

Deciphering Proterozoic Magmatism Utilising Geochemical Techniques: example of the St Peter Suite, Gawler Craton

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The St Peter Suite, a heterogeneous magmatic intrusive suite emplaced during the late Palaeoproterozoic, forms a large portion of the southern Gawler Craton, South Australia. Comprehensive geochemical analysis of the suite, which ranges in composition from gabbroic to granitic, in the context of a defined intrusive stratigraphy has revealed a number of important characteristics.

The bulk of the St Peter Suite illustrates consistent chemical similarities on major element variation diagrams, AFM diagrams and chondrite normalised spider diagrams, which can indicate a common fractionated magma source. Calc-alkaline affinities are expressed by the suite, which also exhibit enrichments in potassium and iron.

Geochemical results were further utilised for classifying the lithologies of the St Peter Suite, including sub-dividing observed gabbros from St Peter Island based on anomalous TiO₂, Fe₂O₃ and P₂O₅. Gabbros on St Peter Island are chemically distinct from the other St Peter Suite lithologies, including other gabbroic outcrops, suggesting a different magma source to the St Peter Suite.

Trace element modelling indicates that a number of the mafic units are cumulates from the fractionating primary magma rather than more primitive versions of the same source. This accounts for a lamprophyric plug and mafic enclaves within the comagmatic St Peter Suite unit. Cumulate mafic chemistry indicates that a closed system magma chamber could account for the observed lithological relationships and chemical affinities of the St Peter Suite with the only external influx accounting for the high TiO₂ St Peter Island gabbros.

Comprehensive isotopic analysis of the suite is being undertaken for understanding the magma source, any contamination, and tectonic setting which were controlling the suites emplacement during the Palaeoproterozoic.