A- & I-type subdivision of the Gawler Ranges-Hiltaba Volcano-Plutonic Association

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Felsic units of the Gawler Ranges-Hiltaba Volcano-Plutonic Association (GRHVP) can be divided into four supersuites: the I-type Malbooma and Jenners Supersuites; and the A-type Roxby and Venus Supersuites. All units are aged between ~1595–1575 Ma. Major and trace element modelling of granites of both the moderately to strongly evolved Malbooma and Jenners I-type Supersuites suggests derivation dominantly by crystal fractionation from granodiorite compositions. Creaser [1] suggested the A-type granites around Olympic Dam (included here in the Roxby Supersuite) likewise formed by crystal fractionation from a quartz-latite composition.

Epsilon $Nd_{(1580Ma)}$ of the granites and volcanics (-8 to +2) indicate a more primitive Nd input than available from the known Archaean and Palaeoproterozoic crust (-12.5 to -1) alone, requiring some mantle input in the genesis of these felsic magmas. A derivation by partial melting of granodiorite compositions, rather than being the result of extensive fractionation from basalts, is suggested. Mafic rocks of the GRHVP have variable isotopic and chemical signatures. The Lady Jane Diorite at Tarcoola has ε_{Nd} ~0.2, and a composition incompatible with OIB derivation, but compatible with partial melting of a crustally-contaminated MORB. Some of the alkaline mafic/ultramafic rocks have ε_{Nd} values as high as +4 [2].

Maximum zircon saturation temperatures of ~800°C and ~900°C for the I- and A-type supersuites respectively, are significantly lower than those of ~1000°C measured by other geothermometers [3] for the Yardea Dacite (Roxby Supersuite), but suggest that the A-type supersuites were hotter than the I-type supersuites. The distribution of high-temperature A-type granites shows some spatial correlation with areas of coeval iron oxide copper-gold mineralisation.

The coincidence of very hot granites with crustal ε_{Nd} signatures, and mafic rocks with primitive to weakly evolved signatures, indicates an extensional environment with very elevated geotherm and mantle upwelling. However, the felsic rocks are dissimilar to those associated with mantle plumes, and, therefore, a back arc distal to a continental subduction zone setting is suggested, perhaps analagous to the present Altiplano – Puna region of the Central Andes [4].

References

[1] Creaser, R.A. (1996) *PreC Res* **79**, 371-394. [2] Johnson, J.P. & McCulloch, M.T. (1995) *Chem Geol* **121,** 177-199. [3] Creaser, R.A. & White, A.J.R. (1991) *Geology* **19**, 48-51. [4] Babeyko, A.Y. *et al*. (2002) *EPSL* **199**. 373-388.