Magmatic History, Fertility and Metallogeny of the Mary Kathleen Domain of the Mt Isa Inlier

Ioan Sanislav
Summary:
• Introduction
• JCU team, current projects and future plans
• Some preliminary results from the Tick Hill area (geochronology)
Introduction

Simplified geology of Mt Isa Inlier
Distribution of mineral occurrences in the Mt Isa Inlier

Cu-Au:
- Mount Colin, Trekelano, Duchess, Overlander, Elaine Dorothy, Little Eva

Au only:
- Tick Hill

U-REE:
- Mary Kathleen

Pb-Zn-Ag:
- Dugald River
The geology of the MKD appears to be notably different:

- The stratigraphy dominated by Argylla (~1780 Ma) and Corella (~1740 Ma) Formations
- Intruded by 1740 Ma granites
- The structure is dominated by an *extensional shear zone*, the Wonga Belt
- Metamorphism is mainly amphibolite facies
- There is evidence of pre-Wonga deformation
- The extent of Isan Orogeny overprint is somehow less obvious
- It lacks 1550-1500 Ma intrusives
### Is MKD prospective for large deposits?

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Interpretation</th>
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<tbody>
<tr>
<td>Numerous mineral occurrences</td>
<td>Large scale flow of mineralized fluids</td>
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<td>A good number of mineral deposits</td>
<td>Good capacity for trapping</td>
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<tr>
<td>A predominance of Cu-Au deposits/occurrences</td>
<td>Similar metal source/processes with deposits further East</td>
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<tr>
<td>Strong structural control</td>
<td>Good fluid conduits</td>
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<tr>
<td>Variable metamorphic grade</td>
<td>Similar to deposits further East</td>
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<tr>
<td>Mineralization postdates peak metamorphism</td>
<td>Similar to deposits further East</td>
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<tr>
<td>A strong lithological/stratigraphic control</td>
<td>Similar to deposits further East</td>
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<tr>
<td>Cl rich fluids</td>
<td>Similar to deposits further East</td>
</tr>
<tr>
<td>Age of mineralization 1550-1500 Ma where dated/inferred</td>
<td>Similar source/genesis to deposits further East</td>
</tr>
<tr>
<td>Lack of 1550-1500 Ma intrusions</td>
<td>Inferred to be present at depth</td>
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<td>Lack of very large deposits</td>
<td>Waiting to be discovered</td>
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Summary of main characteristics of Cu-Au deposits in the MKD
# JCU team and projects

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Position</th>
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<tbody>
<tr>
<td>Paul Dirks, Ioan Sanislav, Carl Spandler</td>
<td>Academic staff</td>
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<tr>
<td>Yanbo Cheng</td>
<td>Post-doctoral fellow (60%)</td>
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<tr>
<td>Robbie Coleman, Alex Brown, Truong Le, Joshua Spence</td>
<td>PhD students</td>
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<tr>
<td>Eric Zurek-Haidamous, Alex Edgar</td>
<td>Honours students</td>
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</tbody>
</table>

EGRU in Mt Isa region
### On-going projects in Mt Isa region

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Project</th>
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</thead>
<tbody>
<tr>
<td>Robbie Coleman, Alex Brown, Eric Zurek-Haidamous</td>
<td>Tommy Creek Domain</td>
</tr>
<tr>
<td><strong>Not part of the New Discovery Program</strong></td>
<td></td>
</tr>
<tr>
<td>Yanbo Cheng</td>
<td>Magmatic evolution of MKD and implications for metallogenesis</td>
</tr>
<tr>
<td>Truong Le</td>
<td>Tick Hill deposit – deposit model, genesis and setting</td>
</tr>
<tr>
<td>Joshua Spence</td>
<td>Skarns, stratigraphic horizons, structure and mineralization in the MKS area</td>
</tr>
<tr>
<td>Alex Edgar</td>
<td>Scapolite around Elaine Dorothy</td>
</tr>
<tr>
<td><strong>Part of the New Discovery Program</strong></td>
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</table>
## Future work in Mt Isa region

<table>
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<tr>
<th>Personnel</th>
<th>Project</th>
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<tbody>
<tr>
<td>PhD student 1</td>
<td>Dugald River mine (structural and geotech study)</td>
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<tr>
<td>PhD student 2</td>
<td>Tectonic evolution of the MKD</td>
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<tr>
<td>PhD student 3</td>
<td>Breccia pipes in Soldiers Cap Group – IOCG connection?</td>
</tr>
<tr>
<td>PhD student 4</td>
<td>Comparison between IOCG deposits in Mt Isa Inlier and SW China</td>
</tr>
<tr>
<td>Honours student 1</td>
<td>Pilgrim Fault</td>
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<tr>
<td>Honours student 2</td>
<td>Fountain Range Fault</td>
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<tr>
<td>Honours student 3</td>
<td>Mt Godkin granite</td>
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<tr>
<td>Honours student 4</td>
<td>Fluid inclusion database for EFB</td>
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To start in early 2019
Some preliminary results from the Duchess Belt
LEGEND

Interpreted trends of bedding/foliation
Interpreted major and minor fault trace
Tick Hill Deposit

The Monument Syenite, Undated (considered Palaeoproterozoic)
Cream, medium to locally coarse-grained, equigranular to locally porphyritic, moderately to poorly foliated, biotite-hornblende syenite; commonly exhibits good linear fabric

Tick Hill Granite, Undated (considered Palaeoproterozoic)
Cream to pink, massive to strongly foliated, fine to medium-grained leucogranite; irregular patches of coarser grained graphic to egmatitic granite; local tourmaline and vuggy quartz zones; scattered calc-silicate granofels rafts and grey to pink granitic gneiss

Saint Mungo granite, Undated (considered Palaeoproterozoic)
Porphyritic hornblende-biotite granite; minor porphyritic biotite granite, aplite. Weakly foliated to gneissic

Birds Well Granite? Undated (considered Palaeoproterozoic)
Medium to coarse biotite granite, strongly foliated to massive

Plum Mountain Gneiss (1862 ± 3 Ma)
Quartzofeldspathic gneiss, augen gneiss, weakly foliated to gneissic even-grained and porphyritic granite; minor calc-silicate rocks, meta-arenite, mica schist, amphibolite; aplite and pegmatite veins

One Tree Granite, Undated (considered Palaeoproterozoic)
Sheeted tourmaline pegmatite and microgranite dykes

One Tree Granite Undated (considered Palaeoproterozoic)
Dark grey, fine to medium biotite-rich granite. Weakly foliated to gneiss

One Tree Granite Undated (considered Palaeoproterozoic)
Medium to coarse biotite granite, locally porphyritic, minor microgranit apilite, pegmatite. Massive to strongly foliated

Magna Lynn Metabasalt
Metabasalt, amphibolite; minor quartzite, meta-arenite, matic schist and quartz +/- feldspar porphyry

Corella formation: undifferentiated rocks
Calcareous siltstone, limestone, calcareous scapolithic granofels, quartzite, amphibolite, shale

Corella formation: Feldspathic granofels, meta-arkose, feldspar porphyry
Corella formation: Cream, massive to layered, albically altered calc-silicate granofels
Corella Formation: Quartzose to feldspathic sandstone, locally calcareous quartzite; grades into schistose quartzite in places
Argylta Formation?: Porphyritic rhyolitic to dacitic tuff, andesite, quartz feldspar porphyry, quartzite, schist, gneiss; minor siltstone, arkose, conglomerate and metabasalt

Geological map of Tick Hill Region
Extracted from Geological Map of Duchess 1:100 000 (GSQ 2017)
One Tree Granite

Geological map of Tick Hill Region
Extracted from Geological Map of Duchess 1:100 000 (GSQ 2017)

Kalkadoon Leichhardt

Intercepts at
-18x44 & 1860.2±3.5 [±6.8] Ma
MSWD = 1.5

Mean = 1859.2±4.3 [0.23%] 95% conf.
Wtd by data-pt rms only, 0 of 25 rej.
MSWD = 0.96, probability = 0.52
Tick Hill Granite

Xenocrysts at 1834±12 Ma
Tick Hill Granite

15780±14 Ma
1844±6 Ma

Weighted Mean

Kernel Density Estimation

Mean = 1871.52 ± 2.92 [0.16%]
Wtd by data-pts uncts 0 of 29 rej.
MSWD = 64.86, over dispersion
(uncertainties are 2 σ)

Skewness = 0.810
Pegmatite dyke

1859±6 Ma
1815±9 Ma
1774±20 Ma

Geological map of Tick Hill Region

Weighted Mean

Extracted from Geological Map of Duchess 1:100 000 (GSQ 2017)
Granitic dyke

1917±10 Ma
1844±6 Ma
1770±9 Ma
Conclusions:

- Saint Mungo Granite is not Burstall age and intrude around 1800 Ma
- Tick Hill granite intruded at ~1780 and is most probably not related to the Wonga-Burstall event
- Deformation and metamorphism south of the Plum Mountain fault appears to be old ≥1770 Ma
- It is unlikely that Corella Formation extends south of this fault,
- The Isan overprint – work in progress