
Synthesis and Characterization of Zeolites in the System $\text{Na}_2\text{O-K}_2\text{O-Al}_2\text{O}_3\text{-SiO}_2\text{-H}_2\text{O}$

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Abstract: Zeolites having the structures of phillipsite, merlinoite, and gobbinsite were synthesized from clear solutions at 80° C in the system $\text{Na}_2\text{O-K}_2\text{O-Al}_2\text{O}_3\text{-SiO}_2\text{-H}_2\text{O}$ and their morphologies, cell parameters, and compositions determined. At 3.5 M silica concentration, the formation of merlinoite (synthetic zeolite W) is favored over the formation of phillipsite (synthetic zeolite ZK-19) by solution conditions of high pH (> 13.6) and low $\text{Na}/(\text{Na} + \text{K})$ ratios (<0.5).

Using the information obtained from the synthesis experiments, the presence of merlinoite was predicted in sediments from Searles Lake, a saline, alkaline lake in California with ideal physiochemical conditions for its formation. Merlinoite was subsequently discovered to occur in tuffaceous sediments as part of an authigenic silicate zonation pattern from phillipsite → phillipsite + merlinoite → merlinoite → K-feldspar with increasing depth. Because of the close similarities in the physical properties of phillipsite and merlinoite, merlinoite may be much more common as an authigenic mineral than is currently realized.

Key Words: Gobbinsite • Merlinoite • Phillipsite • Saline • Alkaline lake • Synthesis • Zeolite P_t • Zeolite W • Zeolite ZK-19

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