CONSTRAINTS ON PROTEROZOIC CRUSTAL EVOLUTION FROM AN ISOTOPIC AND GEOCHEMICAL STUDY OF CLASTIC SEDIMENTS OF THE GAWLER CRATON, SOUTH AUSTRALIA

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MAP SHEETS:

Lincoln (SI 53-11) 1: 250 000
Tumby Bay (SI 53-6129) 1: 100 000

TABLE OF CONTENTS

List of Figures:

List of Tables:

KEY TO ABBREVIATIONS.

CHUR	= Chondritic Uniform Reservior		
εNd, Eps. Nd	= Epsilon Neodymium		
Ma	= Mega-anna; millions of years before present		
Ga	= Giga-anna; billions of years before present		
GRV	= Gawler Range Volcanics		
KMZ	= Kalinjala mylonite zone		
KD1	= Deformation event 1 of Kimban orogeny		
KD2	= Deformation event 2 of Kimban orogeny		
S0	= Sedimentary layering	REE	= Rare Earth Elements
S1	= Metamorphic layering	Nd	= Neodymium
S2	= Axial planar foliation	Sm	= Samarim
Au	= Gold	Rb	= Rubidium
Ag	= Silver	Sr	= Strontium
Cu	= Copper	U	= Uranium
^{143}Nd	= Isotope of particular element	Pb	= Lead

KEY TO STRATIGRAPHIC SYMBOLS

Pp, PMp	= Mesoproterozoic Pandurra Formation
Phi, PMhi	= Mesoproterozoic Hiltaba suite granitoids
Pa, PMa	= Mesoproterozoic Gawler Range Volcanics
Pcc, PMcc	= Mesoproterozoic Corunna Conglomerates
Pbr, PMbr	= Mesoproterozoic Blue Range Beds
Pv, PPv	= Palaeoproterozoic Nuyts Volcanics
Pt, PPt	= Palaeoproterozoic Tarcoola Formation
Pmw, PPmw	= Palaeoproterozoic Wandearah Metasiltstone
Pmg, PPmg	= Palaeoproterozoic McGregor Volcanics
Pmm, PPmm	= Palaeoproterozoic Moonabie Formation
Pd, PPd	= Palaeoproterozoic Myola Volcanics, & Broadview schist
Pl, PPl	= Palaeoproterozoic Lincoln Complex Granitoids
Plmy, PPlmy	= Palaeoproterozoic Lincoln Complex; Moody suite granitoids
Pld, PPld	= Palaeoproterozoic Lincoln Complex; Donington suite granitoids
Ph, PPh	= Palaeoproterozoic Hutchison Group Metasediments
Pbo, PPbo	= Palaeoproterozoic Bosanquet Formation
Phb, PPhb	= Palaeoproterozoic Hutchison Group; Amphibolites
Phy, PPhy	= Palaeoproterozoic Hutchison Group; Yadnarie schist
Phm, PPhm	= Palaeoproterozoic Hutchison Group; Middleback sub-group
Phc, PPhc	= Palaeoproterozoic Hutchison Group; Cookgap schist
Phk, PPhk	= Palaeoproterozoic Hutchison Group; Katunga dolomite
Phw, PPhw	= Palaeoproterozoic Hutchison Group; Warrow quartzite
Ap	= Archaean Sleaford, & Mulgathing complexes

ABSTRACT

The Gawler Craton comprises tocks varying in age from Archaean to more recent Phanerozoic sediments. The rocks of greatest interest in defining processes of early crustal formation and evolution in the Australian continent, are the basement material older than approximately 1400 Ma (pre-cratonisation), comprising deformed and metamorphosed rocks suites of Archaean and Proterozoic metasediments and gneisses. These suites span an immense period of intense geological history, and as such are a topic of much past and present study.

Detailed mapping in the Tumby Bay region of eastern Eyre Peninsula outlines stratigraphic and structural evolution of a sequence of Proterozoic rock suites, these are proposed to be related to other recognised deformation episodes elsewhere within the Gawler Craton, thus regional correlation is inferred. A new theory for development of two lineations within the map region is postulated by two movement directions along the Kalinjala Mylonite Zone.

Geochemically the Proterozoic sediments of the Gawler Craton are similar to upper crustal average values of Taylor & McClennan (1985). However, characteristic depletions in Nb and Sr are recognised. Consistency in trace element compositions for Archaean and Proterozoic samples would suggest recycling of older Archaean crust into Proterozoic sediments and granitoids. Analysis of representative trace element ratios and indices of alteration and weathering suggest some change in geochemistry throughout the Proterozoic period.

Selected Proterozoic clastic sedimentary suites were geochemicaly and isotopically (Sm-Nd) analysed, with the data being presented within this thesis. The most interesting of these being the Pandurra Formation, red-bed sediments deposited within the north-eastern Stuart Shelf region of the Gawler Craton. These sediments exhibit a change in measured isotopic values, with younger epsilon neodymium (εNd), and higher Sm/Nd ratios observed (εNd(0) = -14.67, Sm/Nd = 0.2441), than typical older Gawler Craton rocks (average Proterozoic sediments εNd(0) = -21.85, Sm/Nd = 0.1847). This isotopic shift is also recognised within the Adelaide Fold Belt to the east of the Gawler Craton (average shales εNd(0) = -16.20, Sm/Nd = 0.1942). A source for these younger signatures is not recognised within the Gawler Craton, and therefore more distal province sources, OR isotopic alteration in the originally considered 'robust' Sm-Nd isotopic system, are proposed.