The Mungana porphyry-related polymetallic deposit, North Queensland

KZL EXPLORATION
Mines and Wines, September 2007
• History
• Regional geological setting
• Local geology
• Mine geology
• Age dating
• Geochemical associations
• Ore textures
Mungana - 21 years old
MUNGANA RESOURCES, 2007

BASE METALS RESOURCE (INDICATED + INFERRED)
1.96 Mt @ 14.3 %Zn, 2.8 %Cu, 2.2 %Pb, 188 g/t Ag, 1.15 g/t Au

(280,000 t Zn, 55,000 t Cu, 40,000 t Pb, 12 M oz Ag, 70,000 oz Au)

GOLD RESOURCE (INFERRED)
53.7 Mt @ 1.1 g/t Au, 0.1 %Cu, 0.2 %Zn, 0.1 %Pb, 8 g/t Ag

(2 M oz Au)
MASSIVE SPHALERITE/CHALCOPYRITE IN SANDSTONE

700.7-724.7m: 24m @ 6.1 %Cu, 13.4 %Zn, 510 g/t Ag, 1.3 g/tAu
MASSIVE SPHALERITE/CHALCOPYRITE IN LIMESTONE

700.7-724.7m: - 24m @ 6.1 %Cu, 13.4 %Zn, 510 g/t Ag, 1.3 g/t Au
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700.7-724.7m: 24m @ 6.1 %Cu, 13.4 %Zn, 510 g/t Ag, 1.3 g/t Au
GEOLOGICAL UNITS IN THE CHILLAGOE AREA

- Ord-Dev sediments
- Dev-Carb sediments
- Permo-Carb igneous rocks (undifferentiated)
- Almaden Supersuite
- Claret Creek Supersuite
- Ootann Supersuite
- Lags Supersuite
- Post Permian cover

EXPLANATION
- O'Briens Supersuite plutons
- Blackman Gap Supersuite
- Proterozoic metamorphics
PUBLISHED SUPERSUITE AGE DATES, ATHERTON 250K SHEET

- Lags, 280 Ma
- Claret Ck, 290 Ma
- Ootann, 300 Ma
- Almaden, 300 Ma
- O’Briens, 315 Ma

All dates (93)
PERMO-CARBONIFEROUS SUPERSUITES, CHILLAGOE AREA

- **O’Briens Creek Supersuite (315 Ma)** - felsic I type, reduced, highly fractionated - typically Sn; also W, Cu, Au, Ag, Pb, Zn, Bi, As, Sb

- **Almaden Supersuite (300 Ma)** - felsic to andesitic I type, oxidised, unfractionated - typically Cu, Pb, Zn, Ag, As

- **Ootann Supersuite (300 Ma)** - felsic I type, mostly reduced, highly fractionated - typically W, Mo, Bi

- **Claret Creek Complex (290 Ma)** - felsic to andesitic I type, oxidised, unfractionated

- **Lags Supersuite (280 Ma)** - felsic A type, reduced and oxidised, unfractionated; minor U, F, Au
GEOLOGICAL UNITS IN THE CHILLAGOE AREA

- Ord-Dev sediments
- Dev-Carb sediments
- Permo-Carb igneous rocks (undifferentiated)
- Almaden Supersuite
- Claret Creek Supersuite
- Ootann Supersuite
- Lags Supersuite
- Post Permian cover
- O'Briens Supersuite volcanics
- O'Briens Supersuite plutons
- Dev-Carb sediments
- Ord-Dev sediments
- Blackman Gap Supersuite
- Proterozoic metamorphics

EXPLANATION
Many polymetallic deposits (telescoped) that fall into 3 broad groups -

- high grade base metals only (Zn-Cu-Pb-Ag), no gold
  Examples: - Girofla, Lady Jane, King Vol, Redcap group

- gold-copper, with high-grade base metals (Zn-Pb-Ag)
  Examples: - Mungana, Harpers

- gold-copper only, little or no base metals
  Examples: - Red Dome
PORPHYRY WITH QV & UST

883
729.6
PORPHYRY WITH QV & UST
PORPHYRY WITH QUARTZ STOCKWORK
?QV / ?SIL PORPHYRY – 15 g/t Au
ZIRCON SHRIMP AGE DATES, MUNGANA INTRUSIONS

The diagram shows age dates for porphyry and granite intrusions. The box heights indicate the ages, with porphyry represented by pink bars and granite by red bars.
• **High-grade base metals**
  - typically high Zn, Cu, Pb, Ag, As
  - strongly anomalous Sn +- W

• **Gold**
  - typically Au, Bi
  - Ag, Cu

**NOTE:** Mo, Sb moderately elevated, unknown status
ZONED GARNET IN WOLLASTONITE
MASSIVE SPHALERITE INTERSTITIAL TO GARNETS IN SKARN
SKARN BRECCIA WITH HONEY SPHALERITE MATRIX
MASSIVE SPHALERITE IN SIDERITE
MASSIVE SPHALERITE IN SIDERITE
MOLYBDENITE IN GARNET-WOLLASTONITE-QUARTZ SKARN
ZONED GARNET WITH SPHALERITE INCLUSIONS

Plane polarised light; Length of image = 5.6 mm; matrix mostly retrograded to calcite
Sphalerite intergrown with wollastonite

Plane polarised light; Length of image = 5.6 mm; sphalerite with px inclusions (clear) co-existing with un-retrograded fibrous wollastonite
SPHALERITE INTERGROWN WITH WOLLASTONITE

Plane polarised light, close-up of previous; sphalerite with px inclusions (clear) co-existing with un-retrograded fibrous wollastonite
½NQ2 core

Top half of photo (mottled lt gy) => marble
Bottom half => garnet (yw) + intergrown wollastonite / sphalerite
GARNET IN PYROXENE / SPHALERITE MATRIX

½NQ2 core
Garnet + clinopyroxene on left, garnet in sphalerite-rich matrix on right
ZONED GARNET RIMMED BY SPHALERITE/CHALCOPYRITE

Reflected light, length of photo = 5.6 mm; left to right = garnet (med gy) => sphalerite (lt gy) => chalcopyrite (yw) => retrograded matrix (dk gy); note sp-cp inclusions in gt
Plane polarised light; length of photo = 2.8mm; chalcopyrite / sphalerite (bk), matrix is retrograded qtz + calcite + actinolite (brown)
CONCLUSIONS – KEY POINTS

• high grade base metals developed at fairly high temperatures at an early retrograde skarn phase

• porphyry emplacement followed

• base metal mineralization can be assigned to the “O’Briens Creek” Supersuite event

• Au not so certain, second retrograde event = syn O’Briens porphyry? or post?

• later development of the near-surface breccia cone probably just re-distributed metals, as concluded by previous workers

• preliminary fluid inclusion studies => coexistence of high-temperature vapour-rich and sulphide-rich inclusions
Thank you