

Fig. 1.  $P, T$  diagram for crystallization of andesite under anhydrous conditions (in this and subsequent  $P, T$  diagrams (1-4) solid points represent experimental runs, dashed lines the approximate phase boundaries, solid lines the liquidus and in Fig. 1 the dotted line denotes the approximate solidus. Abbreviations: *L* liquid; *plag* plagioclase; *cpx* clinopyroxene; *qtz* quartz; *coes* coesite; *ga* garnet; *amph* amphibole

Noteworthy features are as follows:

1. There is marked depression of the liquidus with the addition of water. This effect is most pronounced for the first small quantities of water added, e.g. the depression caused by the first 2% of water added is similar to the depression caused by the increase of water present from 5 to 10% by weight. This effect is clearly illustrated in Fig. 5. A separate vapour phase was identified in runs a few degrees below the liquidus at 9 kb with 10% of water present, but the composition was never saturated with water at the liquidus for the pressure range and water contents used in this study.

2. The liquidus phase changes with increasing water content. It is clinopyroxene between 18 and 36 kb (anhydrous), clinopyroxene between 9 and 27 kb (5%  $H_2O$ ) with garnet from 27 to 36 kb (5%  $H_2O$ ), and finally clinopyroxene between 9 and 22 kb (10%  $H_2O$ ) with garnet from 22 to 36 kb (10%  $H_2O$ ).

3. The appearance of quartz (or coesite) in the crystallization interval is markedly depressed below the liquidus at high pressures as water is added to the composition (see Fig. 6), e.g. at 36 kb quartz is present at  $<30^\circ C$  below the liquidus (anhydrous),  $250^\circ C$  below the liquidus (5%  $H_2O$ ) and about  $350^\circ C$  below the liquidus (10%  $H_2O$ ).

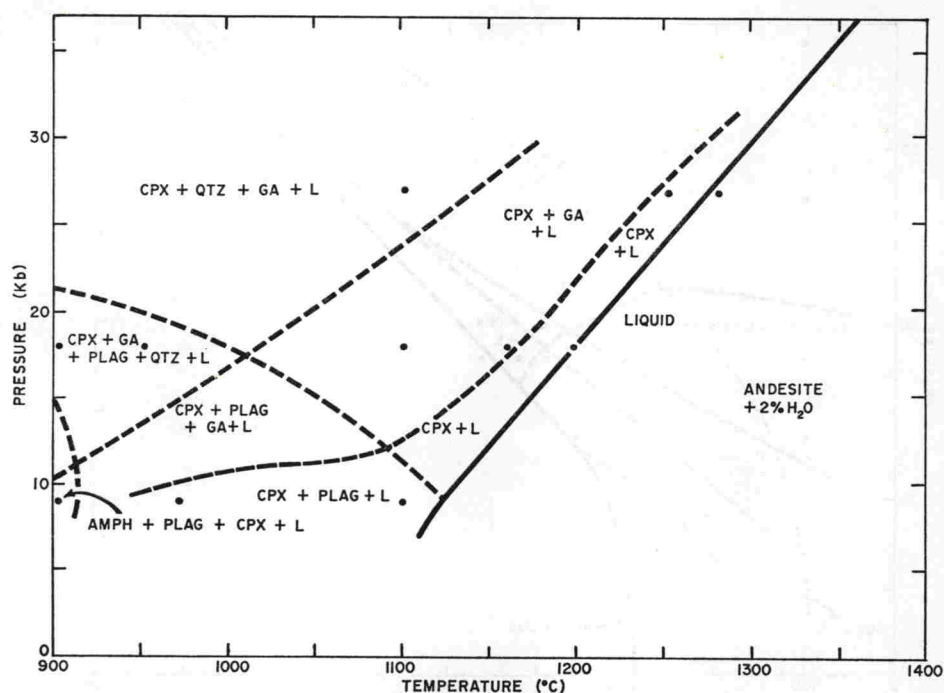


Fig. 2.  $P, T$  diagram for crystallization of andesite + 2% by weight of water

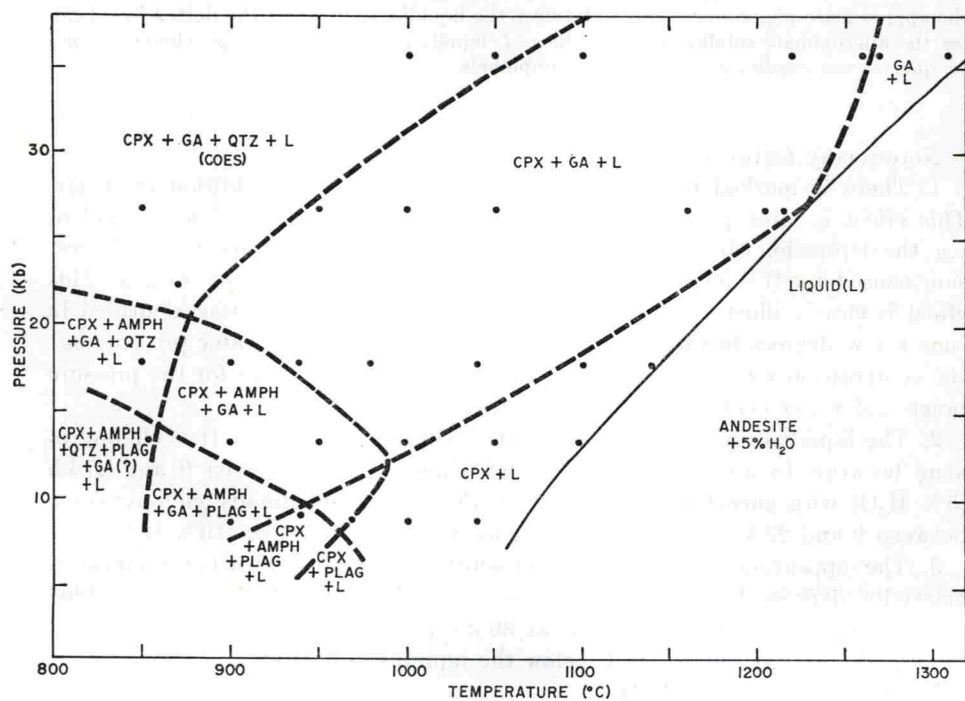


Fig. 3.  $P, T$  diagram for crystallization of andesite + 5% by weight of water