SELECTED PORPHYROIDAL AND GRANITIC ROCKS AT TENNANT CREEK, NORTHERN TERRITORY

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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 copy or paraphrase of material previously published or written by another person, except where due reference is made in the text of the thesis.

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ABSTRACT.

The Lower Proterozoic sedimentary succession of the Warramunga Group, Northern Territory, Australia is composed essentially of shales, greywackes and conglomerates with minor haematite shales and cherts having an estimated total thickness of 25,000 feet. At Tennant Creek, the lower part of the succession contains conformable horizons, discontinuous lenses, dykes and other isolated bodies of porphyroidal rocks. The rocks show varying degrees of recrystallization and deformation due to an incipient greenschist facies regional metamorphism.

Two porphyroidal bodies have been studied in detail and are generally similar with respect to petrography, mineralogy and chemistry. They contain between 28% and 45% of megacrysts of quartz, potassium feldspar, plagioclase and minor biotite set in recrystallized, dominantly quartzo-feldspathic groundmasses in which relict textural patterns indicate the former presence of close-packed shards, perlitic cracks and possible amygdaloidal patches and identify the porphyroids as volcanic pyroclastics. The Great Western Porphyroid forms a grossly conformable, perhaps composite, horizon at least twelve miles in length and up to 1,500 feet thick and is of ash-flow origin. The Creek Bed Porphyroid is half a mile long, several tens of feet thick and appears to be a dyke.

The shape of the embayments and cavities, extensively developed in the quartz and potassium feldspar megacrysts, appear different from the more regular skeletal or dendritic patterns which are known to result from irregular growth. The close association between curved grain perimeters and embayments suggests that the two are genetically connected and is consistent with weak magmatic corrosion of euhedral grain habits resulting

in rounded corners with associated, selective, internal corrosion producin the embayments and cavities. The presence of Carlsbad and Baveno twinning in the potassium feldspar further supports an igneous derivation for these mineral grains.

Optical and X-ray data indicate that both the potassium feldspar and plagioclase are in a highly-ordered structural condition. In conformity with their structural states, the compositions of the potassium feldspar and plagioclase are consistent with recrystallization at temperatures typical of greenschist facies metamorphic, rather than magmatic, condition

The major element compositions of the porphyroids are similar to those of calc-alkaline rhyolites apart from a variable alkali ratio and a low CaO content due to the redistribution of K, Na and Ca, probably as a result of hydrothermal alteration.

The petrographic, mineralogical and chemical similarity of the porphyroids to high-level granites (and selected enclaves) of the neighbou ing Tennant Creek Complex suggests a genetic association.

Compositional and structural data on the feldspars are compared throughout the various environments of porphyroid, granite and enclave. The major element composition of the potassium feldspar and the structural states of both the potassium feldspar and the plagioclase are generally similar in the different rock types. This is a result of secondary proces of hydrothermal alteration and/or metamorphic recrystallization, which mak it impossible to correlate primary order-disorder and compositional featur with environment of occurrence. Delicate, oscillatory zoning preserved in the andesine from the different rock types reveals that the similar plagio-clase composition is an original magmatic characteristic. It is concluded

that the close similarity of the Rb, Sr and Ba abundances in the potassium feldspar from the various environments is a consequence mainly of the generally similar abundances of these elements in the porphyroid, granite and enclave bulk compositions.

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