THE ENCOUNTER BAY GRANITES, SOUTH AUSTRALIA, AND THEIR ENVIRONMENT

by

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SUMMARY

The Encounter Bay Granites are essentially pre-tectonic biotite granites that have intruded Kanmantoo Group metasedimentary rocks in the Encounter Bay area of Fleurieu Peninsula and at Cape Willoughby on Kangaroo Island. The granites are broadly concordant with bedding in the metasedimentary rocks, but in detail the contact between the granites and the metasedimentary rocks is sharp.

The type section of the Kanmantoo Group occurs along the southern coastline of Fleurieu Peninsula and extends into the Encounter Bay area. In the western part of the type section, the Kanmantoo Group, which includes metasandstones and metasiltstones, phyllites and carbonate-rich metasediments, conformably overlies fossiliferous Lower Cambrian metasediments and is therefore regarded as Cambrian in age. East of this boundary, the Kanmantoo Group stratigraphic sequence extends without unconformity into the Encounter Bay area and is relatively straight-forward, despite the andalusite-grade metamorphism and the occurrence of folds.

Two phases of folding are recognised in Kanmantoo Group metasedimentary rocks in the type section. First generation folds are of regional significance and have axial planes defined by a penetrative mica schistosity. Second generation folds are well developed only in the eastern part of the type section and have axial planes defined by a crenulation cleavage. The marginal phase of the Encounter Bay Granites in the Encounter Bay area was deformed during the first phase of folding and contains a well developed S_1 schistosity. Low pressure-intermediate type metamorphism commenced at about the time of emplacement of the Encounter Bay Granites.

The major variety of the Encounter Bay Granites is a medium to coarse grained megacrystic granite which can be subdivided into a border facies and an inner facies on the basis of texture and xenolith population. Other granite types are subordinate in areal extent, and include uncontaminated medium grained granites, leucogranites and aplites, and hybrid granites which are regarded as partly assimilated metasedimentary rock xenoliths. All granite varieties contain a distinctive opalescent blue quartz.

Fe/(Fe+Mg) ratios for biotites in the granites are sensitive to compositional changes due to contamination with metasedimentary rock.

The preservation of orthoclase in the cores of potash feldspar megacrysts in the border facies megacrystic granite, and the enrichment of Ba in the cores relative to the margins, is taken in conjunction with field and petrographic observations as evidence for the early crystallisation of the megacrysts. The compositions of coexisting potash feldspar and plagioclase megacrysts in the megacrystic granites are generally consistent with equilibrium crystallisation.

Chemical analyses of the Encounter Bay Granites define a conspicuous contamination trend of the type described by many authors as the result of differentiation. Normative An, Ab and Or ratios for the granites suggest that potash feldspar was the first phase to crystallise in a liquid of the composition assumed for the parental magma. Subsequent contamination with metasedimentary rock displaced the composition of the parental magma into either the plagioclase field or the quartz field of the Q-An-Ab-Or-H_2O system so that quartz and two feldspars were crystallising at the time of emplacement of the megacrystic granites.

On the basis of Rb-Sr isotope dilution data, the Encounter Bay Granites were emplaced between 523m.y. and 531m.y. ago at the onset of metamorphism in the Kanmantoo Group metasedimentary rocks. Both Rb-Sr and K-Ar data suggest that the metamorphic conditions did not wane until about 470m.y. ago.

Contamination of the border facies megacrystic granite is evident from initial Sr^{87}/Sr^{86} ratios. On the other hand, the uncontaminated granites have a high initial Sr^{87}/Sr^{86} ratio (0.711) which is used as a basis for discussion of the origin of the Encounter Bay Granites.