required for elimination of plagioclase, particularly near the peridotite solidus, is most important for the hypothesis of partial melting in the upper mantle and variations in upper mantle mineralogy. The present investigation began as an attempt to ascertain the limits of stability of plagioclase in 'pyrolite' composition, i.e. a complex peridotite composition suggested as the mean composition of the upper mantle (Ringwood 1962, 1966a, b; Green & Ringwood 1963). The simple systems forsterite (Fo_{100}) + anorthite, fayalite (Fo_0) + anorthite, and olivine (Fo_{90}) + labradorite (An_{59}) were studied to throw further light on the complex reactions in the pyrolite composition.

Experimental methods

Experiments were carried out in a solid-media apparatus similar to that described previously (Boyd & England, 1960; Green & Ringwood, 1967a). Sample capsules were of either platinum or graphite, the former having the advantage that sealing by welding can exclude water, but the disadvantage that some iron may be lost from the sample due to solid solution in the platinum. For this reason, runs on the fayalite + anorthite mix were carried out in graphite capsules. In runs in graphite capsules, water vapour from dehydration of the talc pressure medium cannot be entirely excluded and may result in lowering of solidus temperatures, particularly in long runs. No reduction of fayalite to metallic iron was observed in any of the runs: any such reduction would be also accompanied by appearance of pyroxene in the fayalite + anorthite mix.

Reactants and products were identified by optical examination and X-ray powder diffraction. Experimental difficulty was experienced in the simple Fo + An and Fa + An systems in the sluggish nucleation and growth of phases and in the metastable persistence of low pressure phases. Runs were thus seeded with 10–15% of the synthesized high pressure assemblage containing garnet or spinel + pyroxene. Experiments close to the reaction boundaries required identification of rather small degrees of growth or corrosion of the seed phases. Runs were not seeded with the low pressure assemblages in all cases, since it was shown that olivine and plagioclase nucleated rapidly from the glass within the first few minutes at pressures near their stability limits.

Equations (1), (3) and (9) on the following pages illustrate the expected reactions, and to ensure the presence of an excess of olivine in all high pressure assemblages, the olivine: anorthite mixtures were prepared in the molecular ratio 2.2 : 1, i.e. 10% excess olivine over that required for equation 1 with x = 0. Similarly, olivine is present in excess (in relation to equation (9)) in the olivine + labradorite mix (olivine (Fo_{90}) : labradorite (An_{59}) = 1.8 : 1 mol.ratio) and in the pyrolite mix (Table 1).

The fayalite and anorthite used in the experiments were pure synthetic phases (from Tem-Pres. Inc.); forsterite was synthesized at high tempera-