*American Mineralogist, Volume 84, pages 362–373, 1999*

# The high-pressure synthesis of lawsonite in the MORB+$H_2O$ system

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## ABSTRACT

Lawsonite is an important water reservoir in subducting oceanic crust below the amphibole dehydration depth ~70 km. To determine the maximum pressure stability of lawsonite in the MORB+$H_2O$ system, experiments were carried out using a 1000 ton uniaxial multi-anvil apparatus (SPI-1000). Mixtures of synthetic gel+2wt% $H_2O$ were used for the starting materials with the average MORB composition. Experimental *P-T* conditions were $T$ = 700–900 °C and $P$ = 5.5–13.5 GPa. Run durations were 12 and 24 h.

Lawsonite was synthesized stably up to 10 GPa and $T < 700$ °C in the stishovite stability field, and <900 °C at 8 GPa and 750 °C at 5.5 GPa in the coesite stability field, with a steep positive slope for the lawsonite-out reaction. The lawsonite-out reaction in the coesite stability field changes to have a gentle negative slope in the stishovite stability field. The reaction leading to the disappearance of lawsonite is a continuous reaction due to the compositional enlargement of garnet toward the grossular end-member with increasing *T* and *P*. Lawsonite disappears when the tie line connecting grossular-rich garnet with omphacitic clinopyroxene reaches the bulk composition on the conventional AC(FM) ternary diagram.