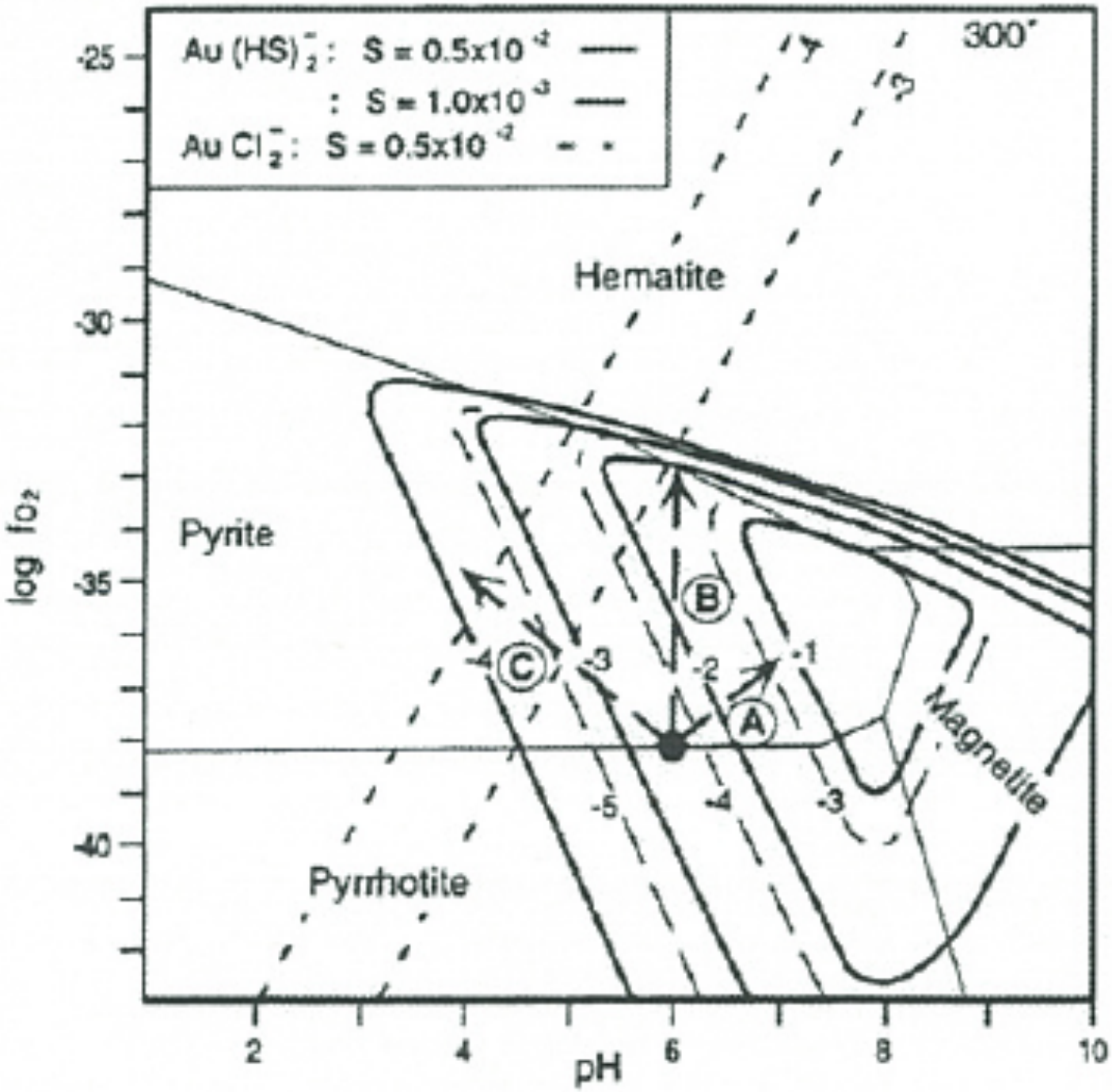
# Gold Solubility




Gold solubility as $HS^-$ and $Cl^-$ complexes as a function of pH, $fo_2$ and S (modified from Seward 1982; Brown 1986).

A: boiling

B: Mixing with oxygenated fluids

C: Mixing with low pH fluids

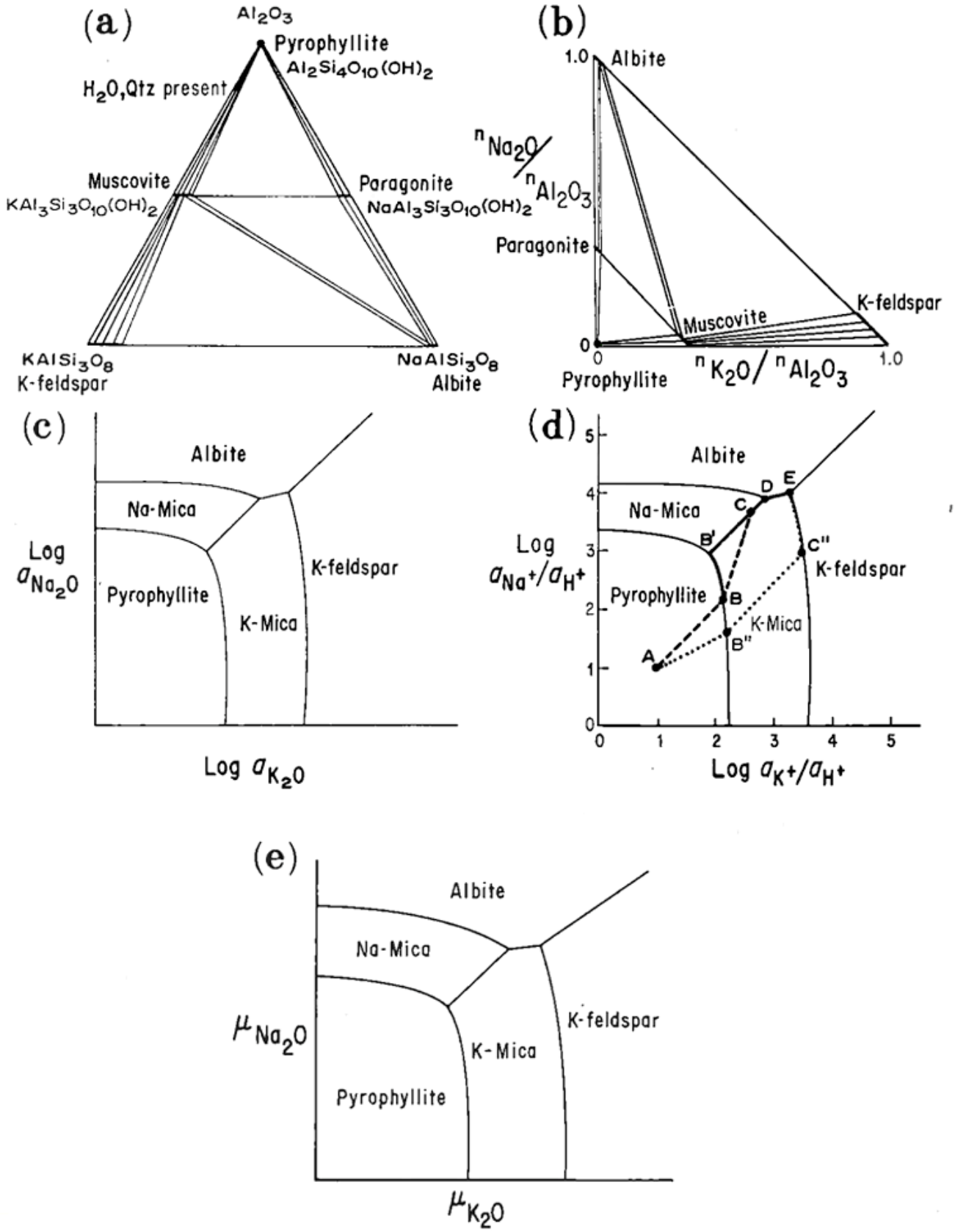



**Fig. 5.5** Schematic stability relations in the system $K_2O$-$Na_2O$-$Al_2O_3$-$SiO_2$-$H_2O$-HCl at 400°C and 1 kb. Pyrophyllite is metastable. (a) Triangular mole fraction diagram, showing solid assemblages with quartz present. (b) Similar plot of molar $Na_2O/Al_2O_3$ vs. $K_2O/Al_2O_3$. (c) Stability of phases as a function of $a_{Na_2O}$ vs $a_{K_2O}$. (d) Stability of phases as a function of log $a_{Na^+}/a_{H^+}$ vs log $a_{K^+}/a_{H^+}$. See text for discussion of the paths of solution composition during reaction of solution A with a mixture of feldspars. (e) Stability as a function of $\mu_{Na_2O}$ vs $\mu_{K_2O}$. Figures based on data in Helgeson (1974), Meyer and Hemley (1967), and Montoya and Hemley (1974).

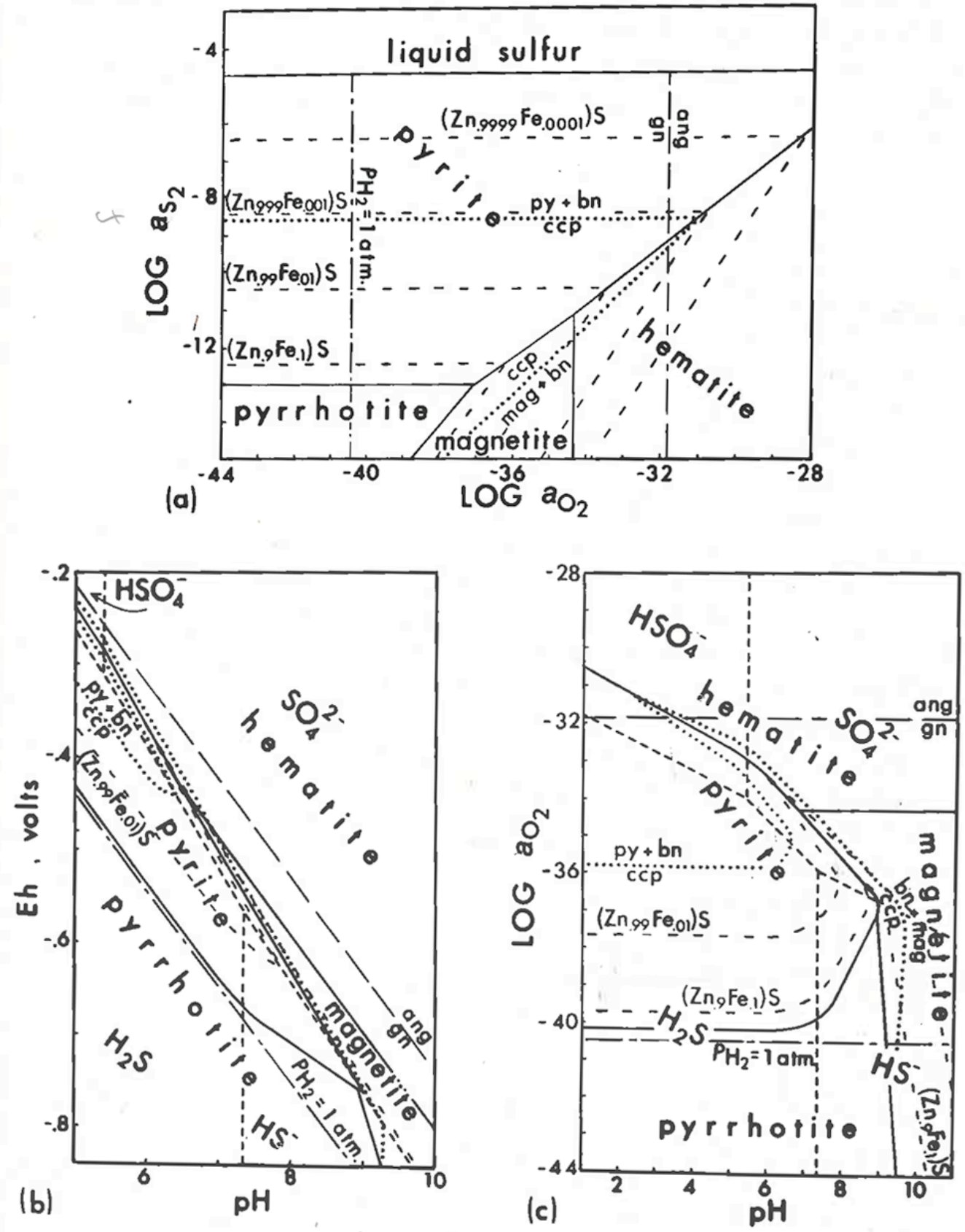
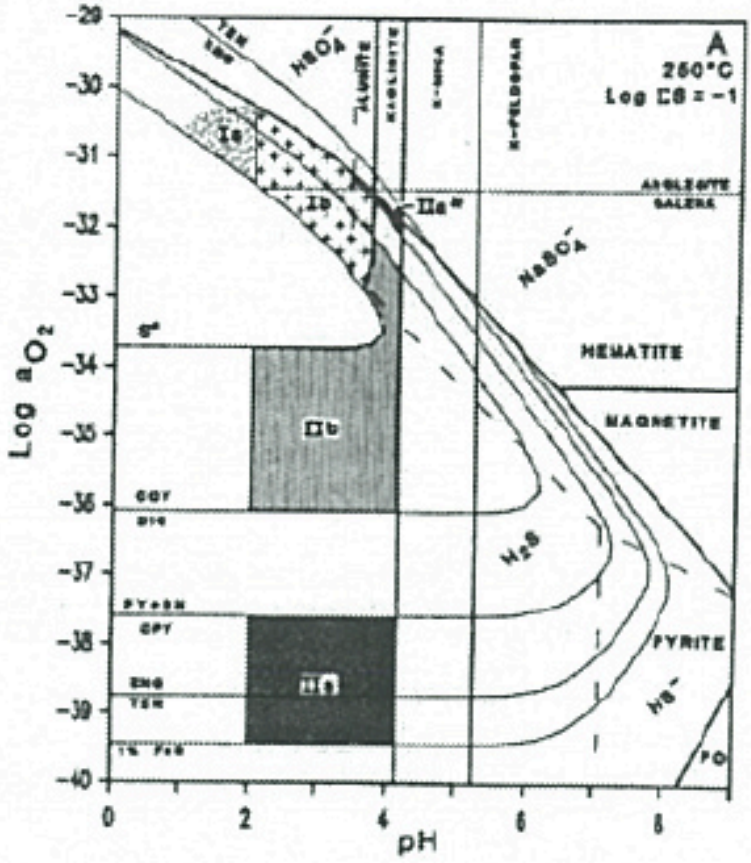
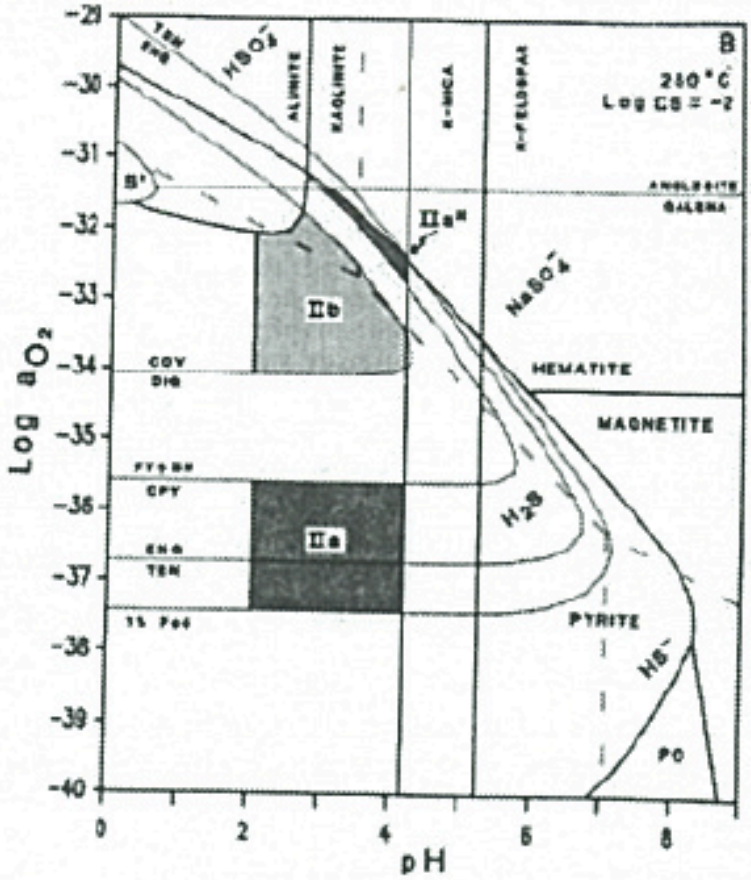
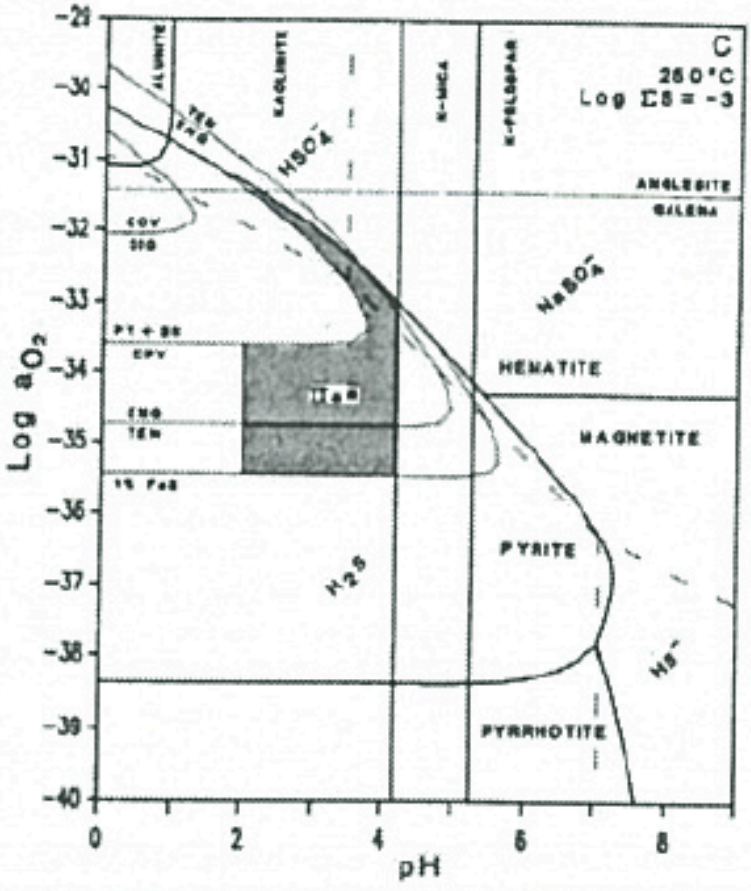



**Fig. 7.5** Commonly employed methods of representing noninterfering, multicomponent equilibria. The same type of line is used to indicate each sort of reaction in each figure, but it is impractical to plot the full set of lines on each diagram. All of these diagrams are calculated for 250°C and an $H_2O$ pressure of 40 bars. Abbreviations: py = pyrite; gn = galena; ang = anglesite; ccp = chalcopyrite; bn = bornite; mag = magnetite. The stability field for ferrous sulfate would appear in (a), but has not been included; it would be off the diagrams at low pH in (b) and (c).



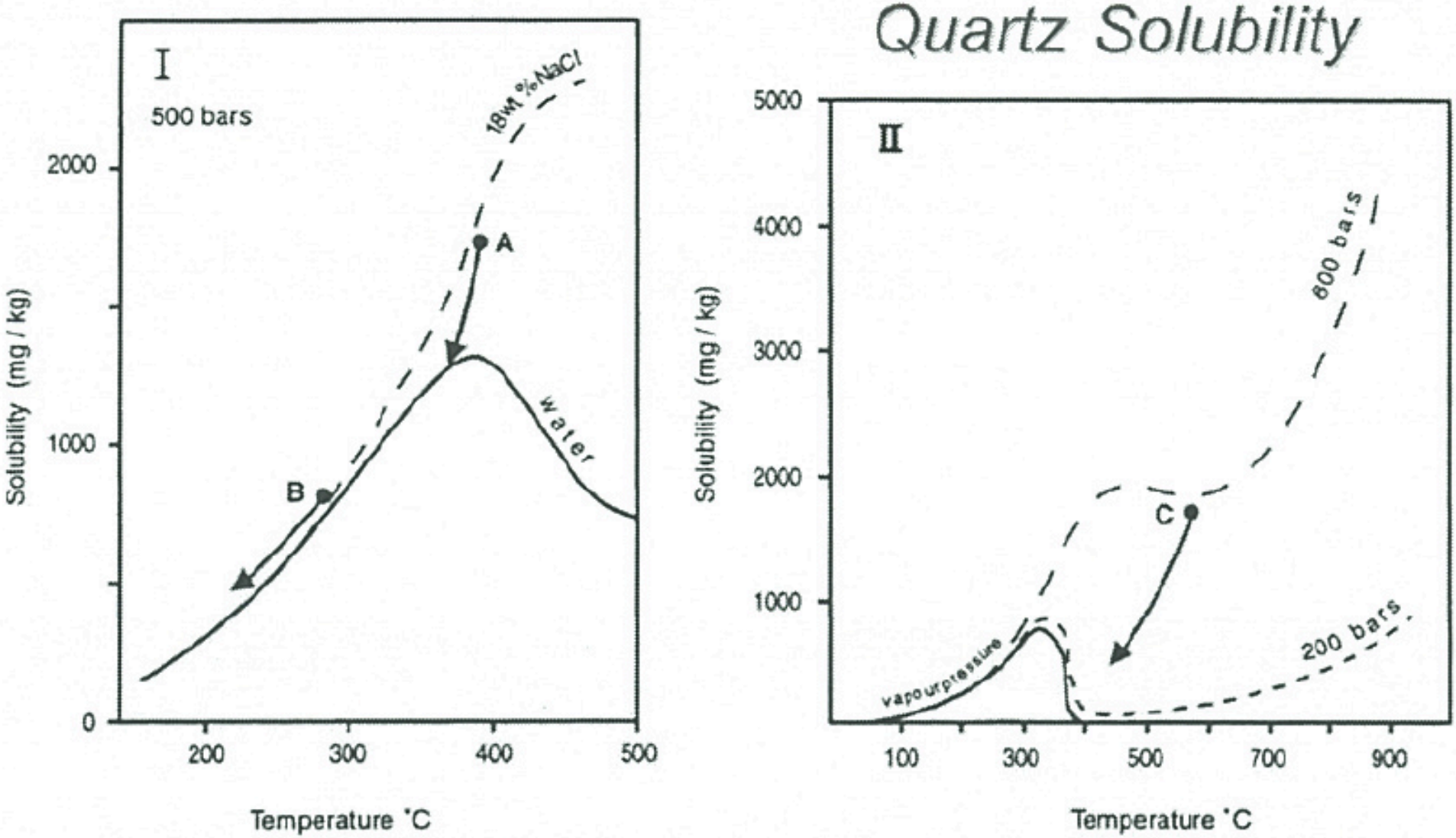




# $fO_2$ - pH

A series of log $a_{O2}$-pH diagrams constructed for 250°C at different total sulfur concentrations relevant to Summitville. The salinity is 1 molal, with Na+/K+ = 10. Stoffregen's (1985) notation for the different mineral assemblages is used: vuggy silica (Ia), quartz-alunite-pyrite (Ib), low f $S_2$ (chalcopyrite-bearing) ore assemblage (IIa), and high f $S_2$ (covellite dominated) ore assemblage (IIb). An alternative to Stoffregen's interpretation for the chalcopyrite-bearing assemblage is shown as "IIa*". Log total sulfur for A). = -1; for B). = -2; and for C). = -3. See Figure 18 for sources of data. Abbreviations: ten = tennantite, eng = engarite, cov = covellite, dig = digenite, py = pyrite, bn = bornite, cpy = chalcopyrite, po = pyrrhotite.

# Quartz Solubility



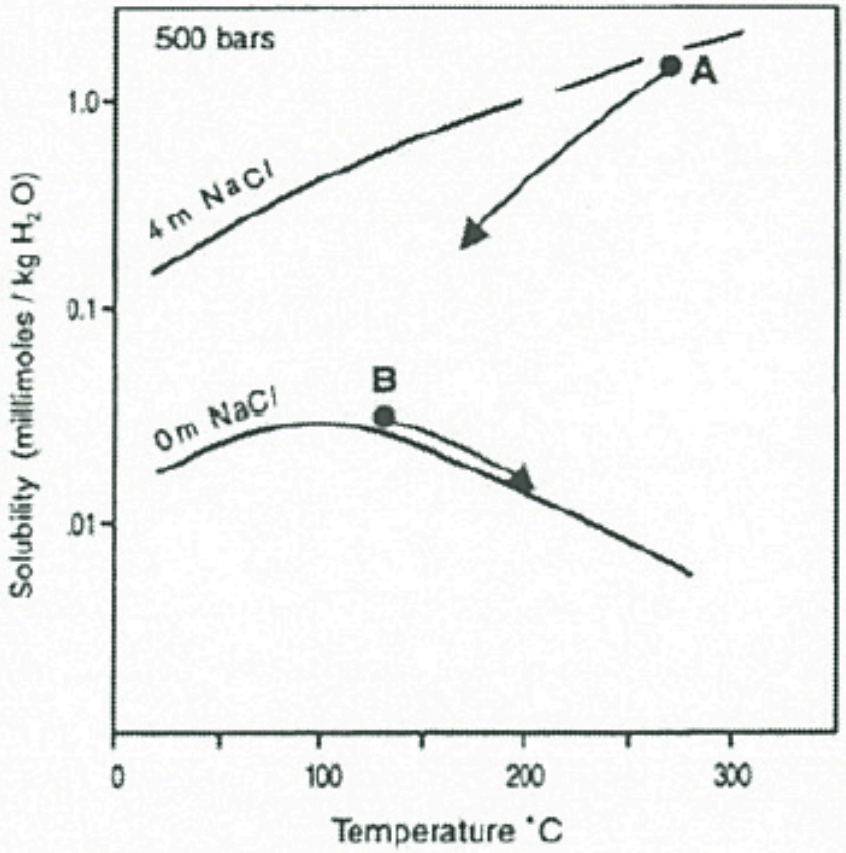

Quartz solubility as a function of temperature and salinity (I) and pressure (II). (Modified from Fournier 1985b)

A. Dilation/cooling of upwelling mesothermal fluids

B. Cooling of upwelling epithermal fluids

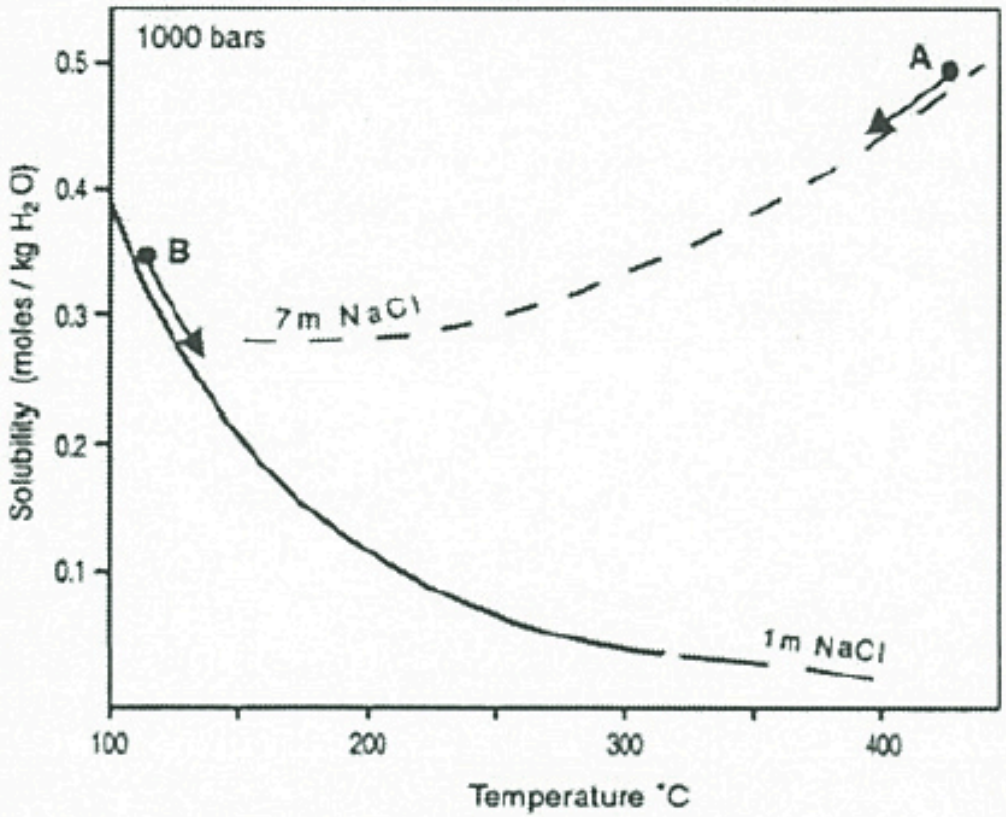
C. Porphyry stockwork veining through pressure release

# Barite Solubility

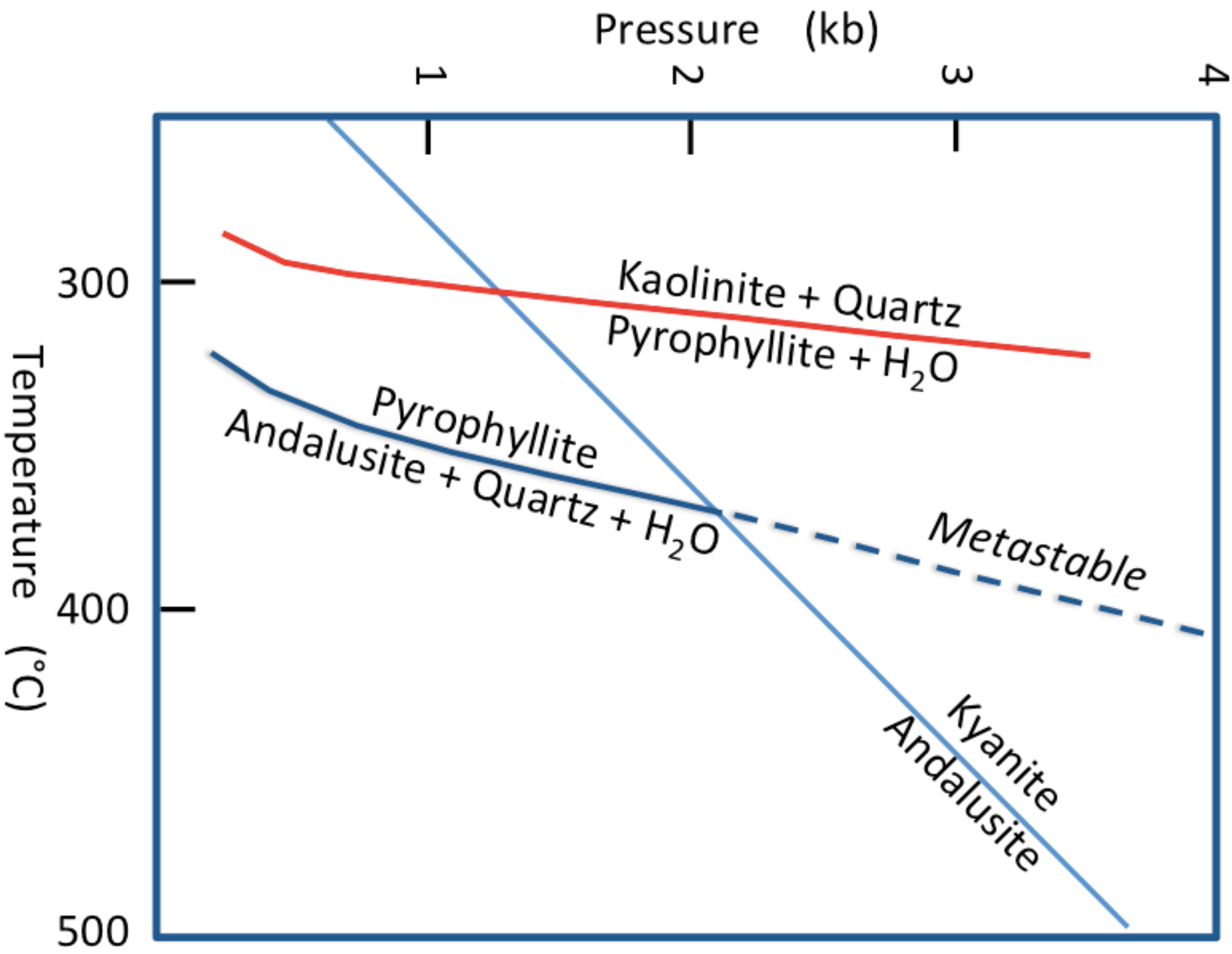



Barite solubility as a function
of temperature and salinity.
(Modified from Blount 1977, in Barnes 1979)
A. Upwelling high sulphidation fluids
B. Descending acid sulphate fluids.

# Anhydrite Solubility

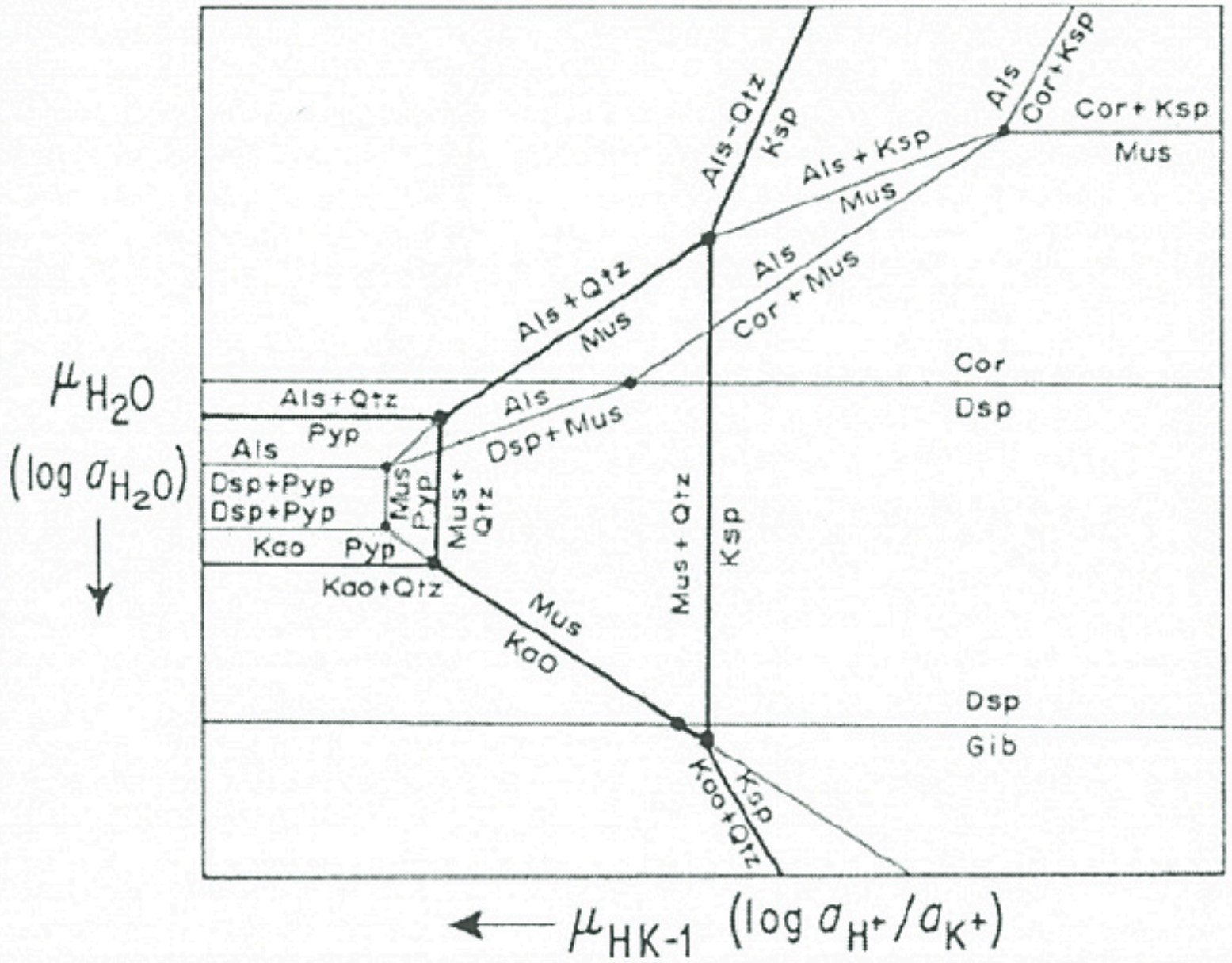



Anhydrite solubility as a function
of temperature and salinity.
(Modified from Blount and Dickson 1969)
A. Upwelling porphyry copper fluids in potassic zone
B. Descending acid sulphate fluids.

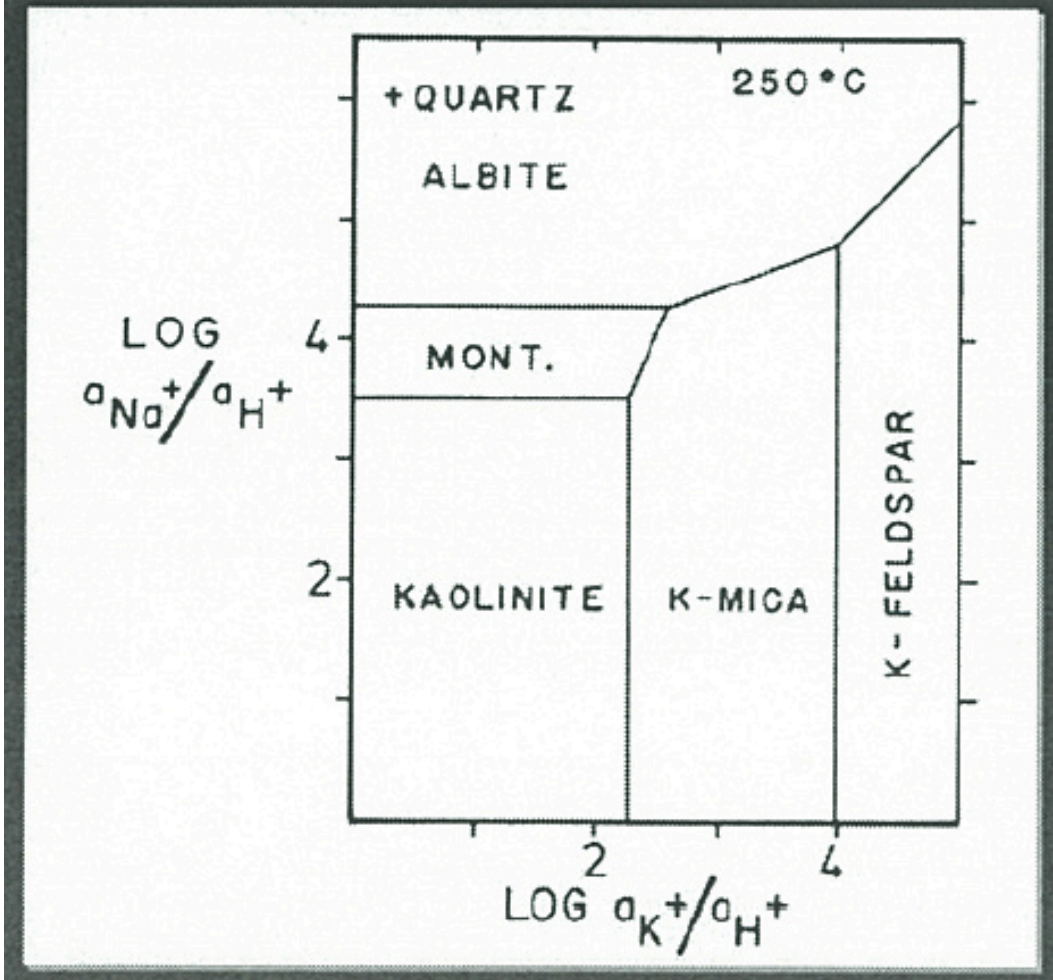

Pressure (kb)
1
2
3
4
Temperature (°C)
300
400
500
Kaolinite + Quartz
Pyrophyllite + H2O
Pyrophyllite
Andalusite + Quartz + H2O
Metastable
Kyanite
Andalusite

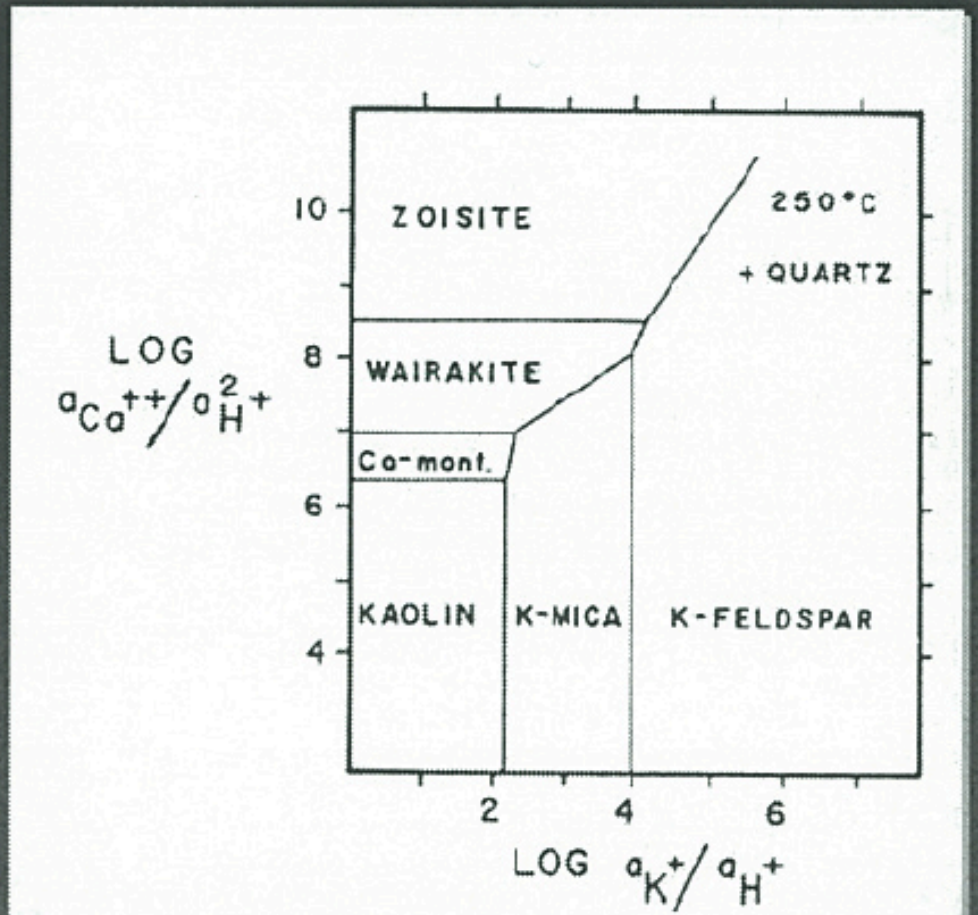
*Schematic stability of minerals in the system $K_2O$ - $Al_2O_3$ - $SiO_2$ - $H_2O$*
*At low to moderate P and T under isothermal and isobaric conditions.*

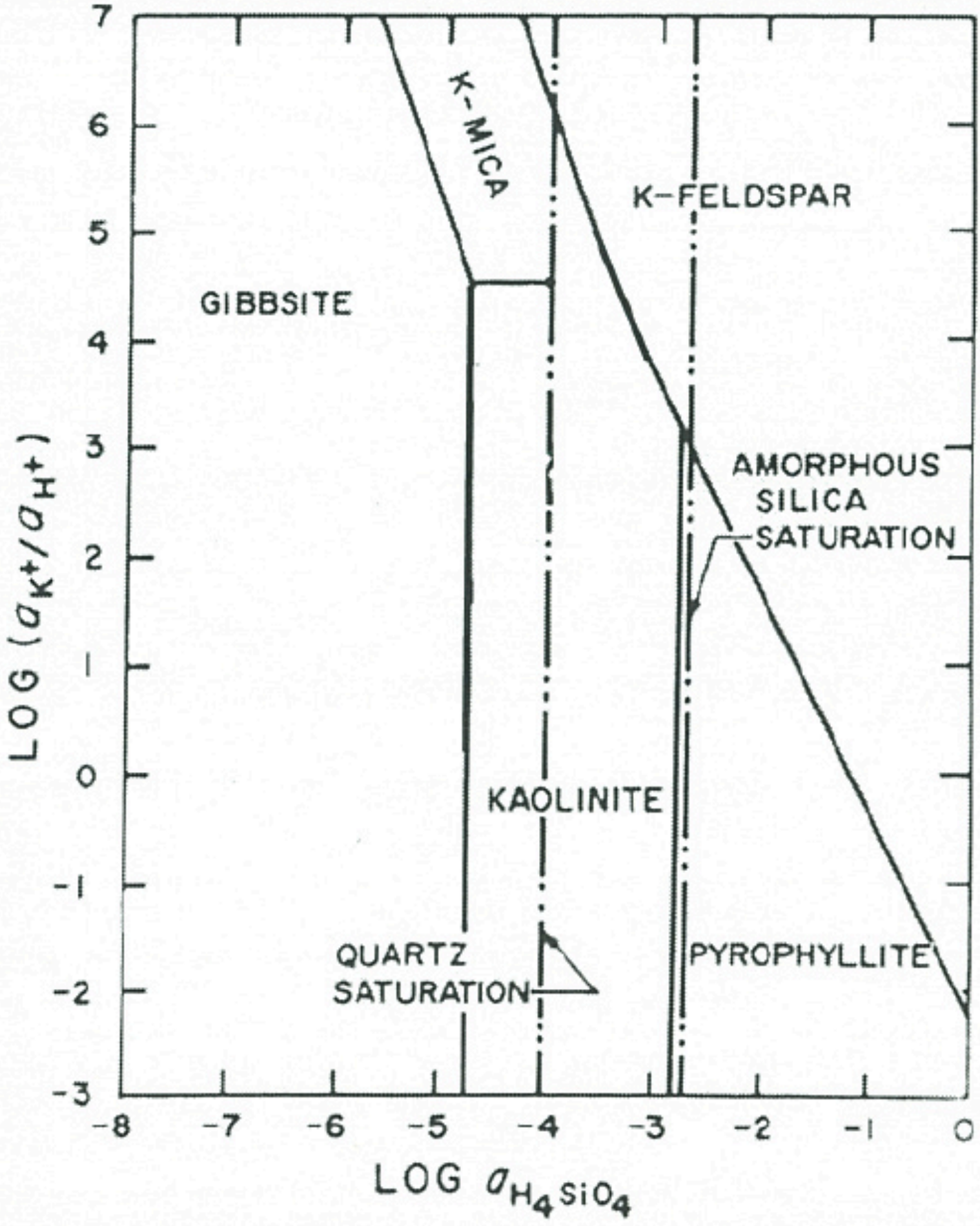
*Als = aluminosilicate, Cor = corundum, Dsp = diaspore, Gib = gibbsite, Kao = kaolinite, Ksp = Kfeldspar, Mus = muscovite, Pyp = pyrophyllite, Qtz = quartz.*



# Activity Diagrams




K-MICA
K-FELDSPAR
GIBBSITE
AMORPHOUS
SILICA
SATURATION
KAOLINITE
QUARTZ
SATURATION
PYROPHYLLITE
LOG $(a_{K^+}/a_{H^+})$
LOG $a_{H_4SiO_4}$
7
6
5
4
3
2
1
0
-1
-2
-3
-8
-7
-6
-5
-4
-3
-2
-1
0