcanics consist of rhyolitic to dacitic pyroclastics, epiclastics and lava's with recently defined porphyritic intrusion.
- Volcanics are characteristic of caldera and intra-caldera facies, thickness of > 500 metres.
- Hardrock cover of Sydney Basin sediments and coal measures.





# **Deposit Setting: Density**

- Rylstone Volcanics consist of rhyolitic to dacitic pyroclastics, epiclastics and lava's with recently defined porphyritic intrusion.
- Volcanics are characteristic of caldera and intra-caldera facies, thickness of > 500 metres.
- Data supports the interpretation of a > 7 kilometre in diameter caldera structure.
- Gravity is a useful tool in mapping geology and deposit recognition.





### **Deposit Setting: Conductivity**









# **Geochronology and Stratigraphy**

- Current U-Pb date for the Rylstone Volcanics is 292 ± 10 Ma.
- Our studies show concordant ages of zircons in dacite are 327.1 ± 1.6 Ma and 324.4 ± 4.9 Ma.
- Hydrothermal muscovite & adularia
  + biotite from outcropping Rhyolite
  submitted for Ar-Ar dating.



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Large partially resorbed plagioclase phenocryst UXP







Chlorite-carbo

#### Geochronology and Stratigraphy

- Thin section work • confirms intrusive origin.
- Porphyritic quartz and plagioclase dacite.
- Strong to complete alteration.

200 un

Common calcitepyrite veinlets.





### Mineralisation

a. Breccia-filled mineralization within polymictic breccia.

c. Sulphide and rhodochrosite vein within welded tuff.



b. Polymictic breccia with later sulphide veinlets.

d. Polyphase sulphide vein, minor rhodochrosite and disseminated sulphide within bleached welded.

e. Sulphide vein with minor rhodochrosite and ankerite hosted within crystal lithic tuff.





f. Sulphide infilling space within the crystal lithic tuff containing primarily sphalerite.



# **Primary Ore** Mineralogy

a. Pyrargyrite-acanthite rimming pyrite as inclusion in sphalerite.

c. Pyrargyrite-acanthite rimming galena with later tetrahedrite cutting pyrargyrite and replacing galena.

e. Typical symplectite texture of galenapyrargyrite with stephanite.



(b)

BD16001 90.3m 23.tif



(e)





aca

50 µm

200 µm

b. Acanthite with atypical symplectite texture with galena.

d. Coarse-grained pearceite rimming galena.

f. Co-existing pearceitepolybasite rimming pyrargyrite-galena and pyrite.



#### **Mineral Zonation**

- 3 zones targeted for underground high-grade mineralisation.
- Each zone mineralogically distinct.
- 39,028 metres drilled since 2020
- 34,723 metres included in Resource Estimate due end of Q2 2022.





# Main and Aegean Zones

- Main Zone is silver-lead-zinc ore to be mined initially.
- Highest grade zone of silver at Bowdens:
  - 34.6m @ 471g/t AgEq incl 7.0m @ 1090g/t AgEq.
  - 6.1m @ 874g/t AgEq
- Aegean Zone is high-grade <u>silver only</u> mineralisation below Main Zone characterised by discrete fracture fill and veinlet style veins.
- Silica-siderite-pyrite alteration. Mineralisation pearcite-polybasite.
- Intercepts include:

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- 8.0m @ 543g/t Ag
- 4.0m @ 979g/t Ag
- 2.0m @ 1421g/t AgEq
- 6.0m @ 382g/t AgEq
- Both Main and Aegean Zones are devoid of gold.





#### Northwest Zone

- Characterised by veins and breccias of galena sphalerite – acanthite ± chalcopyrite.
- Polyphasal, colloform banded carbonate silica sulphide veins and veinlets are common.
- Intercepts include:
  - 10.1m @ 460g/t AgEq
  - 8.0m @ 555g/t AgEq
  - 4.0m @ 1007g/t AgEq
- Gold present in the centre of the Zone coincident with copper and up to 5.41g/t.







#### **Bundarra Zone**

- Highest temperature component of the Bowdens System characterised by stacked lenses to at least 600 metres depth.
- Characterised by semi massive, stinger, quartz carbonate sulphide and fracture filling vein styles.
- Sphalerite pyrite galena ± chalcopyrite and gold.
- Dacite acting as a fluid trap as semi massive sulphide veins forming at the contact.
- Intercepts include:

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- 14.2m @ 374g/t AgEq (36g/t Ag, 4.86% Zn, 2.35% Pb & 0.23g/t Au) *incl* 
  - 4.6m @ 694g/t AgEq (72g/t Ag, 8.76% Zn, 4.40% Pb & 0.49g/t Au)
- 2.4m @ 1520g/t AgEq (269g/t Ag, 15.80% Zn, 10.33% Pb, 0.78% Cu & 0.42g/t Au)
- 18.25m @ 313g/t AgEq (31g/t Ag, 4.60% Zn, 3.0% Pb & 0.52g/t Au)
- Chalcopyrite and gold increasing with depth.



# Ore Paragenesis

Mineral Species	Pre-ore	Stage 1	Stage 2	Stage 3	Post-ore
Pyrite					
Arsenopyrite					
Marcasite					
Sphalerite	_	_			
Galena					
Chalcopyrite					_
Pyrrhotite					
Stephanite					
Acanthite					
Pyrargyite-Proustite					
Polybasite-pearceite					
Freibergite					
Ag-rich Tetrahedrite					
Tennantite					
Ag-Bi sulfosalt					
Gold					
	Aegean Cone Northwest Mino Bundarra	r <b></b> Major <b></b>	=		_



# Machine Learning what is it good for?

All in all it's just another brick in the wall All in all you're just another brick in the wall We don't need no education...





#### How much data, and which to predict what?







### Soils and weathering well suited to ML prediction

Regionally shallow soil profile development



Deposit oxidation from 0 to 8m





#### Predicted Silver from ML Vs Surface blocks of MIK estimate





#### ML at small scales but context matters











Predicted



Predicted



#### Predictions masked to mapped Rylstone (majors)

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BOWDENS SILVER

Low



#### **Predicted multivariate**

#### Anomaly generation











#### Thank You.



