Analyses of late stage, Mesoproterozoic, syn and post tectonic, magmatic events in the Moonta Sub-domain: Implications for Cu-Au mineralisation in the “Copper Triangle” of South Australia.

Andrew T. Wurst (B.Sc.)

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University of Adelaide
Department of Geology and Geophysics
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National Grid Reference
Maitland Sheet I-53/12(1:250 000)
Whyalla I-53/8(1:250 000)
Abstract

The Moonta-Wallaroo area has been of economic, historical and scientific importance in South Australia's history for over 130 years. The nature of mineralisation in the area has long been a point of conjecture. This study looks at the nature of ore deposition and specifically it's relationship to granitoids and pegmatites in the Moonta Subdomain. Using various analytical techniques the study has shown that granitoids in the region have distinctly different petrological, textural, structural, geochemical and isotopic characteristics. Two main granitoids were recognised as the Tickera Granite and the Arthurton Granite.

Geochemical studies suggest that magmatism in the Moonta Subdomain was a continuous process in the Mesoproterozoic. The older Tickera Granite, displays syn-collisional, more I-type characteristics and syn-collisional S-type characteristics (represented by a monzonite and a tonalite respectively). The younger Arthurtan Granite shows A-type, anorogenic characteristics. A temporal shift from syn-collisional to anorogenic granites suggests a tectonic control on magma generation and emplacement during this period. Trace element characteristics of the Arthurtan Granite are homogeneous over a wide spatial range, is suggesting that it may be part of an extensive batholith. Geochemistry of pegmatites implies that they were late stage fractionation products, related to these granite intrusions.

A study of the Tickera Granite (Point Riley-Nth Beach) revealed a dominant structural fabric which suggested the granite was intruded into a tectonic regime in which shearing was prominent. Sediments intruded by the granite suggested deposition in a shallow intracratonic rift setting, followed by polyphase deformation during orogenic activity and subsequent shearing possibly related to the enigmatic Wartakan Event.

Isotopic studies highlighted differences in the petrogenetic source regions of the Tickera Granite and the Arthurtan Granite. The Tickera Granite (represented by monzonite) displayed more mantle like characteristics while the Arthurtan Granite (represented by granite from Arthurtan and adamellite from Moonta) displayed more crustal features, highlighting its A-type nature. Studies also showed that a pegmatite from the Wheal Hughes was most like the later of these two granites.

Tourmaline studies of Wheal Hughes samples implicated derivation from a metapelitic and calcisilicate precursor, a common feature of most tourmaline studied in the area. This may indicate remobilisation of boron rich fluids and metals from these sediments The close association of tourmaline with the ore in the Moonta Mines region implied a common source region.

A tectonic setting and model for ore deposition is proposed on the basis of the study findings. The model proposed the remobilisation of metals which were initially deposited in a ensialic rift type environment (common to other Palaeoproterozoic metalliferous terrains) by the intrusion of the Tickera Granite, during regional shearing. And further concentration of metals by subsequent intrusions of the Arthurtan Granite batholith.
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Map 2 Amethyst Point** 
Map 3 Pt Riley***

* Map 1 Nth Beach is located in the pouch inside the back cover.
** Map 2 Amethyst Point is located in the pouch inside the back cover.
*** Map 3 Pt Riley is located in the pouch inside the back cover.
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## Abbreviations

The following is a key to abbreviations used throughout the thesis, in the text and diagrams. It should be noted that all abbreviations are explained in the sites that they occur but for quick and easy referencing are listed below.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AG</td>
<td>Arthurton Granite</td>
</tr>
<tr>
<td>alb</td>
<td>Albite</td>
</tr>
<tr>
<td>MMJV</td>
<td>Moonta Mining Joint Venture</td>
</tr>
<tr>
<td>bt</td>
<td>Biotite</td>
</tr>
<tr>
<td>chalc or cpy</td>
<td>Chalcopyrite</td>
</tr>
<tr>
<td>chl</td>
<td>Chlorite</td>
</tr>
<tr>
<td>CHUR</td>
<td>CHondritic Undifferentiated Reservoir</td>
</tr>
<tr>
<td>Ga</td>
<td>Giga-anna, billions of years before present</td>
</tr>
<tr>
<td>haem</td>
<td>Haematite</td>
</tr>
<tr>
<td>horn</td>
<td>hornblende</td>
</tr>
<tr>
<td>kspar</td>
<td>K-Feldspar</td>
</tr>
<tr>
<td>Ma</td>
<td>Mega-anna, Millions of years before present</td>
</tr>
<tr>
<td>mag</td>
<td>magnetite</td>
</tr>
<tr>
<td>MESA</td>
<td>Mines and Energy Department of South Australia</td>
</tr>
<tr>
<td>MIM</td>
<td>Mount Isa Mines</td>
</tr>
<tr>
<td>mu</td>
<td>muscovite</td>
</tr>
<tr>
<td>ORG</td>
<td>Ocean Ridge Granites</td>
</tr>
<tr>
<td>plag</td>
<td>plagioclase</td>
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<td>pyrite</td>
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<td>qtz</td>
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<tr>
<td>sph</td>
<td>sphene</td>
</tr>
<tr>
<td>syn-COLG</td>
<td>syn-Collisional Granitoids</td>
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<tr>
<td>TG</td>
<td>Tickera Granite</td>
</tr>
<tr>
<td>tour</td>
<td>tourmaline</td>
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<td>VAG</td>
<td>Volcanic Arc Granitoids</td>
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<tr>
<td>WMC</td>
<td>Western Mining Corporation</td>
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<td>WPG</td>
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