Table 1

Calcite: variation of the refractive indices with pressure
($\lambda = 5893$ Å, $t_0 = 0.205_7$ cm, $T = 22$ °C)

Pressure (kbar)	$\eta_{11}\times10^2$	Strain ($\Delta V/V_0\times10^2$)	$n_0 = 1.658$				$n_e = 1.486$			
			Fringe shift	$\Delta n_0\times10^2$	A_0^{LL}	A_0^{D}	Fringe shift	$\Delta n_e\times10^2$	A_0^{LL}	A_0^{D}
0.552	−0.015	−0.08	0.27	0.028	0.54	0.56	0.10	0.027	0.45	0.48
1.103	−0.030	−0.15	0.45	0.056	0.55	0.57	0.22	0.051	0.44	0.48
1.655	−0.045	−0.22	0.82	0.086	0.54	0.56	0.39	0.075	0.44	0.47
2.201	−0.060	−0.30	1.21	0.116	0.53	0.56	0.53	0.099	0.44	0.47
2.758	−0.075	−0.37	1.33	0.143	0.54	0.56	0.69	0.122	0.43	0.47
3.309	−0.089	−0.45	1.54	0.170	0.54	0.56	0.73	0.147	0.44	0.47
3.861	−0.104	−0.52	1.74	0.198	0.55	0.57	0.86	0.172	0.44	0.47
4.412	−0.119	−0.59	1.99	0.226	0.55	0.57	1.00	0.196	0.44	0.47
4.964	−0.134	−0.67	2.25	0.254	0.55	0.57	1.19	0.220	0.43	0.47
5.515	−0.149	−0.74	2.43	0.282	0.55	0.57	1.41	0.245	0.43	0.46
6.067	−0.164	−0.81	2.70	0.310	0.55	0.57	1.58	0.270	0.43	0.46
6.619	−0.178	−0.88	2.92	0.338	0.55	0.57	1.72	0.293	0.43	0.46
6.894	−0.186	−0.92	3.03	0.352	0.55	0.57	1.79	0.305	0.43	0.46

If the data based on Voigt's elastic constants were plotted the shape of the graphs would have been exactly the same but with a slope larger by about 15%.

The above values obtained by us compare well with the values of $0.58 \times \times 10^{-3}$/kbar and 0.51×10^{-3}/kbar calculated from the strain-optical data of Pockels [1]. The agreement is very good when we realize that Pockels used the elastic constants data of Voigt in his calculations and hence we should expect his values to be larger than ours by about 15%.

The theoretical calculation by W. L. Bragg for the indices of refraction of calcite at room temperature and pressure, can be extended to the region of high pressure and the value of dn/dP evaluated therefrom. For these calculations we assumed the more recent value of Sass et al. [11] for the C–O distance, as 1.294 Å. The anisotropy of the oxygen polarizability was also taken into account by using the values given by Lawless and Devries [12] $\alpha_z = 1.384$ Å^3 and $\alpha_x = 1.328$ Å^3. The polarizability of the calcium ion was taken as 1.1 Å^3 [13]. The polarizability of the carbon was taken to be zero [3].

The index of refraction was then calculated with the help of the relation [3]

$$n^2 - 1 = \frac{4\pi \Sigma C_i N_i \alpha_i}{1 - \frac{4\pi}{3} \Sigma C_i N_i \alpha_i}, \tag{2}$$

where N_i is the number of atoms of type i per cm^3, C_i are constants not differing greatly from unity depending on the type of atom, and α_i is the polarizability of atom i in the appropriate direction. This type of calculation was carried out, taking the sum over only the oxygen atoms in one CO_3 group, and the values for the respective indices agree with the measured values within 1 to 2%. This is about the same order of agreement that Bragg obtained using earlier data. Bragg in an effort to obtain better agreement extended his sum to include up to 42 neighboring dipoles. However the theoretical value for the index

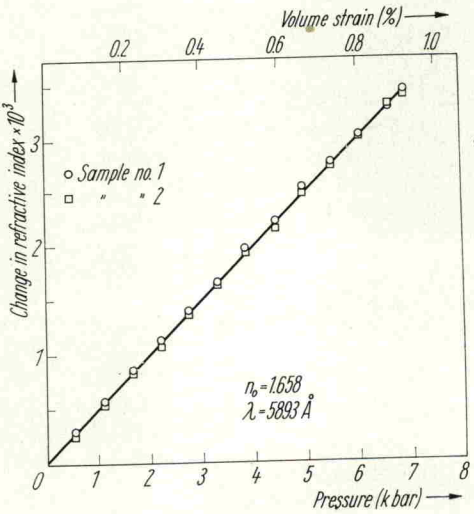

Fig. 1. Variation of the ordinary refractive index of calcite with pressure and volume strain. $T = 22$ °C

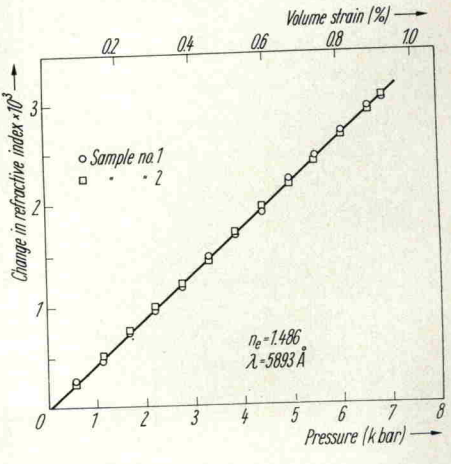

Fig. 2. Variation of the extraordinary refractive index of calcite with pressure and volume strain. $T = 22$ °C