

Fig. 2. Form of the vapor pressure curve of tremolite. The numbers must be considered very approximate because of the distance of some extrapolations involved

These boundaries give a fix on the free energies of these separate reactions and hence, by addition, $\Delta G_1 + \Delta G_2$ gives the ΔG_3 of the reaction:



Using data from GREEN and RINGWOOD (1966) and YODER and TILLEY (1962); at 900° C, reaction (1) is in equilibrium at about 1 kb (water pressure) and reaction (2) at 15 kb (total pressure). Assuming that the water content of an amphibolite is about 2% and densities of 3.42 (E), 2.96 (B) and 2.99 (A), then based on 100 g of amphibolite, $\Delta G_{(3)}$ is about 1350 cal at 900° C and 1 kb. From this figure and thermodynamic data for water of SHARP (1962), reaction (3) will be in equilibrium at about 35 kb (water pressure) at 900° C. The estimate is very approximate but can hardly be in error by as much as 15 kb which would be necessary to accomodate ESSENE and FYFE's positive boundary.

It is interesting to note that for the comparable reaction



the phase diagram must be about as shown in Fig. 2. This type of diagram is probably general for all known mineral hydrates if we consider lower crust and upper mantle pressures, and obviously has bearing on water in the deeper portions of the earth.

In Fig. 3 we give a schematic diagram for some phase relations in the basalt-water system.

Line X-Y is the basalt-eclogite transition line of GREEN and RINGWOOD.

Curve C-D is the amphibolite-basalt transition of TILLEY and YODER.

Line D-Z is the calculated amphibolite-eclogite transition.

Curve F-G-H is the beginning of melting curve of basalt with excess water.

Portion F-G is based on YODER and TILLEY; portion G-H is based on data of LAMBERT and WYLLIE (1968).

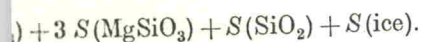
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Form of phase relations between amphibolite (A), basalts (B) and eclogites (E) proposed by ESSENE and FYFE (1967). Melting phenomena have been ignored

any of the above reaction could have occurred at moderate pressures. This would lead to the $A \rightarrow E$ boundary would be in accord with the diagram.

Experimental study of the $A \rightarrow E$ boundary is which indicates that ESSENE and FYFE'S

is rather low on the additivity model (3) compared to pyroxenes. Thus, if we take the entropy of tremolite by adding



$$8.66 + 98.8 + 9.6 \text{ e.u.}$$

e.u., considerably lower than the amphibolites, then ESSENE and FYFE'S estimate is unlikely. The boundary between amphibolite and eclogite is negative in slope and continues to go to higher temperatures.

Approximately the positions of the boundaries

(eclogite) \rightarrow basalt + water



\rightarrow eclogite

