

milliliters per hour. Various imperfections in the valves caused the actual rate to vary from 40 to 60 milliliters per hour. Run A41 used as a starting fluid 5 liters of solution collected at 600°/2000 bars. The fact that the analysis of run A41 agrees with that of run A42, which used distilled water as a starting fluid, suggests that equilibrium is closely approached by the steady state achieved during the runs.

Runs A70 and A73 are duplicate runs conducted on different days on different charges. They suggest that analytical results for a given temperature and pressure are reproducible within about 10 percent of the amount present for soda and alumina and about 5 percent for silica.

The results of 44 experimental runs are tabulated in table 3 and figures 3, 4, and 5. Two results of Morey and Hesselgesser (1951), which fall in the range of the present experiments, are also tabulated and agree with the newer runs within experimental error.

The solutions are clear and colorless and display remarkable stability at room temperature if kept sealed. Sample A50 has been analyzed at intervals of about two months for more than 2 years and still yields results in agreement with the original analysis, although it contains 2415 ppm silica and 532 ppm alumina. The solutions are moderately to strongly alkaline when fresh, but the pH slowly declines with age to values between 7 and 8. Titration curves of the solutions with 0.01 normal HCl show a slight break at pH 8.3, suggesting the presence of silicate ion. Lowering the pH of the solutions below about 4.0 causes rapid precipitation of alumina and silica.

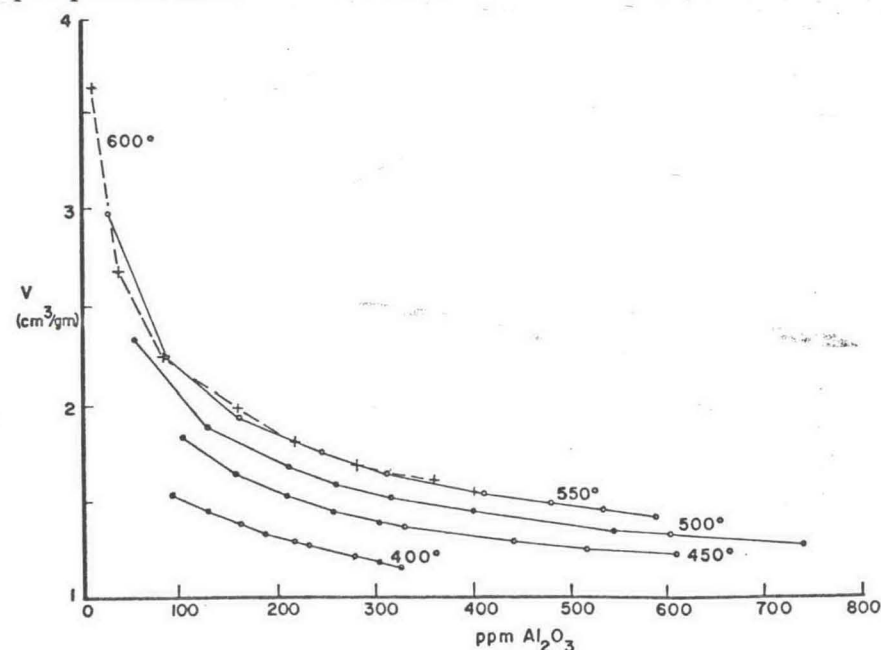


Fig. 4. Content of alumina in albite solutions at various temperatures and pressures.

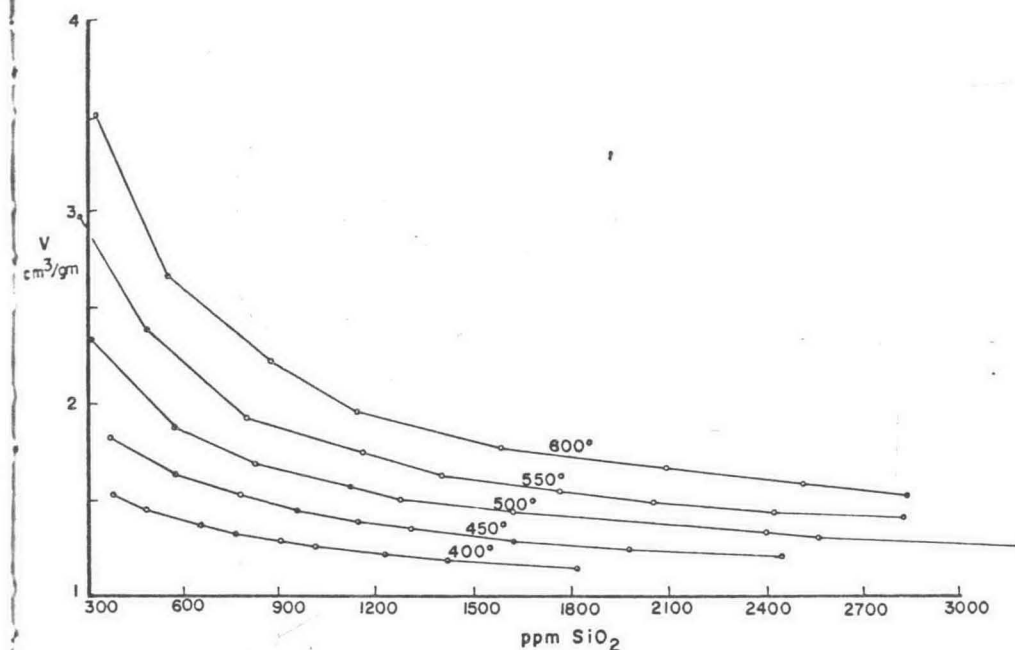


Fig. 5. Content of silica in albite solutions at various temperatures and pressures.

At the end of a run, the charge was always found to be partly reduced to an extremely fine powder. Routine X-ray powder diffraction patterns of this material only yield a pattern for albite. The non-stoichiometry of the solutions implies that the composition of the solid residue must depart from that of albite. However the total amount of material dissolved during a run is only 4 to 5 grams of the original charge of 120 grams, and the changes produced in the residue evidently either remain within the compositional range of albite or produce different phases in amounts so small as not to be detected. In runs A37 and A60, which suffered partial valve failures, much larger amounts of the charge were dissolved. Small amounts of a porcelain-like deposit on some fragments of the residue yielded an X-ray pattern of nepheline.

In none of the runs does the dissolved material have the same composition as the starting material. This phenomenon was noted by Morey and Hesselgesser (1951) in both albite and orthoclase. They suggested that stoichiometric solutions would be obtained at temperatures and pressures only slightly higher than those used by them. The present results show that departures from stoichiometry are pronounced at all temperatures and pressures in the range examined. These departures are shown graphically in figure 6. If stoichiometry were preserved, the ratio $\text{SiO}_2/\text{Al}_2\text{O}_3 = 3.47$ and $\text{SiO}_2/\text{Na} = 7.83$, where all quantities are expressed in ppm. Figure 6 shows that $\text{SiO}_2/\text{Al}_2\text{O}_3 > 3.47$ for all the experimental runs, while SiO_2/Na varies markedly on both sides of 7.83. Particularly spectacular deviations resulted from unintentional experi-