Reactive transport modelling in hydrothermal systems using the Gibbs minimisation approach

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Current analysis of mineral systems is driven by an integrated approach that couples many disciplines (i.e. structural analysis, isotopes, geochemistry, and mineral paragenesis). In doing this we have to interpret complex multidiscipline observations and datasets, at multiple scales, and unravel the feedback that occurs between different physical processes. In order to understand the coupling and feedback between these observations and their processes we have to turn to computer modelling, in particular reactive transport modelling, that attempts to couple the simulation of fluid-flow, heat and chemical transport, and chemical reactions.

As part of the predictive mineral discovery-Cooperative Research Centre we have taken a novel approach to reactive transport modelling of hydrothermal systems by coupling a Gibbs minimisation solver (WinGibbs, see [1]) with a partial differential equation solver (Fastflo4 [2]), using a finite element geometry, to solve the equations of flow, heat and mass transport, and chemical reaction.

Initial models are used to simulate the devolatalisation of cooling granite beneath a greenstone/felsic volcanic rock pile, and the associated gold mineralization that results from coupling of the physical processes. It is found that one of the most critical factors in deciding the outcome of the model is the introduction of a dynamic permeability-porosity function as a fully coupled process.

References

[1] Shvarov, Yu.V., and Bastrakov, E.N. (1999) *AGSO Record* **1999/25,** pp 61.

[2] Gross, L. (2002) *CSIRO Mathematical and Information Sciences Sofwtare.*