Similarly, differentiating Eq. (26), with respect to pressure, yields

$$(\partial c_{44}^T/\partial p)_T=(\partial c_{44}^s/\partial p)_T=(\partial c_{44}/\partial p)_T. \quad (36)$$

Equations (34) and (36) are the desired expressions by which one finds the isothermal pressure derivatives of the isothermal elastic constants in terms of the experimentally measured $(\partial c_{\mu\nu}^s/\partial p)_T$, the isothermal pressure derivatives of the adiabatic elastic constants.

The adiabatic pressure derivatives of the adiabatic elastic constants can also be calculated from the experimentally measured isothermal pressure derivatives of the adiabatic elastic constants. Using the differential rule

$$(\partial/\partial p)_s=(\partial/\partial p)_T+(\partial/\partial T)_p(\partial T/\partial p)_s, \quad (37)$$

where

$$(\partial T/\partial p)_s=TV\beta/C_p=T\gamma_G/K^s=T\gamma_G\chi^s=C, \quad (38)$$

we find the relation[11]

$$(\partial c_{\mu\nu}^s/\partial p)_s=C(\partial c_{\mu\nu}^s/\partial T)_p+(\partial c_{\mu\nu}^s/\partial p)_T. \quad (39)$$

Thus, for cubic crystals, Eq. (39) results in the following relations:

$$(\partial c_{11}^s/\partial p)_s=C(\partial c_{11}^s/\partial T)_p+(\partial c_{11}^s/\partial p)_T, \quad (40)$$

$$(\partial c_{12}^s/\partial p)_s=C(\partial c_{12}^s/\partial T)_p+(\partial c_{12}^s/\partial p)_T, \quad (41)$$

and

$$(\partial c_{44}^s/\partial p)_s=C(\partial c_{44}^s/\partial T)_p+(\partial c_{44}^s/\partial p)_T; \quad (42)$$

and, for the case with the bulk modulus,

$$(\partial K^s/\partial p)_s=C(\partial K^s/\partial T)_p+(\partial K^s/\partial p)_T. \quad (43)$$

The thermodynamic relations given thus far are for the single-crystal elastic constants and their pressure derivatives. In terms of these relations, the corresponding thermodynamic relations for the polycrystalline values can be obtained.

The pressure derivative of the polycrystalline longitudinal modulus can be given in terms of Eqs. (1) and (2) as

$$(\partial L^*/\partial p)_T=(\partial K^*/\partial p)_T+\tfrac{4}{3}(\partial G^*/\partial p)_T, \quad (44)$$

or in terms of the single-crystal elastic constants and

TABLE III. Single-crystal elastic constants and their pressure derivatives of hexagonal Mg (~300°K).[a]

Index for elastic constants	11	33	44	66	12	13
$c_{\mu\nu}^s$ ($\times 10^{11}$ dyn/cm^2)	5.974	6.170	1.639	1.680	2.614	2.167
$(\partial c_{\mu\nu}^s/\partial p)_T$	6.11	7.22	1.58	1.36	3.39	2.54

[a] R. E. Schmunk and C. S. Smith, J. Phys. Chem. Solids 9, 100 (1959).

[11] G. R. Barsch, Phys. Status Solidi 19, 129 (1967).

TABLE IV. Comparison of predicted and experimental isotropic pressure derivatives of polycrystalline elastic moduli for hexagonal Mg.

Isotropic pressure derivatives	Density (g/cm^3)	dK/dp			dG/dp			dL/dp		
		$(\partial K_V/\partial p)_T$	$(\partial K_R/\partial p)_T$	$(\partial K^*/\partial p)_T$	$(\partial G_V/\partial p)_T$	$(\partial G_R/\partial p)_T$	$(\partial G^*/\partial p)_T$	$(\partial L_V/\partial p)_T$	$(\partial L_R/\partial p)_T$	$(\partial L^*/\partial p)_T$
Calculated (59SI)[a]	1.738	4.06	4.06	4.06	1.63	1.61	1.62	6.24	6.20	6.22
Measured (61VI)[b]	1.731	...	...	4.18	...	...	1.53	...	...	6.22

[a] Calculation based on the values given in Table III.

[b] 61VI: F. F. Voronov and L. F. Vereschchagin, Fiz. Metal Metalloved. 11, 443 (1961).