Mineral assemblages & AFM diagrams

Modified from C. Tom Foster and Lukas Baumgartner, Rev: July 2011

Objective

The objective of this lab is discover the wide variety of mineral assemblages that are possible at the same pressure and temperature (PT) conditions. For this lab, we'll be working with a sequence of metamorphic AFM (or Thompson) diagrams, a pelitic petrogenic grid, and a group of thin sections.

Pre-lab

Complete this portion prior to the start of lab:

- The following mineral assemblages were found at a contiguous outcrop; determine the appropriate PT conditions using the provided AFM diagrams:
  - Kyanite + staurolite + chlorite + muscovite + quartz
  - Chloritoid + chlorite + staurolite + muscovite + quartz
  - Chloritoid + chlorite + biotite + muscovite + quartz
  - Chloritoid + garnet + biotite + muscovite + quartz
  - Chlorite + biotite + muscovite + quartz
- Draw a sketch of the appropriate PT field and label each line bordering the region with reaction it represents
- Reflection questions:
  - What assumptions did you make in order to determine the appropriate PT field?
  - Under what circumstances is it inappropriate to plot a mineral assemblage on an AFM diagram?
- Bring your optical mineralogy notes on common metamorphic minerals with you to lab

Lab

There are 11 thin sections labeled 03MI__ (4-7, 11-13, 17, 18a&b, 20) in our lab. Scans of the thin sections are located online in the Adula folder and are only meant as an aide, not to replace time spent examining the thin sections with a microscope.

For each thin section:

- Determine the minerals present
- (you do not need to determine mode or textural relationships at this time)
- hint: they're pelitic rocks from the same metamorphic region, so the minerals should overlap from one slide to another
- from the mineral assemblage, determine which triangles on the AFM handout are possibilities for this thin section

For the thin sections as a whole:

- narrow down the pressure-temperature appropriate triangle(s) and determine what the pressure & temperature boundaries are based on the petrogenic grid handed out

- record the boundaries by drawing the appropriate field(s) and labeling each corner with an approximate P & T

Reflection questions

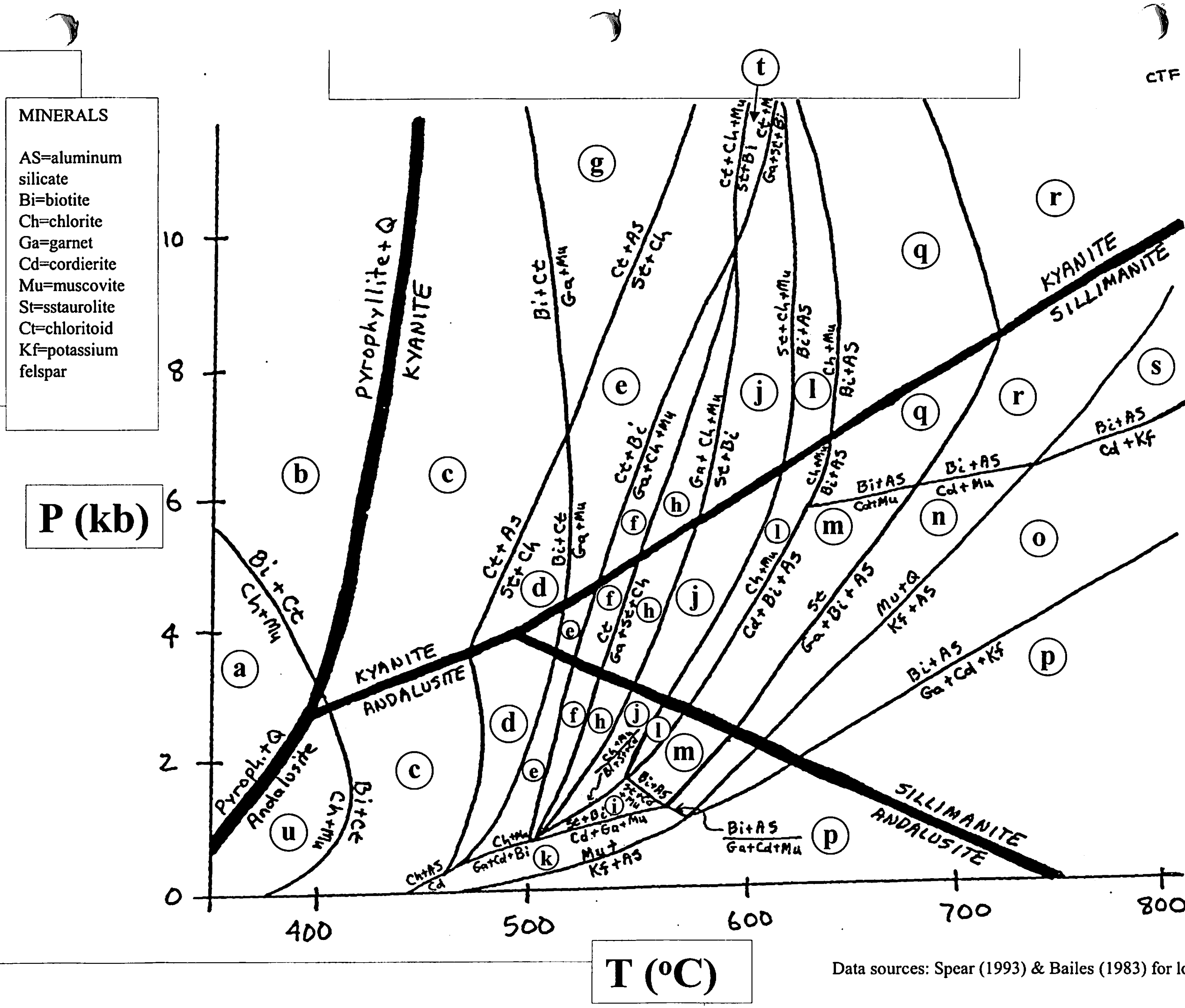
- Compare and contrast which minerals are more useful in narrowing down the possible PT field
- What other data could you collect from these things sections? Would any of that data help in narrowing down the PT conditions?

What you should turn in

- Typed answers to the prelab questions plus a drawing of the prelab appropriate PT field
- typed list of the minerals within each thin section (or you can make an excel spreadsheet like the one below)
- which triangles are appropriate for each thin section
- drawing of the narrowed down PT field with the corners labeled and each reaction line labeled

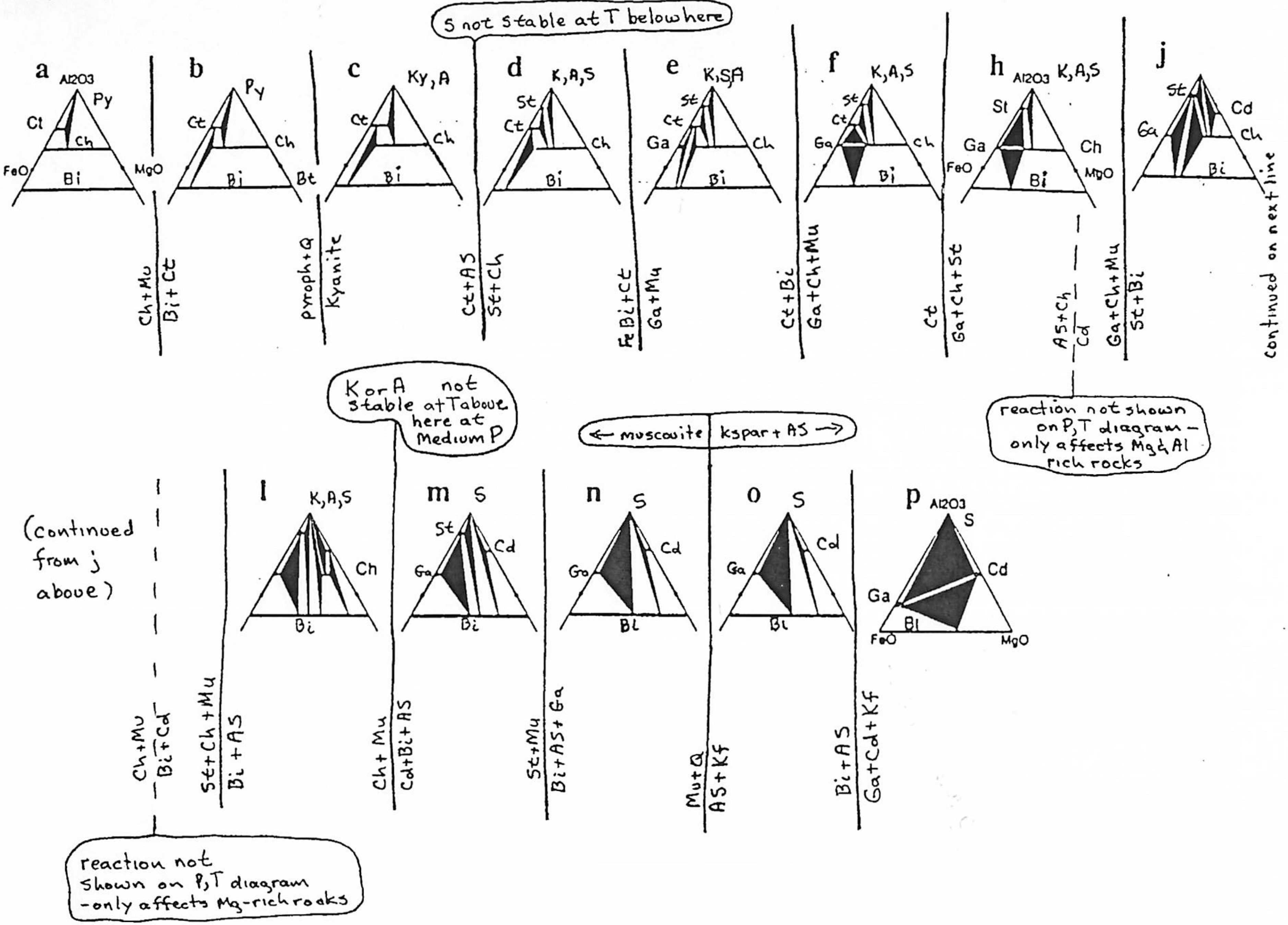
Example chart:

	03MI4	03MI5	03MI6	O3MI7
Mineral A	X		X	X
Mineral B		X	X	
Mineral C			X	X
Appropriate triangles	C, D, E, F, H, K	D, E, H, K	C, D, H, K	D, F, K



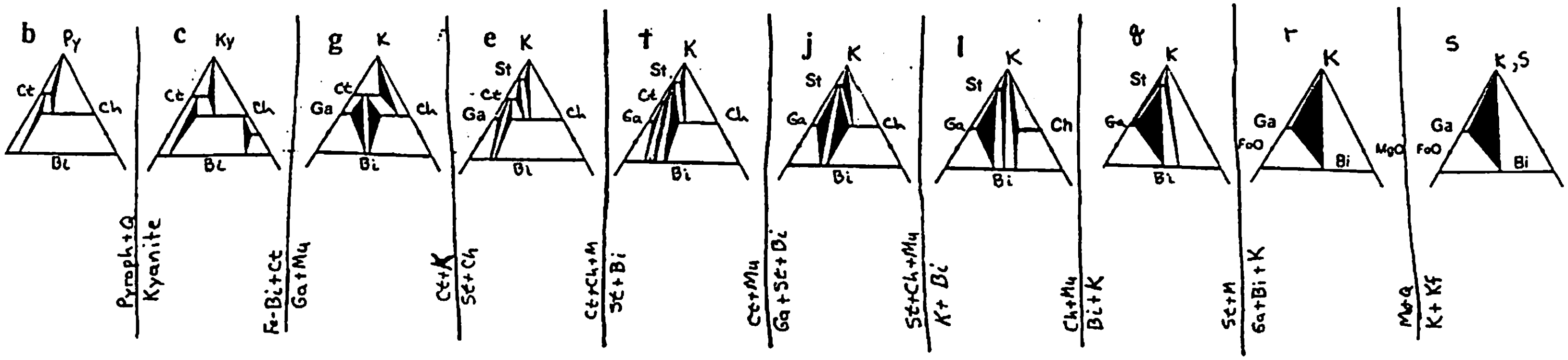
Data sources: Spear (1993) & Bailes (1983) for low P

Medium Pressure (2 to 6 kb) Mineral Assemblages & Reactions in Pelites



High Pressure (~10kb) Pelitic Mineral Assemblages & Reactions

Kyanite is predominant AS, Never Andalusite, Sillimanite only at very high T



Low Pressure (~1kb) Pelitic Mineral Assemblages & Reactions

Andalusite is predominant AS