THERMOCALC Workshop 2001:
Calculating Metamorphic Phase Equilibria

Practical 2

1. Consider the the KFMASH (+ q + ksp) system involving biotite (bi), sillimanite (sill), garnet (g), cordierite (cd), and silicate melt (liq). For an "average pelite" bulk composition, the amphibolite to granulite facies reaction in this system, bi + sill = g + cd + liq, would be expected to be "seen" over at least part of its length, so we will look at that. The datafile to use is "th dp4". Run this reaction between say 4 and 8.5 kbar, and see how it is "seen" (indicated by modal information being given) only in a part of its length. This is hardly surprising given how quickly the Fe-Mg of the minerals ("x") change with pressure along the reaction.

   Look at the modal information and sketch in PT which divariants abut the univariant on each side. Note that THERMOCALChas got the modal information the wrong way around for this univariant (not low-T, then high-T). Now work out which trivariants are involved at the ends of the "seen" part of the univariant, and along each side of it. Now calculate the divariant-trivariant boundaries that are involved, and sketch what the pseudesection looks like. Now add the information to the DRAWPD datafile "dr dp4", specifying the part of each line that should be drawn.

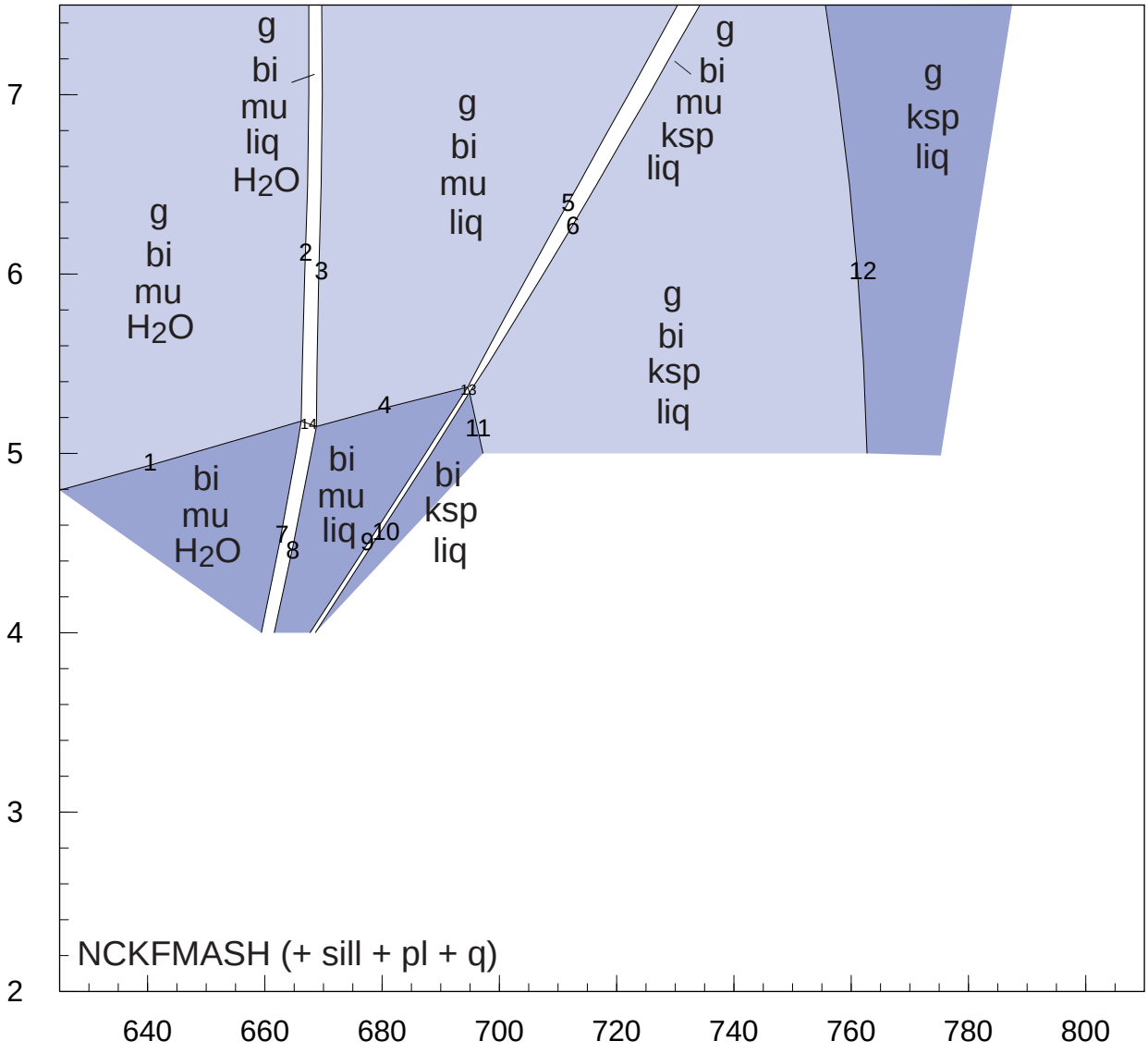
2. Consider the NCKFMASH (+ q + pl) system involving muscovite (mu), biotite (bi), garnet (g), cordierite (cd), orthopyroxene (opx), sillimanite (sill), alkali feldpar (ksp), silicate melt (liq) and H_2O fluid (H_2O). Use THERMOCALC datafile "th dp5" which include a bulk composition for an aluminous pelite . The construction of this pseudosection has been started: the DRAWPD datafile so far is in "dr dp5" and the resulting Illustrator file (with the u numbers on the lines) is Fig 1. The invariant points are i1 to i4 from left to right on the Figure.

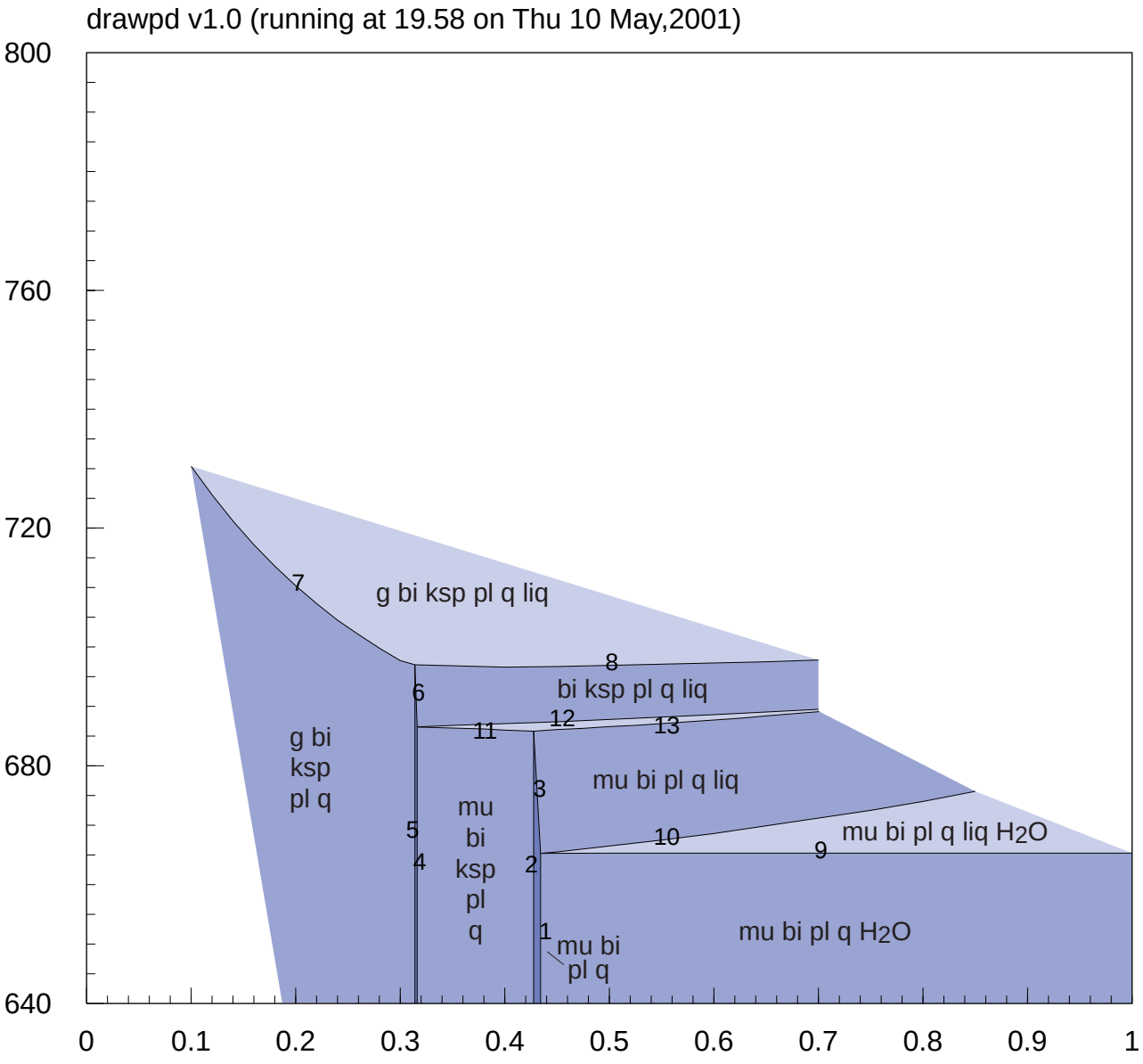
   Fill out the rest of the pseudosection. You might need to calculate lines u7 to u12 to their full extent to lower pressure... It may be useful to look at Fig 2, the equivalent diagram for an "average pelite" (so one less aluminous than that in "th dp5"), even though it is rather more complicated than the diagram you are calculating.

3. Continuing with the aluminous pelite of Q2 in NCKFMASH (+ q + pl) with the same phases, we now wish to see the dependence of the mineral equilibria on the amount of H_2O in the bulk composition. The bulk composition used in Q2 included just enough H_2O for the mineral assemblages at higher P to be saturated at the solidus. The construction of a $T-x$ pseudosection at 5 kbar involving a range of H_2O content has been started: the DRAWPD datafile so far is in "dr dp6" and the resulting Illustrator file (with the u numbers on the lines) is Fig 2. The datafile to use is "th dp6". The invariant points are i1 to i4 with increasing T on the Figure. Fill out the rest of the pseudosection.

4. Only for the masochists, the high H_2O end of the divariant at about 735°C in this last question is quite difficult. It is (deliberately) just off window to higher H_2O content in that question. Can you sort it out? The datafile to use is "th dp6h" (in which now plagioclase is not "in excess"—as it melts out in this vicinity). The range of H_2O content in the datafile is wider than in "th dp6" so the topology can be investigated.

drawpd v1.0 (running at 17.43 on Thu 10 May,2001)




drawpd v1.0 (running at 19.58 on Thu 10 May,2001)
800
760
720
680
640
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
7
g bi ksp pl q liq
8
bi ksp pl q liq
6
11
12
13
g bi
ksp
pl q
mu bi pl q liq
3
mu
bi
ksp
pl
q
5
4
10
9
mu bi pl q liq H2O
2
1
mu bi
pl q
mu bi pl q H2O