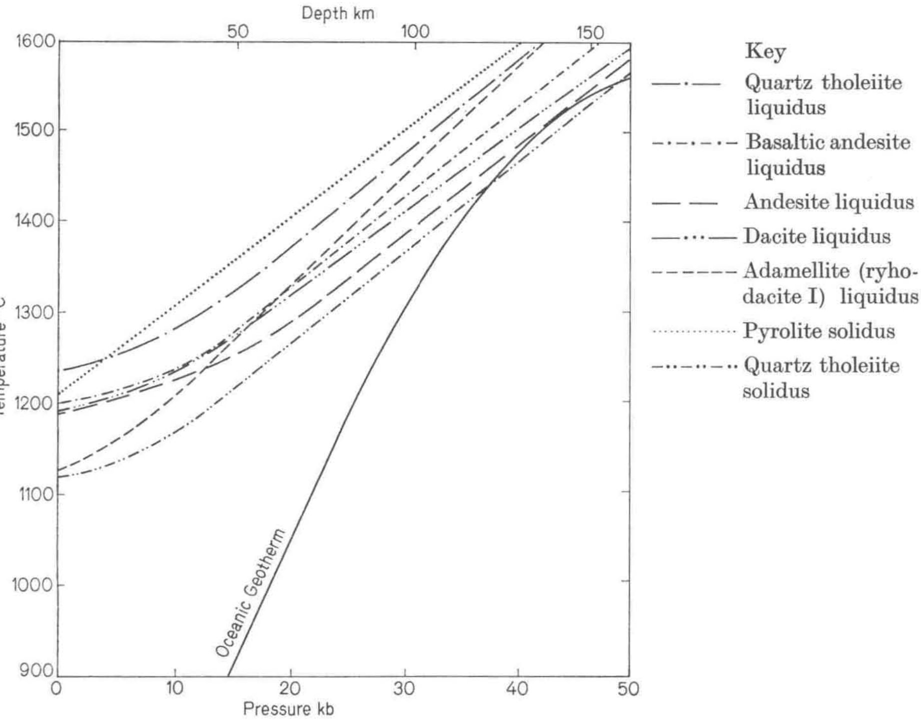

Fig. 7. Combined liquidi plot for the compositions studied under dry conditions

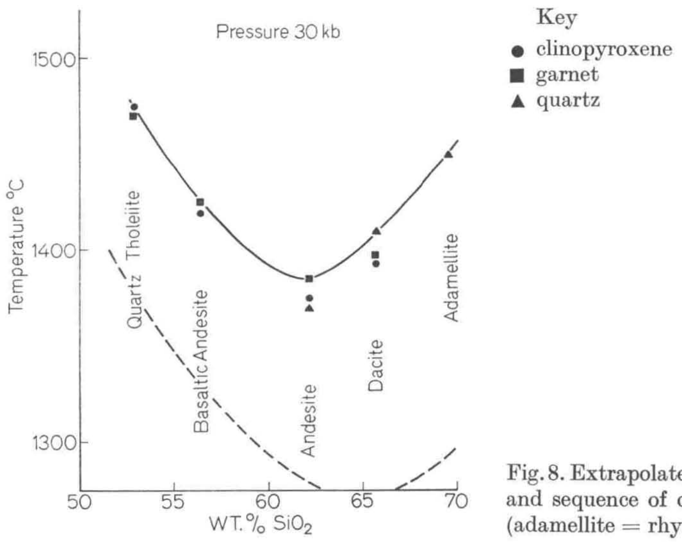

Fig. 8. Extrapolated liquidus temperatures and sequence of crystallization at 30 kb (adamellite = rhyodacite I)

the liquids formed from basaltic compositions by the fractional crystallization of garnet and pyroxene follow the calc-alkali trend (see Tables 16—20 and Figs. 10 and 11).

The results have been discussed above in terms of fractional crystallization at high pressure. However the same observations apply to the reverse case of fractional melting of a basaltic composition at high pressures where the sub-solidus mineral assemblage consists of garnet, pyroxene and quartz. It is envisaged that varying degrees of fractional melting can give rise to liquids of typical calc-alkaline descent, e.g. basaltic andesite and andesite. The residuum is composed of varying proportions of garnet and clinopyroxene, depending on the degree of melting. Thus at depths of 100—150 kms if the temperature is sufficiently

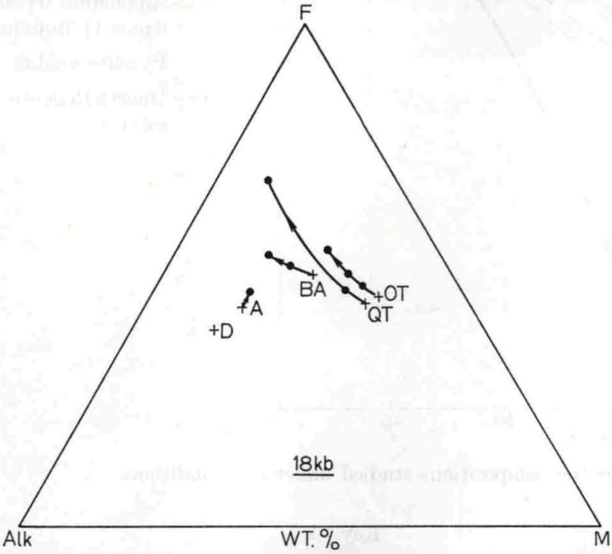

Fig. 9. Experimentally determined fractionation trends at 18 kb shown on an FMA plot Note: In this and subsequent FMA diagrams: $F = FeO + 0.9\ Fe_2O_3$; $M = MgO$; $Alk = Na_2O + K_2O$; OT = high-alumina olivine tholeiite; QT = high-alumina quartz tholeiite; BA = basaltic andesite; A = andesite; D = dacite

high for partial melting of the tholeiite to take place under dry conditions, the early forming liquid will trend towards an andesitic composition rather than more acid compositions. The degree of melting will to some extent govern the Fe/Mg ratio of the liquids obtained, since the Fe/Mg ratio of the garnet and clinopyroxene (as well as the relative proportions of garnet and clinopyroxene) varies with temperature. Thus a family of compositions with some variation in Fe/Mg ratio, but nevertheless still with an overall calc-alkali trend showing only slight iron enrichment relative to magnesium, may be obtained by the fractional melting of basalt under dry conditions at high pressure. For degrees of melting less than those required to produce andesite (40—50% melting), but nevertheless still large enough to allow magma segregation (probably at least 20% melting required), the liquids produced will be enriched in alkalies, but not silica, for dry melting conditions. These alkali-enriched liquids may have affinities with some over-saturated syenites found associated with calc-alkaline rocks (Joplin, 1965). The residuum remaining after derivation of such compositions will consist mainly of garnet and pyroxene, together with some quartz.