

TABLE 2

	amphibole	garnet	pyroxene	biotite	rutile	opaque	quartz
Alkali olivine basalt							
amphibolite	××	×	×	×	tr	tr	—
eclogite	tr	××	××	×	tr	—	—
Quartz tholeiite							
amphibolite	××	×	×	—	—	tr	—
eclogite	tr	××	××	—	tr	—	tr

×× = major component; × = minor component; tr = trace.

compressibility of the solids was neglected, i.e. $\Delta V_{\text{solids}} =$ constant.

Because of the approximations involved in the estimation of volumes and entropies at high pressures and temperatures, the slopes and locations of the solid-solid reactions can only be regarded as approximate. Negative slopes for these curves cannot be ruled out at present.

Appendix II: Details of experimental procedure

The starting material for the synthesis runs were glasses of the appropriate composition prepared as described by GREEN and RINGWOOD (1967). Weighed amounts of glass (10–40 mg) were sealed in Au, Pt or Ag–Pd capsules with 5–10 wt% water added with a microburette. The capsules were sealed with a carbon arc-welder and reweighed to ensure against loss of the water. For reversals, products of earlier runs containing amphibolite and eclogite were mixed, weighed with additional water and rerun. The capsules were enclosed with a talc assembly which fitted into the standard graphite furnace and external talc sheath of the Boyd piston-cylinder apparatus. Pt-(Pt+10% Rh) or chromel–alumel thermocouples were used to measure and control temperatures to ± 10 °C. Pressure (10–40 kb) was first applied then the cell was brought to temperature (600–900 °C) with the piston remaining on the compression stroke; a –10% pressure correction was applied to all runs. Synthesis run times were generally 12–24 hours, but successful reversals required at least 2–3 days. At temperatures >800 °C large pressure and/or temperature drops often occurred due to talc dehydration, and boron nitride was substituted for the talc internal to the graphite furnace. After the run was quenched in ≈ 30 s by cutting the power input, the capsule was removed, cleaned and reweighed. It was then punctured and examined for excess water, usually

seen only when >2 mg water had initially been added. Runs were then heated to ≈ 120 °C for at least 1 hour and reweighed to measure the water loss insuring that excess water had been present during the run. The sample was then optically examined and powder photographs taken. Iron loss to the Pt capsule at these relatively low temperatures was probably restricted to a narrow 2–5 μ bleached zone observed at the edge of the sample after a run. Reducing conditions of an uncontrolled nature were guaranteed by the presence of the graphite furnace external to the sample.

Appendix III: Phases observed in the experimental runs

The phases observed in the alkali olivine basalt and the quartz tholeiite are listed in table 2. Feldspar was not positively identified in low pressure runs though small amounts of glass are difficult to distinguish from these phases. In synthesis runs on the quartz tholeiite at 27 kb and 700 °C, large weakly birefringent crystals with a low refractive index were tentatively identified as quartz. When amphibole is a major constituent, other minor phases (except for biotite) are difficult to distinguish with powder photographs because of the overlap with amphibole lines, and an optical identification is necessary. Small amounts of pyroxene can be distinguished from amphibole by their equant habit, and garnet by its characteristic shape, refringence and lack of birefringence. The trace amounts of amphibole in the eclogite may be quench material. For the alkali olivine basalt, some of the pyroxene may be orthopyroxene though much has probably reacted with the K-feldspar component to give biotite. The eclogitic pyroxene of the quartz tholeiite has $\approx 20\%$ Jd and that of the alkali olivine basalt $\approx 10\%$ Jd, as determined by the $\bar{2}21$ *d*-spacing (see ESSENE and FYFE, 1967).