

same sequence as in the periodic table. Under normal conditions, metallic beryllium crystallizes, like its neighbor magnesium, in the hcp type A3 lattice. We must mention that two more elements—zinc and cadmium—in group II have a similar lattice and if the ideal ratio of axes for this type of structure is $c/a = 1.63$, then beryllium and magnesium have unit cells flattened along the c -axis, while zinc and cadmium have unit cells elongated along this axis.

Beryllium exhibits a somewhat unusual high-temperature polymorphism: at 1254°C , its crystal structure changes to the bcc type A2,^[33] and the high-temperature phase has a higher density. This phase is probably stable also at high pressures. If this is correct, then the boundary between the two phases with the structures A3 and A2 should have a negative slope intersecting, at room temperature, the pressure axis in the region of 93 kbar, where a strong discontinuity of the electrical resistance, ascribed to a polymorphic transition, was observed.^[34]

Magnesium does not exhibit polymorphism when the temperature or pressure is increased. The electrical resistance of magnesium varies monotonically with pressure up to 500 kbar, exhibiting only several weak maxima and minima.^[35] The fusion curves of magnesium and beryllium are not yet known.

The P-T phase diagrams of calcium and strontium were obtained up to 40 kbar;^[36] they are shown in Figs. 5a and 5b. Under normal conditions, these metals crystallize in the fcc type A1 lattice but on heating they undergo a polymorphic transition with a change in structure to the bcc type A2. From the phase diagrams,

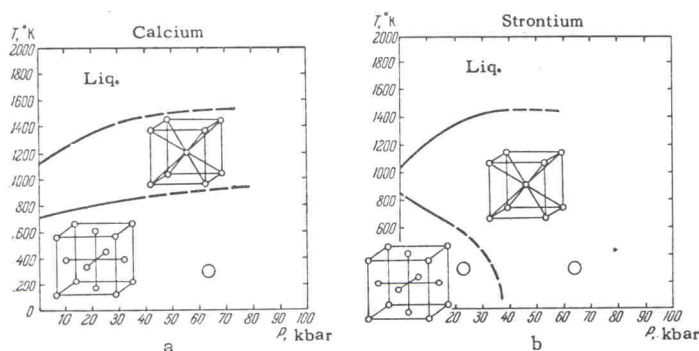


FIG. 5. P-T diagrams of Ca and Sr (according to DTA data^[36]). Circles denote conditions under which Bridgman observed volume discontinuities.^[37]

it follows that the high-temperature phases of these elements are stable also at high pressures. It should be mentioned that highly impure samples of these metals exhibited stable phases with the hexagonal type A3 structure, but the purification of Ca and Sr established that in their pure form these metals had only the two phases mentioned above.^[38] The volume discontinuities observed in calcium and strontium by Bridgman (denoted by circles in the P-T diagrams) were prob-

ably due to impurities. X-ray diffraction analysis of the high-pressure phase of strontium, carried out at 40 kbar and room temperature, showed definitely that the structure was identical with the high-temperature modification.^[39] The identity of the pressure dependences of the electrical resistance of strontium and calcium allows us to assume that the transitions at 35 kbar in strontium and at 375 kbar in calcium^[35] have the same nature; these dependences are shown in Figs. 6 and 7. The boundary between the solid phases of calcium is initially parallel to the fusion curves and then it turns in the direction of the pressure axis, passes through the coordinate $P = 375$ kbar, $T = 20^\circ\text{C}$ and intersects the pressure axis in the region of absolute zero, making a right-angle with this axis. In this case, as in the case of alkali metals, the P-T diagram of strontium is the "compressed" variant of the P-T diagram of its immediate neighbor, calcium.

Metallic barium has properties very similar to those of elements of groups I-A and it crystallizes, under normal conditions, in the bcc form. Its P-T phase diagram, shown in Fig. 8, is also very similar to the P-T diagrams of alkali metals. The phase diagram of barium is plotted on the basis of data taken from several papers: the fusion curve up to 70 kbar was found by the differential thermal analysis (DTA) method, but the data were contradictory for the boundary between the solid phases Ba I and Ba II. The differential thermal analysis gave a boundary with a positive slope^[40] and the method of electrical resistance discontinuities gave a phase boundary with a negative slope.^[41] Dash-dot

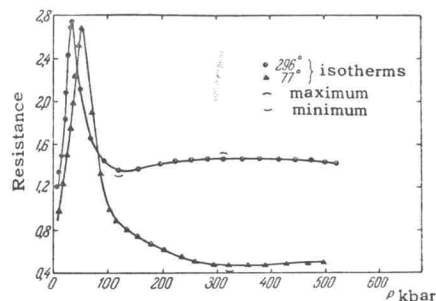


FIG. 6. Dependence of the electrical resistance of Sr on pressure.^[35]

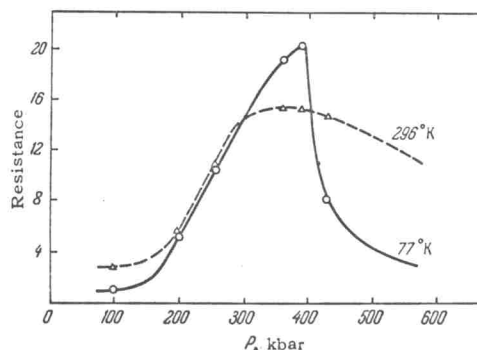


FIG. 7. Dependence of the electrical resistance of Ca on pressure.^[35]