GY-343 Petrology Exercise
Binary Phase Diagrams

Phase Diagram Exercise for Binary Systems

Problem 1. Figure 1 is the binary phase diagram for the Anorthite-Diopside system. With this diagram calculate the following assuming equilibrium crystallization:

Composition X	%Melt	Comp. of Melt ($\%CaMgSi_2O_6$ $+\%CaAl_2Si_2O_8$)	%Solid	Comp. Solid (%Di+%An)
T = 1600	_____	_____	_____	_____
T = 1400	_____	_____	_____	_____
T = 1270	_____	_____	_____	_____
T = 1250	_____	_____	_____	_____

With the above data, draw a picture of a pluton that would result from the crystallization of composition X under fractional crystallization conditions. Use labels to clearly label mineral percentages in different portions of the pluton. Use lines to separate portions of the pluton where significant changes in mineral percentages (and therefore rock type) occur. The division lines between the various rock types should reflect the relative percentage of rock types as determined from the crystallization history.

Composition Y	%Melt	Comp. of Melt ($\%CaMgSi_2O_6$+ $\%CaAl_2Si_2O_8$)	%Solid	Comp. Solid (%Di+%An)
T = 1600	_____	_____	_____	_____
T = 1350	_____	_____	_____	_____
T = 1270	_____	_____	_____	_____
T = 1250	_____	_____	_____	_____

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Problem 2. Figure 2 is a 2-component phase diagram that contains a eutectic and peritectic invariant point. Solve for the following assuming equilibrium crystallization:

Composition X	%Melt	Comp. of Melt ($\%Mg_2SiO_4+\%SiO_2$)	%Solid	Comp. Solid (%Fo+%En+%Cr)
T = 1900	_____	_____	_____	_____
T = 1570	_____	_____	_____	_____
T = 1550	_____	_____	_____	_____
T = 1530	_____	_____	_____	_____
Composition Y				
T = 1900	_____	_____	_____	_____
T = 1800	_____	_____	_____	_____
T = 1570	_____	_____	_____	_____
T = 1550	_____	_____	_____	_____
Composition Z				
T = 1900	_____	_____	_____	_____
T = 1550	_____	_____	_____	_____
T = 1530	_____	_____	_____	_____

For composition X, lowering of the temperature from 1570°C to 1550°C changed the state of the magma chamber dramatically. Describe what must have happened at the peritectic invariant point when the temperature was lowered by this relatively small increment.

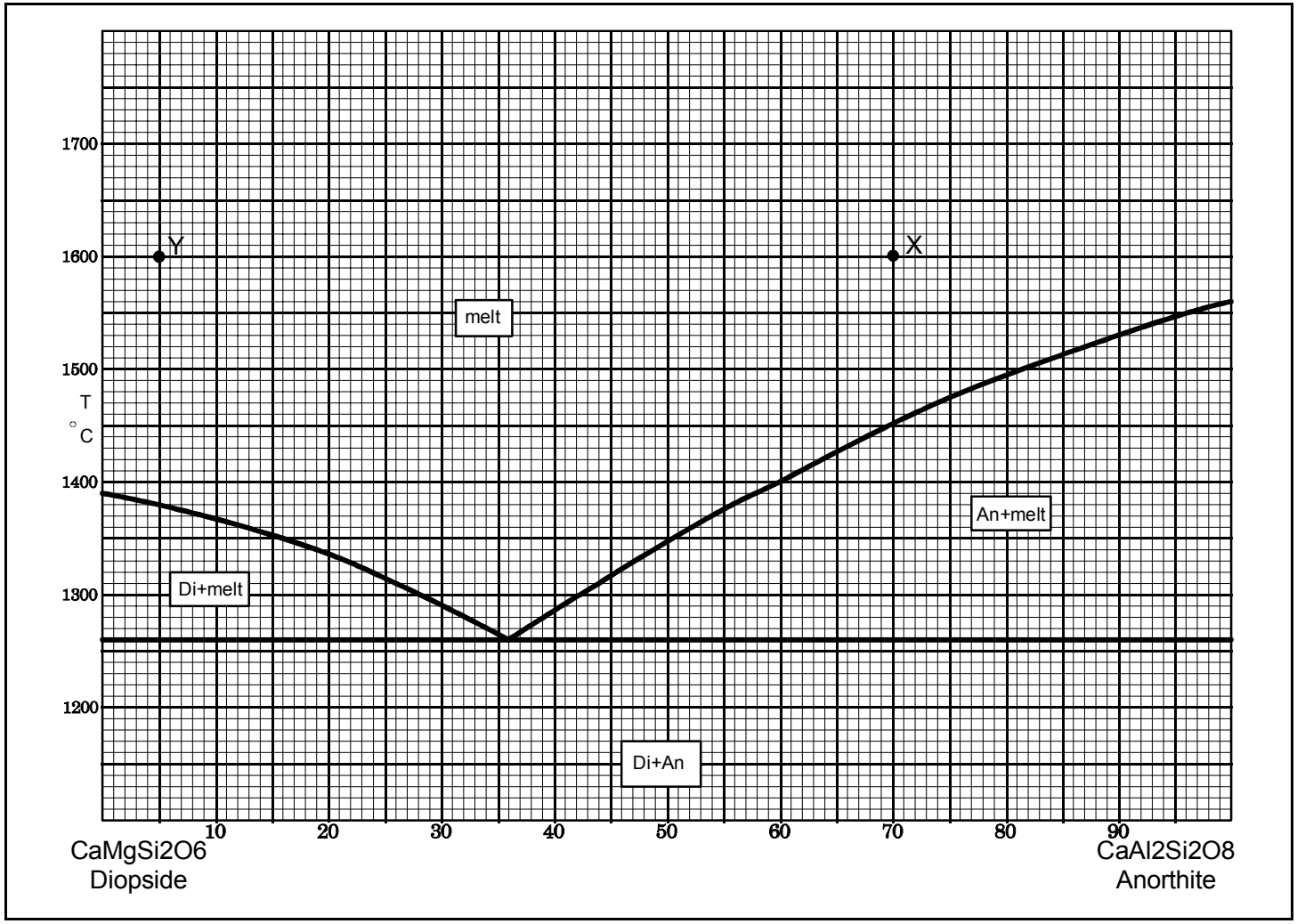

Figure 1. Phase diagram for Problem 1.

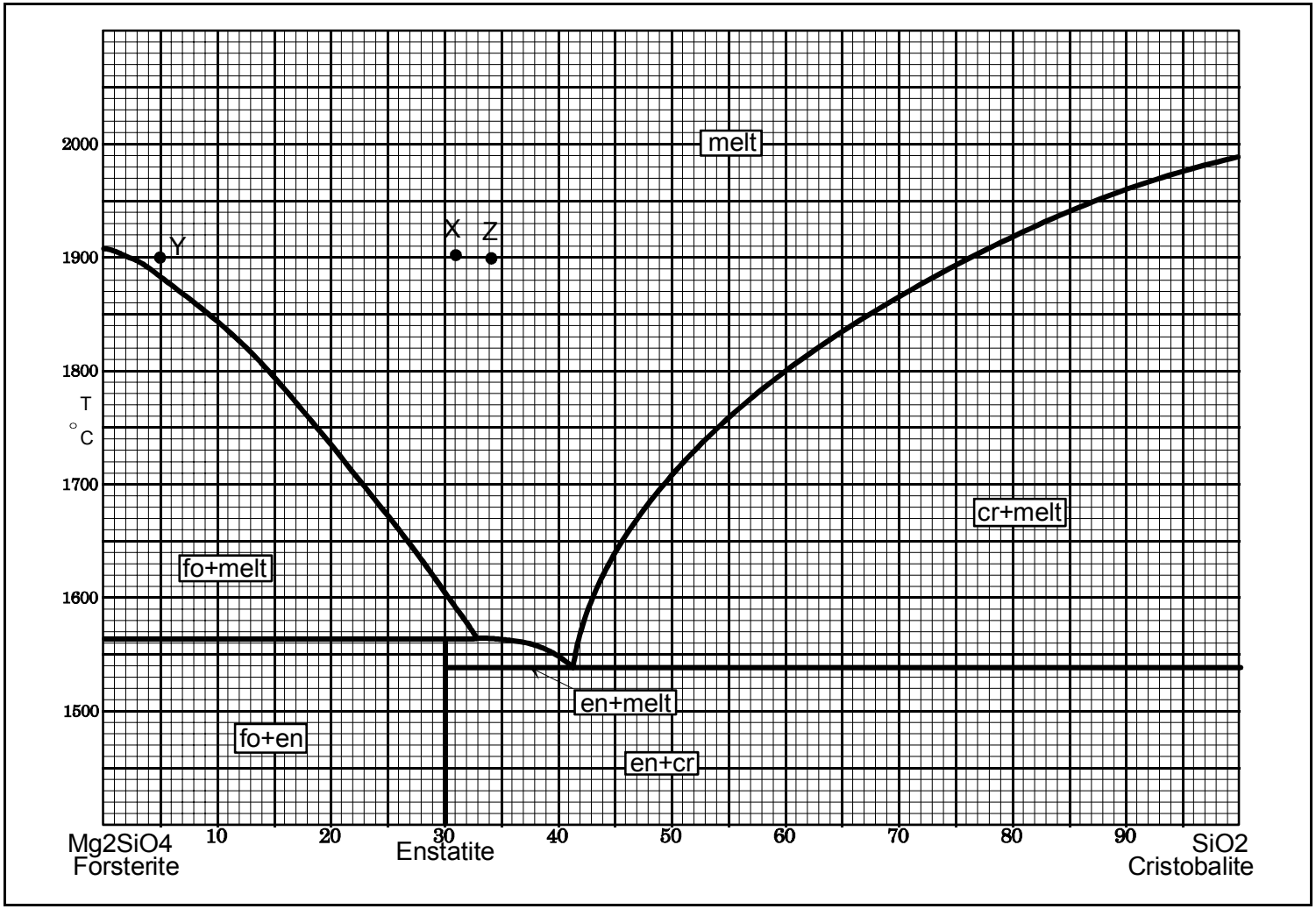

Figure 2. Phase diagram for Problem 2.