Introduction

The crystallization of a variety of basaltic rocks at sub-solidus conditions at temperatures of 1100°C to 1250°C and at pressure up to 40kb was reported by Ringwood and Green (1964, 1966), Green and Ringwood (1967a), T.H. Green (1967). Similar experiments on a rhyodacite composition (Green and Lambert, 1965) and on andesite and gabbroic anorthosite compositions (T.H. Green, 1970) have also been published. These experiments established a general pattern of mineralogical variation with increasing pressure from low pressure pyroxene + plagioclase ± olivine assemblages through pyroxene + plagioclase + garnet ± quartz assemblages to plagioclase-free assemblages dominated by garnet + clinopyroxene. It was shown that the width of the mineralogical transition zone is strongly controlled by the chemical composition of the rock, parameters of importance including the degree of silica saturation, the $\frac{Ab}{Ab+An}$ ratio of the plagioclase and the $\frac{Mg}{Mg+Fe^{++}}$ ratio of the rock.

Cohen, Ito and Kennedy (1967) published data on the mineralogy of an olivine tholeiite (NM5) at pressures up to 40kb and at temperatures thought to be sub-solidus. Their results gave a much narrower pressure interval for the pyroxene + garnet + plagioclase field (garnet granulite) than predicted for the NM5 composition from a comparison with the spectrum of compositions studied in the Canberra laboratory. Ito and Kennedy (1968, p.179) contrasted their narrow pressure interval for the gabbro-eclogite transition with the broader interval in the Canberra results and noted(p.179) "It seems barely possible that the continental Mohorovicic discontinuity can be a phase change if the transition takes place over an interval of

4kb but it seems quite impossible if the transition takes place over an interval of 9kb". Subsequently, Ito and Kennedy (1970, 1971) have re-investigated the sub-solidus mineralogy of NM5 at high pressures and obtained results differing drastically from their previous data. The pressure interval between appearance of garnet and disappearance of plagioclase is now reported as ~17kb on the solidus or ~15kb at 1100°C. In presentation of their more recent data, Ito and Kennedy (1971) also state that their new data are "remarkably in contrast to those published by Green and Ringwood (1967a)". The authors do not detail where the supposed conflict in experimental data occurs but make the unjustified inference that the problem of melting which in part invalidated their own earlier results also invalidates the Ringwood and Green (1966), Green and Ringwood (1967) and Green (1967, 1970) work. Ito and Kennedy therefore state that our conclusions on eclogite stability in the crust and upper mantle cannot be justified. It will be shown in the following discussion that the latest Ito and Kennedy work is in excellent agreement with our earlier work and conclusions, and, indeed, adds little information not already demonstrated in that work. Furthermore, the conclusions of Ito and Kennedy (1971) on the role of garnet granulite and eclogite in orogenic regions where the M-discontinuity cannot be clearly identified, closely follow those of our 1966 paper. In contrast to their 1967 paper, Ito and Kennedy (1970) abandoned the gabbro-eclogite transformation as the explanation for the existence of the continental shield M-discontinuity, requiring this to be caused by a chemical change from 'granitic crust' to eclogitic 'upper mantle'. In oceanic regions, Ito and Kennedy assert that