clase, minor olivine and minor spinel. This assemblage differs from the subsolidus run at 1,100° C (GREEN and RINGWOOD, 1967) only in having lower plagioclase and olivine contents.

c) Crystallization at 11.3 kb

Only two runs, both aimed at establishing the phases present close to the liquidus, were carried out at 11.3 kb. In the olivine tholeiite composition, a run at 1,370° C showed large orthopyroxene euhedra and less common but well crystallized olivine euhedra. Either phase may be the liquidus phase (at $1380 \pm 10°$ C) but it is clear that both phases are important in the early stages of fractioning of the olivine tholeiite at this pressure. Since olivine is absent in the subsolidus assemblage in this composition at 1,100° C, 11.3 kb (GREEN and RINGWOOD, 1967), there is either a subsolidus reaction (e.g. spinel + orthopyroxene + clinopyroxene = olivine + anorthite) to yield olivine above 1,100° C or an incongruent melting relationship in the opx + cpx + plag + spinel assemblage.
A second run, at 11.3 kb 1,270° C, was carried out on the alkali olivine basalt composition. This run yielded glass as the major phase but with quite common clinopyroxene and rare orthopyroxene. The firm identification of olivine was not possible.

d) Crystallization at 13.5 kb

In contrast to the important role of olivine at 9 kb, this phase does not occur at 13.5 kb in any composition studied except the picrite. Orthopyroxene is the liquidus phase in both the olivine tholeiite and olivine basalt compositions and both orthopyroxene and clinopyroxene occur near or on the liquidus in the alkali olivine basalt. In the olivine tholeiite composition, there is an extensive field of crystallization of orthopyroxene alone (Fig. 2 B) from a temperature of 1,400° C or slightly greater, down to about 1,360° C. Orthopyroxene is then joined by clinopyroxene and these two phases crystallize together down to 1,300° C. At 1,350° C orthopyroxene is more abundant than clinopyroxene and both occur as large, well-formed crystals. In this run, glass is more common than crystals but in the 1,310° C run crystals are more abundant than glass and the small, equant or short, prismatic crystals of clinopyroxene are much more abundant than the distinctive large orthopyroxene laths. Spinel first appears in the 1,290° C run and remains a minor phase down to a temperature between 1,100° C and 1,180° C where garnet first appears.
Plagioclase does not appear in the olivine tholeiite until practically at the solidus at 1,250° C approximately (for the dry composition). In 1 hr and 3 hr runs at 1,220° C, the presence of minor amounts of glass and uncertainty in plagioclase identification are attributed to access of small amounts of water to the charge, resulting in depression of the solidus. The 3 hr run at 1,180° C showed appreciable plagioclase, but less than observed at 1,100° C — this could result from the presence of minor glass in the run or from increasing solubility of Al_2O_3 in the pyroxenes at higher temperatures. The replacement of the px + plag + spinel assemblage by px + plag + ga with decreasing temperature at 13.5 kb is matched by the same reactions with increasing pressure at 1,100° C (GREEN and RINGWOOD, 1967).
The liquidus phase in the olivine basalt at 1,330° C is also orthopyroxene but in this composition there is a much smaller temperature interval before appearance of the second phase, clinopyroxene. Definite primary clinopyroxene first appears at 1,310° C but in this run is less abundant than orthopyroxene. There is a marked increase in the degree of crystallization between 1,310° C and 1,290° C and in the latter run clinopyroxene is much more abundant than the orthopyroxene.
In the alkali olivine basalt composition, a run for 60 min at 1,290° C, 13.5 kb is very near the liquidus with a very few large euhedral crystals of both orthopyroxene and clinopyroxene. The composition of the glass used is given in Table 1. In a later series of runs, a new batch of glass of slightly different composition (normative olivine 28%; normative nepheline 3.1%; normative diopside 16.0%) was used for 30 min runs at 1,290° C to 1,310° C. In these runs it is difficult to distinguish fine-grained anhedral quench clinopyroxene from aggregates of fine-grained primary clinopyroxene. None of these runs contain large crystals of either orthopyroxene or clino- pyroxene but the 1,290° C and 1,300° C runs both contain uncommon medium-sized rectangular laths with straight extinction and very low birefringence which are probably orthopyroxene. These crystals have rims and outgrowths of quench clinopyroxene.

At 1,270° C and 1,250° C the alkali olivine basalt crystallizes to clinopyroxene and glass and orthopyroxene is not identifiable.

The picrite differs from the three compositions described above in that olivine and not pyroxene is the liquidus phase at 13.5 kb. The liquidus temperature was not established but is greater than 1,380° C. Orthopyroxene is the second phase to appear — it is present in a 40 minute run at 1,360° C but only olivine was observed in a 30 minute run at the same temperature. There is a rather abrupt increase in degree of crystallization between 1,360° C and 1,340° C and clinopyroxene is the major phase at 1,340° C. Olivine continues to remain stable with both the orthopyroxene and clinopyroxene down to at least 1,320° C. The roles of orthopyroxene and clinopyroxene in the picrite composition are similar to those in the olivine basalt composition in that orthopyroxene appears at the higher temperature but there is only a small temperature drop before the crystallization of abundant clinopyroxene.

e) Crystallization at 18 kb

In all compositions, except the alkali olivine basalt, the liquidus phase at 18 kb is the same as that observed at 13.5 kb. Orthopyroxene is the liquidus phase in the olivine tholeiite and olivine basalt composition but in the alkali olivine basalt composition, orthopyroxene does not appear at all at 18 kb and clinopyroxene is the liquidus phase. The temperature interval over which orthopyroxene alone co-exists with the liquid is much smaller at 18 kb than 13.5 kb in the olivine tholeiite and olivine basalt compositions.

The liquidus of the olivine tholeiite at 18 kb is about 1,430° C and orthopyroxene co-exists with liquid down to 1400° C or 1,410° C. At 1,400° C, 1,380° C and 1,375° C both pyroxenes form large crystals, in some cases showing parallel intergrowth of the two pyroxene types. In the lower temperature runs clinopyroxene is more abundant than the orthopyroxene and at 1,370° C orthopyroxene is not identifiable, the run consisting entirely of clinopyroxene + liquid. The disappearance of orthopyroxene at lower temperatures in the partial melting interval is analogous to the behaviour of the alkali olivine basalt at 13.5 kb. The runs at 18 kb differ from those at lower pressures in showing the appearance of garnet at temperatures above the solidus. Garnet first appears at 1,350° C and increases in abundance in lower temperature runs. The solidus at 18 kb is close to 1,300° C giving a partial melting or crystallization interval of about 130° C.

The behaviour of the olivine basalt at 18 kb is notable for the very small temperature interval over which crystallization and rapid changes in phase assemblages occur. The liquidus is at $1{,}350 \pm 10$° C and duplicate runs at 1,340° C both yielded orthopyroxene + liquid. At 1,335° C, the mineral assemblage consists of large primary orthopyroxene and primary clinopyroxene with liquid but at 1,330° C orthopyroxene is not present, the degree of crystallization is much greater and garnet appears as a minor phase with the abundant clinopyroxene. The solidus for this composition is near 1,300° C. The sequence of appearance of phases in the olivine basalt matches that observed in the olivine tholeiite but the different fields for the various phase assemblages are compressed into a melting interval of about 50° C.

The liquidus of the alkali olivine basalt at 18 kb is at 1,325° C approximately. The rare clinopyroxenes present in the 1,320° C run are large and well crystallized but there is an abrupt increase in the degree of crystallization between 1,320° C and 1,300° C. Clinopyroxene is the only primary crystalline phase present in the 1300° C run but garnet is moderately common at 1,250° C.

In the picrite composition, olivine is still the liquidus phase at 18 kb and is joined by orthopyroxene in the 1,410° C and 1,400° C runs. In these runs there is no definite identification of primary clinopyroxene but this becomes a major phase and orthopyroxene disappears in the 1,390° C and 1,370° C runs. Minor garnet first appears in a near-solidus run at 1,350° C Unlike orthopyroxene, olivine persists as a stable phase right through to the subsolidus assemblage.

f) Crystallization at 22.5 kb

At 22.5 kb, clinopyroxene is the liquidus phase in both the olivine tholeiite and the picrite compositions. No runs have been carried out at this pressure on either the alkali olivine basalt or olivine basalt compositions. In the olivine tholeiite composition, the amount of clino-