EXPERIMENT

We took x-ray photographs of powdered specimens of sodium chloride under various pressures. At our disposal was "Ékstra" table salt and powder made from a single crystal. Semi-qualitative spectrographic analysis showed the presence of the following impurities:

"Ékstra"	Fe $<$ 0.003%,	Cu $<$ 0.0003%
Single crystal	Fe $<$ 0.002%,	Cu $<$ 0.0001%

No traces of Co, Mn, Ni, Rb were found. The small difference in composition did not affect the results, and we shall not, therefore, distinguish in what follows between the specimens.

The pressure chamber which we used has been previously described.[13] Its basic part is a tapered beryllium piston, which moves along a bore of the same form in the chamber to increase the pressure of the petroleum. The pressure was measured with a manganin manometer with an error of ± 100 kg/cm^2. The specimen was placed in a bore drilled out of the body of the beryllium cone. The chamber was used with a cassette allowing several photographs on the same film.

The effect of pressure on the specimen is to displace the lines due to the specimen towards larger angles on the x-ray photograph. This enabled us to calculate the change of volume of the cell compared with its original volume. The curve showing the change of volume with pressure is given in Fig. 1. Its coefficients are: $a = 36 \times 10^{-7}$, $b = -22 \times 10^{-12}$. As in the case of barium and strontium, the curves of change of volume with pressure found by the x-ray method lie below the curves obtained by Bridgman[2] using the method of linear compressibility; this is additional confirmation of the conclusions we previously reached.[13] The mean departure of the experimental points from the smooth curve amounted to 0.20%.

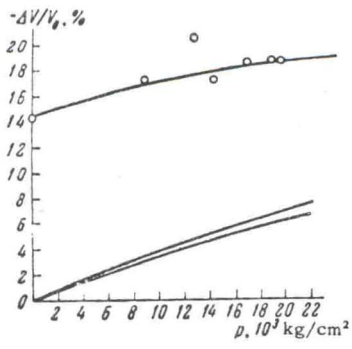

FIG. 1. Curves showing the changes of volume in sodium chloride under pressure. Of the two lower curves, the bottom one is constructed from our data, the upper one from Bridgman's data for the original phase. The topmost curve is for the high pressure phase.

Our pressure chamber had one feature which, in fact, assured success in the study of sodium chloride; namely, the beryllium piston is squeezed during its forward motion by the walls of the chamber with ever increasing force. Thus, contraction and filling-in of the bore containing the specimen sometimes occurs. As a result, significant shear forces arise in the specimen, and the quasi-hydrostatic pressure in the bore becomes greater than the hydrostatic pressure of the petroleum, which we measured with the manganin manometer. We observed similar phenomena frequently. We were always able to note this, since the displacement of the lines under pressure considerably exceeded the expected amount in these cases.

In eight cases we did, in fact, find on such films lines belonging to the high-pressure phase of NaCl. One of the typical x-ray photographs is shown in Fig. 2. The pressure acting on the specimen at the time of the photograph was determined from the displacement of the lines of the original phase. Taking into account the errors of measurement, we found that the new phase occurs at pressures greater than 17700 kg/cm^2. It should, however, be noted that this value does not correspond to the pressure of total transformation, because we usually dealt only with very small quantities of the transformed phase, i.e., with the start of the transition.

The scattering angles of the new phase were calculated by photographing alongside a standard. The untransformed NaCl phase provided the standard here. However, we did not succeed in attaining great accuracy in determining the parameter, since the photographs were made with molybdenum radiation, and the maximum angle of scattering did not exceed $\theta = 21°$. Also the error in determining the distance between the lines of the new phase and the standard was 0.05—0.15 mm.

In Table II are collected data on the eight lines observed. Here, I is the intensity of the line; h, k, l are the Miller indices; θ is the Bragg scattering angle; d is the distance between the planes;

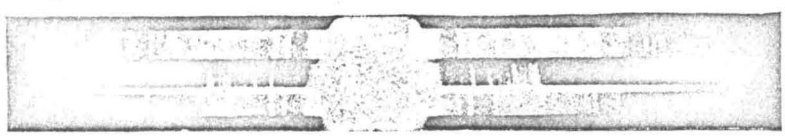

FIG. 2. Reproduction of one of the typical x-ray photographs. The topmost photograph was obtained before pressure was applied; the middle one while pressure was acting on the specimen; the lowest after taking off the pressure. The third bright line on the middle photograph belongs to the new phase; other weaker lines are not visible on the photograph.