of the Birch equation of state. Thus equation 8 may be used to extrapolate to moderately high pressure. Equation 18 should be used to extrapolate to high pressure.

Temperature Correction

Comparison of the seismically observed values of ϕ_{FLD} for the earth with laboratory data must be done at the same reference temperature. Consider a material suspected to occur at a depth where the temperature is T and the pressure P. The values of K_0, V_0, and ρ_0 determined in the laboratory at temperature t (likely room temperature) and zero pressure must be extrapolated to T and P. Either equation 8 or equation 18, as appropriate for the pressure, both of which are expressed here as the adiabatic equations of state, may be used. The generalization of these equations to an arbitrary temperature T follows a formalism presented by *Gilvarry* [1957, 1962] and involves replacing K_0, V_0, and ρ_0 (the laboratory temperature measurements) by $k(T)$, $v(T)$, and $\rho(T)$ defined as

$$\begin{aligned} k(T) &= K_0 \exp\left[-\int_t^T \psi_0\alpha_0 \, dT\right] \\ v(T) &= V_0 \exp\left[\int_t^T \alpha_0 \, dT\right] \qquad (19) \\ \rho(T) &= \rho_0 \exp\left[-\int_t^T \alpha_0 \, dT\right] \end{aligned}$$

where α_0 is the coefficient of volume expansion evaluated at $P = 0$ and ψ_0 is an anharmonic parameter arising from temperature effects given by

$$\psi_0 = \psi_T = -\frac{1}{\alpha}\left(\frac{\partial \ln K}{\partial T}\right)_P \qquad (20)$$

At high temperature, where the specific heat at constant volume approaches the Dulong-Petit limit,

$$\psi_T = \psi_s + \gamma_G \qquad (21)$$

where γ_G is Grüneisen's ratio and

$$\psi_s = -1/\alpha(\partial \ln K_s/\partial T)_P \qquad (22)$$

as given originally by *Grüneisen* [1912, p. 278].

With this temperature correction, the tables in the appendix are still applicable if we understand the pressures to be $P/k(T)$, the relative volumes to be $[V/v(T)]_B$, and the normalized seismic parameter to be $[\phi(P, T)/\phi(T)]_B$ where $\phi(T) \equiv k(T)/\rho(T)$.

Appendix

Comparison of volume and the seismic parameter ϕ as a function of pressure for different values of m. For most solids, value of m ranges from 4 to 6; Tables 1, 2, and 3 below are useful for estimating the seismic parameter (as well as volume) whenever K_0 and m are known for a solid under discussion.

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