quartz, plagioclase and mica, has a grossular content comparable with the natural garnets, but the almandine content is high and the pyrope content is low when compared with the natural garnets. This is illustrated in Fig. 1, where triangular plots of the garnet end members of the natural and experimental garnets are given.

Thus the major discrepancy in composition is the higher grossular content in the garnet obtained experimentally when compared with the natural garnets. It is important to note that the compositions of the garnets crystallizing at 18 kb showed a decrease in grossular content with decreasing degree of crystallization. The grossular content of the garnet well below the solidus is significantly higher where garnet crystallizes in conjunction with other calcium-bearing phases (e.g. clinopyroxene or amphibole). Also there is a probable trend of increasing grossular content with increasing pressure, for constant degrees of crystallization (as observed in other calc-alkaline compositions at high pressure, T. H. GREEN and RINGWOOD (1968). At 9 kb the rare garnet observed occurs well below the liquidus and it is not a near-liquidus phase. Hence at some pressure less than 18 kb but greater than 9 kb, garnets with composition corresponding to the natural garnets (particularly in grossular content) will probably form on the liquidus of the rhyodacite II composition.

Conclusions

From this study of natural garnet phenocrysts in calc-alkaline rocks of Victoria, we conclude that these garnets crystallized directly from the calc-alkaline magma at an early stage of its crystallization, then at a later stage became out of equilibrium with the magma and began to react to cordierite and hypersthene. The experimental investigation of the stability and composition of almandine-rich garnet occurring as a liquidus phase in the natural rhyodacite at high pressure demonstrates that garnets with the same composition as the natural garnets, may in fact crystallize from the rhyodacite as a near-liquidus phase at pressures greater than 9 kb but less than 18 kb, for conditions of $P_{H_2O} < P_{LOAD}$. These results support the interpretation that the garnet phenocrysts represent early crystallization of rhyodacite magma at great depth (e.g. at the base of the crust or in the upper mantle). The cordierite-hypersthene reaction rim represents a low pressure-high temperature equilibrium assemblage.

The liquidus temperature and nature of the liquidus phase will be governed to an important degree by the P_{H_2O}. In a relatively dry magma ($P_{H_2O} \ll P_{LOAD}$) the liquidus temperature will be higher, and a higher pressure will be necessary to obtain garnet as a near-liquidus phase. In such cases, near-liquidus garnet phenocrysts will only form at mantle depths, even in continental areas. This may well be true for the Victorian calc-alkaline garnet-bearing rocks, since HILLS (1959) believed that the magmas were relatively dry and must have commenced crystallization at a high temperature. The reverse will hold true for a very wet magma and garnet may then form at lower crustal pressures. If the magma has a high P_{H_2O} amphibole, not garnet, may appear on the liquidus. Thus for any particular acid calc-alkaline composition there is a limited range of pressure and temperature (depending on the P_{H_2O}) over which garnet may form as a near-liquidus phase.

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