

LETTER

Mineralogical variation of silica induced by Al and Na in hydrothermal solutions

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ABSTRACT

Various silica minerals form in hydrothermal settings; however, the main controls on mineralogical variations in such environments remain poorly understood. In this study, we investigate the effects of Al and Na on the mineralogy of silica precipitates by hydrothermal flow-through experiments for silica precipitation at 430 °C and 31 MPa. We used solutions with elevated Si concentrations, exceeding the solubility of amorphous silica. As the Al and Na concentrations in the input solution were raised from 0 to 7 ppm, the dominant silica minerals systematically changed from amorphous silica to cristobalite to quartz. The positive correlation between Al and Na contents in precipitated quartz indicates that Al coupled with Na substitutes for Si. Our results suggest a possible mechanism for quartz vein formation in which quartz nucleates directly without precursor amorphous silica or cristobalite due to the presence of feldspar-derived Al and Na in hydrothermal fluids.

Keywords: Hydrothermal experiments, silica precipitation, quartz, amorphous silica, trace elements, feldspar