

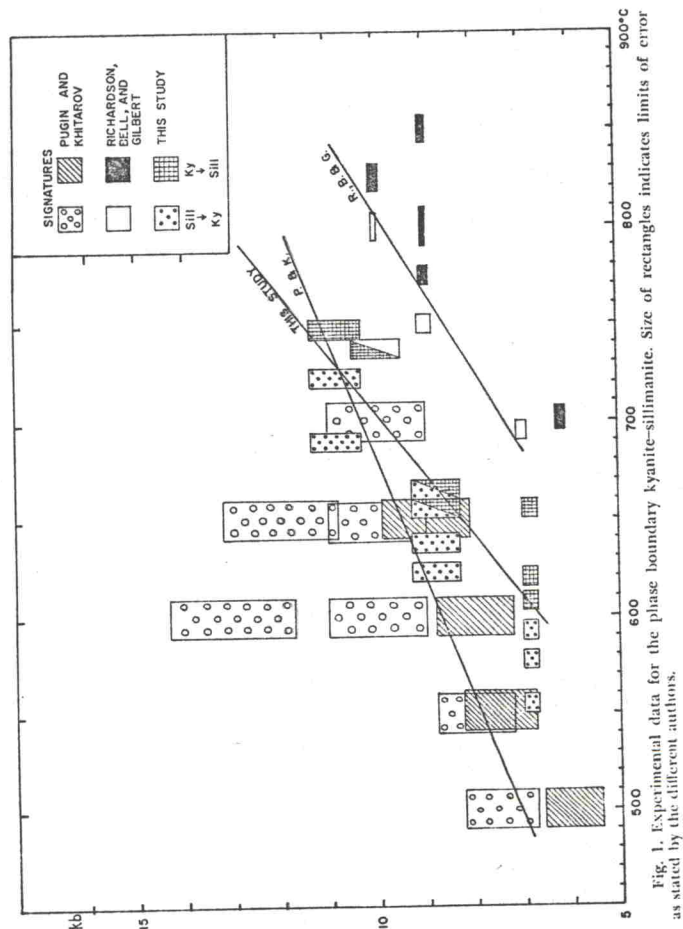


Fig. 1. Experimental data for the phase boundary kyanite-sillimanite. Size of rectangles indicates limits of error as stated by the different authors.

kb (instead of 525°C at 6.1 kb in the previous paper). Again there is reasonable agreement between this study and the work of Richardson, Bell, and Gilbert (1968a). The results of these studies disagree, however, with respect to the reactions kyanite-sillimanite and kyanite-andalusite.

KYANITE-SILLIMANITE

Although most of the previous experiments were conducted with finely ground materials, comparison runs were also made with coarser grained materials in the same size range as those used in the present work. It is not surprising, therefore, that the position of the curve was not changed by several redeterminations. The data of Pugin and Khitarov (1968) have such large uncertainties attached to them ($\pm 10^\circ\text{C}$ for the temperature, ± 5 to 10 percent for the pressure) that it is hard to place confidence in the curve indicated by their work. In the higher temperature range at least, their data overlap considerably with that of the present study. There need not be, therefore, a true discrepancy to the data presented here. In contrast to this, the experimental errors estimated by Richardson, Bell, and Gilbert (1968) are much smaller, and there is no overlap between their limits of error and those of the present study. (The difference between the best fitting lines describing the two sets of data is about 2 kb).

In an attempt to resolve this dilemma, a sample of the original starting materials used by Richardson, Bell, and Gilbert was run, side by side and in the same bomb as a charge containing 5 percent kyanite, 55 percent sillimanite, and 40 percent quartz of the Althaus (1967) starting materials. Experimental uncertainties were thereby eliminated. After 5 days at 750°C and 10 ± 0.5 kb the kyanite in the Althaus charge had essentially disappeared (only the strongest kyanite line could still be detected on a Guinier photograph), whereas in the Richardson, Bell, and Gilbert charge the sillimanite had essentially disappeared, and kyanite had grown in its place. The two starting materials had reacted exactly as reported in the original papers. In both cases the changes in the amounts of minerals were much larger than necessary to eliminate the possibility of misinterpretation of X-ray data.

Because the Richardson, Bell, and Gilbert charge contained only traces of quartz, the possibility remained that this compositional difference might account for the different reactions. The experiment was then repeated, using an 8 day run, but with 20 percent quartz mixed in their charge. Again the Althaus material reacted to sillimanite, while the Richardson, Bell, and Gilbert material reacted to kyanite. Clearly the differences were real.

DISCUSSION

The results of these experiments exhibit quite clearly that the system Al_2SiO_5 cannot be as simple as that suggested by the formula. Although other effects such as Al-Si-disorder in sillimanite may have a great influence, it is tempting to ascribe the observed differences to chemical