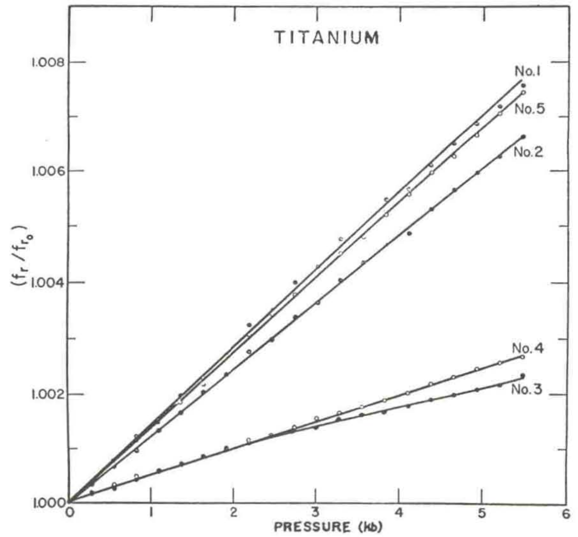

Fig. 1. Frequency ratio vs. pressure for the following 5 modes of wave propagation in Ti crystals: (1) and (2) are longitudinal modes perpendicular and parallel, respectively, to c axis, (3) shear mode propagated parallel to c axis, (4) shear mode with propagation and polarization rectors in basal plane and (5) longitudinal mode propagated 45° to c axis.

3. RESULTS

(a) *Single crystal data*

The values of the stiffness moduli as evaluated at intervals of 0·276 Kb (4,000 psi) are plotted against pressure in Fig. 2. The values of the pressure derivatives as derived from the best straight line through the plotted points are shown in parentheses. It should be noted that the small change in slope indicated in the f_r/f_{r_0} data for C_{44} (Fig. 1) is not distinguishable in Fig. 2 because of the difference in scales along the ordinates. It is clear, however, that $dC_{44}/d\bar{P} > 0$ at any given pressure up to 5·516 Kbar, whereas for Zr, dC_{44}/dP is constant and less than zero between 1 bar and 4·7 Kb pressures [1].

The variations with pressure of the adiabatic and isothermal compressibilities are shown in Fig. 3. Within the error of the calculations, $d\beta_{\|}/dP \approx d\beta_{\perp}/dP$ and the isothermal values give $d\beta_{\|}/dP = -1{\cdot}3\,(\text{mb})^{-2}$ and $d\beta_V/dP = -3{\cdot}8\,(\text{mb})^{-2}$. Since the pressure derivatives for $\beta_{\|}$ and $\beta_{\perp}$ are constant over the 5·5 Kb pressure range, the variation of the c/a ratio with pressure,

$$\frac{d(c/a)}{dP} = \frac{c}{a}(\beta_{\perp} - \beta_{\|}) \qquad (3)$$

is negative for Ti and decreases in magnitude with increasing pressure.

(b) *Pressure dependence of isotropic elastic parameters*

The variations with pressure of several bulk properties, as calculated from the present data through the Voigt–Reuss–Hill approximation [6], are plotted in Fig. 4. The pressure derivatives for several parameters are given in Table 1. In contrast to Zr, the isotropic Poisson's ratio of Ti has a very small pressure derivative. The isotropic shear modulus varies linearly with pressure.

The variation of density with pressure,

$$d\rho/dP = \rho\beta_v, \qquad (4)$$

Table 1. Isotropic elastic parameters of titanium and their pressure derivatives

Elastic parameter, X	Value at 1 Bar, 25°C	(dX/dP)
Adiabatic bulk modulus, K_s	1072·7 Kb	4·31
Isothermal bulk modulus, K_t	1063·4 Kb	4·35
Shear modulus, μ_H	433·6 Kb	0·47
Compressional-wave velocity, V_p	6·05 km/sec	$6{\cdot}1 \times 10^{-3}$ km/sec/kb
Shear-wave velocity, V_s	3·10 km/sec	$2{\cdot}6 \times 10^{-3}$ km/sec/kb
Poisson's ratio, σ_s	0·322	$2{\cdot}5 \times 10^{-3}$ kb^{-1}
Density, ρ	4·5063 gm/cm³	$4{\cdot}1 \times 10^{-3}$ gm/cm³/kb

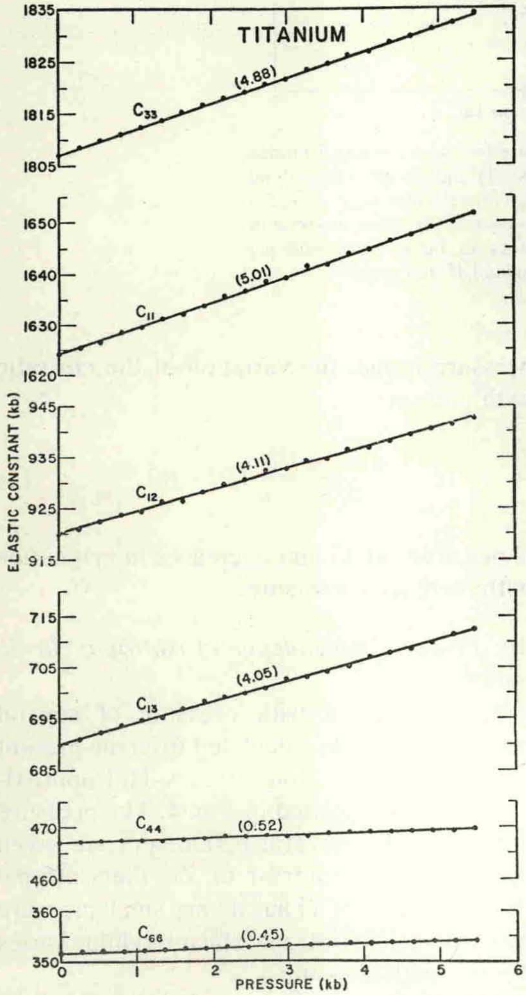

Fig. 2. Elastic stiffness moduli vs. pressure for Ti. Numbers indicate values of pressure derivatives assuming linear relation.

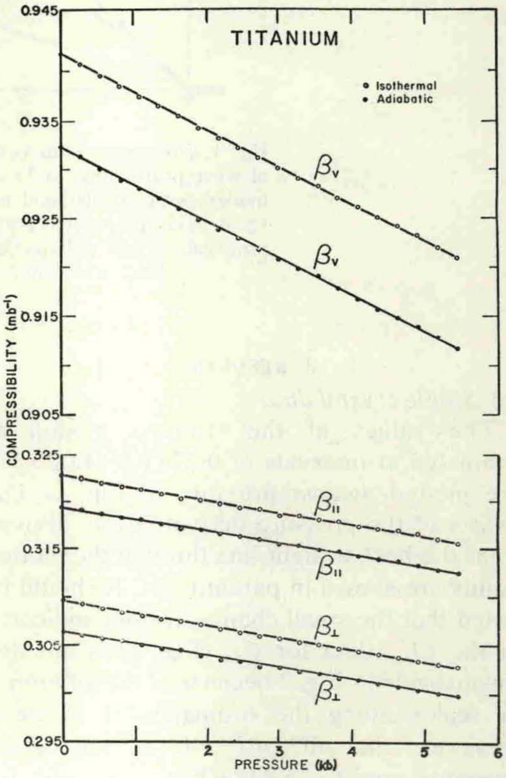

Fig. 3. Linear and volume compressibilities vs. pressure for Ti.

over the initial 5·5 Kb applied pressure is considerably smaller for Ti as compared to the value for Zr. The value of dK_s/dP, where K_s is the adiabatic bulk modulus, is about 8 per cent higher for Ti than for Zr, i.e., 4·39 vs. 4·08.