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100 Fa	Olivine	4.393	6.637	3.494	27.8	1.220	5.92
	Spinel*	4.849	8.05	4.28	40.4	1.96	5.1

A systematic discussion is presented for the effects of iron substitution on the elastic properties. The geophysical implications of these effects of iron on the equation of state are also discussed.

T96

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Extrapolation of Elastic Properties to High Pressure Using a Lattice Model. The equations for the elastic properties under compression are given for several simple cubic lattices, under the assumption of a simple atomic model involving long-range coulombic forces and short-range central interactions between nearest neighbors and between next nearest neighbors. The arbitrary parameters in these equations are evaluated by using the density, elastic constants and pressure derivatives at zero pressure. The model is tested by comparing the derived ionicity and short-range force constants to results obtained by other means. This model provides a good method for extrapolating elastic properties to high pressure when elastic data is used to evaluate parameters, but the uncertainties inherent in this model prevent its use with non-elastic data to predict accurately the elastic constants at zero pressure.

T97

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Bulk Modulus - Volume Relationships for Oxide Compounds. It is found that for many complex close packed oxides, the product of the bulk modulus and the molecular volume at zero pressure is the sum of this product for the constituent oxides, i.e. $KV(MgAl_2O_4) = KV(MgO) + KV(Al_2O_3)$. By considering a lattice model, it is shown that this additivity property depends mainly on the form of the repulsive part of the potential energy that is assumed. In conjunction with the result that classes of oxides with isomorphic electronic structures have KV equals a constant at zero pressure, this allows the calculation of the bulk modulus for unmeasured oxides of geophysical interest.

T98

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Remarks on Ultrasonic Measurements of the Elastic Properties of Hot Pressed Polycrystalline Samples. Ultrasonic measurements of the elastic properties of high quality polycrystalline samples of MgO and Al_2O_3 have revealed significant changes in the elastic properties after the samples had been exposed to 10 Kbar and 1000°K. This change can be attributed to a redistribution and partial relocation of the residual strain, initially induced when the samples were hot pressed. The existence of this effect raises questions about the usefulness of polycrystalline samples for such measurements. The unique elastic properties of "perfect" polycrystals can be calculated from single crystal properties by Kroner's method. A measure of the quality of a polycrystal is thus available. This will be illustrated with several examples. The effect of porosity on the properties of polycrystals will be compared with the effect of exposure of the sample to high temperature and pressure. Previous conclusions as to the effect of porosity on the elastic properties will be critically examined and the data reinterpreted in view of the above effect. The effect of permeability of the sample to the pressure medium significantly influences the values of the elastic properties as calculated from the ultrasonic measurements, and should be taken into account.

T99

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Porosity Effects on Measured Values of Bulk Modulus and Its Pressure Derivative. Measurements of pressure derivatives of sound velocity are made upon polycrystalline aggregates of high density. This has been preferred over single crystals for geophysical applications because it avoids many of the complications that arise from the need to apply averaging schemes to extract the isotopic properties. Elastic properties are, however, sensitive to even small amounts of porosity; in particular, the bulk modulus and its pressure derivative. A porosity correction should be made before these experimental values are employed in equations of state. Several approaches have been tried and led to diverging results. Recently Walsh has shown that higher order terms are needed to define the porosity correction, and that both positive and negative corrections are possible. Experimental results on the validity of Walsh's equations are presented.