STEINHART, 1966); in some regions it is argued to be discontinuous at the Conrad discontinuity (e.g. RICHARDS and WALKER, 1959), whereas in other areas it is considered to be continuous (e.g. TATEL and TUVE, 1955). Early crustal models proposed to explain this increase have attributed it to a granitic upper crust overlying a basic lower crust. PAKISER and ROBINSON (1966) have given estimates of the average composition of three super-provinces of the North American continental crust, based on seismic evidence. Their conclusion is that the overall composition is intermediate, though they assume that there is a composition change from granitic to basic with depth, rather than a mineralogical change in a single bulk composition.

However RINGWOOD and GREEN (1966) have argued, using experimental results on high pressure assemblages in basic compositions, that an anhydrous lower crust of basic composition could not give rise to the observed seismic properties of this region. RINGWOOD and GREEN (1966) further suggested that rocks approaching diorite ($\approx$andesite) in average chemical composition would best fit the physical properties of the lower crust. The present experimental work supports these conclusions. Garnet is stable in diorite under conditions equivalent to high-pressure granulite facies and eclogite facies (i.e. conditions expected in the lower crust) and so in an anhydrous lower crust, the presence of relatively dense phases garnet and aluminous pyroxene may be responsible for increasing seismic velocity with depth, rather than a compositional change (cf. GREEN and LAMBERT, 1965). A gabbroic anorthosite composition would behave in a similar fashion to diorite.

The density of the high pressure mineral assemblage has been measured directly on two experimental runs using a Berman balance. The gabbroic anorthosite composition at 25 kb, 900 °C has a density of 3.15 g/cm^3 while the diorite composition at 18 kb, 900 °C has a density of 2.88 g/cm^3. Using solutions 6 and 7 of the equation given by BIRCH (1961) ($V_P = a+b\rho$ where V_P is the compressional wave velocity in km/s at 10 kb and ρ the density in g/cm^3) the calculated compressional wave velocities at 10 kb confining pressure for these assemblages are 7.4 km/s (gabbroic anorthosite) and 7.0 km/s (diorite). The particular gabbroic anorthosite run represents a mineral assemblage stable at P–T conditions greater than those generally considered likely in the lower crust, so that the calculated seismic velocities may be regarded as the upper limit for a lower crust of this composition. The diorite run represents a mineral assemblage likely for intermediate P–T conditions predicted in the lower crust (e.g. extrapolated to 550 °C at 10 kb), so that the calculated seismic velocity may be regarded as a median value for a lower crust of dioritic composition. The compressional wave velocities should be somewhere between 6.8 and 7.4 km/s for gabbroic anorthosite or 6.6 and 7.2 km/s for diorite, where the lower values are those predicted for the low pressure mineralogy (table 1).

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