

TABLE 1. Compressibility Parameters ($\kappa = \text{bar}^{-1}$) and Calculated Volume and Refractive Index Effects at 50 kb

Substance	$10^6 a$	$10^{12} b$	Calculated: 50 kb		
			$(\Delta V/V_0), \%$	$(\Delta n/n_0), \%$	$(\Delta V/V_0)$ $(\Delta n/n_0)$
Diopside, 25°C (0-40 kb, 25°C)*	0.92	+3.0	-4.0 ^{a,b}	2.0 ^c	-2.0
Albite, 25°C (2-10 kb, 25°C)*	2.11	+21.6	-7.2 ^a	3.0 ^c	-2.4
SiO ₂ glass, 25°C (0-98 kb, 25°C)*	-13.6 ^d	4.7 ^e	-2.9
SiO ₂ glass, 600°C (0-10 kb, 11-390°C)*	2.35	+6.1	-10.4 ^{a,b}	3.4 ^e	-3.0

* P and T range of compressibility measurements.

^a Murnaghan equation.

^b Quadratic equation.

^c Lorentz-Lorenz equation.

^d Measured at 49 kb [Bridgman, 1948].

^e Equation 2, $\beta = 1.37$.

measured quadratic parameters as

$$\ln \left(\frac{V}{V_0} \right) = \frac{-\ln \{1 + [(2b/a^2) - 1]aP\}}{[(2b/a^2) - 1]} \quad (8)$$

Both equations were used to extrapolate the albite volume compression above 10 kb. For diopside in the extrapolation range 40-50 kb, the volume compressions calculated from (5) and (8) do not differ significantly.

At room temperature neither the quadratic nor the Murnaghan equation gives a correct extrapolation of the SiO₂ glass compression above 10 kb, as can be seen by comparing the volumes extrapolated by using the quadratic parameters with the volume compression measured by Bridgman [1948] from 0 to 100 kb. The volumes extrapolated with (5) and (8) go to zero at $P = 140$ and 36 kb, respectively, whereas the volume compression measured by Bridgman is only 20.2% at 98 kb. That is, the compressibility of SiO₂ glass at room temperature increases with pressure up to about 35 kb, and beyond this pressure it decreases as in a normal substance. This effect was measured by Bridgman several times. For the calculations at room temperature, the volume compression data measured by Bridgman [1948] from 0 to 100 kb were therefore used. For the high-temperature calculations, however, no data on SiO₂ glass are

available above 10 kb, and it was necessary to use the high-temperature quadratic parameters, extrapolated (to 600°C) from equations 6 and 7, for extrapolation to pressures above 10 kb with equations 5 and 8. Since the initial compressibility decreases with pressure in the normal manner above 510°C, as shown by (7), the high-pressure extrapolation at 600°C should be adequate, and, in fact, both the quadratic and the Murnaghan equations give essentially identical volume compression along the 600°C isotherm.

The compressibility parameters used for the three minerals at the indicated temperatures are given in Table 1, together with the magnitude of the calculated volume and refractive index variations at 50 kb. The fractional volume change is seen to be of the order of 2 to 3 times the fractional index change for all three substances and at both temperatures for SiO₂.

CALCULATIONS FOR DIOPSIDE AND ALBITE

The refractive index was calculated as a function of pressure by using the Lorentz-Lorenz equation (3) and the V/V_0 values from both the quadratic and the Murnaghan equations, under the assumption of constant molar refractivity. (The quadratic and Murnaghan equations give identical results for diopside over