# Synthesis and Paragenesis of Na-Beidellite as a Function of Temperature, Water Pressure, and Sodium Activity*

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**Abstract:** In the chemical system $Na_2O$-$Al_2O_3$-$SiO_2$-$H_2O$, the stability field of Na-beidellite is presented as a function of pressure, temperature, and Na- and Si-activity. $Na_{0.7}$-beidellite was hydrothermally synthesized using a stoichiometric gel composition in the temperature range from 275 ° to 475 ° C and at pressures from 0.2 to 5 kbar. Below 275 ° C kaolinite was the only crystalline phase, and above about 500 ° C paragonite and quartz developed instead of beidellite. An optimum yield of 95% of the $Na_{0.7}$- beidellite was obtained at 400 ° C and 1 kbar after 20 days. Gels with a Na-content equivalent to a layer charge lower than 0.3 per $O_{20}(OH)_4$ did not produce beidellite. They yielded kaolinite below 325 ° C and pyrophyllite above 325 ° C. With gels of a Na-content equivalent to a layer charge of 1.5, the Na-beidellite field shifted to a minimum between temperatures of 275 ° and 200 ° C. This procedure offers the potential to synthesize beidellite at low temperatures. Beidellite synthesized from $Na_{1.0}$-gel approach a $Na_{1.35}$ composition and those from $Na_{1.5}$- and $Na_{2.0}$-gels a $Na_{1.8}$ composition.

**Key Words:** Beidellite • Electron microprobe • Hydrothermal synthesis • Kaolinite • Paragonite • Pyrophyllite • Scanning electron microscopy • X-ray diffraction

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