

Experiments on CaCO_3 - MgCO_3 solid solutions at high pressure and temperature

ALESSANDRA BUOB,¹ ROBERT W. LUTH,² MAX W. SCHMIDT,¹ AND PETER ULMER^{1,*}

¹Department of Earth Sciences, ETH-Zentrum, Zurich, Switzerland

²C.M. Scarfe Laboratory for Experimental Petrology; Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, Canada

ABSTRACT

Multi-anvil experiments have been performed in the system CaCO_3 - MgCO_3 at pressures of 5.0–7.0 GPa and temperatures of 800–1600 °C. The reaction dolomite = aragonite + magnesite has been reversed and located near 750 °C at 5.0 GPa, 900 °C at 6.0 GPa, and 1000 °C at 7.0 GPa. Between 5 and 6 GPa, the reaction boundary is strongly curved and its dP/dT slope increases from 2 to 12 MPa/°C, expanding the stability field of dolomite. This increase is attributed to increasing Ca-Mg disorder in the dolomite. In addition to the reaction boundary, an isobaric section of CaCO_3 - MgCO_3 has been determined at 6.0 GPa. There is a two-phase field of aragonite + dolomite on the Ca-rich side, which closes before minimum melting temperatures of 1350 °C are reached. The two-phase field on the Mg-rich side, where dolomite + magnesite coexist, intersects with the solidus. Inferred minimum melts are close to dolomite composition suggesting congruent melting of dolomite at 6 GPa. The melt compositions and temperatures in the pure carbonate system are surprisingly similar to solidus phase relations in the CMAS- CO_2 system, implying that minimum melting conditions in carbonated peridotite at high pressures are dominated and controlled by the carbonate component.

Keywords: experimental petrology, high-pressure studies, phase equilibria, metamorphic petrology