

FIG. 6. Plot of calcite-hydrogen system showing mole % CH₄ generated and residual CO₂ remaining as calcite in experiments run at 700°C; 2000 psi (H₂) exp. no. 77, 79 and 8000 psi (H₂) exp. no. 78; for 8, 4, and 2 hours respectively.

run at 605°C and 2000 psi $P(\text{H}_2)$ for 2, 4, 8, 16 hours respectively is shown in Figure 3. The deviation from linearity is not excessive, and the agreement of the calculated rate constants for the same experiments is within the experimental error (Table 2). Both evaluations support the assumption of a pseudo-first-order reaction.

TABLE 2. CALCITE-HYDROGEN AT 605°C, 2000 PSI $P(\text{H}_2)$

t (hours)	Wt % CO ₂ ^a remaining in solid	k (hour ⁻¹)
2	42.0	0.019
4	41.0	0.016
8	37.8	0.018
16	34.2	0.015
		mean = 0.017

^a Initial CO₂ Wt % is 43.7.

The Arrhenius equation:

$$\frac{d \ln k}{dT} = \frac{E_a}{RT^2}$$

can be used with the data from experiments 71 and 77. The variation of the rate constants with temperature is shown in Figure 7. The Arrhenius apparent energy of activation (E_a) is calculated from the slope of the line.

Figure 7 is a plot of the Arrhenius equation for experiments nos. 70, 71, 91, 80, and 81. The pressures (2 hours) were common to all experiments. The temperatures were 535°C, 605°C, 735°C, 790°C, and 870°C respectively. The energy is calculated from the linear portion of the plot.

The Arrhenius equation: $d \ln k/dT = E_a/RT^2$

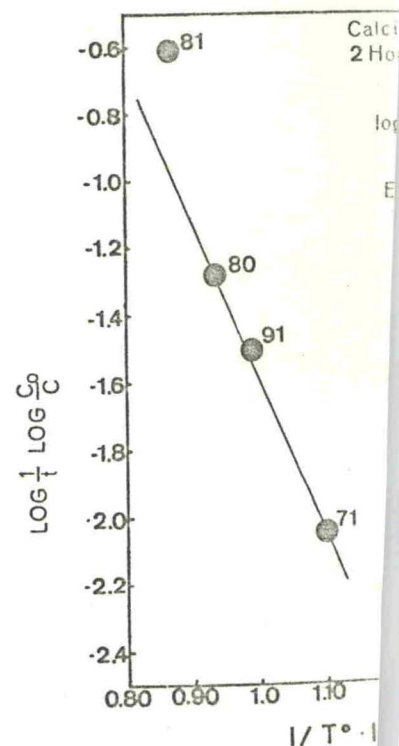


FIG. 7. Plot of $\log(1/t \log C_0/C)$ or $\log k$ against $1/T$ for experiments numbered 70, 71, 92, 80, and 81. The pressures (2 hours) were common to all experiments. The temperatures were 535, 605, 735, 790, and 870°C respectively. The energy is calculated from the slope of experiments 71.