

Adakitic Signatures from Permian Granitoids Around the Georgetown Region – Potential for Porphyry Cu Mineralisation and Implication for Tectonic Setting

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The Permian granitoids around the Georgetown region (GT) have distinctive adakitic characteristics such as higher Sr and LREE contents; high Sr/Y and (La/Yb)_N ratios; low Y and HREE contents and steep REE patterns with no or weak negative Eu anomalies. These characteristics differentiates them from granitoids in the other provinces like Herberton and Daintree provinces, which have been considered as sources of W or Sn mineralisation. These granitoids were analysed to investigate their petrogenesis, tectonic setting and potential for mineralisation, especially for porphyry Cu deposits. Discrimination diagrams for adakitic sources indicate that these granitoids have compositions similar to continental crust-derived adakites (partial melting of lower continental crust or melting due to delamination). These observations are consistent with the Hf isotopes in zircons, which show negative ϵ_{Hf} values, reflecting derivation from continental crust sources and as their ages became younger, the values decrease indicating thickening of the continental crust in GT as opposed to the Herberton area where similar age granitoids have positive ϵ_{Hf} values indicating thinning and mantle input. Zircon geochemistry indicates that during Permian, the less felsic granodiorites plot in the porphyry Cu(-Au) productive fields showing high oxidation and hydration degrees (higher (Ce/Nd)/Y and Eu/Eu^{*}).

Adakitic signatures are commonly associated with porphyry Cu(-Au) mineralisation even when they occur in non-arc settings such as the Tibetan examples and this may be the case in the GT region. In addition, two distinct metallic Permian mineralisation corridors (Au, Ag, base metal) occur in close spatial association with the Permian granitoids suggesting a fertile environment. Therefore, we suggest that the less felsic Permian granitoids from the GT region have the potential to produce porphyry Cu mineralization and the newly discovered Cu mineralization associated with the Permian Yataga intrusive complex indicates that that may be the case.