QUIZ 8 – 28 & 29

1) In the metamorphism of mafic rocks, ACF diagrams like that to the left is commonly used to portray equilibrium mineral assemblages for a particular P & T. For the metamorphism of pelitic rocks, this diagram is inappropriate and instead AKF diagrams, like that to the right, are used. (1.5 pts)

A) What is it about the compositions of these rocks that would make the C component more appropriate for mafic rocks and the K component more appropriate for pelitic rocks?

Ca is more abundant in mafic rocks; K is more abundant in pelitic rocks

B) The F component stands for Fe + Mg; in which rock type would Mg be more abundant?

Mafic rocks

C) What would be the main aluminum-bearing mineral type in pelitic sedimentary rocks?

Clay

2) Answer the following questions regarding the KFMASH petrogenetic grid for pelitic rocks below.
A) For the medium P/T field gradient, what reaction # would represent the biotite(Bt)-in isograd? 2; the garnet(Grt)-in isograd? 4; the staurolite(St)-in isograd? 5; the garnet-out isograd? 7; the sillimanite(Sil)-in isograd? 10 (2.5 pts)

B) Which field gradient would you most likely andalusite (And)? Low P/T; staurolite (St)? Med P/T; Mg-chloritoid (Mg-Cld)? High P/T (.75 pts)

C) Shade the P-T area where garnet (Gtr & Alm) will be stable (.25 pt) Poor Question- ignore

3) What will be the equilibrium phases for pelitic rocks with compositions A, B, and C under the two metamorphic conditions X and Y shown above? (2 Pts)
   X Conditions A: Prl+Chl+Ms(phengite), B: Chl+Ms(phengite), C: Chl+Ms(phengite),
   Y Conditions A: Cld + Chl + Ms, B: Chl + Ms C: Bt + Chl + Ms

4) What will be the mineral assemblages with the progressive high P/T metamorphism of a pelitic rock with a composition corresponding to the center of the open circle? (1.5 pts)
   a) Cld + Ky + Chl    b) Cld + Tlc + Bt    c) Cld + Ky + Bt
5) Write simple mineral reactions for phase transitions (no need to include H₂O or CO₂) between successive CMS-HC diagrams portraying the progressive metamorphism of calcareous rocks (2.5 pts)

\[ a \rightarrow b \quad \text{Dol} + \text{Qtz} = \text{Tlc} + \text{Cal} \]

\[ b \rightarrow c \quad \text{Cal} + \text{Tlc} + \text{Qtz} = \text{Tr} \]

\[ c \rightarrow d \quad \text{Tlc} + \text{Cal} = \text{Tr} + \text{Dol} \]

\[ d \rightarrow e \quad \text{Tr} + \text{Cal} + \text{Qtz} = \text{Di} \]

6) The arrowed curve that progresses from \( X_{\text{CO}_2} = 0.5 \) to pt C corresponds to the path of a calcareous with a fluid internally buffered by metamorphic reactions. Answer the following questions about this path. (2.5 pts)

A) At invariant point A, what 5 phases are in equilibrium? \( \text{Tr} + \text{Cal} + \text{Dol} + \text{Qtz} + \text{Tlc} \)

B) Leaving point A to decreasing \( X_{\text{CO}_2} \) requires which phase to be lost? \( \text{Qtz} \)

C) Which phase would have to be lost for the reaction path to head toward B instead? \( \text{Tlc} \)

D) Why would \( X_{\text{CO}_2} \) increase along this path? Because CO₂ is being released as \( \text{Dol} + \text{Qtz} \rightarrow \text{Tr} + \text{Cal} \)
7A) What is the reaction represented by the tie-line flip in this diagram? (0.5 pt)

\[ \text{Gt+Chl} = \text{Bt} + \text{St} \]

2) What would be the equilibrium mineral assemblages for points B and E before and after the reaction. (1 pt)

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<th>Before</th>
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<tbody>
<tr>
<td>B</td>
<td>Gt+Chl+St</td>
<td>Grt+St+Bt</td>
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<tr>
<td>E</td>
<td>Chl+Bt</td>
<td>Chl+Bt</td>
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