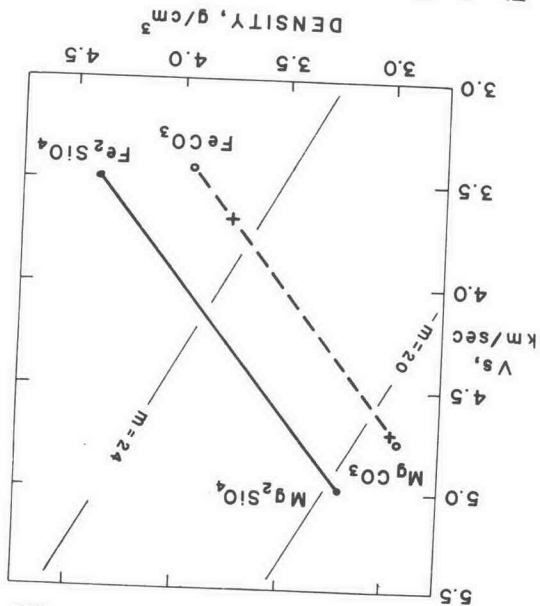


TABLE 3. Elastic Properties of Magnesite, Siderite, and Rhodochrosite

Pressure, K _b	μ	mb	V/V ₀	σ	ϕ , (km/sec) ²						
						Magnesite		Siderite		Rhodochrosite	
2.0	1.12	0.62	1.77	0.27	37.8	1.22	0.66	1.79	0.27	1.20	0.41
6.0	1.19	0.65	1.78	0.27	39.8	1.22	0.66	1.79	0.27	1.24	0.44
10.0	1.22	0.66	1.79	0.27	40.9	1.24	0.51	1.94	0.32	1.25	0.45
2.0	1.16	0.48	1.94	0.32	31.0	1.22	0.50	1.94	0.32	2.05	0.34
6.0	1.22	0.50	1.94	0.32	32.2	1.24	0.51	1.94	0.32	2.04	0.34
10.0	1.24	0.51	1.94	0.32	32.8	1.25	0.45	2.02	0.34	2.05	0.34
2.0	1.20	0.41	2.05	0.34	33.6	1.24	0.44	2.04	0.34	2.04	0.34
6.0	1.24	0.44	2.04	0.34	34.5	1.25	0.45	2.02	0.34	2.05	0.34
10.0	1.25	0.45	2.02	0.34	34.8	1.25	0.45	2.02	0.34	2.05	0.34

Because of their relative purity, carbonates offer an excellent opportunity to examine the effect of iron, magnesium, and manganese substitution on the elastic moduli and wave velocities in minerals. In Figures 1 and 2 the data of Chung [1970] for the olivine series are compared with velocities of magnesite and siderite at 10 kb. Velocity-density relations for the magnesite-siderite series appear to be remarkably similar to those for the olivine series. The agreement between the two series suggests that velocity measurements for additional carbonates may provide important information about the relationships between various cation substitutions and elastic properties, which can be applied to silicates.

Fig. 2. Shear-wave velocity-density relations for the olivine series Mg_2SiO_4 - Fe_2SiO_4 [Chung, 1970] and the siderite-magnesite series $FeCO_3$ - $MgCO_3$ (between the plus signs). The extended velocity-density lines to the densities of pure $MgCO_3$ and $FeCO_3$ are also shown.



The bulk moduli K_s and shear moduli μ for the pure end members $MgCO_3$ and $FeCO_3$ estimated by extending the velocity-density lines of Figures 1 and 2 to the densities of pure $MgCO_3$ and $FeCO_3$ show changes with iron substitution of -0.02% and -29.9%, respectively. A similar relation between K_s and iron substitution in the olivine lattice has been noted by Mao *et al.* [1970] and Chung [1970]. The small decreases in K_s for both magnesite-siderite and olivine are presumably related to the similar unit cell volumes for the end member of each series. For corundum Al_2O_3 to hematite Fe_2O_3 , however $\Delta K_s = -20\%$, which is comparable to the volume increase of 23% [Liebemann, 1970].

Fig. 1. Compressional-wave velocity-density relations for the olivine series Mg_2SiO_4 - Fe_2SiO_4 [Chung, 1970] and the siderite-magnesite series $FeCO_3$ - $MgCO_3$ (between the plus signs). The extended velocity-density lines to the densities of pure $MgCO_3$ and $FeCO_3$ are also shown.

