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Oceanic basalt glass: A simple relationship between the seismic parameter F and optical refractive index - Geothermal investigations

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A correlation between the optical specific refraction Rsp = (n-1)/d
(where n and d denote refractive index of yellow light and density medium, respectively) and hydrostatic pressure p (from 0 to about 5 GPa)for oceanic basalt glass material suggests the following characteristic equation: F = Rsp/(dn/dp), where F is the seismic parameter and (dn/dp)
denotes the pressure gradient of refractive index. All necessary experimental data on the refractive indices and densities were taken from R.G. Kuryaeva and V.A. Kirkinskii (1997). With very good approximation Rsp is constant and equals 0.2035 cc/g in the whole 0-5 GPa range. In this case, the derivative dRsp/dp = 0 and we obtain a very simple expression of the form dn/dp = Rsp/F or F = Rsp/(dn/dp).
Since the mean values of dn/dp are 0.013 [1/GPa] (0-1.0 GPa range),
0.016 [1/GPa] (1.0-2.1 GPa range), and 0.010 [1/GPa] (2.1-5.1 GPa range), and Rsp = 0.2035 cc/g, we estimate that the probable values of seismic parameter F are 15.65, 12.72 and 20.35 (km/s)$\hat{2}$ for basalt glass under pressures of 0-1.0, 1.0-2.1 and 2.1-5.1 GPa, respectively.
On the other hand, one of many equations applied of geothermics and mineral physics is a semi-empirical relationship between the phonon thermal conductivity (k) and seismic parameter F for silicate and oxide minerals. At room temperature (To) it is of the form: logk = (5/6)logF -
0.7422, where the k-value is in W/m K and parameter F is in (km/s)$\hat{2}$.
Thus, we obtain the following three values of k(To) = 1.79 W/m K [(0-1.0)GPa range], 1.51 W/m K [(1.0-2.1) GPa range) and 2.23 W/m K [(2.1-5.1) GPa range] for oceanic basalt glass.