TABLE 1

Experimental Results

°C Temperature	Kilobars Pressure	Hours Duration	Reactants	Products
1500	23.6	3	K + (S)	S
1500	24	2	A	S
1500	24	2	A	S + Q* + C*
1500	24.5	2	A	K
1500	25	2½	S + (K)	K + (S)
1400	22	2¼	A	S
1400	22	5	K + (S)	K + (S)
1400	22	5¼	K + (S) + H_2O	K + C + G
1400	22	5	K + (S)	S + (K)
1400	22.5	4	A	K + S + Q* + C*
1400	23	5	S + (K) + H_2O	C + G
1400	23	3	A	K + Q* + C*
1400	23.1	5	S + (K)	K
1350	21	5	K + (S)	S + (K)
1300	20	4½	K + (S)	K + (S)
1300	20.5	4½	K + (S)	K + (S)
1300	20.5	2¼	MK	S + Q
1300	21	2	MK	S + K + Q
1300	21.5	2	MK	K + Q
1300	22	5	S + (K)	K
1200	19.5	3	MK	S + Q + C*
1200	20	2¾	MK	K + S + Q + C*
1200	20.5	2¾	MK	K + Q
1100	18	4½	MK	S + Q + C*
1100	18.5	5	MK	S + (K) + Q + C*
1100	19	4	MK	K + Q
1000	17	6½	MK	S + Q + C*
1000	17.5	6¾	MK	S + Q + C*
1000	18	5¼	MK	K + Q + C*
900	15	18	MK + (K) + (S)	S + (K)
900	15.5	16¾	MK + (K) + (S)	S + K
900	16.5	15	MK + (K) + (S)	K + S
900	17	15	MK + (K) + (S)	K + (S)

MK, metakaolinite; A, andalusite; K, kyanite; S, sillimanite; G, glass; Q, quartz; C, corundum.

Parentheses indicate phase present in minor amounts. *Metastable phase.

arrived at previously (Clark, Robertson, and Birch, 1957), but the present evidence is much less equivocal.

Kyanite and sillimanite were synthesized together in several runs close to the equilibrium curve. This is probably due to small gradients of pressure and temperature. The persistence of both phases can be attributed, in part at least, to the extreme sluggishness with which reaction between kyanite and sillimanite takes place close to the equilibrium curve.

Attempts were made to locate the equilibrium curve at temperatures below 1000°C, using as a reactant metakaolinite seeded with about 10 percent each of kyanite and sillimanite. In runs 1 kilobar or more away from the extrapolated phase boundary at 900°C, the polymorph stable under the conditions of the experiment was decidedly the more plentiful product of the run. The results of runs closer to the equilibrium curve were not sufficiently clearcut

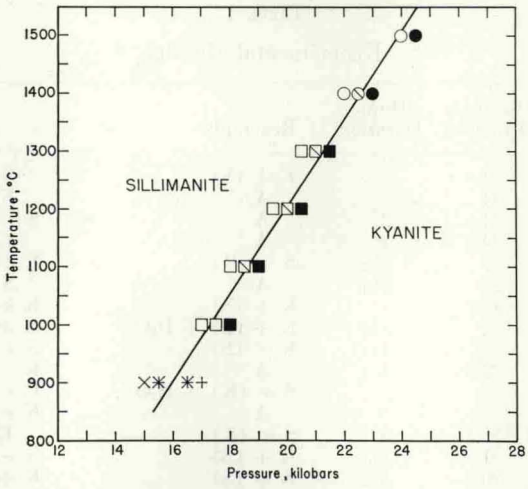

Fig. 1. Syntheses of kyanite and sillimanite. Circles stand for runs in which andalusite was the reactant, squares represent metakaolinite, and crosses and pluses represent metakaolinite seeded with kyanite and sillimanite. Solid symbols mean kyanite was produced, open symbols mean sillimanite, and open symbols with a diagonal line mean both. Crosses represent the growth of sillimanite and pluses the growth of kyanite.

to permit them to be assigned definitely to either field of stability. Both kyanite and sillimanite grew in about equal amounts.

Several experiments in which the reactant was either kaolinite or an aluminosilicate to which a small amount of water had been added were carried out at temperatures above 1000°C. These runs produced corundum plus glass, in agreement with the results of Yoder and Schreyer (1959) at lower pressures. The water content of these charges is not really known, as it was not possible to demonstrate the absence of leak during the run. These observations of melting are of only qualitative value as a result. The appearance of corundum in these experiments is of interest because it suggests a possible explanation of the metastable formation of quartz plus corundum that plagued the previous study (Clark, Robertson, and Birch, 1957). In those runs, kaolinite or andalusite which contained pyrophyllite as an impurity were heated in unsealed capsules. It is possible that partial fusion and the nucleation of corundum took place before all the water escaped. Once formed, corundum will persist practically indefinitely. The appearance of this metastable assemblage was not troublesome in the present work.

COMPARISONS WITH OTHER WORK

The present results are compared with those of the previous study (Clark, Robertson, and Birch, 1957) in figure 3. Within the common range of experiment (1000°C to 1300°C) the two sets of data agree to within 1 kilobar. The discrepancy could be reduced by applying a smaller correction for friction and the strength of the pressure medium to the present results, but the difference is probably within experimental error as it stands. It may also be a measure of the width of the zone of indifference between kyanite and sillimanite.