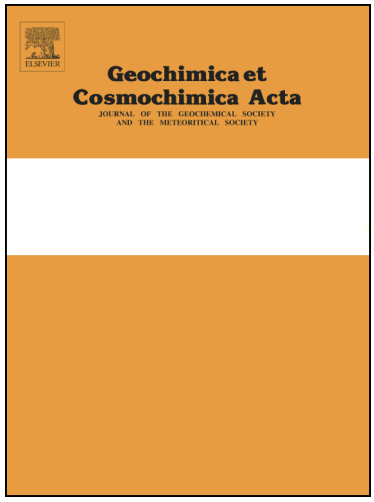

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Sulfate brines in fluid inclusions of hydrothermal veins: Compositional determinations in the system H_2O-Na-Ca-Cl-SO_4

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ABSTRACT

Sulfate is among the most abundant ions in seawater and sulfate-bearing brines are common in sedimentary basins, among other environments. However, the properties of sulfate-bearing fluid inclusions during microthermometry are as yet poorly constrained, restricting the interpretation of fluid-inclusion compositions where sulfate is a major ion. The Schwarzwald mining district on the eastern shoulder of the Upper Rhinegraben rift is an example of a geologic system characterized by sulfate-bearing brines, and constraints on the anion abundances (chloride versus sulfate) would be desirable as a potential means to differentiate fluid sources in hydrothermal veins in these regions. Here, we use the Pitzer-type formalism to calculate equilibrium conditions along the vapor-saturated liquidus of the system H_2O-Na-Ca-Cl-SO_4, and construct phase diagrams displaying the predicted phase equilibria. We combine these predicted phase relations with microthermometric and crush-leach