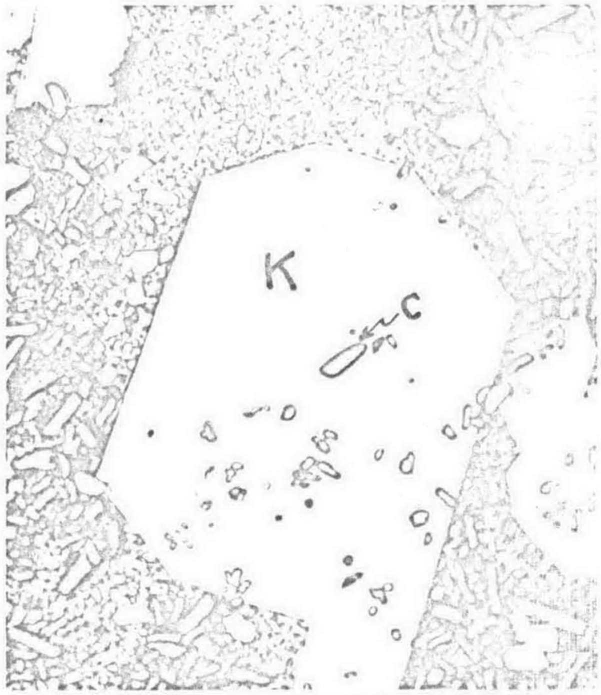

Fig. 9. Kyanite formed from gel at 41.5 kbars and 1450°C for 35 minutes. The inclusions are corundum. The matrix is composed of corundum, kyanite, and glass. (As polished, bright field, ×500.)

The formation of sillimanite (?) plus corundum plus glass from kyanite is shown in Fig. 10. Corundum appeared to have formed early in the decomposition and was then enclosed by the other phases as they nucleated and grew.

(4) Comparison of Sillimanite and Andalusite Results

The results with sillimanite defined quite sharply a boundary between a kyanite field (drawn on the basis of the first appearance of this phase) and a corundum plus glass region. On the basis of the trend of the reaction in the hotter parts of the cell, i.e., corundum crystals growing (not disappearing) at higher temperatures, it is concluded that corundum plus liquid is an equilibrium assemblage. The crenulated borders

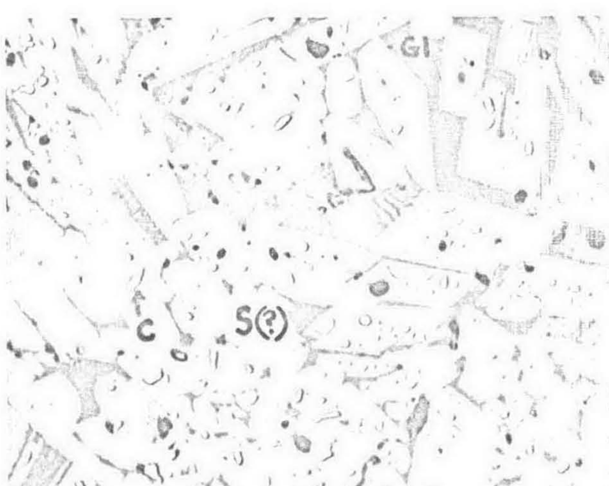

Fig. 10. Sillimanite (?) with included corundum in glass at 28.5 kbars and 1850°C for 4 minutes. (As polished, bright field, ×500.)

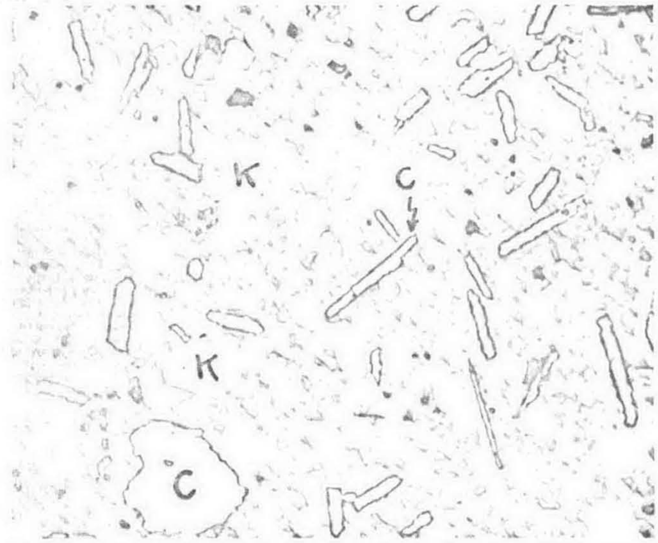

Fig. 11. Kyanite with corundum plus glass from sillimanite at 54 kbars and 1850°C for 3 minutes. Crenulated borders of the corundum needles and plates indicate that corundum is dissolving. (As polished, bright field, ×500.)

of corundum crystals in a kyanite-glass matrix in the cooler portion of the cell were considered to be good evidence for the incomplete solution of corundum (Fig. 11); or, in other words, corundum was disappearing in the lower-temperature region.

For the andalusite runs the kyanite stability region was easily delineated from a region where sillimanite (?) was a persistent phase along with corundum and glass. The trend of the reaction to corundum and liquid was obvious, however, in the outer rim of the runs. The kyanite decomposition boundary was nearly the same for both sillimanite and andalusite as starting materials but differed considerably from the results for the kyanite and the gel. With both sillimanite and andalusite, kyanite was formed in a pressure-temperature region which would be unstable for this phase on the basis of the results for the kyanite and the gel. Further discussion of the anomaly is given later.

When kyanite was formed from sillimanite and andalusite, a microstructure with grain boundaries typical of a dense sintered compact was found (effectively a high-density, hot-pressed kyanite body) and the internal grain structure as revealed by etching was simpler and looked more like growth twinning than the slip-kink structure, suggesting little or no shearing. The rate of conversion to kyanite was very high and the amount converted was also high compared with runs with the gel mixture.

IV. Discussion

It was shown in the foregoing that by using the three forms of Al_2SiO_5 and Al_2O_3:SiO_2 gel as starting materials, corundum was a persistent phase in most of the runs. Clark *et al.*[1,2] described the same problem (plus the formation of quartz) in their runs and concluded that both corundum and quartz were metastable in their experiments. In the present work the observation of the solution of corundum crystals provides experimental confirmation for that conclusion for corundum in the stability region shown for kyanite in Fig. 6.

On the basis of the sillimanite and andalusite data, the pressure-temperature curves obtained from the gel mixture and from kyanite are judged to represent the metastable formation of corundum. The sharp and relatively complete conversion of andalusite and sillimanite to kyanite, the stability of this kyanite until the temperature was increased, and the growth of corundum crystals with time at the higher temperatures lead to the interpretation that an equilibrium region