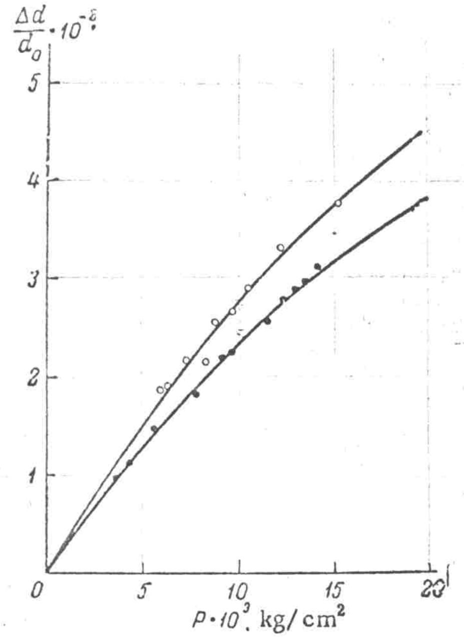

Fig. 3. Variation of the relative change of interplanar distance with pressure for strontium (lower curve) and barium (upper curve).

This arrangement allowed us to get two photographs on one film – before and after the application of pressure.

The pressure was transmitted by benzine and measured by the change of resistance of the manganin manometer.

We investigated metallic strontium of relatively low purity; it contained 3% FeO, 2% CrO, and 0.003% Cu. The samples were thin wires drawn in baths filled with water-free vacuum oil. The bath was fixed in a special box filled with pure argon. The sample was introduced into the beryllium container while in the argon box. As a result of these precautions, the diffraction patterns were free from strontium oxide and hydroxide lines.

The x rays used were obtained with a copper anticathode; the exposure was 15-20 hours.

Our apparatus is not free of defects. The main defect has been pointed out by many investigators using beryllium pressure chambers. It consists in the fact that one can see on the photograph only a limited number of lines belonging to the sample (essentially obtained with a small angle θ) on the background of dark bands corresponding to the beryllium container. We obtained only three face lines corresponding to the strontium sample: the (111) line, the same line from β-radiation, and the (200) line.

Figure 2 represents the photogram of one of the patterns. The upper curve corresponds to atmospheric pressure, the lower to a pressure P = 11,400 kg/cm². Three peaks corresponding to the diffraction line on the x-ray photograph can be seen on both curves. Two peaks are displaced relative to each other. The last, undisplaced peak – a hair line – was made mechanically for reference.

We performed about 50 experiments with strontium at different pressures up to 15,000 kg/cm². The pressure was measured with the manganin manometer, which was graduated by comparison with a free-piston manometer.

The pressure was determined with a precision of 100 kg/cm². In a number of experiments, the pressure in the chamber dropped 1000-2000 kg/cm² during the exposure. This leads to an uncertainty in the corresponding values of compressibility, and, consequently, to the necessity for corrections.

Absolute measurements of lattice parameters by the face lines is imprecise. However, we were interested only in relative measurements of the lattice parameters; these were made by measuring the displacement of the lines corresponding to the sample before and after the application of pressure.

The fact that, in our apparatus, both x-ray photographs are obtained on the same film allowed us to eliminate the corrections due to absorption by the sample and curling of the film during processing.

Figure 3 represents the variation of the relative change of the interplanar distance as a function of pressure for strontium and barium. The experimental points were obtained by averaging the values for all indices, which is quite legitimate in the case of cubic crystals.

The barium metal investigated contained the following impurities: 0.01% Fe, 0.0023% Zn, 0.004% Cr, 0.004% Pb, 0.0001% Cu, and 0.00018% Cd.

The samples were obtained by the same method used for strontium. For barium we used a chamber designed by one of the authors (Fig. 4). In this case, the beryllium container plays the role of a cone-shaped piston in the pressure chamber. As the result of forward motion, the beryllium piston fits tightly into the channel of the chamber due to the developed force of friction. The dimensions of the pressure chamber were decreased to a minimum, which allowed the creation of pressure with a screw piston hand pump. When the pressure was established, the press with the chamber was fixed on the bench of a standard x-ray apparatus of the URS-70 type (Fig. 5). The