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STUDIES ON THE ANALYTICAL GEOCHEMISTRY
OF URANIUM AND ASSOCIATED ELEMENTS IN THE
HAWKS CRAG BRECCIA OF NEW ZEALAND

A thesis
presented in partial fulfilment of the
requirements for the degree of
Doctor of Philosophy in Chemistry
at
Massey University

NOEL EDWARD COHEN
1969

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ACKNOWLEDGEMENTS

The author wishes to thank his supervisors, Dr R. R. Brooks and Dr R. D. Reeves, for their enthusiasm and assistance throughout the work undertaken. He is also indebted to Dr G. Coote of the Institute of Nuclear Sciences for his assistance in the Gamma Spectrometry part of the studies; to staff of the Geological Survey for valuable advice, to Mr Simon Nathan, Mr John Foster and Mr Jock Braithwaite for assistance in the field work.

He also wishes to thank Mrs Barbara Sanderson for typing the thesis, Miss Doreen Scott for photographic assistance and Mr Peter Herbert for printing the figures.

The author is most grateful to the Mineral Resources Sub-Committee of the New Zealand Grants Committee for the provision of funds to support this project.

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ABSTRACT

Part I

Studies were carried out on the optimum conditions for the successful use of a large quartz spectrograph for the determination of thorium, yttrium and the rare earths in silicate rocks. The best line-to-background ratios were achieved by arcing samples in a matrix of 4% sodium chloride in carbon powder. An atmosphere of 20% argon and 80% oxygen was used to reduce background and eliminate cyanogen band interference. An anion-exchange procedure was used to separate the rare earths from other elements. The resulting enrichment allowed use to be made of less sensitive rare earth lines in the ultraviolet end of the spectrum where the spectrographic dispersion is greater. Line interferences were studied and necessary corrections for these interferences were calculated. The technique was tested by analysing the standard rocks, G-1, W-1 and CAAS syenite. Depending on its concentration, uranium was analysed by either fluorometric or spectrographic techniques. Good agreement with the recommended values for the standard rocks was obtained.

Part II

An investigation of the known areas of uranium mineralization in the Lower Buller Gorge of New Zealand was carried out to investigate the suitability of stream-sediment analysis for geochemical prospecting for uranium. General analysis of the minerals revealed certain elemental associations. The distribution of these elements in the weathering sequence, minerals, soils, stream-sediments, was studied in an attempt to discover

suitable pathfinders for uranium. All results were treated statistically. Rare earth analysis of stream sediments provided new information concerning the possible origin of the Hawks Crag Breccia.

Part III

Use was made of a high-resolution gamma spectrometer to study the gamma radiation of uranium minerals in the low energy region of the spectrum, 30-360 KeV. Identification of the gamma radiation, in this region, was achieved by use of chemical separations and standard sources. This provided the basis for the development, and successful use, of a new method for the determination of "percentage equilibrium radium". The significance of the values for the "percentage equilibrium radium" of the minerals studied is discussed.