Fig. 1. K in relation to $v_0$. The numbers are those of the minerals in Table 1.

instance, monteponite (CdO) has $\rho = 8.24$ g/cm³, which is largely due to the high atomic weight of Cd (112.41), where its K is close to that for CaO ($\rho = 3.35$ g/cm³). Also, bromellite ($\rho = 3.0$ g/cm³) has a very high K, as have stishovite (4.35 g/cm³) and corundum (3.98 g/cm³). The density involves two components [3, 23]: 1) the weight, 2) the packing density d, so there can be low-density substances with close packing and high K (BeO) and high-density ones with more open packing (CdO, ZnO, MnO, FeO).

The silicates (Fig. 1) also show no direct relation of K to $\rho$, but the groups feldspars, quartz, pyroxenes, olivines, and garnets in general lie on a line $K = f(v_0)$ in order of increasing density, and so igneous rocks often show a correlation between $\rho$ and K (and also the wave speed) [23]. There is an indirect relation between $\rho$ and K for silicates because these usually consist of elements similar in weight, and increase in $\rho$ corresponds to an increase in d.

Analogy with other ionic crystals indicates that K for these compounds is dependent not only on d but also on factors such as the cation radius and valency, and also the number of bonds per unit volume [25]. These effects are reflected in the additional parameters b and $d_1$ (Table 1), in which b

(dimensionless) is the number of cations per 100 Å³ and is

$$b = \frac{n_C \cdot z}{v_C} \cdot 100, \tag{3}$$

in which $n_C$ is the number of cations in the chemical formula. Also, $d_1$ is

$$d_1 = b \cdot \omega \cdot l (\text{Å})^{-3}, \tag{4}$$

in which $\omega$ is the mean cation valency and $l = 1/v_0$ is the oxygen packing density. Then $\omega$ equals the cation valency for a simple oxide; for complex oxides, it is calculated as the ratio of the cation charges to the number of cations. For instance, $\omega = 8/3$ for spinel, and forsterite, or $\omega = 24/8$ for garnets.

Figure 2 shows $K = f(d_1)$. The oxides and silicates form two fairly narrow bands having the same slope, with the silicates above the oxides. Quartz in the silicates deviates from the general scheme, as does bromellite in the oxides. In general, $K = f(d_1)$ resembles $K = f(v_0)$, but the correlation is closer. Figure 2 can be used with known $d_1$ to determine K approximately.

A full elucidation of the relation of K to structure would involve other parameters