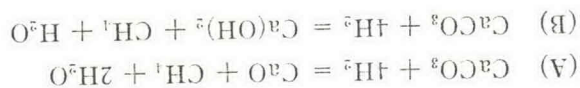


CALCITE-HYDROGEN

In the calcite-hydrogen system using calcite fragments of 40 to 60 mesh, between 535-870°C, and 200-8000 psi of initial hydrogen, the following compounds were observed: solid CaO; Ca(OH)₂; graphite; and carbon "soot." Gaseous CH₄; C₂H₆; CO; CO₂; and H₂O also formed.

The experimental results are summarized in Table I and plotted in Figures 3, 4, and 5. The weight percent CO₂ in the remaining solid and the mole percent CH₄ formed are plotted against the duration of the run in hours at 2000 psi (P_{H₂}).

Below its dissociation temperature Ca(OH)₂ is the stable solid reaction phase. In runs allowed to cool to room temperature under the reaction gases, Ca(OH)₂ is always present. In experiments run above the dissociation temperature of Ca(OH)₂, CaO is present if the reaction gases are replaced with helium at the operating temperature. Analyses of the reaction gases indicate that water is the oxygenated product. Simplified equations for the reactions are the following:



The change in free energy for reaction B is negative below approximately 325°C; whereas for reaction A it is positive. However, the free en-

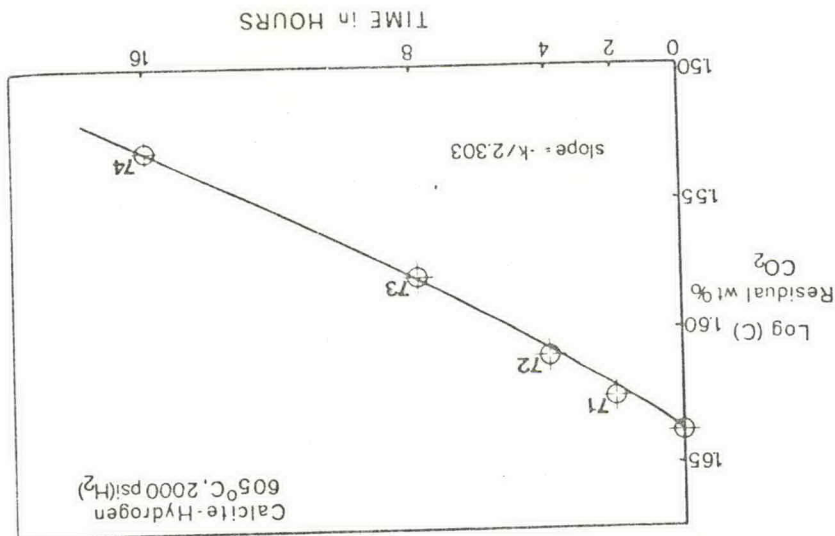


Fig. 3. Linear plot of log C against time for calcite-hydrogen data from experiments 71, 72, 73, and 74; run at 605°C, 2000 psi (H₂) illustrating the pseudo-first-order nature of the reaction.

TABLE I. MASS SPECTROGRAPHIC ANALYSES OF REACTION GASES^a AND Wt-CHEMICAL ANALYSES OF RESIDUAL CO₂ IN UNREACTED CALCITE-CALCITE-HYDROGEN SYSTEM

Experiment No.	Temperature (°C)	Pressure (psi)	Experiment No.	Temperature (°C)	Pressure (psi)
70	535	2000	71	605	2000
72	605	2000	73	605	2000
74	605	2000	75	700	200
77	700	2000	78	700	8000
79	700	2000	80	700	2000
81	870	2000	82	650	2000
90	610	2000	91	735	2000
92	713	400	93	700	1000