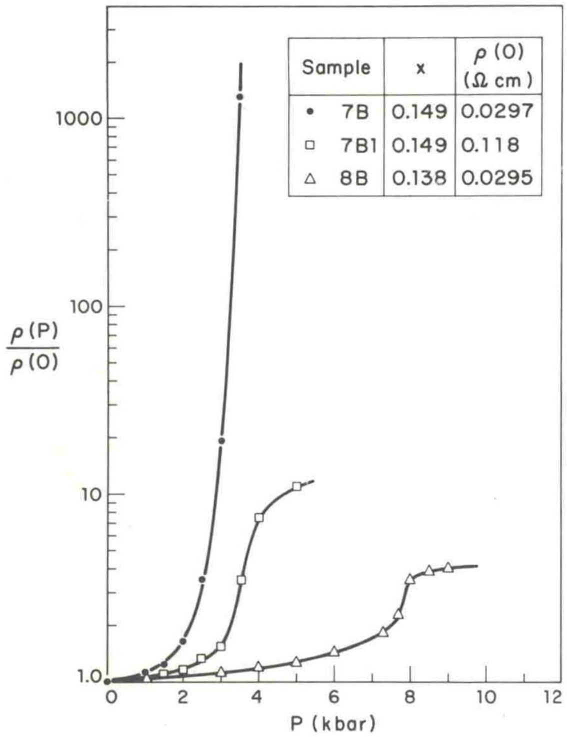

FIG. 1. Values of the relative resistivity as a function of pressure at 4.2 °K. The inset shows the composition of the samples and the resistivity at atmospheric pressure.

ities of electrons and holes in the samples as a function of pressure, the magnetic field dependence of the Hall coefficient and the conductivity were measured at a set of pressures. These measurements were made at both 77 and 4.2 °K. Examples of the results obtained at 77 °K are shown in Figs. 3 and 4. Data of this type are frequently analyzed by using multiband expressions for R and ρ to obtain a least-squares fit.[26,27] We believe that this procedure is not applicable in the present case, since it is based on the implicit assumption that the concentration of holes and electrons is independent of magnetic field. This assumption is not valid for electrons at 4.2 °K (and probably not valid at 77 °K), since, owing to the pinned Fermi level and the small electron effective mass, the lowest Landau level passes through the Fermi level. Over most of the pressure range used for our measurements, the position of the Fermi level in the samples is fixed relative to the valence-band edge by the high hole concentrations, and a magnetic field reduces the electron concentration by changing the density-of-states distribution in the conduction band. In sample 7B at 77 °K, for example, $\mu_n B$ is greater than unity even in magnetic fields smaller than 1 kG, and the electron-Landau-level separation may be comparable with kT in fields less than 10 kG. We return to this point below in discussing longitudinal magnetoresistance effects.

In some cases the carrier concentrations and mobilities at zero field can be obtained by a method that employs only the low-field and strong-field values measured for the Hall coefficient and conductivity. This method, which is outlined in the Appendix, was used to analyze the data for sample 7B at 77 °K.

The electron concentration and mobility of sample 7B as a function of pressure are shown in Figs. 5 and 6. The maximum magnetic field available for the measurements on this sample was 25 kG, and saturation of the positive Hall coefficient was only observed at 4 kbar and higher pressures. Above 4 kbar, the hole concentration and mobility were constant at 1.5×10^{16} cm^{-3} and 450 cm^2 V^{-1} sec^{-1}, respectively. The electron concentration can be obtained for pressures below 4 kbar since $\sigma_n \gg \sigma_p$ and $n = 1/R(0)e$ (see the Appendix). The dashed lines in Figs. 3 and 4 for sample 7B at 7.5 kbar were computed using a two-band expression for R, which assumes energy-independent relaxation times for both carriers, and the zero-field carrier concentrations and mobilities for this pressure, obtained from the analysis. The change in sign of R occurs experimentally at a lower magnetic field than the one given by the calculated curve. This discrepancy is consistent with a decrease in electron concentration with increasing magnetic field.

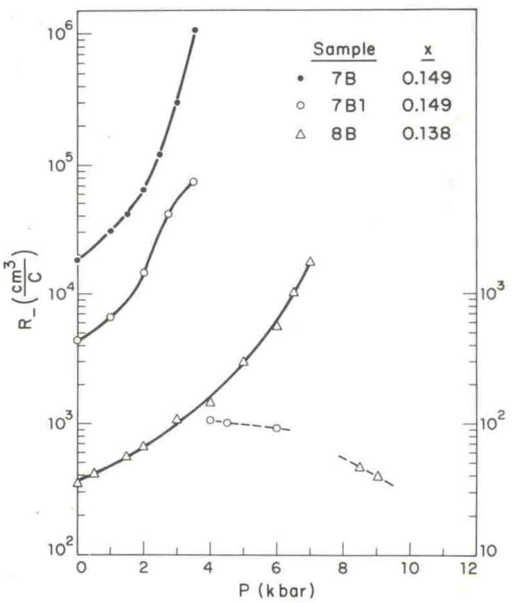

FIG. 2. Low-field Hall coefficient R as a function of pressure at 4.2 °K. The solid lines indicate negative values of R (left scale) and the dashed lines positive values (right scale).

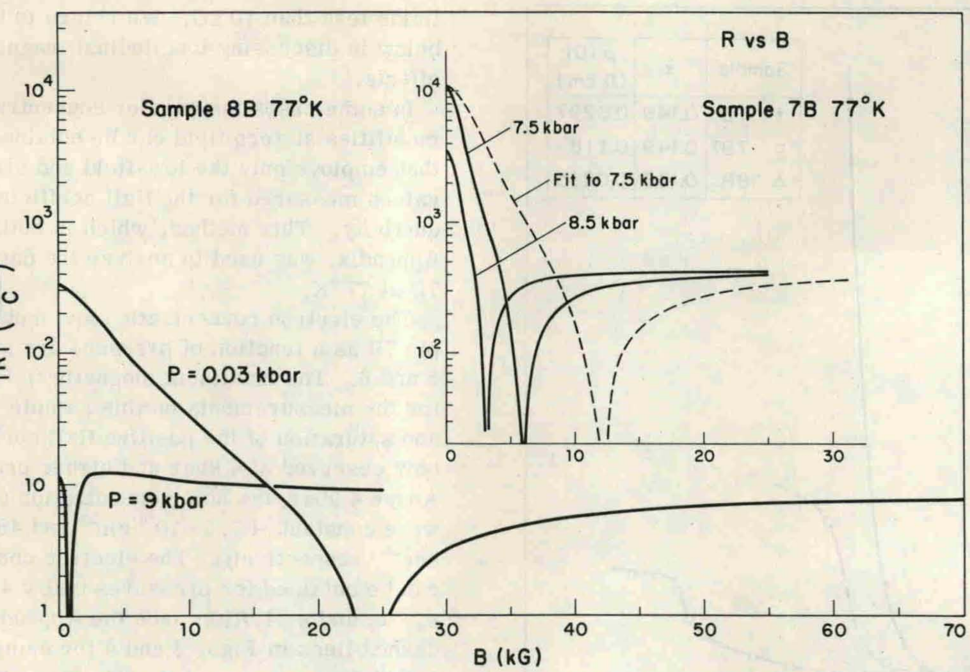

FIG. 3. Hall coefficient R as a function of magnetic field in samples 8B and 7B at 77°K. R is negative for low fields and changes sign with increasing field. The fitted curve (dashed) represents the usual two-carrier expression for R with the two-carrier densities and two mobilities obtained by making the Hall coefficient and conductivity agree at $B=0$ and $B=\infty$. The lack of agreement in the crossover region is due to quantum effects (see text).

For the as-grown samples 7B1 and 8B the hole concentrations at 77 °K, determined from the saturation value of R, are much higher and decrease by approximately 20% with pressure from 0 to 9 kbar. In these two samples the ratio $\sigma_p(0)/\sigma_n(0)$ becomes large at quite low pressures, and the analysis of the Appendix becomes inaccurate. The electron concentration and mobility at 77 °K have therefore been obtained only at zero pressure. The results for all three samples at $P=0$ are summarized in Table I.

Figure 7 shows some examples of the Hall coefficients vs magnetic field curves obtained at 4.2 °K. For sample 7B at low pressure (0.03

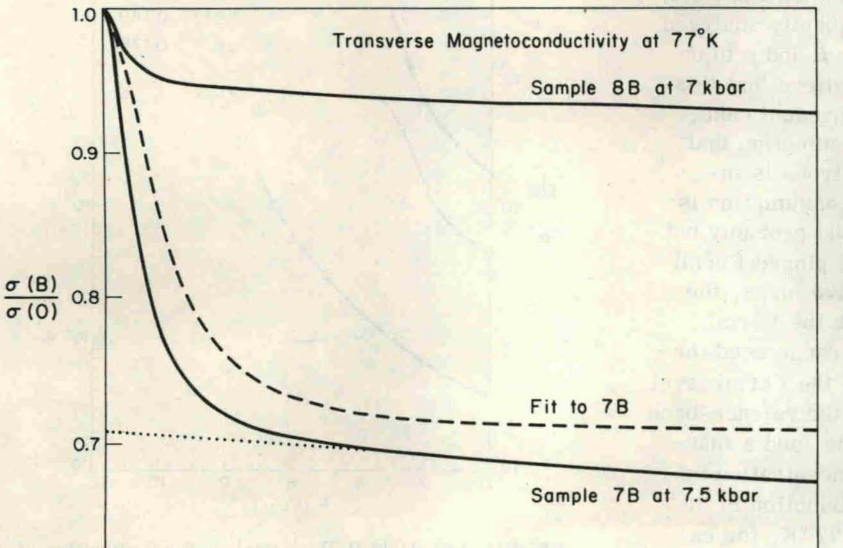

FIG. 4. Transverse magnetoconductivity as a function of magnetic field for samples 7B and 8B at 77°K. The steady decrease in the conductivity at higher fields is believed to be due to geometric effects. (The sample width is approximately one-half the voltage-contact spacing, and about one-fourth of the sample length.) The asymptotic value of $\sigma(\infty)/\sigma(0)$ was found by extrapolating the experimental curve back to zero field (dotted straight line).