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The role of water in the synthesis of glaucophane

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ABSTRACT

Syntheses have been done at 2.5 GPa and 750 °C to examine the effects of varying the water content and composition of the solid starting mixture on the formation of glaucophane [$Na_2Mg_3Al_2Si_8O_{22}(OH)_2$]. Amphiboles of apparently ideal glaucophane composition, confirmed by electron microprobe analyses, were obtained by treating oxide or oxide-hydroxide mixtures with bulk water contents of 4–5 wt% for durations of about 400 h in multiple treatments with intermittent grindings. This water content is necessary to permit growth of amphibole while preventing the intervention of a sheet silicate, which was identified in this study as vermiculite. To maximize amphibole yields, multiple treatments with intermittent grinding are needed on account of the low water contents that reduce the reaction rate of the synthesis process. Calculation of the solubility curves of talc, jadeite, and glaucophane in $\log[a_{Mg(OH)}{}^{+}/a_{H}{}^{+}]$ vs. $\log[(a_{Na}{}^{+})(a_{AlSiO_4}{}^{-})]$ space at 2.5 GPa and 750 °C shows that glaucophane has a very narrow field of stability without coexisting jadeite or talc. This same diagram can be used to illustrate that the growth of vermiculite relative to glaucophane is not an issue of metastability but of the activity of water.

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