One sees immediately that, at a fixed temperature T_0, the slope of the R vs. $\ln T$ curve goes through a maximum if the Kondo temperature T_k, which is less than T_0 at zero pressure, increases with pressure and finally exceeds T_0. This was observed in our experiments and is shown in Figs. 2 and 4a. Further, under the same conditions, it is easily deduced from Eq. (4) that, at a fixed temperature T_0, the resistance varies monotonically with T_k, showing a turning point when T_k equals T_0. As seen in Fig. 3, such a behaviour was also observed in our experiments for the pressure dependence of $R(p)$ at T_0 (Fig. 3). This correlation again is most naturally explained by a continuous increase of T_k with pressure. To illustrate this, and to compare it with the results of the first procedure given in Fig. 4a, we have plotted both the derivatives of the measured curves, i.e. $1/R(p=0) \cdot \Delta R/\Delta p$ at 4.2 K and of the theoretical function (Eq. (4)), i.e. $1/R(T=0) \cdot dR/d \ln T_k$ at 4.2 K, in Figs. 4b and c, respectively. The maxima in Fig. 4b are again located near 13 kbar.

Comparison with Fig. 4c shows, as marked by points B, that a pressure of approximately 13 kbar has raised the Kondo temperature from 0.2 K (points A) to 4 K. The fact that the $R(p)$ curves do not coincide for both concentrations may be interpreted as due to a stronger interaction between the impurity spins at the higher concentration. In principle, an empirical function $T_k(p)$ can be determined from the theoretical and experimental curves in Fig. 4. However, one sees immediately that a simple relation like $\ln(T_k(p)/T_k(0)) = K \cdot p$, with $K = 0.50 \pm 0.05\ \text{kbar}^{-1}$, holds only in a limited pressure regime (about ± 5 kbar) around the maximum.

If one accepts the Hamann function as describing the resistance anomaly correctly, one then expects a slight curvature in the R versus $\ln T$ dependence, especially for zero pressure and for 21 kbar (Fig. 2). Because of the small temperature interval, bordered by the onset of superconductivity and lattice resistivity, this could not be resolved within experimental accuracy.

In Fig. 5 we summarize our results on the depression $\Delta T_c(p) = T_{c0}(p) - T_c(p)$. One notes that its magnitude is much larger than reported by Maple *et al.* for comparable Ce concentration, indicating a phase mixture or inhomogenity in their "as cast" samples. We mention that the measurements of Maple *et al.* show the largest decrease of $\Delta T_c(p)$ near 25 kbar, which might be interpreted by the transition to a nonmagnetic state. However, since *we* see no such kink, it is most likely that it is due to the dhcp-fcc phase change in La. The maximum depression for our La 1% Ce alloy amounts to $\Delta T_{c\,\max} = 6.4$ K*, which is in

* If the depression of the transition temperature due to cold work is taken into account, the $\Delta T_{c\max}$ becomes 5.7 K.

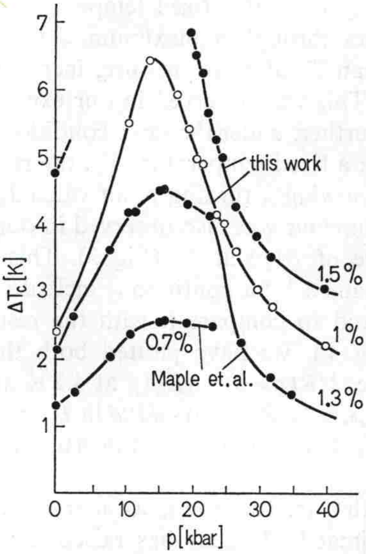

Fig. 5. Depression of the superconducting transition temperature in LaCe alloys under pressure. Numbers denote cerium concentrations. Samples with 1 and 1.5% Ce (this work) were fcc, those of Maple *et al.*[7] "as cast"

remarkable agreement with the theoretical value of 6.05 K, obtained from the formula of Müller-Hartmann and Zittartz[4]

$$\Delta T_{c\,\max} = -\frac{c}{8\,k_B\,N(0)}$$

with $N(0) = 2.4\ \mathrm{eV}^{-1}$ [8]. Also the dependence on concentration c is qualitatively obeyed. We wish to mention here that the results of Fig. 1 and 4, according to which $T_k = 4$ K and $T_{c0} = 7.7$ K at 14 kbar, i.e. $\vartheta \simeq 0.5$ for maximum pair breaking are inconsistent with the theoretical predictions of $\vartheta \simeq 2$ (Zuckermann[3]) and $\vartheta \simeq 12$ (Müller-Hartmann and Zittartz[4]). It must be recalled, however, that the theoretical results hold for very low concentrations only, whereas at 14 kbar the concentration of 1% Ce is close to the critical concentration at which the order parameter vanishes. Here it is noteworthy that, according to a theory of Coqblin and Schrieffer[12], Ce alloys cannot be described exactly by the Hamiltonian $H = J\boldsymbol{S}\cdot\boldsymbol{\sigma}$ because of the strong spin-orbit interaction of the 4*f* state. Taking this into account, but using the Born approximation only, they obtain for the decrease of T_c nearly the same result as Eq. (3).

12 Coqblin, B., Schrieffer, J. R.: Phys. Rev. **185**, 847 (1969).