(a) (b)

Fig. 15 Pressure-volume relations in diamond cell

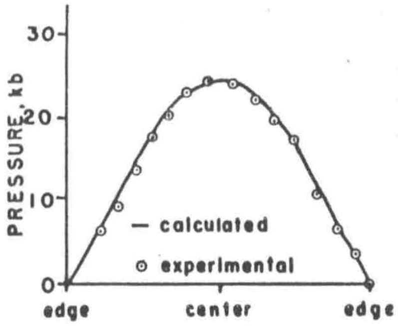

Fig. 16 Calculated pressure gradient - TlBr, 12 kbar

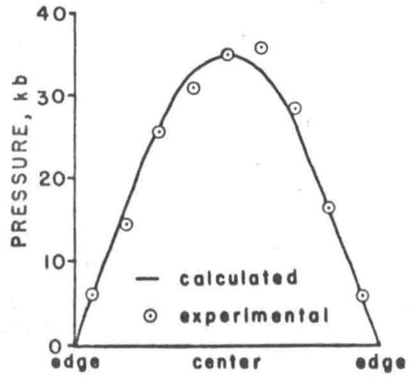

Fig. 17 Calculated pressure gradient - NaCl, 20 kbar

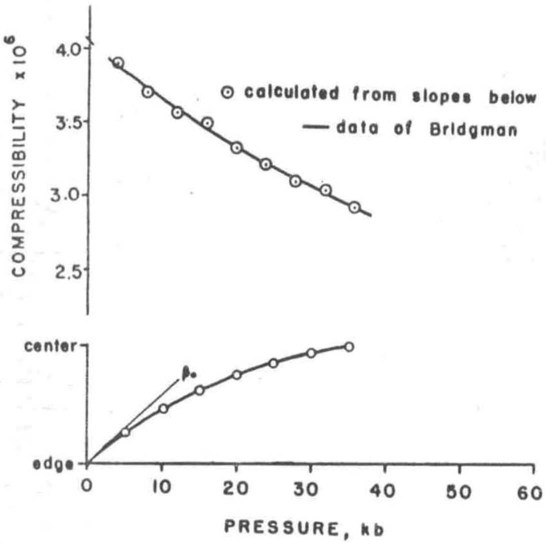

Fig. 18 Compressibility calculation - NaCl

$$V = f\,(P,T,h,r) = \pi r_o^2 h$$

At constant temperature and pressure

$$(dV/dP)_{P,T,r} = \pi r_o^2\,(dh/dP)_r$$

However, this is the same volume change which would occur at a given applied pressure in an identical system of constant h and variable r, Fig.26(b), i.e.

$$(dV/dP)_{P,T,h} = 2\pi r h_o\,(dr/dP)$$

This volume change can be related to β and give a relations for dP/dr, the pressure gradient. Combining the definition of β, equation (1) and the foregoing expression, we get

$$-\,(1/V_o)\,2\pi r h_o\,(dr/dP) = \beta$$

Multiplying both sides by $V_o/\Delta V_a$, where $\Delta V_a = \pi h_o(r_o^2 - r_a^2)$, we get

$$-\,(2r/r_o^2 - r_a^2)\,dr = (\beta dP)\,(V_o/\Delta V_a)$$

Integrating between r_o and r corresponding to P= 0 kbar at the edge to P = P at r, we get

$$-\int_{r_o}^{r} (2r/r_o^2 - r_a^2)\,dr = V_o/\Delta V_a \int_0^P \beta dP$$

or

$$\frac{1 - r^2}{1 - r_a^2} = \frac{(aP - bP^2)V_o}{V_a} = \frac{aP - bP^2}{aP_a - bP_a^2} \qquad (2)$$

Similarly, the pressure, P, and r may be compared to P_m, the maximum pressure at the center of the cell by means of a similar derivation to get relation (3).

$$\frac{1 - r^2}{1 - r_m^2} = \frac{(aP - bP^2)V_o}{\Delta V_m} = \frac{aP - bP^2}{aP_m - bP_m^2} \qquad (3)$$

Now it is necessary to introduce another relation to evaluate the constant r_a; viz.

$$\bar{P} = \sum_i A_i P_i / \sum_i A_i$$