BRIEF REPORT

Pressure, kb	K _s , mb	μ, mb	V_p/V_s	σ	ϕ , $(\text{km/sec})^2$
		Ma	gnesite		
2.0	1.12	0.62	1.77	0.27	37.8
6.0	1.19	0.65	1.78	0.27	39.8
10.0	1.22	0.66	1.79	0.27	40.9
		Si	derite		
2.0	1.16	0.48	1.94	0.32	31.0
6.0	1.22	0.50	1.94	0.32	32.2
10.0	1.24	0.51	1.94	0.32	32.8
		Rhod	ochrosite		
2.0	1.20	0.41	2.05	0.34	33.6
6.0	1.24	0.44	2.04	0.34	34.5
10.0	1.25	0.45	2.02	0.34	34.8

 TABLE 3.
 Elastic Properties of Magnesite,

 Siderite, and Rhodochrosite

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 com-



Fig. 1. Compressional-wave velocity-density relations for the olivine series Mg_2SiO_4 -Fe₂SiO₄ [*Chung*, 1970] and the siderite-magnesite series FeCO₃-MgCO₃ (between the plus signs). The extended velocity-density lines to the densities of pure MgCO₃ and FeCO₃ are also shown.



Fig. 2. Shear-wave velocity-density relations for the olivine series Mg_SiO₄-Fe₂SiO₄ [*Chung*, 1970] and the siderite-magnesite series FeCO₂-MgCO₃ (between the plus signs). The extended velocity-density lines to the densities of pure MgCO₃ and FeCO₃ are also shown.

pared 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.

The bulk moduli K_s and shear moduli μ for the pure end members MgCO₃ and FeCO₃, estimated by extending the velocity-density lines of Figures 1 and 2 to the densities of pure MgCO₃ and FeCO₃, 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 Al₃O₃ to hematite Fe₂O₃, however $\Delta K_s = -20\%$, which is comparable to the volume increase of 23% [Liebermann, 1970].

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