

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.

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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 its 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 Arthurton 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 Arthurton 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 Arthurton Granite. The Tickera Granite (represented by monzonite) displayed more mantle like characteristics while the Arthurton Granite (represented by granite from Arthurton 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 metapelite and calcsilicate 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 an 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 Arthurton Granite batholith.

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Map 3 Point 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.

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