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89.304 - IGNEOUS & METAMORPHIC PETROLOGY
WATER IN MAGMAS

1. If a magma that initially contains 2 wt.% H_2O crystallizes only quartz and alkali feldspar, calculate the percent crystallization at which it will reach a saturation level of 10 wt.% H_2O.

2. Calculate the percent crystallization required for a granitic magma that contains 2 wt.% H_2O to reach the water saturation value of 10 wt.% H_2O. The crystallizing mineral assemblage consists of 80 wt.% quartz and 20 wt.% muscovite (the muscovite contains 4.2 wt.% H_2O).

3. a. A granitic magma that initially contains 2 wt.% H_2O crystallizes only quartz and alkali feldspar during the first 50% of its crystallization. It then crystallizes a mixture of quartz, alkali feldspar, and hornblende that contains an average of 1 wt.% H_2O. Calculate the percent of solidification required to reach a saturation level of 10 wt.% H_2O.

b. A granitic magma that initially contains 2 wt.% H_2O crystallizes phenocrysts of biotite containing 3.5 wt.% H_2O. After 20% crystallization quartz and alkali feldspar join the biotite, and the crystallizing phases now contain only 0.1 wt.% H_2O. Draw a graph of the concentration of H_2O in the magma as a function of the degree of crystallization and determine the degree of crystallization at which the magma reaches a saturation value of 10 wt.% H_2O.

c. By comparing the answers to part (a) and (b), discuss the significance of early versus late crystallization of hydrous phases on the development of water saturated magmas.