

FIG. 3. Diffraction angle  $2\theta_{101}$  versus pressure—magnesium.

From Fig. 5 it can be seen that the  $a$  axis varies smoothly with pressure, but that the  $c$  axis shows some unusual features which result in the peculiar shape of the  $c/a$  curve. There is a sharp drop in  $c/a$  in the first 20 kbar. At first we were inclined to attribute this initial drop in  $c/a$  to production of stacking faults or some similar phenomenon due to nonhydrostaticity. The change in  $c/a$  ratio is, however, entirely reversible and reproducible, and the peaks do not change in shape or relative intensity. From about 20–70 kbar the ratio is relatively independent of pressure. From 70–120 kbar the  $c$  axis becomes quite incompressible, resulting in a distinct rise in  $c/a$ . From about 120–200 kbar the  $c$  axis exhibits larger compressibility and  $c/a$  is essentially constant. Beyond 200 kbar the compressibility of the  $c$  axis decreases rapidly and  $c/a$  accordingly increases sharply.

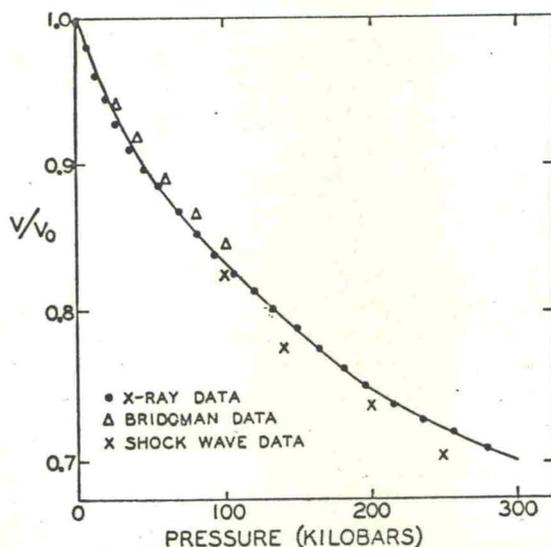


FIG. 4. Fractional change in volume versus pressure—magnesium.

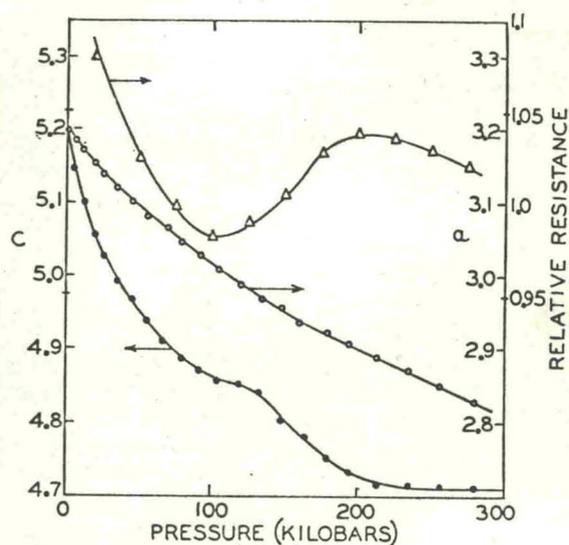


FIG. 5. Lattice parameters  $a$  and  $c$  and resistance versus pressure—magnesium.

In order to discuss these results it is necessary to review the available studies of the electronic structure of magnesium, in particular the relationship between the Fermi surface and the Brillouin zone boundaries.

Since the magnesium atom contains only filled shells, it would be an insulator if there were not holes in the second Brillouin zone and some overlap of electrons into the third or higher zones. Jones<sup>6</sup> discussed the arrangement on the basis of a spherical Fermi surface. His picture showed overlap at two points, but none in the [002] direction. He then accounted for the axial ratios of magnesium alloys on the basis of overlap in this direction because of the increased electron/atom ratio in the alloy. In particular, Jones showed that there

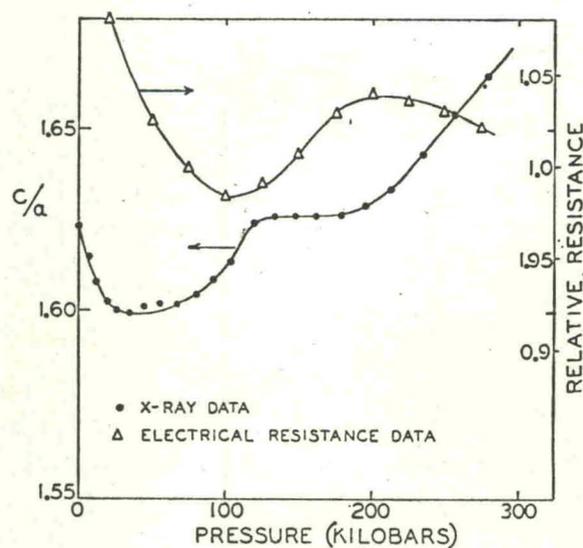


FIG. 6. Lattice parameter ratio  $c/a$  and resistance versus pressure—magnesium.

<sup>6</sup> H. Jones, Proc. Roy. Soc. (London) A147, 396 (1934).