



THE PETROLOGY, GEOCHEMISTRY AND GEOCHRONOLOGY  
OF THE FELSIC ALKALINE SUITE  
OF THE EASTERN YILGARN BLOCK, WESTERN AUSTRALIA.

VOLUME I

by

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## ABSTRACT

The felsic alkaline suite of the eastern part of the Archaean Yilgarn Block of Western Australia consists of a series of sparsely distributed oversaturated syenites, quartz syenites, monzonites and alkali granites. They occur predominantly within the Norseman-Wiluna belt of the Eastern Goldfields Province, and exhibit a close spatial relationship to major regional deep-seated crustal lineaments. Members of the suite are characterised by the presence of one or more of the following mineralogical criteria: hypersolvus alkali feldspar, alkali pyroxene or alkali amphibole as a primary or major modal phase, and quartz contents of less than 20%. Depleted geochemical signatures and light rare earth element-enriched patterns are characteristic of the suite, and evidence for the influence of autometasomatic fluids in response to decreasing temperatures and increasing  $f_{O_2}$  of the crystallising magmas is widespread. Rb-Sr isotope systematics define a range of Late Archaean crystallisation ages from 2629-2471 Ma, and low initial Sr ratios are consistent with derivation from a depleted source.

Mineralogical, geochemical and isotopic evidence suggests generation of the felsic alkaline magmas via high temperature anatexis of depleted lower crustal sources consisting predominantly of felsic granulite, with a minor mafic component. Depletion of these source regions resulted from the prior removal of granitic melts which formed the extensive batholiths of the granite-greenstone terranes. Subsequent lower crustal melting occurred in response to the presence of mantle thermal anomalies associated with upwelling plumes, which played a purely passive role in felsic alkaline magma generation. Deep-seated crustal structures facilitated magma emplacement to relatively high crustal levels. The felsic alkaline suite compares favourably with some examples of A-type magmas, but represents a unique association within Archaean environments.



STATEMENT OF ORIGINALITY

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university, and to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

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JUNE 1991

NAME: Geoffrey Ian Johnson COURSE: PhD

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