Variation of the Volume Decrements for Cerium, Calculated from Eq. (4) in [16] and Smoothed According to Eq. (1) of this Paper; Experimental Values

P, kg/cm^2	$\Delta V/V_0$	
	Calc. from (4) [16]	Calc. from (1)
1	0.0000	0.0000
1000	0.0027	0.0033
2000	0.0071	0.0077
3000	0.0126	0.0132
4000	0.0190	0.0198
5000	0.0270	0.0275
10000	0.1672	
15000	0.1826	
20000	0.1985	
25000	0.2143	
30000	0.2291	

a point that is vague when the pressure is either raised or lowered. In processing our data we made a graphical normalization of the $\Delta l(F)$ curve to $F = 0$ and extrapolated according to the equation

$$-\left(\frac{\Delta V}{V_0}\right) = a\,(P-1000) + b\,(P-1000)^2, \qquad (1)$$

where P is in kg/cm^2, $a = 38.5 \times 10^{-7}$, $b = 55 \times 10^{-11}$.

The constant coefficients a and b were determined by the method of least squares from the experimental data, as described in [16]. It is clear that Eq. (1) is valid only to the transition point, i.e., for the gamma modification.

The accompanying table gives the experimental values of $(\Delta V/V_0)$ at 19°C, processed according to Eq. (4) of [16], and the values obtained by the smoothing process using Eq. (1) above and reduction to $(\Delta V/V_0) = 0$ at $P = 1$ atm.

For the x-ray investigations we used the camera described in [17]. A conical beryllium receptacle in this case took the part of the piston in a steel bomb. Slits were cut in the latter for the transmission of the x-radiation. The sample, in the shape of a very thin wafer 0.45 mm wide, was placed in an opening of the beryllium piston filled with dehydrated gasoline. The pressure was measured with a manganese manometer. Characteristic x-radiation from a molybdenum target was used during a 24-h exposure. As the pressure was increased, a series of lines typical of the high-pressure phase appeared on the x-ray diagram; under more or less ideal conditions eleven lines

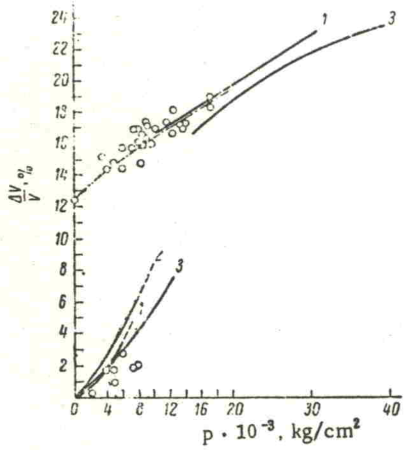

Fig. 1. Curves showing the variation of the volume decrement with pressure for the α- and γ-phases of cerium. 1) From our data, determined by the "piston displacement" method (the dashed curves were obtained by processing of the x-ray data represented by the circles of curve 1); 2) obtained by ultrasonic method [15]; 3) constructed from Bridgman's data, which were obtained by the "piston displacement" method [14].

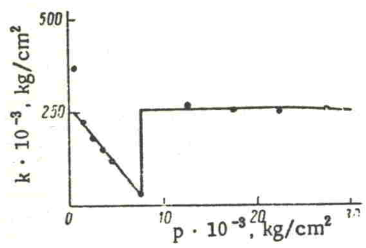

Fig. 2. Variation of the bulk compression modulus with pressure for α- and γ-cerium.

of the series could be distinguished against the background of the beryllium bands. Since the same film contained a photograph taken at atmospheric pressure we could calculate the relative change in volume with changing pressure for the gamma and alpha phases.

The results of our determination of $\Delta V/V_0$ are shown in Fig. 1, where the analogous dependences of $\Delta V/V_0 = f(P)$ obtained by other authors [14, 15] are also shown for comparison. It is evident that the compressibility data obtained in the present paper for the high-pressure phase of cerium using two alternative methods are in rather good agreement. As for the compressibility of the low-pressure phase, the piston displacement method bears out the anomalous variation with pressure. Figure