Deviation of the shock isothermal resistivity from the hydrostatic results is attributed mainly to resistivity of lattice imperfections generated by plastic deformation associated with passage of the shock wave. Estimated uncertainties in temperature, temperature coefficients of resistivity, and hydrostatic resistivity extrapolation do not account for the difference. The deviation is given by

$$\frac{\Delta\rho_D}{\rho_o} = \frac{[\rho(V,T_o)]_{\text{Expt.}} - [\rho(V,T_o)]_{\text{Calc.}}}{\rho(V_o,T_o)} \quad ;$$

$[\rho(V,T_o)]_{\text{Calc.}}$ comes from Eq. (4). Examination of metals which have been shocked and relieved back to ambient conditions shows evidence of this increased lattice imperfection; evidence is found in changes in microstructure, changes in hardness, and results of annealing studies (O. Jones, 1970; A. Jones, Marden, and Isbell, 1970; Christou, 1971; Rose and Berger, 1968; van Wely, 1968; Kressel and Brown, 1967; Mahajan, 1970; present work, Sec. IV.K).

If we accept the above interpretation of the deviation, the number of defects generated by the shock is quite large. Fig. 11 shows the excess resistivity $\Delta\rho_D/\rho_o$ of the shock data as a function of pressure. At 100 kbar $\Delta\rho_D/\rho_o = 0.099$ for MRC silver and 0.158 for W3N silver. In comparison, shock conductivity data of Keeler and Royce (1971) for copper and iron result in $\Delta\rho_D/\rho_o = 0.12$ and 0.16, respectively. (They corrected their data for shock temperature rise but details of the calculation were not discussed (Duff, 1969).)

Theory and experiments indicate that vacancies are formed preferentially to interstitials in face-centered cubic (f.c.c.) metals (Nabarro, 1967; Rose and Berger, 1968; Christou, 1971; Kressel and Brown, 1967). Electron microscopy of shocked and recovered aluminum and nickel gives some evidence for prismatic dislocation loops formed by the collapse of vacancy clusters (van Wely, 1968; Rose and Berger, 1968).

Actually, imperfections produced by shock deformation will include vacancies, interstitials, dislocations, and possibly deformation twins. Besides evidence for predominance of vacancy production mentioned in the previous paragraph, production of vacancies appears to cause the most resistivity increase for a given amount of energy spent in defect production. Production of interstitials or dislocations to cause a given resistivity increment requires roughly two to three times as much energy as vacancy production. For the record, a resistivity increment of 0.15 μΩcm ($\Delta\rho_D/\rho_o \approx 0.1$) corresponds to a dislocation line density of 8×10^{11} cm/cm^3 in silver.

To find approximate defect concentrations, let us assume for simplicity that all the excess resistivity is due to vacancies. The vacancy concentration then is $x_v = \Delta\rho_D/\rho_v$ where ρ_v is the resistivity per vacancy. Since vacancy resistivity as a function of pressure is not available, we will use the vacancy resistivity at one atmosphere, $\rho_v = 1.3 \pm 0.7$ μΩcm/at.% for silver (Balluffi, Koehler, and Simmons, 1963). Since $\rho_o = 1.6$ μΩcm,