TABLE II. Adiabatic second-order elastic constants of columbium obtained in the present and in previous investigations. The investigators of Refs. 24 and 27 used ultrasonic methods and Refs. 25 and 28 used the resonance method. The values for the present samples listed without parentheses were determined directly from the measured ultrasonic wave velocities and the other values were calculated from them. $C_S'=(C_{11}-C_{12})/2$, $C_L'=(C_{11}+C_{12}+2C_{44})/2$, $K=(C_{11}+2C_{12})/3$, and $A=C_{44}/C_S'$.

Present	Temp. (°K)	density (g/cm³)	C_{11} [a]	C_{12} [a]	C_{44} [a]	C_S' [a]	C_L' [a]	K [a]	A
Present									
Sample 1	298	8.578	(2.4653)	(1.3335)	0.28368	0.56592	2.1831	(1.7108)	(0.5013)
Sample 2	298	8.578	2.4645	(1.3323)	0.28431	0.56618	2.1828	(1.7098)	(0.5022)
"Best" values	298	8.578	(2.465±0.005)	(1.333±0.007)	0.2840±0.0006	0.5661	2.1829	(1.7102)	(0.5017)
Previous									
Ref. 24	300	8.578	2.456±0.0098	1.345±0.014	0.2873±0.0011	0.5604	2.187	1.718	0.5127
Ref. 27	300	8.5605	2.456±0.015	1.387±0.46	0.2930±0.0018	0.5345	2.215	1.743	0.5482
Ref. 25	298	8.578	2.34	1.21	0.2821±0.0004	0.571	2.06	1.59	0.495
Ref. 28	RT	···	2.40±0.11	1.26±0.11	0.2809±0.0007	0.57	2.11	1.64	0.493

[a] Units of 10^{12} dyn/cm².

in the calculational equation

$$m_n=[F(C_{ij})/\Delta p](2\Delta f/f_0). \tag{2}$$

This equation was used to calculate the value of the slope m for each of the runs. Uncertainty limits for the slopes were established based on the estimated uncertainty in Δf and in the stress, p. Examples of a hydrostatic pressure and a uniaxial stress run are shown in Figs. 1 and 2.

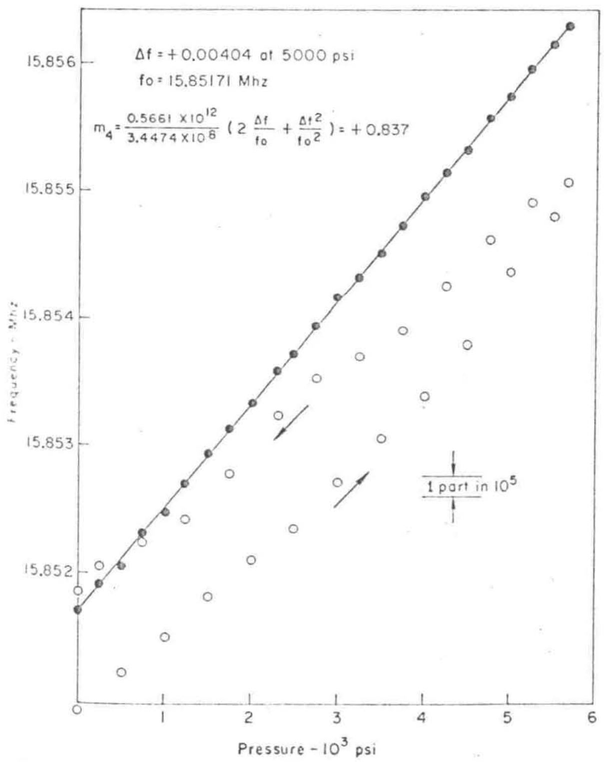

FIG. 1. Example of data for a hydrostatic pressure run. The open circles are data before correcting for temperature changes during the run. The temperatures at the start, middle, and end of the run were about 25.5°, 26.0°, and 25.0°C, respectively. After each 500 psi pressure change, about 15 min was allowed for the temperature to approach equilibrium before frequency readings were taken.

Because of the redundancy in the number of relations available to determine the values of the single-crystal TOEC, and the wide range of uncertainties in the values of m_n, the data analysis from this point is highly subjective. Several procedures were tried with only slightly different results, so only one of these are described. The hydrostatic pressure data was considered the most reliable and was found to have the best internal consistency based on the relations $m_2 \equiv m_5$, and $m_1+m_2=m_3+m_4$, which can readily be shown. The hydrostatic pressure equations were then solved

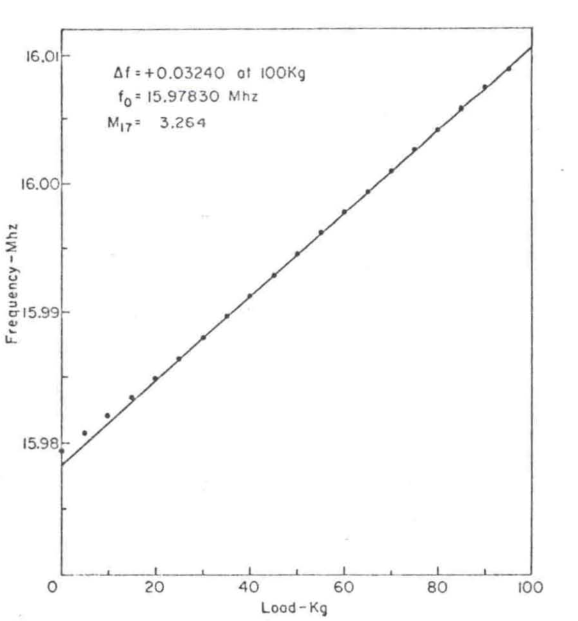

FIG. 2. Example of data for a uniaxial stress run. Some nonlinearity in the stress-frequency dependence at low stresses was often seen.