melting curves. When less fluid is present, the position of a melting curve depends on the amount of fluid and on the amount of melt, for those factors determine the amount of H_2O in the melt.

In certain instances, this diagram may be applied to natural rocks. For instance, fluid inclusions effectively sample the subsolidus fluid phase, which on the diagram (and often in analyzed rocks) is 50 mole percent CO_2. If we could estimate the amount of fluid relative to rock, we could then deduce phase relations, melting temperatures, and fluid-phase composition in the hypersolidus region. Alternatively, inference of position of the melting curves from phenocryst assemblages could allow an estimate of the amount of fluid phase present.

Andesite Generation

Experiments and theory developed in this paper set limits on mechanisms for andesite generation by fractionation at pressures less than 10 kb, that is, in the crust and shallow upper mantle. Fractionation of basalt parents by plagioclase-pyroxene-oxide phase subtraction is unlikely because of the instability of oxide phases at the liquidus of andesite melt at reasonable geologic conditions. Fractionation by subtraction of amphibole is also unlikely, because in two separate andesites studied, amphibole is not stable at the liquidus below 8 kb and is not stable at the liquidus in H_2O–undersaturated melts at pressures to 10 kb. (The effect of other volatiles, particularly fluorine, has not been investigated and may be large.)

Partial melting at greater depths in the upper mantle, either of subducted basaltic oceanic floor or of peridotite, is a more reasonable mechanism. Such melts must be hydrous, both to produce requisite andesitic compositions (Kushiro, 1972), and because andesite melts can be shown to contain small but significant amounts of H_2O (Eggler, 1972a). The water content of initial melts should be estimated, for it provides one more clue to the nature of the upper mantle.

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