### b) Crystallization at 27 kb

Several runs have been conducted on the dacite composition, in order to determine the effect of the presence of water on the sequence of crystallization in the dacite composition at high pressure and also to obtain garnet crystals suitable for electron microprobe analysis. Garnet is the liquidus phase in the dacite at 1140° C and is joined at lower temperatures by clinopyroxene (1100° C), quartz (1040° C) and kyanite (960° C).

*Analytical Data*

### a) Pyroxenes

Analyses of ortho- and clino-pyroxene from wet runs on the high-alumina quartz tholeiite composition are given in Table 23. The clinopyroxenes crystallizing from the wet runs are noteworthy for their high lime content compared with the lime content of the clinopyroxenes crystallizing from the higher temperature dry runs, indicating more solid-solution of orthopyroxene in clinopyroxene at the higher temperature. Alumina in tetrahedral co-ordination is also high in the clinopyroxene crystallizing from the wet runs and so the silica content is correspondingly low. Only two analyses of orthopyroxene crystallizing from wet runs at 9—10 kb have been obtained. These show a high alumina content in tetrahedral co-ordination, only slightly less than found in the co-existing clinopyroxene. The alumina content is higher, and the lime content lower than found in orthopyroxenes crystallized from basalts at similar pressures but under dry conditions and higher temperatures (D. H. Green and Ringwood, 1967b). The low lime content indicates lower solid-solution of clinopyroxene in orthopyroxene at lower temperatures.

### b) Amphiboles (Table 24)

Five amphibole analyses are given in Table 24. Since water content could not be analyzed using the electron microprobe, the chemical formula has been calculated on an anhydrous basis, with 23 oxygens per formula unit. These amphiboles correspond to aluminous edenitic hornblendes with a significant alumina content in tetrahedral co-ordination and a low silica content. The titanium content is high. The $\frac{Mg}{Mg + Fe}$ ratio is significantly lower in the amphiboles than in co-existing pyroxenes.

### c) Plagioclase (Table 25)

The plagioclase crystallizing well below the liquidus of the high-alumina quartz tholeiite under wet conditions is noteworthy for its high anorthite content, when compared with plagioclases crystallizing from a similar basalt under dry conditions (T. H. Green, 1968 in preparation).

*Summary of the Most Significant Results*

1. There is a large field of crystallization of amphibole, clinopyroxene and minor orthopyroxene at 9—10 kb in the basalt and basaltic andesite compositions i.e. crystallization of plagioclase is suppressed.
2. The amphiboles crystallizing are extremely sub-silicic (39.8—40.8% $SiO_2$).
3. The pyroxenes crystallizing have high alumina contents (7.5—10.6% $Al_2O_3$) and low silica contents (47.2—48.0% $SiO_2$).
4. The plagioclase crystallizing well below the liquidus in the basalt composition is quite calcic ($An_{66}$).
5. Plagioclase occurs near the liquidus in the andesite composition and is joined by garnet and amphibole at lower temperatures. Similar crystallization occurs in the rhyodacite, except that mica is present as well.
6. Increasing pressure results in increasing importance of garnet as a near-liquidus phase until at 18 kb in the rhyodacite (T. H. Green and Ringwood,

*experimental runs on the high-alumina quartz tholeiite, basaltic andesite and andesite compositions*
*owed > 1 mgm $H_2O$ was added to the sample*

| Time (hrs) | Phases present | Estimated % of glass | Comments and estimated r crystal phases present |
|---|---|---|---|
| *eiite* | | | |
| les | | | |
| 8 | cpx ? amph plag ? glass | 15 | Abundant medium sized ar identification of clinopyr |
| $7^1/_2$ | cpx opx amph plag psdb glass | 45 | Abundant prismatic amphi clinopyroxene, minor pla pyroxene, accessory pseu amph > cpx ≫ plag > opx |
| 4 | cpx opx amph psdb glass | 55 | As above except no plagioc |
| 4 | cpx opx amph psdb glass | 75 | Common stubby clinopyrox amphibole, rare large ort pseudobrookite; cpx ≫ ar |
| 1 | cpx glass | 99 | Rare medium sized crystals |
| es | | | |
| $5^1/_2$ | cpx opx amph mt glass | 60 | Abundant amphibole, some clinopyroxene, rare laths euhedra of magnetite; ar |
| 3 | cpx opx amph mt glass | 75 | As above except amph, cpx |
| 4 | cpx opx amph ? mt glass | 85 | Common stubby clinopyrox pyroxene, amphibole not cpx, opx ≫ mt, amph ? |