DETERMINATION OF HIGH-TEMPERATURE TRANSITION IN CALCITE TO 5 KBAR BY DIFFERENTIAL THERMAL ANALYSIS IN HYDROSTATIC APPARATUS

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ABSTRACT

The high-temperature transition in calcite, located by extrapolation near 985° at 1 bar, has been determined to 5 kbar by differential thermal analysis in hydrostatic apparatus. The transition temperature increases with pressure at the rate of 3.0 ± 0.3°C/kbar, in contrast to the recent hypotheses which project a decrease.

INTRODUCTION

In a thermal analysis study of calcite, Boeke (1912) reported a subtle anomaly near 970° ± 5°C. Existence of the anomaly was corroborated by Eitel (1923), who placed it near 975°–980°C under ~0.1 kbar CO_2 pressure. However, Smyth and Adams (1923) could not verify the anomaly in their careful differential thermal analyses. Following Jamieson's (1957) suggestion, Boettcher and Wyllie (1967) strongly inferred that this anomaly in calcite corresponded to a transition whose temperature decreased with pressure to near 480°C and 9.4 kbar in order to explain a kink in the trajectory of the calcite-aragonite boundary there. Goldsmith and Newton (1969) confirmed the kink discovered by Boettcher and Wyllie (1967) and also unsuccessfully sought to confirm the anomaly in calcite by several methods, including differential thermal analysis (DTA) in piston-cylinder apparatus. Zimmermann (1971) apparently located no change in slope within his experimental range, but Johannes and Puhan (1971), in subsequent work, found a gradual curve in the trajectory of the transition between 300° and 500°C.

The present DTA investigation in hydrostatic apparatus has established the trajectory of the thermal anomaly in calcite, which does not correspond to the trajectory postulated by Jamieson (1957) and others.

EXPERIMENTS AND RESULTS

AR primary standard $CaCO_3$, obtained from Mallinckrodt and verified by X-ray diffraction to be calcite, was dried at ~200°C for 1 day under 0.5 atm of air.

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