Fluid/mineral equilibrium calculations for geothermal fluids and chemical geothermometry

Mwakio P. Tole, Halldór Ármannsson, Pang Zhong-He, Stefán Arnórsson

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**Abstract**

Aquifer temperatures of 13 geothermal wells in Iceland whose measured reservoir temperatures range from 47 to 325°C have been estimated from the chemical composition of the discharged fluid by considering simultaneously temperature dependent equilibria between many mineral phases and the solution. This approach to chemical geothermometry was initially proposed by Reed and Spycher [(1984) *Geochim. cosmochim. Acta* 48, 1479–1492]. Its advantage over individual solute geothermometers such as the silica and the Na—K and Na—K—Ca geothermometers is that it allows a distinction to be made between equilibrated and non-equilibrated waters. However, care should be taken in interpreting the results of multi-mineral/solute equilibria as the results depend on both the thermodynamic data base used for mineral solubilities and the activities of end-member minerals in solid solutions. When using old analytical data attention has to be paid to analytical methods, especially in the case of important constituents present at low concentrations in the fluid, such as aluminium, for which analytical results obtained by two methods yielded very different equilibrium temperatures. The results for selected wells in Iceland, presented here, indicate that the geothermometry results are with few exceptions within 20°C of measured aquifer temperatures, and within 10°C for about half the wells considered. The method responds rapidly to changes such as cooling or mixing.