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A GEOCHEMICAL AND ISOTOPIC STUDY OF MAFIC AND INTERMEDIATE ROCKS IN THE OLARY PROVINCE, SOUTH AUSTRALIA - MAGMA SERIES DISCRIMINATION AND GEOCHRONOLOGICAL FRAMEWORK.

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Abstract

Sampling and analysis of the mafic and intermediate igneous rocks from the Olary Block in South Australia has revealed eight geochemically distinct rock types. The Outalpa Amphibolite is characterised by low concentrations of Fe(total), Ti, P, LREE and HFSE relative to the Cathedral Rock samples of Pierini (1994). The Antro and Poodla granitoids have intermediate compositions and exhibit remarkable geochemical similarity except for alkali abundances. Three types of apparently later greenschist facies dolerites can be distinguished by geochemical means. The HPT (high phosphorous & titanium) dolerites have higher concentrations of LREE and HFSE than the LPT (low phosphorous & titanium) dolerites. The Rainy Day dolerite has low phosphorous and high titanium concentrations, and has HFSE and LREE concentrations intermediate between the HPT and LPT dolerites.

The Maldorky Lamprophyre that crops out south of the Olary township has lamproitic affinities, and is geochemically similar to the post-Delamerian Ordovician lamprophyres near Truro and Anabama Hill.

εNd(T) values are generally higher for the Outalpa amphibolite, LPT dolerites and Rainy Day dolerites, indicating derivation from a more depleted source or greater crustal interaction. The Poodla Granitoid has significantly lower εNd(T) than the Antro Granitoid: this is consistent with petrographic and geochemical evidence that suggests a greater level of crustal contamination of the former.

A Pb/Pb zircon date for the Antro Granitoid was obtained using the evaporation ('Kober') method. A magmatic age of 1679±13Ma is comparable to SHRIMP ages from the Broken Hill Block (e.g. Page and Laing, 1992). Significantly, this age may constrain the intrusion of the Outalpa Amphibolite to post ~1700Ma and pre- ~1680Ma.

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Map I: THE GEOLOGY OF THE AREA WEST OF AMEROO HILL, OLARY BLOCK (1:5000).

Map II: THE GEOLOGY OF THE AREA 2km NE OF ANTRO WOOLSHED, OLARY BLOCK *'Rainy Day* '(1:2500).

MapIII: THE GEOLOGY OF THE AREA 5km EAST OF ANTRO WOOLSHED, OLARY BLOCK (1:2500).

Abbreviations

B.E.	Bulk Earth
bt	biotite
CFB	continental flood basalt
CHUR	chondritic uniform reservoir
cpx	clinopyroxene
DM	depleted mantle
EMI	enriched mantle type I
EMII	enriched mantle type II
εNd(T)	epsilon neodymium value at time, T
E-type MORB	enriched mid ocean ridge basalt
feld	feldspar
Ga	Giga-anna (billions of years before present)
HFSE	high field strength element
HPT	Olary Block high phosphorous & titanium dolerite
HREE	heavy rare earth element
LIL	large ion lithophile (element)
LOI	Loss on ignition
LPT	Olary Block low phosphorous & titanium dolerite
LREE	light rare earth element
Ma	Mega-anna (millions of years before present)
Mg#	magnesium number (=$Mg^{2+}/Mg^{2+}+Fe^{2+}$)
MORB	mid-ocean ridge basalt
mu	muscovite
OIB	ocean island basalt
OIT	ocean island tholeiite
plag	plagioclase
P.M.	primordial mantle
P-T-t	pressure-temperature-time
qtz	quartz
REE	rare earth element
T_{DM}	depleted mantle model age
tour	tourmaline
XRF	X-ray fluorescence
zir	zircon

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