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CALCITE-ARAGONITE EQUILIBRIUM FROM 50°C TO 150°C

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ABSTRACT

The slope of the calcite-aragonite transition curve from 50°C to 150°C is determined as 13.8 bars/degree; the 0°C intercept as 3.04 kbar. These data confirm recent work at higher temperatures and pressures and the previous determination of the 100°C equilibrium pressure of 4.35 kbar.

Recent works on the calcite-aragonite equilibria rely on the equilibrium point of 100°C and 4.35 kbar established by Crawford and Fyfe (1964). It seemed well to examine this system between 50°C and 150°C to provide a check of the location of the 100°C point, to permit an experimental determination of the slope of the equilibrium curve in this region, and to give a comparison of this curve with that obtained from higher temperature data.

A banded sample containing approximately equal widths of a bladed aragonite layer on a druzy calcite layer was ground to pass a 325 mesh screen (Table 1). An X-ray powder diffractogram of this start material exhibits strong peaks of both aragonite and calcite. The powder was placed in small hot-seal vessels, brought to the desired temperature dry, and then pumped to the desired pressure. The phase produced and changes in relative quantities were determined by com-

Table 1. The start material of bladed aragonite on druzy calcite is specimen no. 1201, Rand Collection, Bryn Mawr College. Collected from the Knickerbocker quarry, 2 miles north of Frazer, Chester County, Pennsylvania.

	Analyses of Start Materials		
Oxide	Druzy Calcite	Bladed Aragonite	
CaO	54.6±0.4	56.1±0.5	wt.%
BaO	0.9	0.98	wt.%
SrO	Nil	200	ppm
MgO	10200	500	ppm
FeO	100	80	ppm
MnO	Nil	Nil	

Table 2. Results of calcite-aragonite experiments: C, calcite; A, aragonite; parentheses denote minor phase. Starting material bladed aragonite on druzy calcite.

Temp (°C)	Pressure (kb)	Products	Time (days)
128	5.18	A + (C)	21
132	5.18	A +(C)	21
153	4.83	C + (A)	35
76	4.48	A	3
90	4.14	C + (A)	28
93	4.14	C	17
56	4.14	A + (C)	28
70	4.14	A + (C)	17
70	3.69	C	8
81	3.52	C	36

parison of X-ray diffraction patterns of the product with that of the start material (Table 2). The results are plotted in Figure 1.

Table 3 contains the slope of the boundary curve at lower temperatures, its intercept at 0°C, and the resulting pressure at 100°C as obtained from our data, that of Boettcher and Wyllie (1968), and that of Johannes and Puhan (1971). The slope and 0°C intercept of our data and that of Boettcher and Wyllie are in near agreement. Both of the 100°C points are within the limits of experimental error of the 4.35 ± 0.15 kbar pressure of Crawford and Fyfe (Fig. 1, C and F). The slope, intercept, and 100°C point obtained from the data of Johannes and Puhan are not in agreement with the above information. Perhaps this discrepancy results from the difficulty they acknowledge in obtaining their 180°C point (Johannes and Puhan, 1971, p. 33). The 300°C point of Johannes and Puhan is in complete agreement with the projection of our data and that of Boettcher and Wyllie.

The results of this study verify the validity of the location of the 100°C point of Crawford and Fyfe and give a slope that is in agreement with one projected into this region from the higher temperature and pressure data of Boettcher and Wyllie.

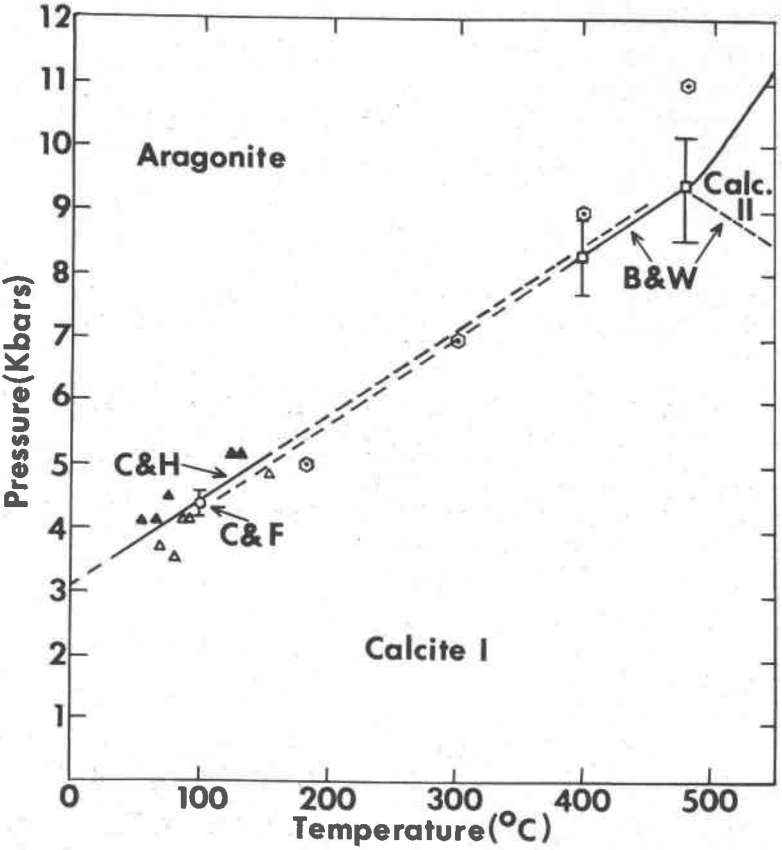

FIG. 1. Calcite-Aragonite Equilibrium Curves. Solid triangle, run product = aragonite; open triangle, run product = calcite; line labeled C and H, equilibrium curve established by this paper. Open circle labeled C and F, equilibrium point established by Crawford and Fyfe (1964). Open squares, equilibrium points established by Boettcher and Wyllie (1968). Line labeled B and W, equilibrium curves established by Boettcher and Wyllie. Bars extending from open symbols denote limits of experimental error. Open hexagons, equilibrium points established by Johannes and Puhan (1971). Size of hexagon indicates approximate limit of experimental error. Curve extrapolations dashed.

Table 3. Comparison of slopes and equilibrium pressures obtained from our data with that of others.

	Crawford and Hoersch	Boettcher and Wyllie (1968)	Johannes and Puhan (1971)
Slope of the boundary curve (bars/degree C)	13.8*	13.7**	16.7***
Pressure of 0° C Intercept (kbars)	3.04	2.82	1.99
Pressure at 100° C (kbars)	4.42	4.19	3.66

* Slope based on least squares determination from data presented in Table 2.

** Slope calculated from points 480° C, 9.4 kbar and 400°, 8.3 kbar (Fig. 1).

*** Slope calculated from points 300°C, 7 kbar and 180°, 5 kbar (Fig. 1).

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THE USE OF FAR INFRARED INTERFEROMETRIC SPECTROSCOPY FOR MINERAL IDENTIFICATION

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ABSTRACT

Interferometric infrared spectroscopy in the range 20–400 cm^{-1} can provide a simple method for differentiation of the major mineral groups, and of individual types within each group. Results are shown for some representative micas and clay minerals.