

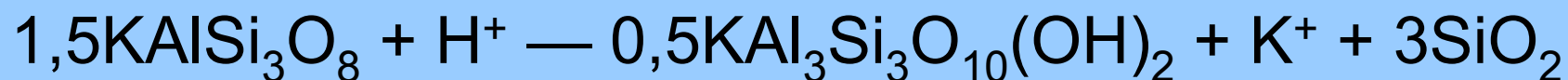
Metasomativity



Rozložník: kap.2.4
Evans: kap. 13, 14

Metasomaty - ložiska

- definice a společné znaky
- původ fluid – různý -> příčiny metasomatických přeměn?
- $H_2O \rightleftharpoons H^+ + OH^-$... alterace – H-hydrolýza
- magmatogenní metasomaty
- hydrotermální metasomaty

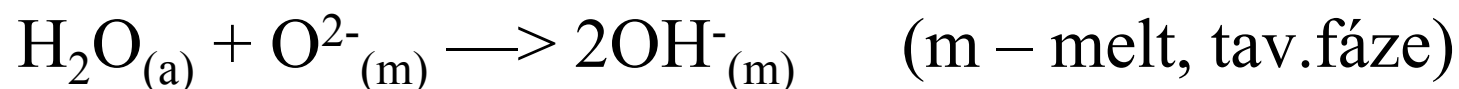




Magmatogenní metasomaty

vodní fluida z kyselějších magmat: H_2O , CO_2 , HCl , HF , H_2 .

H_2O není v tavenině jako neutrální molekula



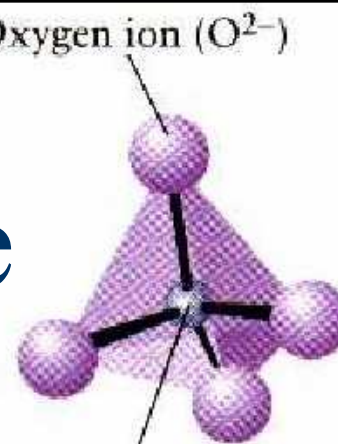
OH nahrazuje O^{2-} ve struktuře alumosilikátové taveniny – depolymerizace

Taková fluida způsobují:

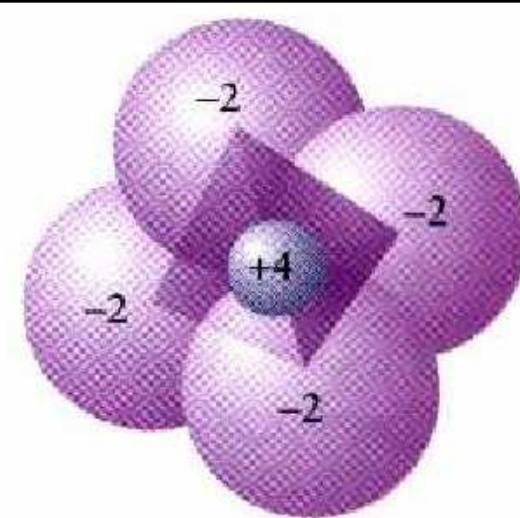
- 1) depolymerizaci — snížení viskozity
- 2) zvýšení rychlosti difúze
- 3) snížení T krystalizace
- 4) odštěpení magmatu a expanze magmatu — explozivní vulkanismus
- 5) příp. var: 1. dekomprese v magmatu (při výstupu), 2. ...

Depolymerizace

Oxygen ion (O^{2-})



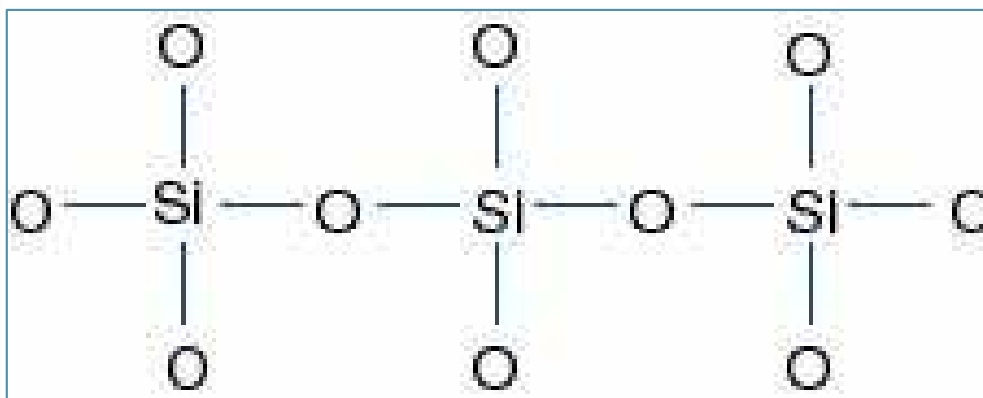
Silicon ion (Si^{4+})



$$(+4 \times 1 \text{ silicon}) + (-2 \times 4 \text{ oxygens}) = 4 - 8 = -4$$

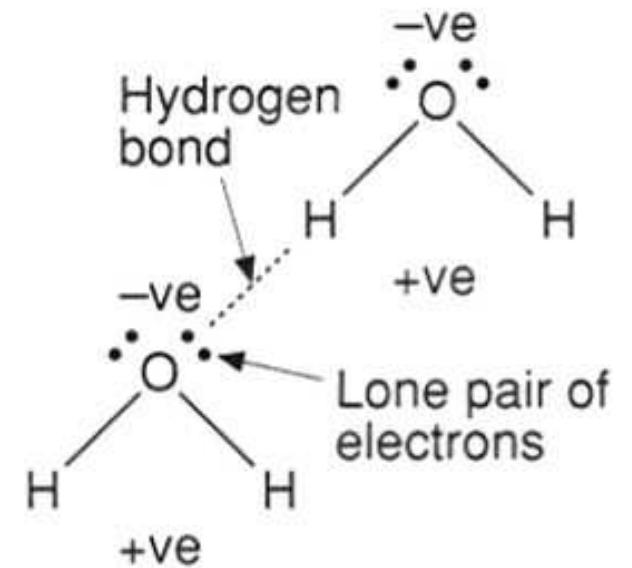
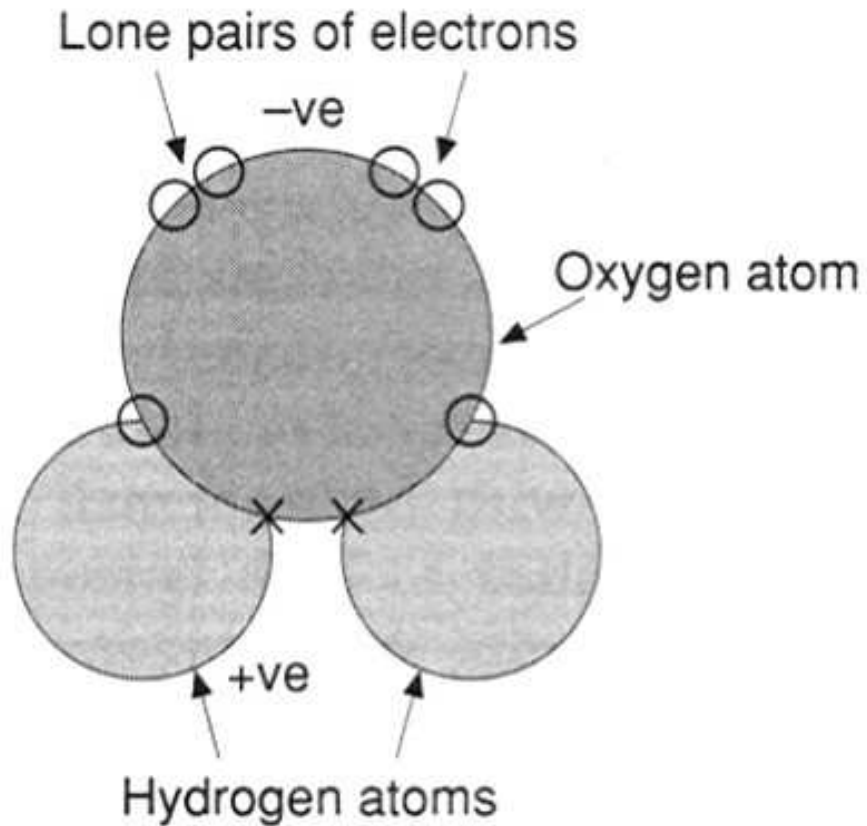
Charge on individual ions

Charge on SiO_4 complex



vyměním-li O^{2-} za OH^- spojení se rozpadnou – depolymerizace taveniny

H₂O - hydrolýza



Model 1

■ Model

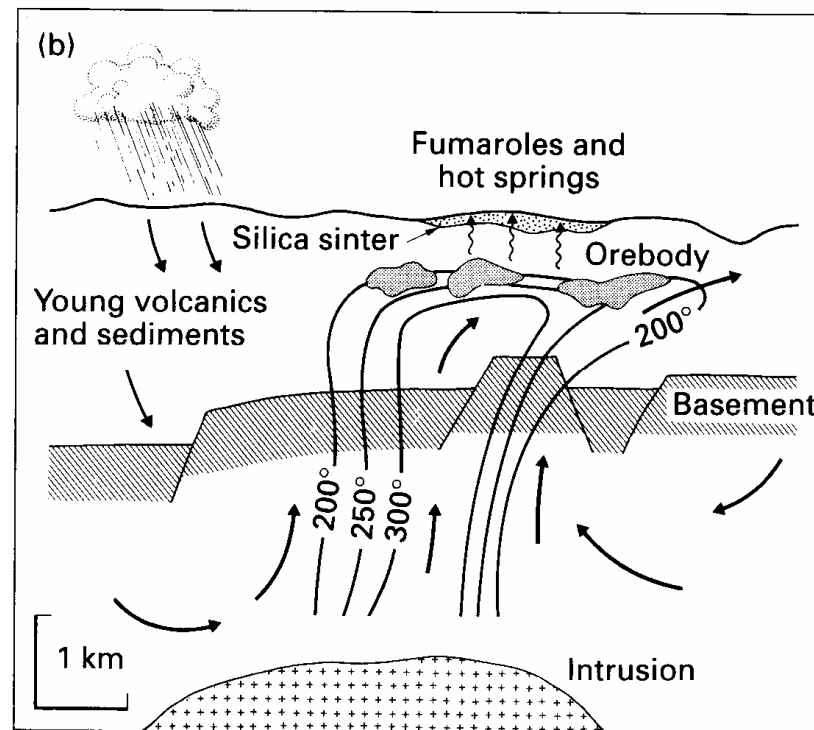
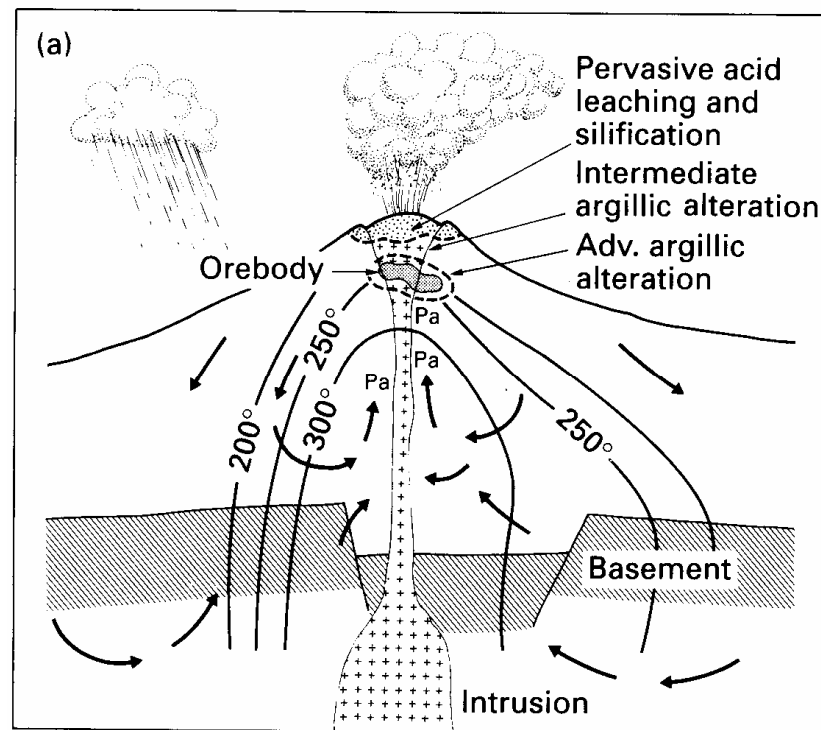
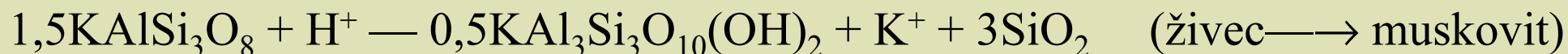


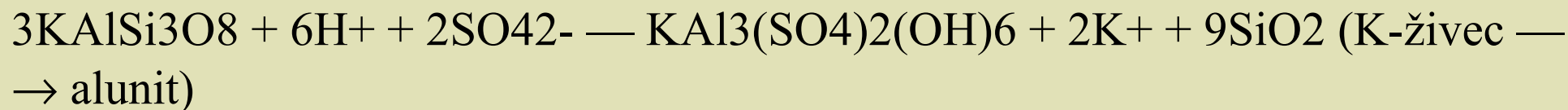
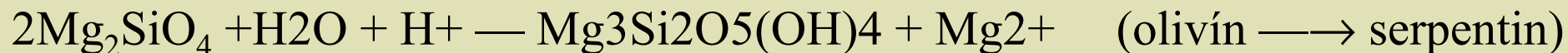
Fig. 17.5 Schemata for the formation of two types of precious metal deposits in volcanic terranes. (a) Acid sulphate type. Pa, propylitic alteration. Note that the mineralization occurs within the heat source. (b) Adularia-sericite type. The upwelling plume of hydrothermal fluid is outlined by the 200°C isotherm. The mushroom-shaped top reflects fluid flow in the plane of major fracture systems, a much narrower thermal anomaly would be present perpendicular to such structures. The heat source responsible for the buoyancy of the plume is shown as an intrusion several kilometres below the mineralized zone. In both schemata the arrows indicate the circulation of meteoric water. (a) Is at the same scale as (b).

H⁺ metasomatóza

Hydrolýza – H⁺-metasomatóza: zahrnuje **iontový rozklad H₂O na H⁺ a OH⁻**. Během hydrotermální alterace je H⁺ spotřebováván při reakcích se silikátovými minerály — poměr H⁺/OH⁻ se mění. Zdroj H⁺ jsou reakce během alkalické metasomatózy, voda a kyseliny.



často spojeno s hydratací:



Model 2

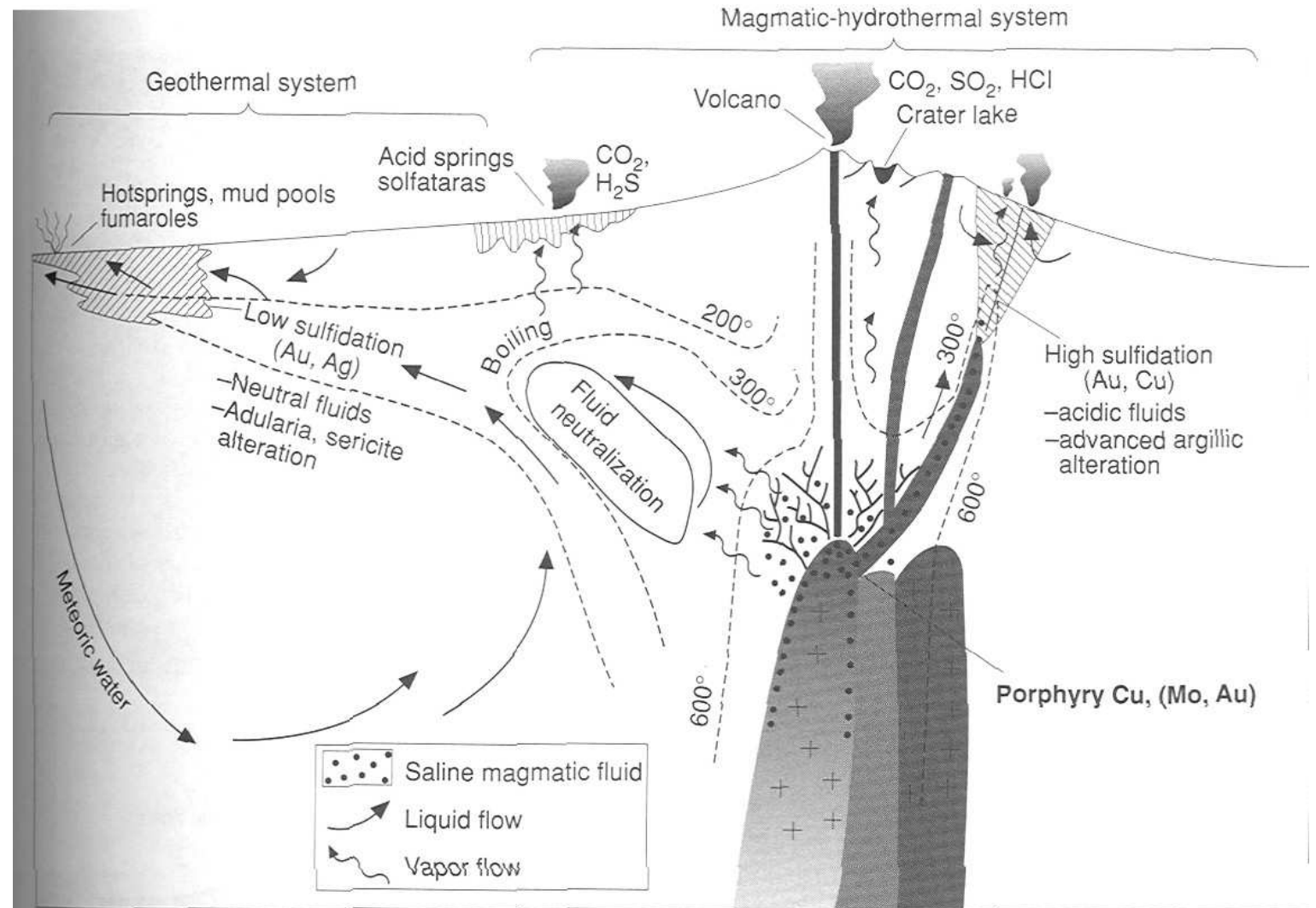
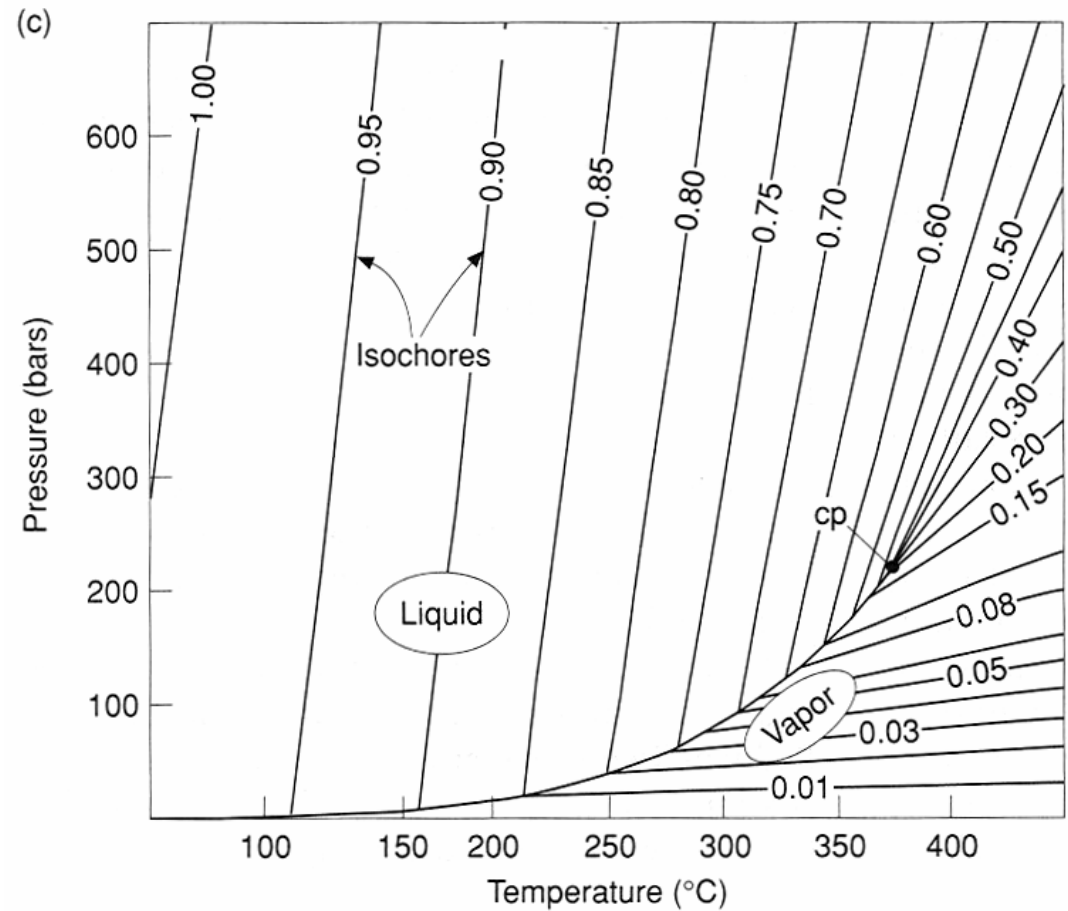
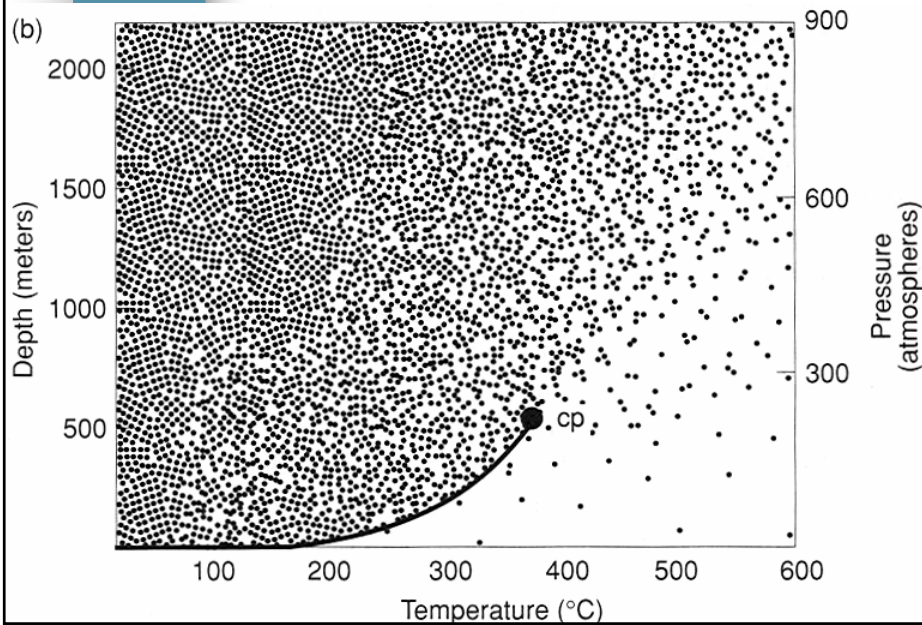
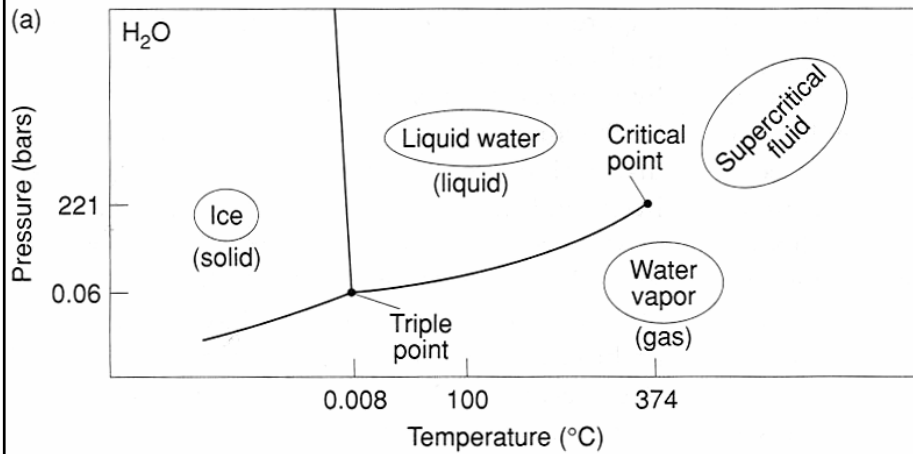


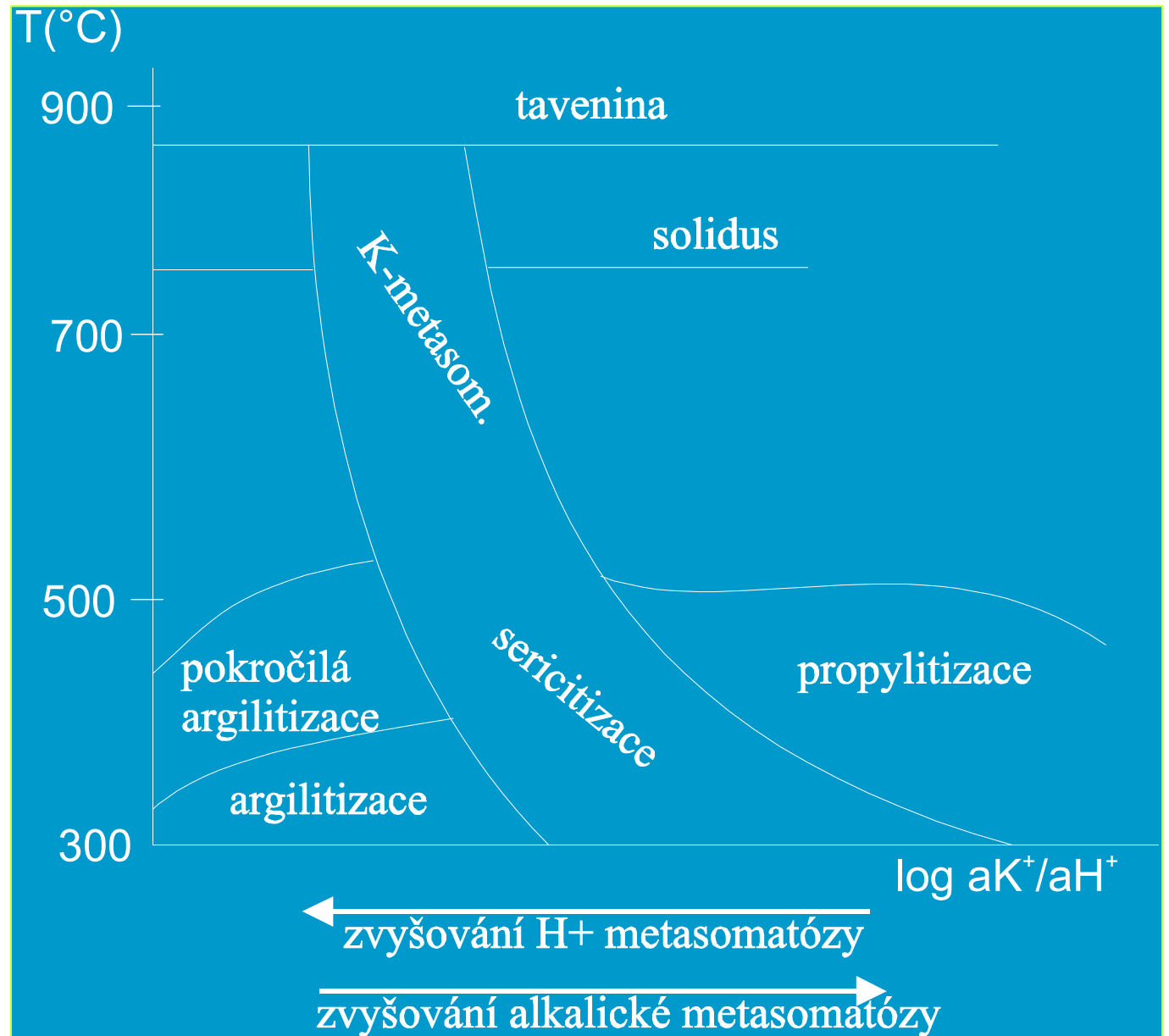
Figure 2.22 The geological setting and characteristics of high-sulfidation and low-sulfidation epithermal deposits. A genetic link between high-sulfidation epithermal Au-Cu and sub-volcanic porphyry type Cu-Au deposits is also suggested (after Hedenquist *et al.*, 2000).

Voda i magmatická

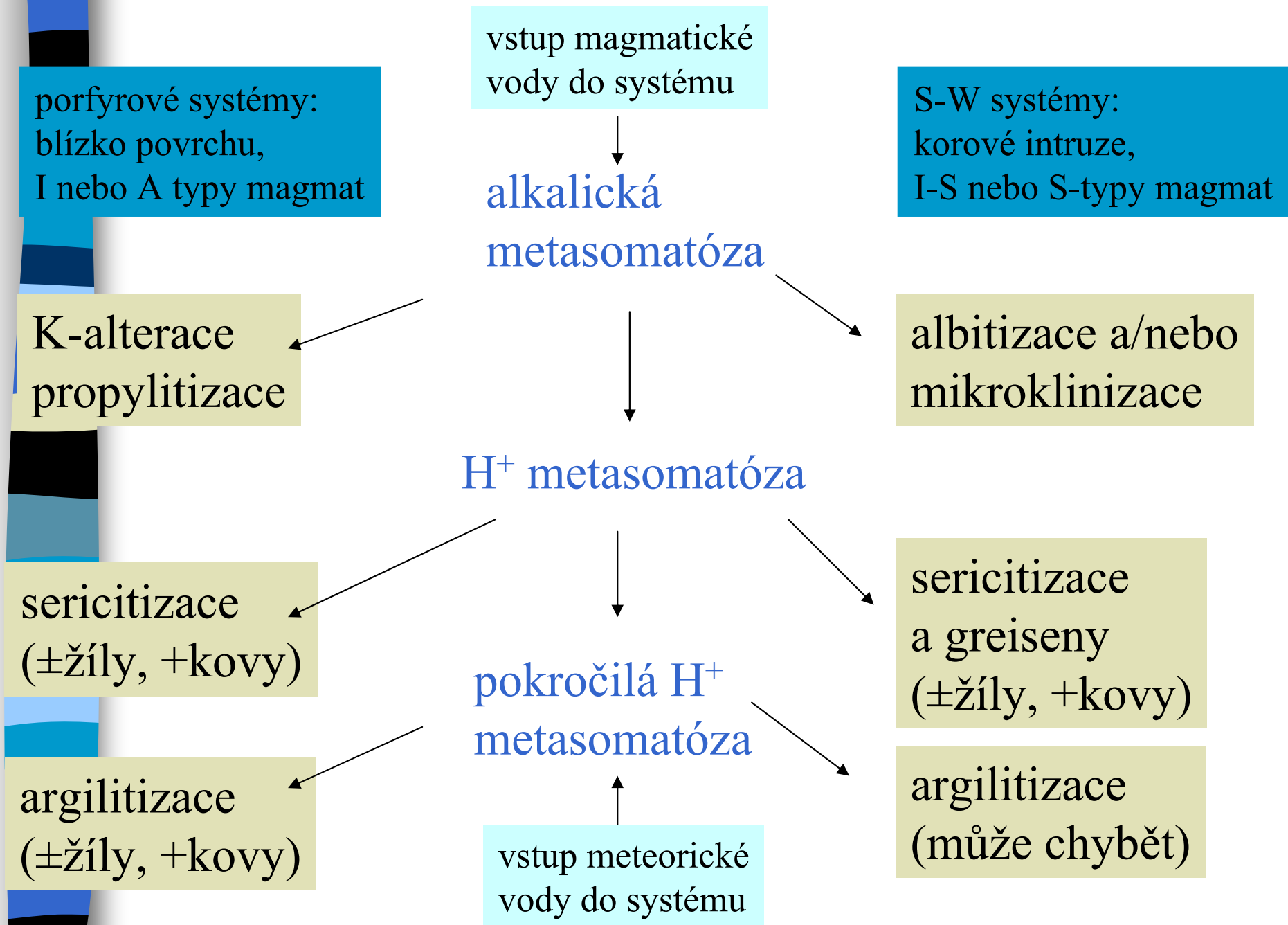
chování a stav vody v P-T prostoru



Funkce T a aktivity K^+ a H^+



Metasomatity



Rozdíly → typy ložisk.akumulací

<i>typy metasomatitů</i>	<i>parametry hydrotermálních roztoků</i>				<i>charakteristika rudní mineralizace</i>
	<i>T °C</i>	<i>pH</i>	<i>složení</i>		
fenity	800-500	10-8	Na ⁺ > K ⁺ , (Mn ⁺² , Sr ⁺²), Cl ⁻ , F ⁻ , (CO ₃ ⁻² , SO ₄ ⁻²)	nenasyčené SiO ₂	Ti, Zr, Nb, Ta, Be, REE
mikroklinity	600-400	8,5-7	Na ⁺ > K ⁺ , (Li ⁺), Cl ⁻ , F ⁻ , SO ₄ ⁻² , (HCO ₃ ⁻)	obs. H ₂ O	Nb, Ta, Be, Zr, U, Th, REE
albitity	300-500	7-8	Na ⁺ >> K ⁺ , (Li ⁺), Cl ⁻ , F ⁻ , CO ₃ ⁻² , (HCO ₃ ⁻ , BO ₃ ⁻³)	obs. H ₂ O	Nb, Ta, Be, Zr, U, Th, REE
ejsiity					
argility	100-300	3-4			

- skarny, albitity, greiseny, porfyrové rudy
- berezity, (sek.kvarcity) – hydroterm.silicity

Fáze metasomatózy

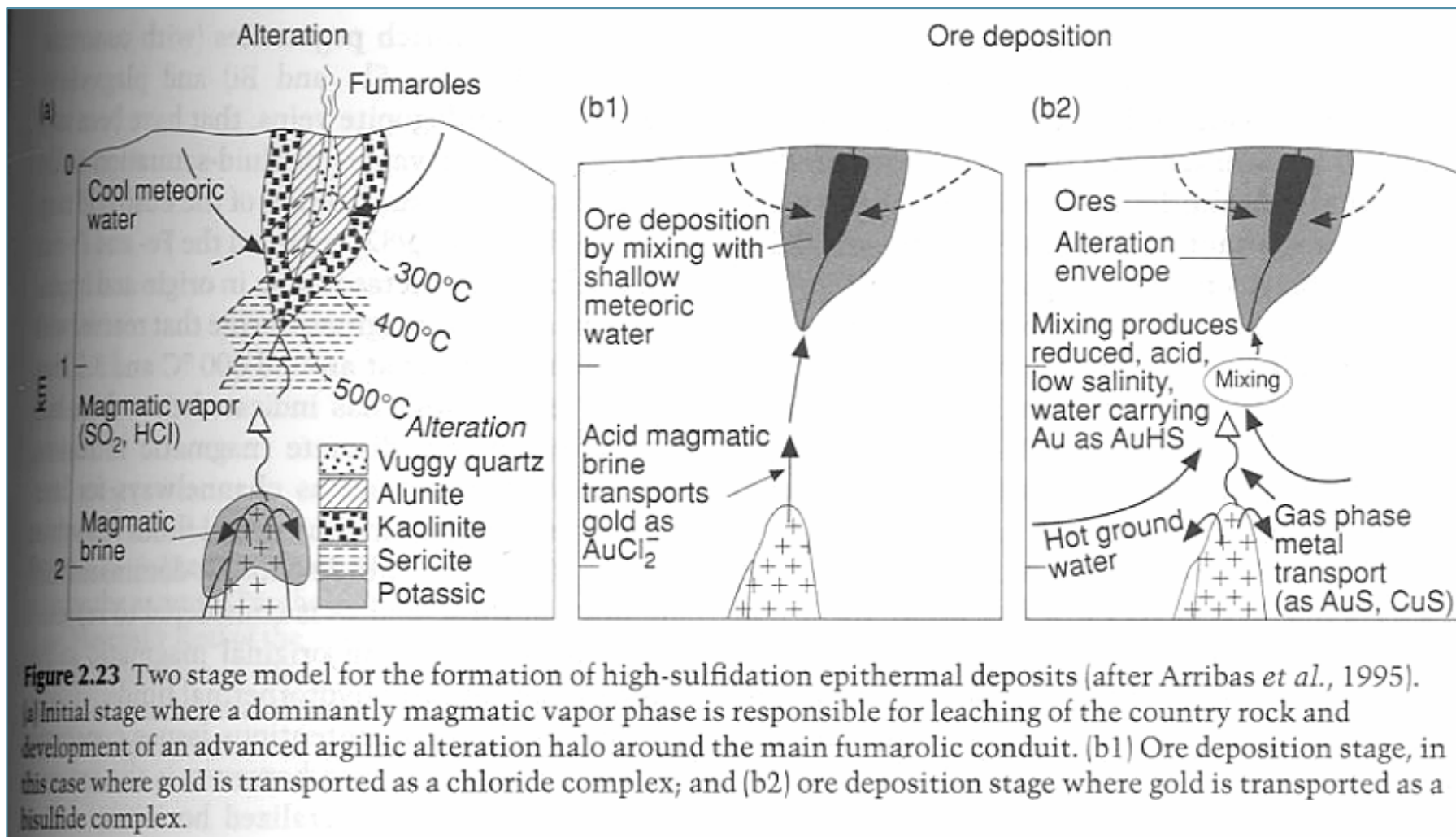


Figure 2.23 Two stage model for the formation of high-sulfidation epithermal deposits (after Arribas *et al.*, 1995). (a) Initial stage where a dominantly magmatic vapor phase is responsible for leaching of the country rock and development of an advanced argillic alteration halo around the main fumarolic conduit. (b1) Ore deposition stage, in this case where gold is transported as a chloride complex; and (b2) ore deposition stage where gold is transported as a bisulfide complex.

Typ Carlin

■ Au

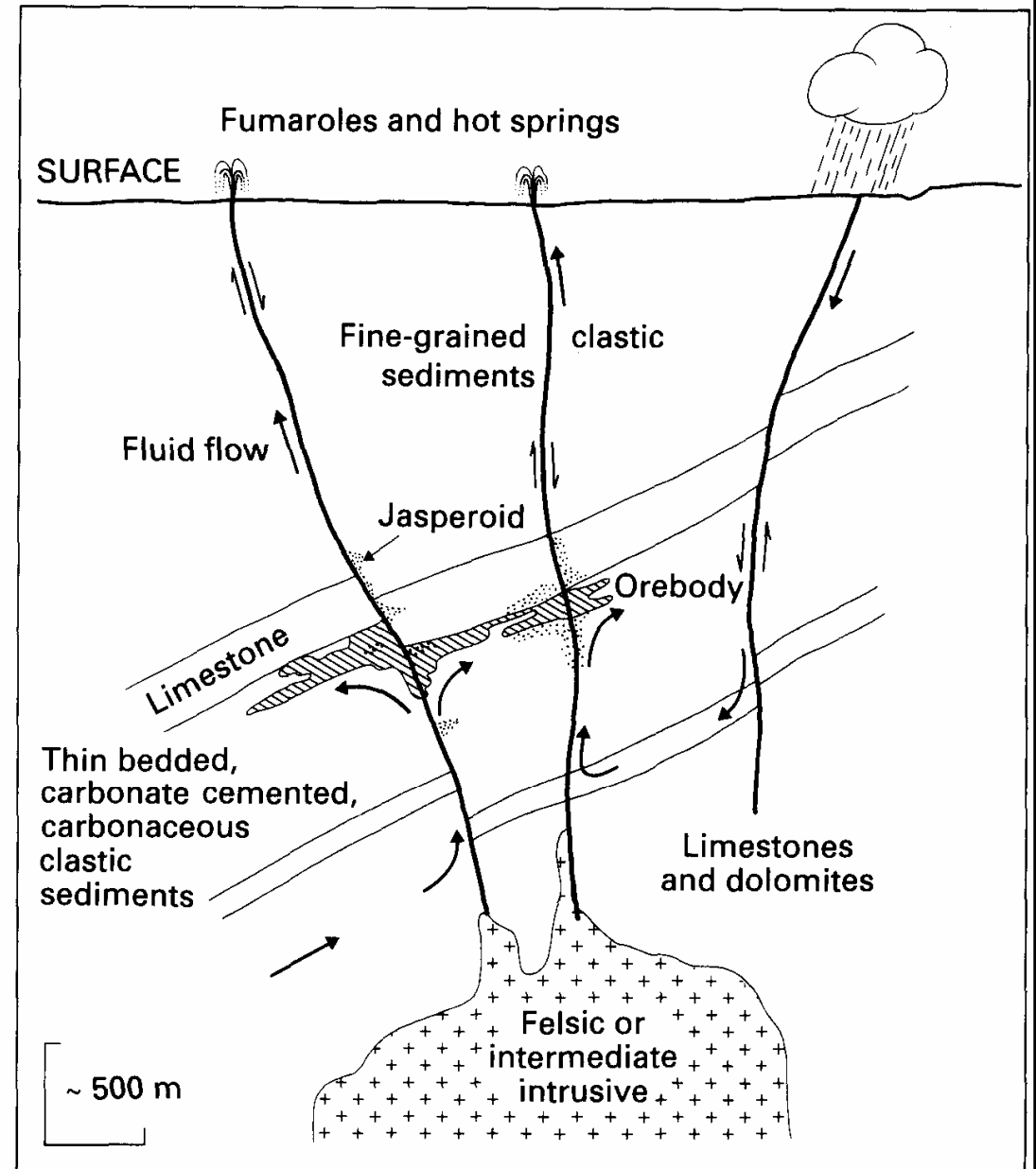


Fig. 17.7 Schema for the formation of Carlin-type deposits.

Skarny

- skarny – Ca, Mg – metasomatoza!!
- vápenato-silikátové rohovce – izochemická metamorfóza -> skarnoidy!!

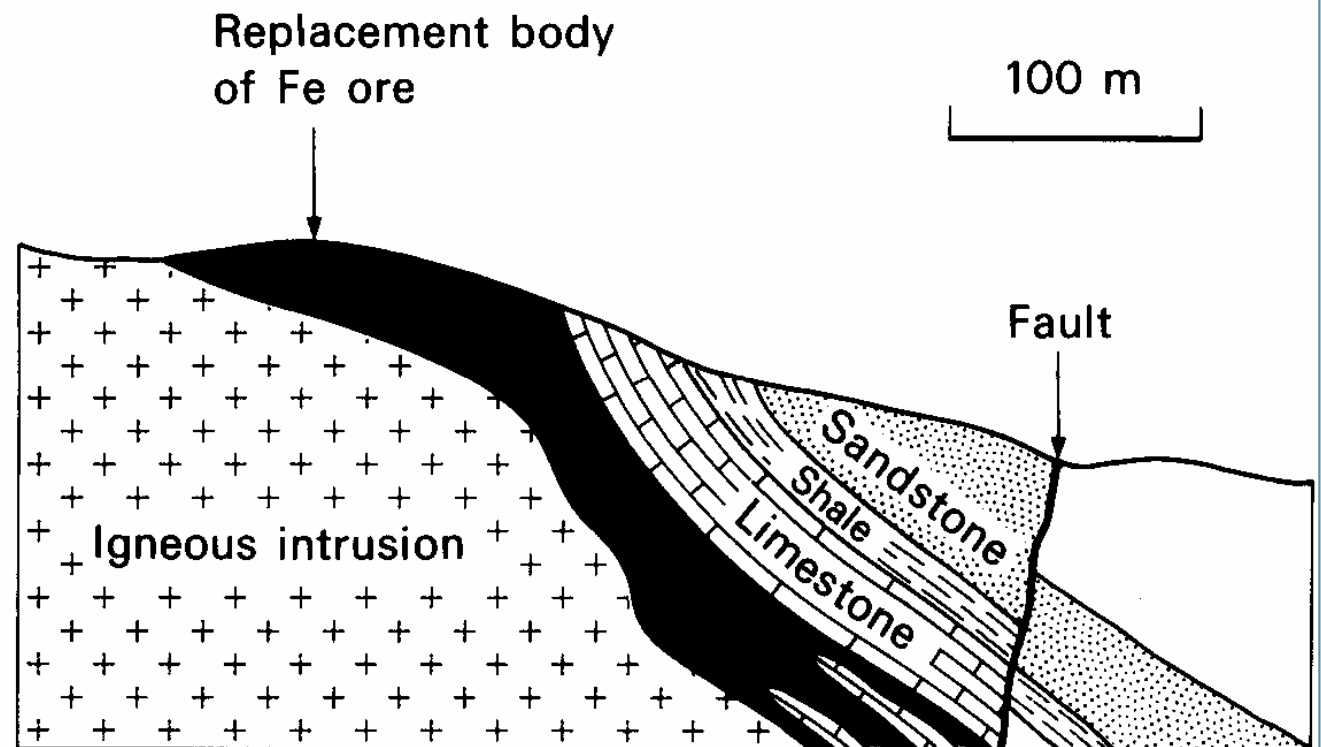


Fig. 4.5 Skarn deposit at Iron Springs, Utah.

Skarn - stages

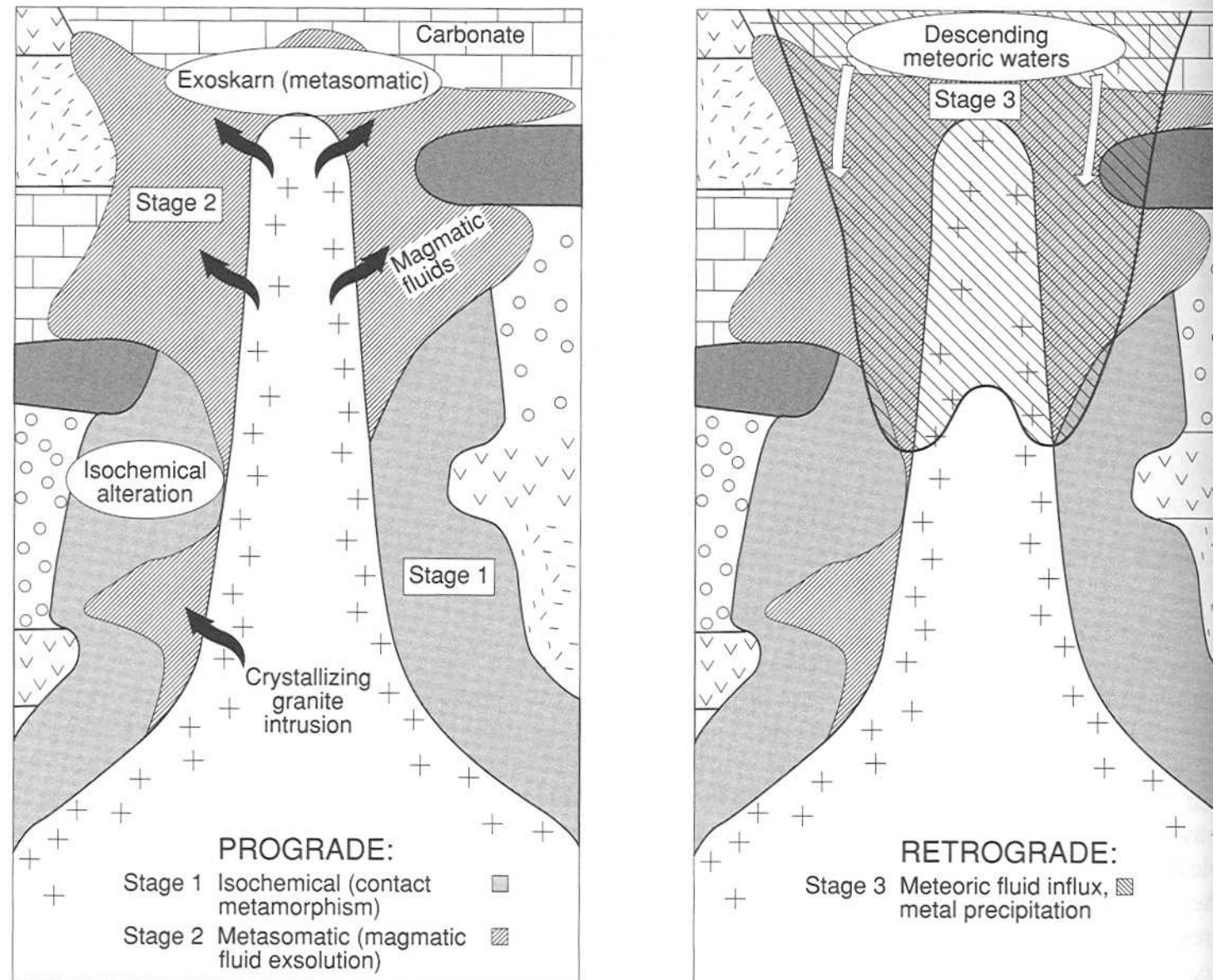


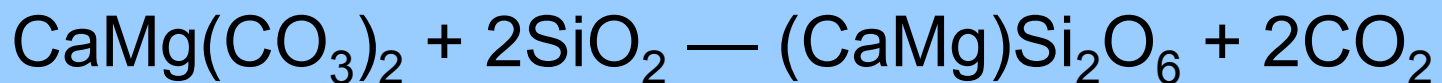
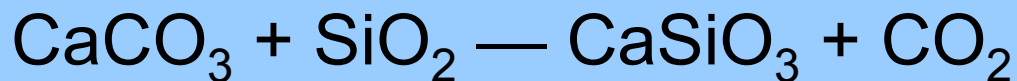
Figure 2.21 The evolution of intrusion-related skarn deposits showing the three sequential stages of formation. (a) Prograde stages, and (b) retrograde stage (modified after Corbett and Leach, 1998).



Podmínky vzniku skarnů

- geotektonické prostředí
- geologické prostředí
- tvary těles

wolastonit a diopsid





Skarny - formace

W – skarny: fluida hlavně magmatického
původu

Pb-Zn skarny

Cu skarny



Albitity, greiseny

- S-typy granitoidů,
geotekt. pozice
- hydrotermální roztoky
- formace

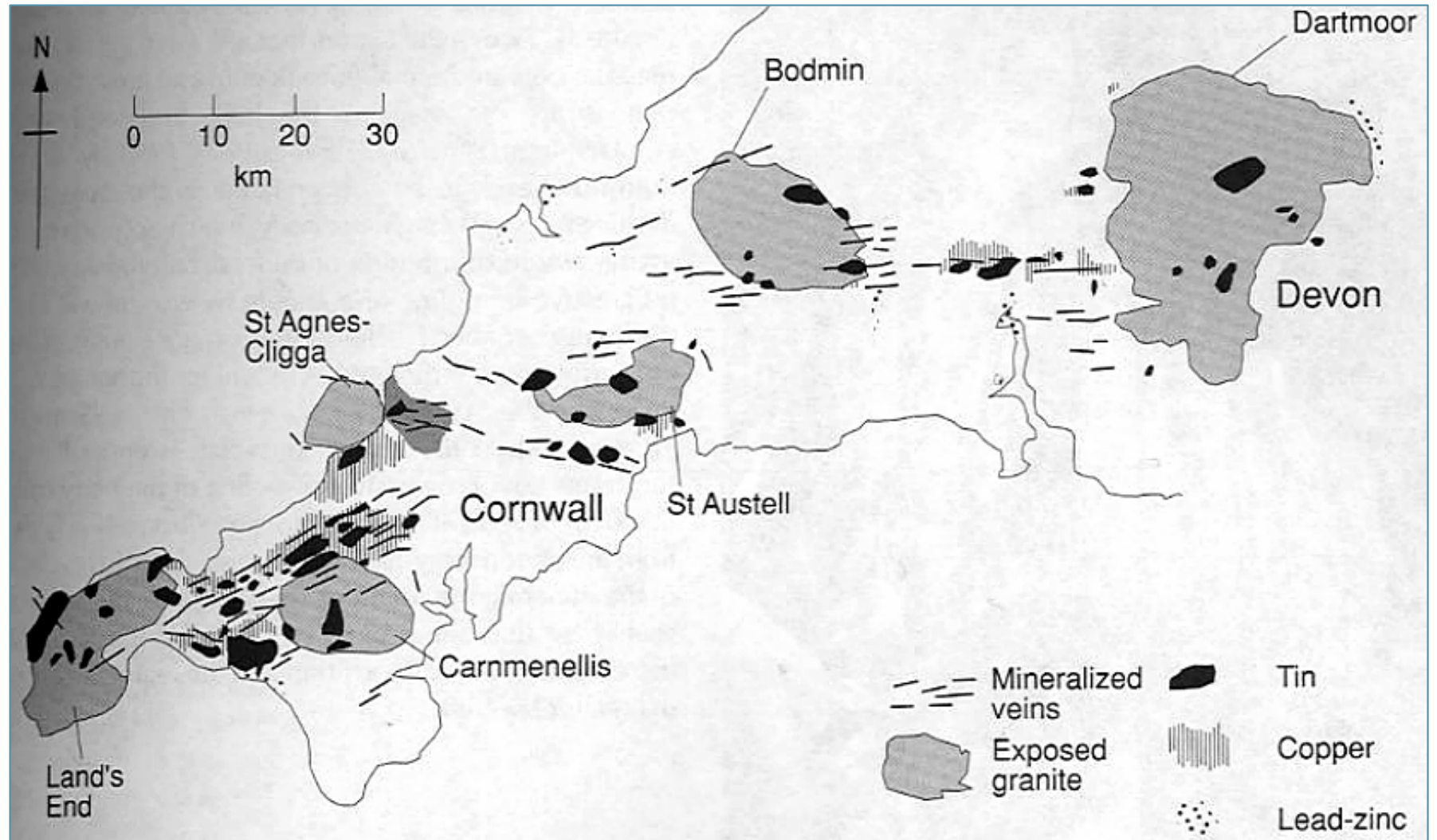
topaz-lithionické alb. (amazonit, Massif Central)

kryolit-lithionické alb. (riebeckitické alb.)

albitiz. nefelinické syenity (Nb, Zr (Nb >>Ta), pyrochlor,
zirkon (Ural)

lineární albitity (v krystaliniku, na zlomech, na platformách,
pyrochlor, zirkon)

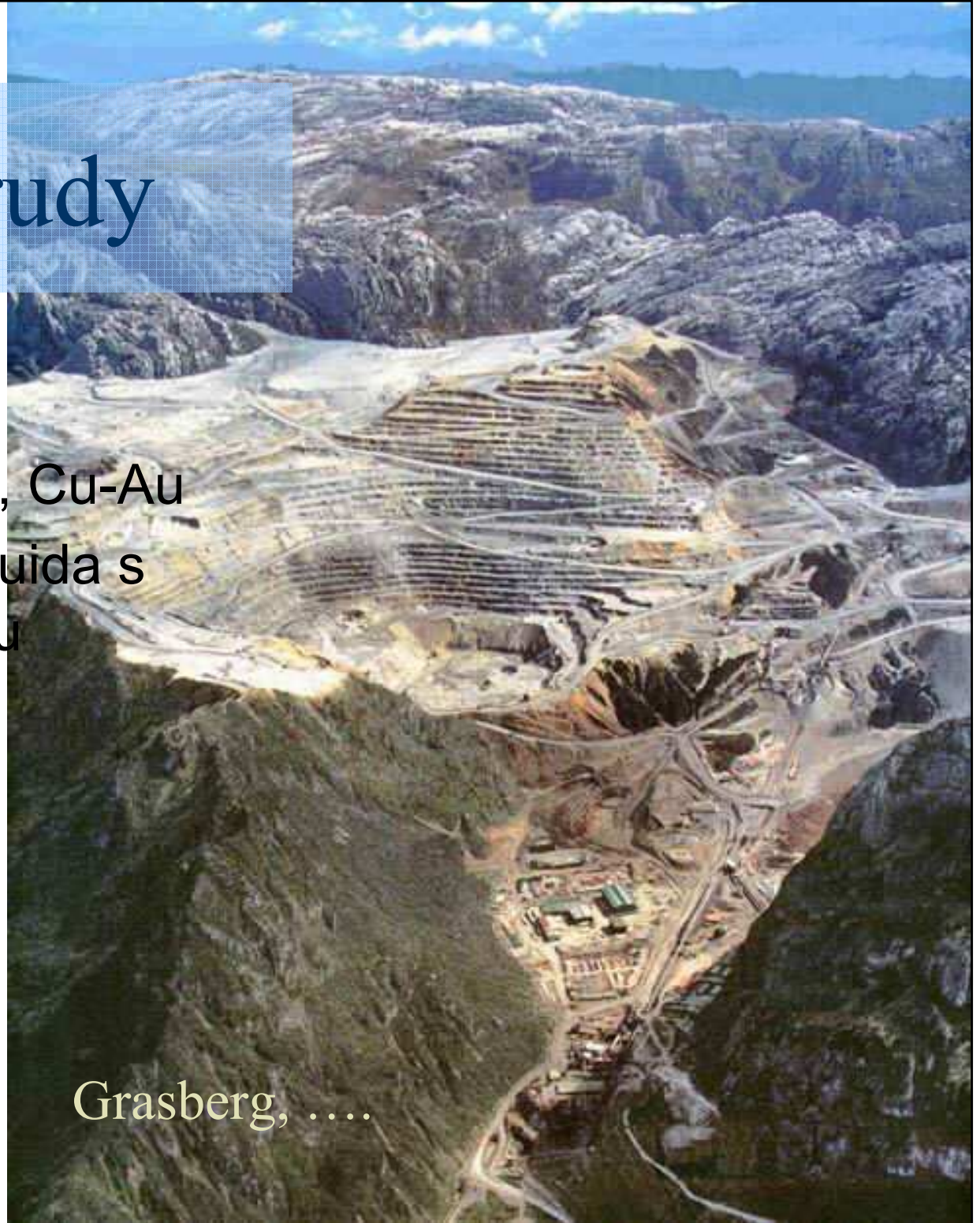
Cornwall



Porfyrové rudy

- základní rysy
- formace: Cu-Mo, Cu-Au
- vysokoteplotní fluida s vysokou salinitou
- Bingham

Grasberg,



Porfyrové rudy – pozice a hloubky

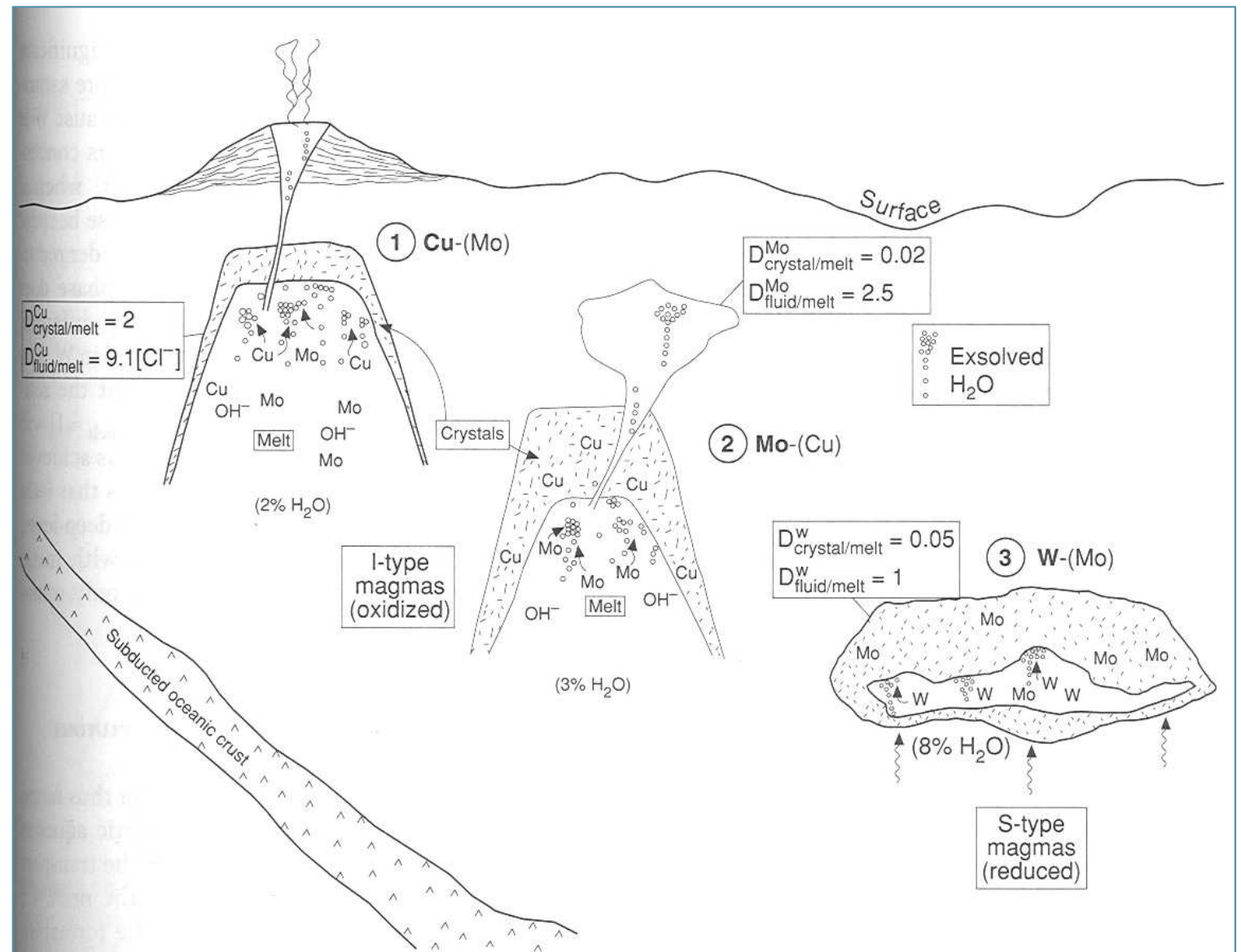


Figure 2.18 Schematic model for the origin and formation of porphyry-type Cu, Mo, and W deposits. Detailed descriptions are provided in the text (modified after the models of Candela and Holland, 1984; 1986; Strong, 1988; Candela, 1992).