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THE LANDSCAPE EVOLUTION, GEOCHEMISTRY AND BIOGEOCHEMISTRY OF KANGAROO ISLAND

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Abstract

This work provides a landscape context and framework for the use of regolith and vegetation in mineral exploration on Kangaroo Island, South Australia. Regolith field observations and the production of a regolith–landform map have improved constraints on the ferricrete plateau formation and also on the landscape history of the Island. The ferricrete and ferruginous materials on Kangaroo Island have been found to be the result of continous formation but have been largely in place since the Eocene.

Through field observations, microanalysis and a large scale geochemical survey, the nature of the ferruginous materials and the processes that form them have been examined. Ferrolysis and the movement of groundwater have been interpreted to play major roles in the formation of the ferruginous materials. These processes have a significant impact on the use of the weathered materials for mineral exploration as economic and indicator elements are leached early in the weathering process. Ferruginous materials do contain the signature of mineralisation over areas that contain known deposits, however, the apparent lack of dispersion halos makes these materials difficult to use for a large scale geochemical survey for mineral exploration as target zones may be missed by low sampling densities. Despite this, the ferricrete materials can be useful for mineral exploration, as although potentially only providing small target areas, they do highlight areas of mineralisation. Conversely, the underlying weathered bedrock potentially has less use for mineral exploration as the economic metals have been readily mobilised out of the bedrock during the weathering processes on Kangaroo Island.

The biogeochemical surveys were successful in highlighting areas of mineralisation, and displayed a greater dispersion halo than observed in the ferruginous materials. The biogeochemical surveys also helped to provide further information into the processes occurring in the landscape. The eucalypts are interpreted to source groundwater from the weathering zone in the bedrock and effectively pick up elements as they are leached. While displaying a high degree of variability, even over areas of known mineralisation, this dataset was better suited to identifying signals of mineralisation at a larger scale than the ferricrete. A limiting factor on the use

of eucalypt for biogeochemical surveys is the occurrence of systematic inter-species variations. This makes large, regional scale surveys difficult, as there is a high possibility that there will not be a consistent vegetation species, resulting in a dataset in which different species need to be compared and potentially excluded in order to correctly identify meaningful anomalies. The xanthorrhoea, overall, was less successful in taking up elements of interest, most likely due to its shallower root system, which is likely to tap into the already leached saprolite or groundwater that has only been recently recharged by meteoric water (diluting any chemical signature of the underlying bedrock).

This thesis has been able to demonstrate the potential usefulness as well as challenges associated with utilising ferricrete and vegetation for geochemical and biogeochemical sampling for mineral exploration. In doing so it has also furthered understanding of the landscape evolution of Kangaroo Island, building on previous work, and providing a basis for future landscape evolution studies and mineral exploration on the island.

Thesis Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Katherine Allison Stoate

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