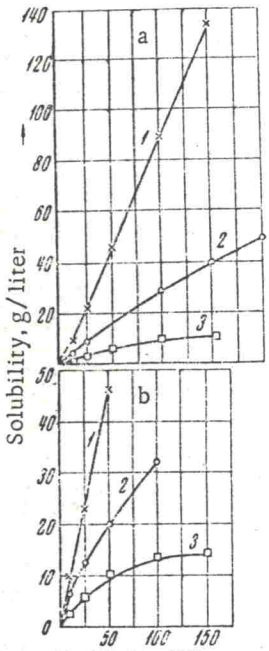

Fig. 3. Dependence of the solubility of corundum in aqueous solutions of NaOH (1), Na_2CO_3 (2), and $NaHCO_3$ (3) on concentration at temperatures of 460 (a) and 500° (b) (1600 atm pressure).

It should be mentioned that the solubility of sodium carbonate in water increases in the presence of aluminum oxide [3]. This is because part of the sodium carbonate takes part in the dissolution of the aluminum oxide through the formation of aluminate complexes. A comparison of data on the solubility of corundum in aqueous Na_2CO_3 (our data and those of Barns et al. [1]) with data on the solubility of Na_2CO_3 in water makes possible an approximate estimate of the increase in solubility of Na_2CO_3 in the presence of aluminum oxide. The time at which all of the sodium carbonate was dissolved was taken to be that at which a further increase in pressure caused no further increase in the solubility of corundum (the inflection points on the curves showing the dependence of corundum solubility on pressure at constant temperature and solution concentration). It was not difficult to determine from the data of Ravich and Borovaya [2] the solubility of Na_2CO_3 in water at the same temperature and at the pressure corresponding to the inflection point. This analysis revealed that the solubility of Na_2CO_3 increases by ~20-25% in the presence of aluminum oxide.

The experimental results of the study of the solubility of corundum in aqueous $NaHCO_3$ as a function of pressure are shown in Fig. 2.

As in the case of the Na_2CO_3 solutions, with an increase in pressure the solubility of corundum in the $NaHCO_3$ solution at first increased (up to ~1400 atm), and then decreased somewhat. On the basis of these results, it would be expected that the solubility of $NaHCO_3$ in water, like the solubility of Na_2CO_3, would depend greatly on pressure.

Dependence of the Solubility of Corundum on Solution Concentration. In order to avoid the possible presence of undissolved sodium carbonate or bicarbonate in the system, which would alter the results of experiments at high concentrations of Na_2CO_3 or $NaHCO_3$, all studies of the dependence of corundum solubility on concentration were carried out at a pressure of ~1600 atm. The solubility of corundum in NaOH solutions does not depend on pressure [1].

Our experimental results are shown in Fig. 3. It is evident from the figure that the curves relating corundum solubility to electrolyte concentration differ.

The dependence of corundum solubility in aqueous NaOH on the concentration of base is linear over the entire range of concentrations studied. According to the data of Barns et al. [1], the linear dependence of corundum solubility on NaOH concentration holds up to the highest concentration studied, 10 m.

A similar constancy of the corresponding ratios of dissolved substance to solvent was not observed for aqueous solutions of Na_2CO_3 and $NaHCO_3$. An analogous phenomenon, ascribed to hydrolysis of the salt, has been observed with aqueous solutions of $Na_2B_4O_7$ and K_2CO_3 [5].

On the basis of the above material, it may be concluded that solution of corundum in aqueous solutions of hydrolyzable salts (Na_2CO_3, K_2CO_3, $NaHCO_3$, $Na_2B_4O_7$) at elevated pressures and temperatures is determined wholly by the amount of alkali metal hydroxide dissolved as a result of hydrolysis.

The authors desire to thank I. V. Churikov for assistance in the experimental work.

LITERATURE CITED

1. R. L. Barns, R. A. Laudise, and R. M. Shields, J. Phys. Chem., 67, 4, 835 (1963).
2. M. I. Ravich and F. E. Borovaya, Dokl. Akad. Nauk SSSR, 156, No. 4, 894 (1964); 180, No. 6, 1372 (1968).
3. V. A. Kuznetsov, Investigation of the Crystallization of Corundum Under Hydrothermal Conditions. Dissertation. Institute of Crystallography, Academy of Sciences of the USSR, Moscow 1967.
4. L. A. Samoilovich, Experimental Investigation of Thermodynamic Relationships of Mineral-Forming Solutions (as Applied to Thermobarometry and the Growth of Crystals). Dissertation, Moscow State University 1968.
5. S. Levinson, G. Douglas, and L. R. Johnson, Am. Mineral., 50, 3/4, 403 (1965).