

# Geologie sedimentárních pánví

K. Martínek, LS 2019, 2/1, St 12,20 – 14,40h G1

## Typy pánví a pánevní analýza

### **1. úvod (1 h)**

typy pánví, geotektonická pozice, tepelný tok, potenciál k zachování, délka života, subsidenční historie, stratigrafický záznam

### **riftové pánve (2 h)**

kontinentální rifty, mořské rifty, pasivní kontinentální okraje

### **2. kratonické pánve (1 h)**

"sag" basins – "průhybové" pánve

### **pánve na horizontálních posunech (3 h)**

mořské, kontinentální pull-apart pánve

### **3. praktika (2 h) (mikrotužka + pastelky s sebou !)**

interpretace seismických řezů – riftové a strike-slip pánve; identifikace typu pánve

### **4. subdukční systémy (3 h)**

oceánské p., ofiolity, předobloukové p., zaobloukové p., retro-arc p., meziobloukové p., intraobloukové p., hlubokomořské příkopy, akreční prizma

### **5. orogenní pánve (2 h)**

předpolní pánve, piggy-back (nesené) pánve

### **komplexní historie (1 h)**

pánevní inverze

### **6. praktika (3 h) (mikrotužka + pastelky s sebou !)**

interpretace seismických řezů – kratonické, subdukční, předpolní, piggy-back pánve, pánevní inverze; identifikace typu pánve

## Metody studia pánevní výplně

### **3. reflexní seismika (1 h)**

základní principy, migrace řezů, 3D seismika

praktika – interpretace 2D řezů, stratigrafické i strukturní aspekty

### **7. stratigrafie (1/2 h)**

erozní báze, fyzická stratigrafie, litostratigrafie, genetická stratigrafie, sekvenční stratigrafie, alostratigrafie

### **magnetometrie, gravimetrie, karotáž (1/2 h)**

geofyzikální metody studia pánví – pánevní podloží, výplň, isopachové mapy

### **praktika (2 h)** (mikrotužka + pastelky s sebou !)

korelace profilů, stanovení stratigrafického rámce; korelace karotážních profilů jako stratigrafický nástroj

### **8. subsidenční historie (1 h)**

kompakce, dekompakce, backstripping, subsidenční křivky

### **praktika (2 h)**

subsidenční analýza (notebook s MS Excell s sebou !)

### **9. pánevní modelování (3 h)**

termální historie, odraznost vitrinitu, analýza štepných stop apatitu a zirkonu, fluidní inkluze, 1D, 2D, 3D a 4D modely pánevního vývoje, Petrel

### **10. seminář (3 h)**

studentské prezentace odborné literatury, diskuse

**25.5. 12,20 zkouška (3 h)** – test = esej + interpretace seismického nebo karotážního řezu

**Požadavky ke zkoušce: aktivní účast na praktikách, prezentace odborného textu, zkouška – alespoň 70%**

## Čtení:

### Základní

**P.A. Allen a J.R.Allen (2005): Basin Analysis, Principles and Applications. 2nd ed., Blackwel, 549 pp.**

### Doplňkové

C.J. Busby a R.V. Ingersoll (1995): Tectonics of Sedimentary Basins. Blackwel, 579 pp.

G. Einsele (2000): Sedimentary Basins, Evolution, Facies, and Sediment Budget. 2nd ed., Springer, 792 pp.

M. Wangen (2010): Physical Principles of Sedimentary Basin Analysis. CUP, Cambridge, 527 pp.

### Vybrané kapitoly

G. Nichols (2004): Sedimentology and Stratigraphy. Blackwell, 355 pp. Kapitoly 17 – 24.

M. Leeder (2005): Sedimentology and Sedimentary Basins, From Turbulence to Tectonics. Blackwell, 592 pp. Kapitoly 1 a 8.

# pánevní analýza v kontextu ostatních geověd

- eroze – transport – sedimentace
- *základní výzkum* – identifikace sedim.hornin, porozumění procesům vzniku těchto hornin
- *vztahy k ostatním oborům* – petrologie, sedimentologie, paleoklimatologie, stratigrafie; geochemie, geofyzika, petrofyzika, geotektonika
- *aplikovaný výzkum* – porozita - rezervoárová geologie (voda, ropa, plyn, úložiště CO<sub>2</sub>, ...); permeabilita – hydrogeologie; geomechanické vlastnosti – inženýrská geologie, ....

# studium sedimentárních procesů v laboratoři



procesy &  
produkty  
(nezpevněný  
sediment)



# studium recentních sedimentárních systémů



procesy & produkty (nezpevněný sediment)

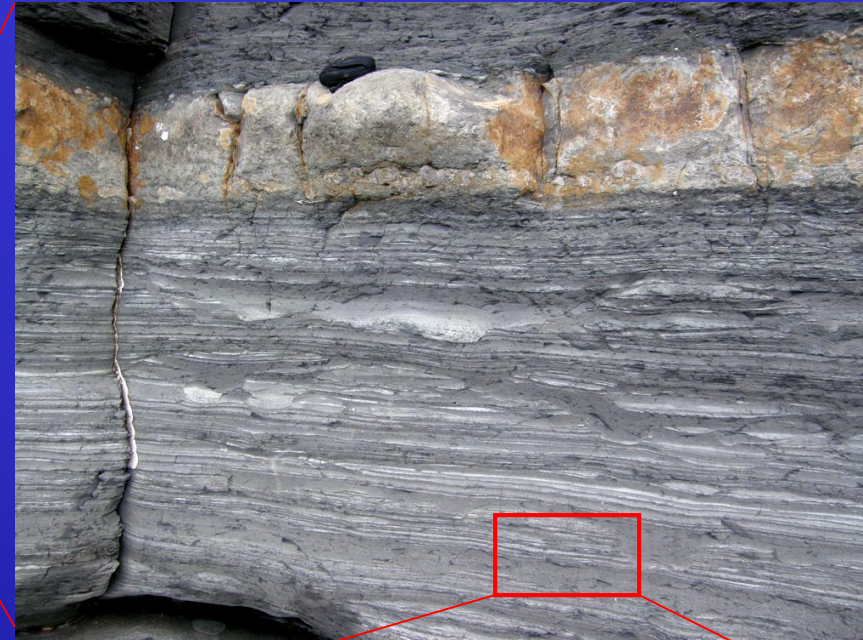


Esequibo River, Guyana



# fosilní sedimentární systémy

# Výchozy (Scarborough, s. Anglie)



# vrty procesy & produkty (zpevněný sediment)

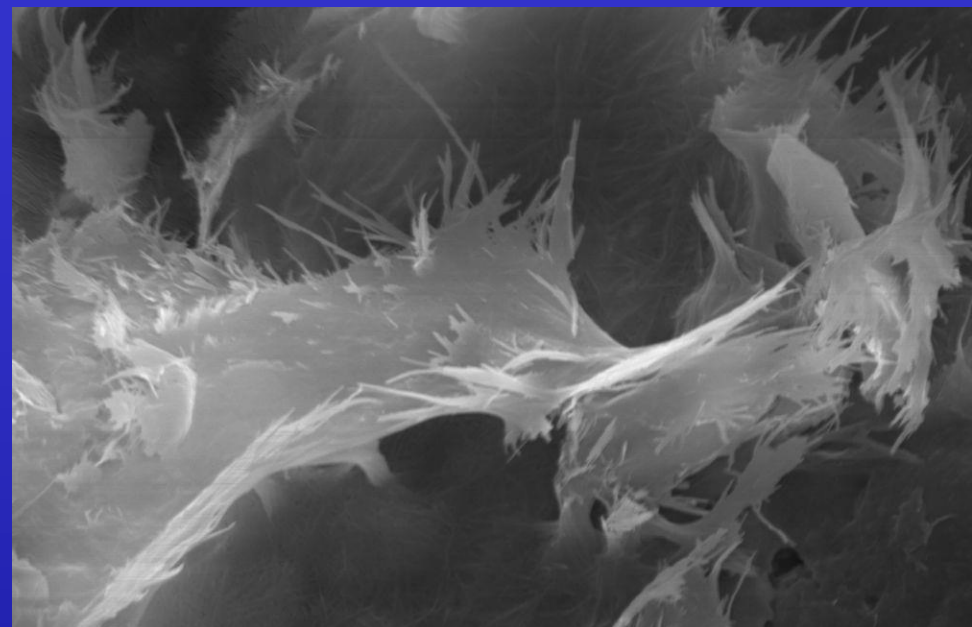
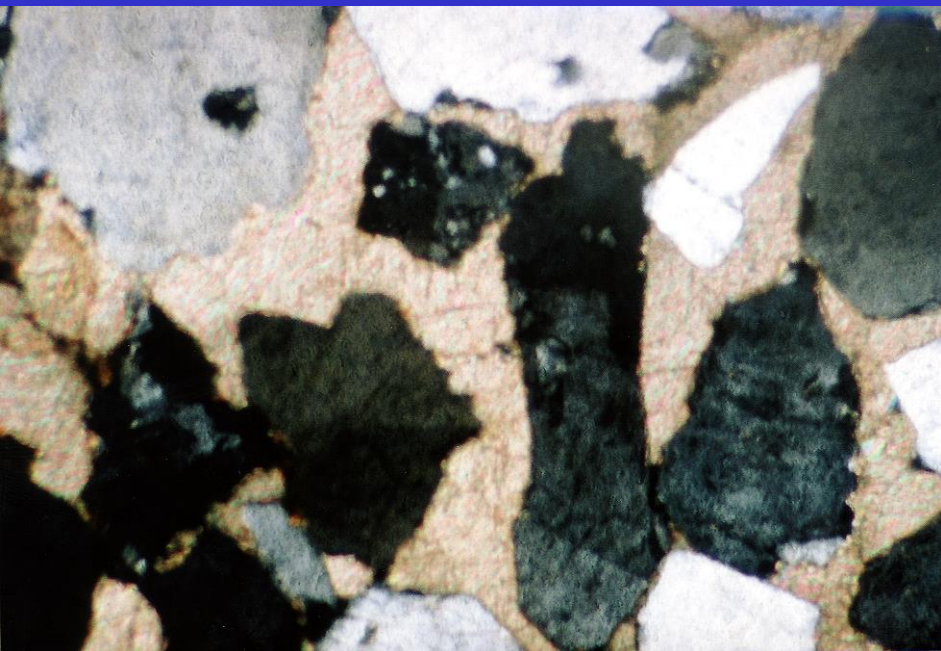




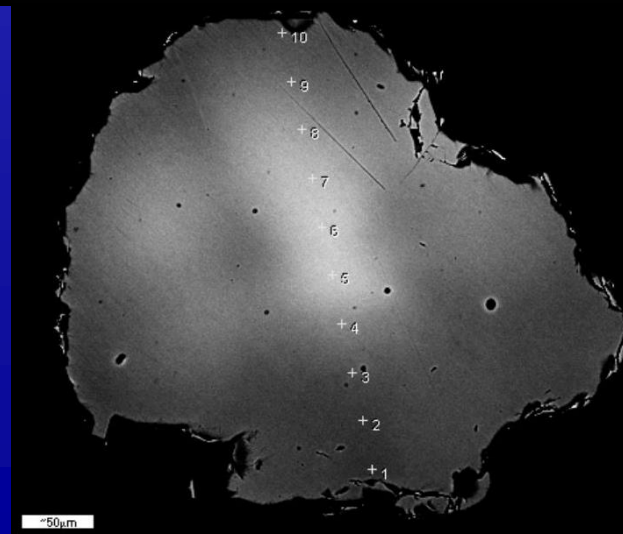
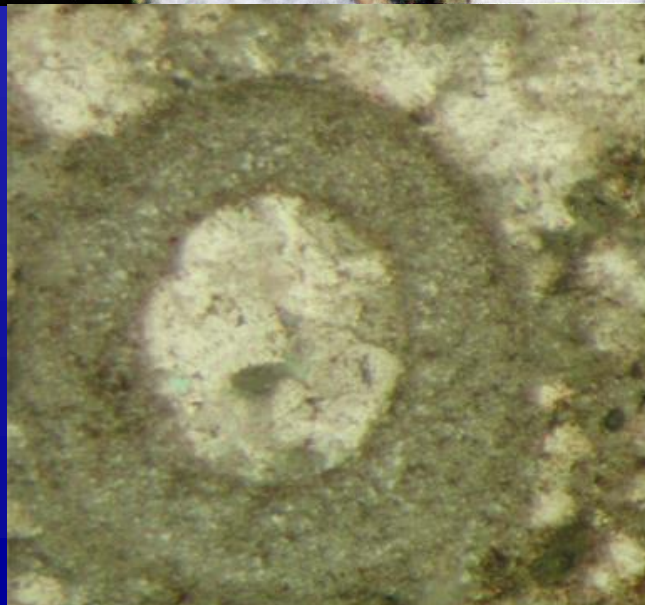
optický mikroskop

mikrostruktury

elektronový mikroskop



25kV X3,000 5µm 0025 13 49 SEI







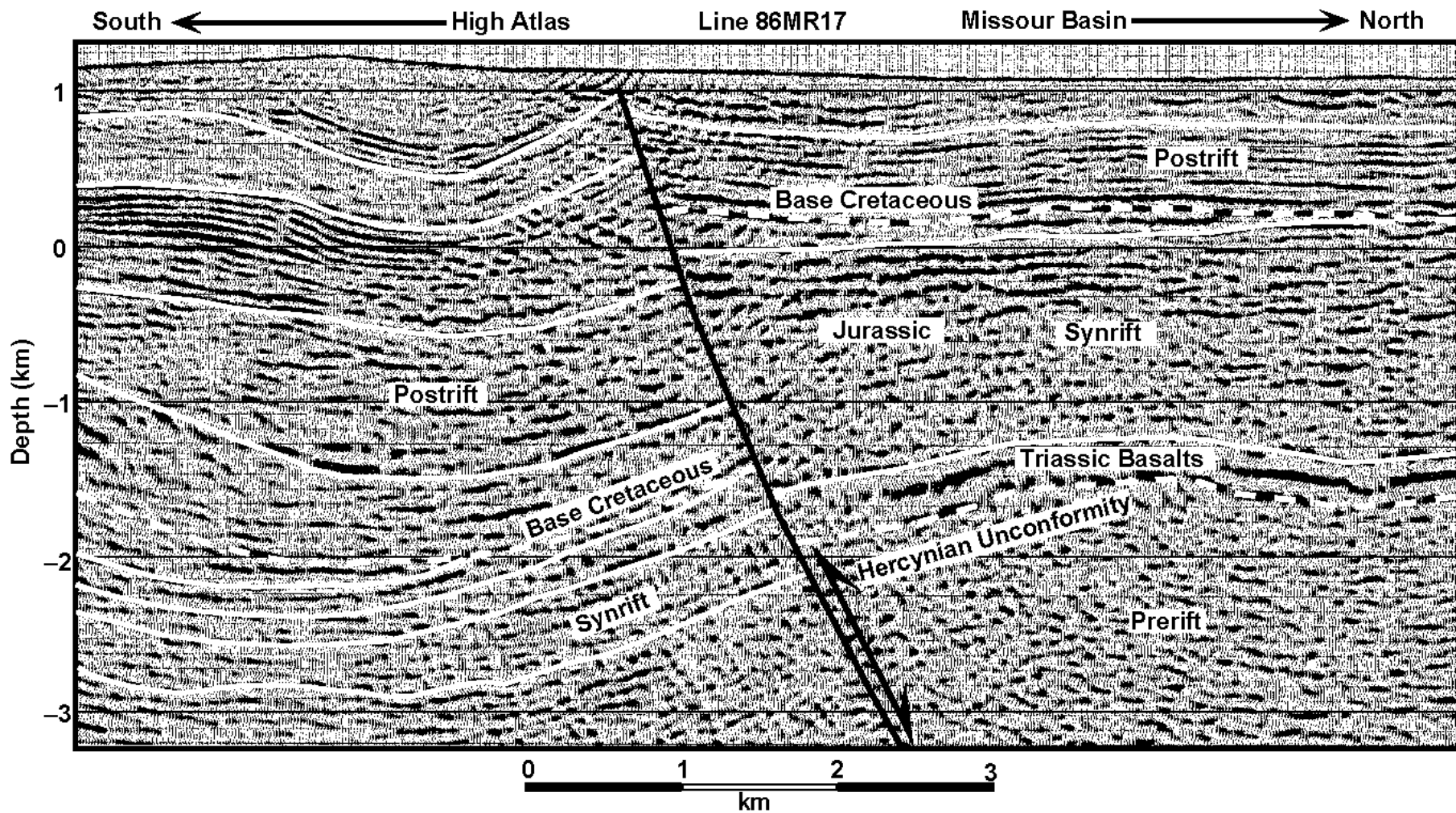
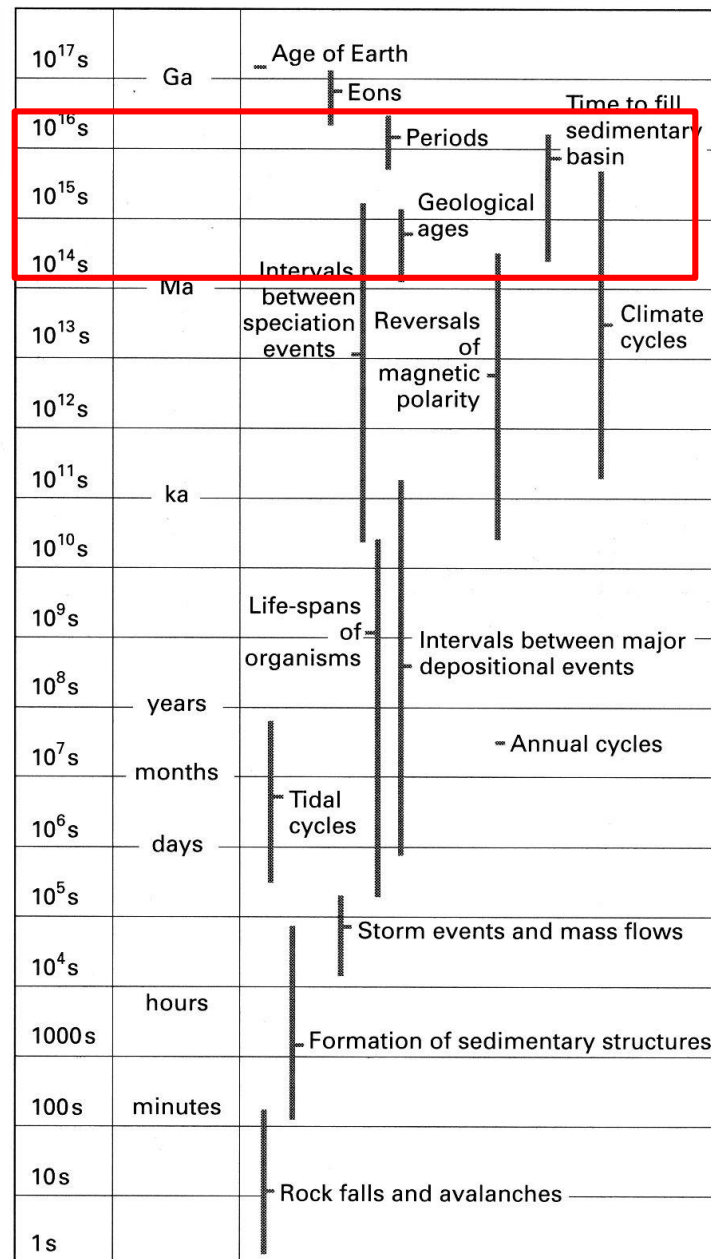
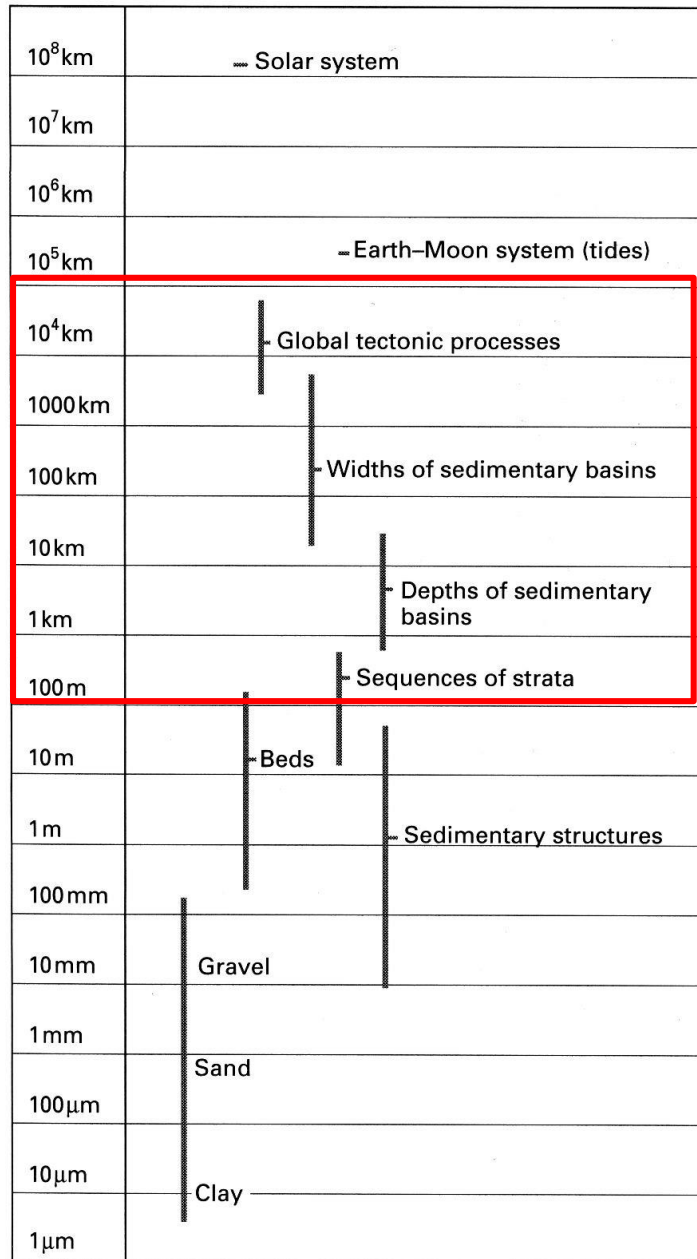


Figure 15—Seismic profile 86MR17 shows the uplift of the Hercynian unconformity above the null point. There has been an apparent uplift of 2 km on the Hercynian unconformity. The amount of shortening normal to the fault, and subsequent strain is accommodated by strike-slip or oblique-slip movement (location on Figure 12).



# rozsah geologických procesů v prostoru: a v čase:



## SEDIMENTÁRNÍ PÁNEV

- oblast na Zemském povrchu charakteristická dlouhotrvající subsidencí, která je řízena procesy probíhajícími v litosféře a souvisí s pohyby jednotlivých litosférických desek.



## ZPŮSOBY KLASIFIKACE

- ❑ podle typu litosférického podkladu (kontinentální, oceanické, přechodové)
- ❑ podle pozice vůči litosférickým deskám (intrakrtonické, deskookrajové)
- ❑ podle typu deskového rozhraní (divergentní, konvergentní, transformní)
- ❑ podle mechanismu vzniku

# MECHANISMY VZNIKU SEDIMENTÁRNÍCH PÁNVÍ

(Tři hlavní skupiny, jednotlivé mechanismy se však mohou kombinovat.)

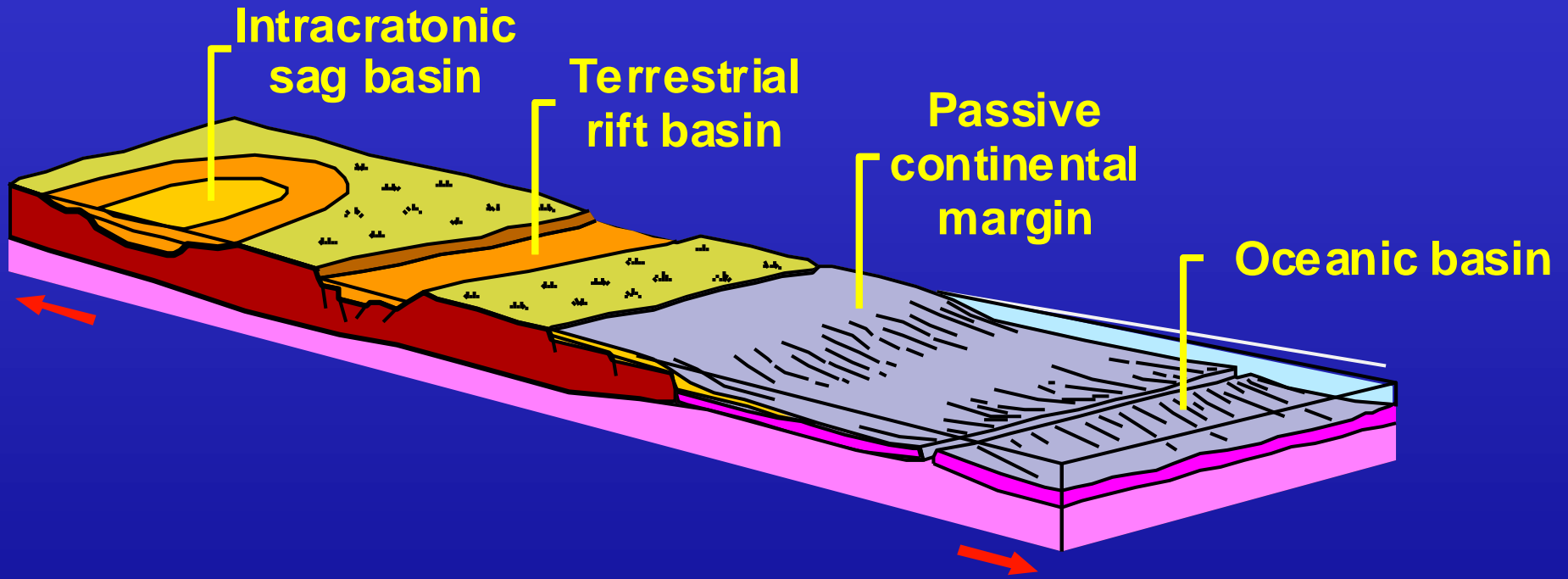
- ❑ změny mocnosti litosféry (natažením, povrchovou erozí,...)
- ❑ termální mechanismy (např. subsidence chladnoucí litosféry)
- ❑ zatížení (tektonické zatížení, zatížení sedimenty nebo vulkanity)  
⇒ izostatická kompenzace ⇒ vznik flexury



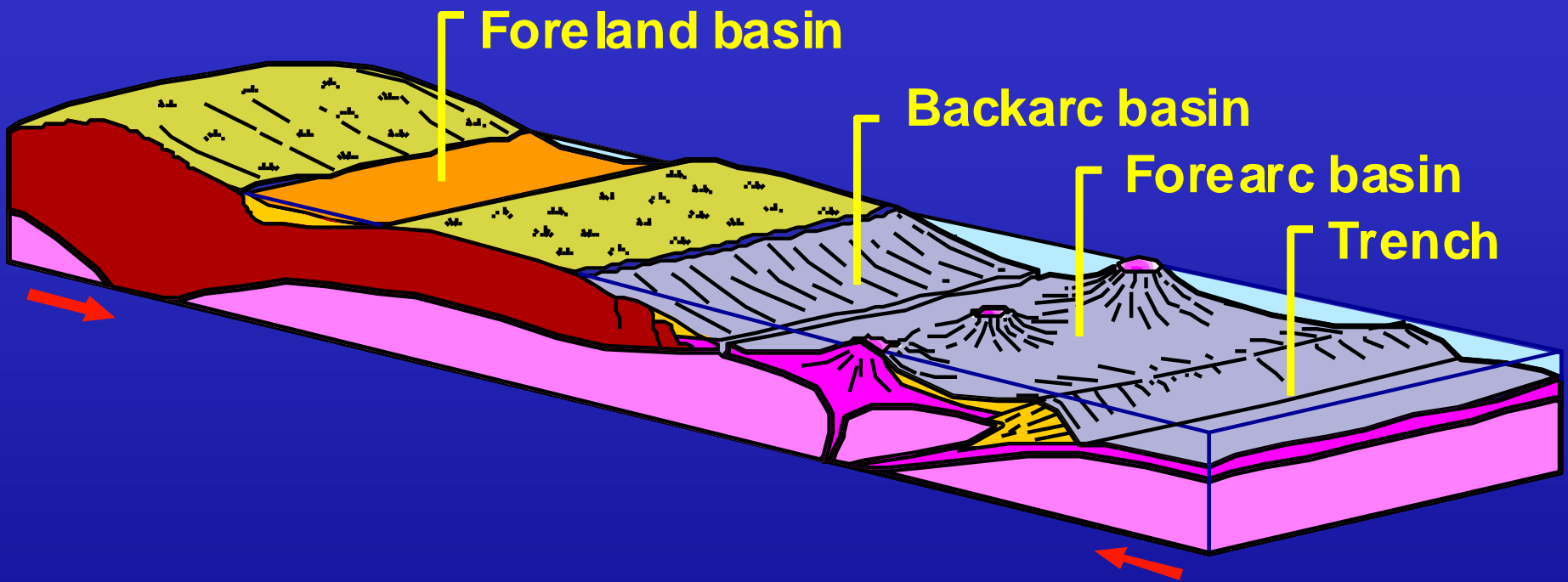
# GENETICKÉ DĚLENÍ SEDIMENTÁRNÍCH PÁNVÍ

- ❑ Pánve vzniklé natahováním litosféry
- ❑ Pánve vzniklé flexurou litosféry
- ❑ pánve na horizontálních posunech (strike-slipové pánve)

# Tectonic setting of sedimentary basins

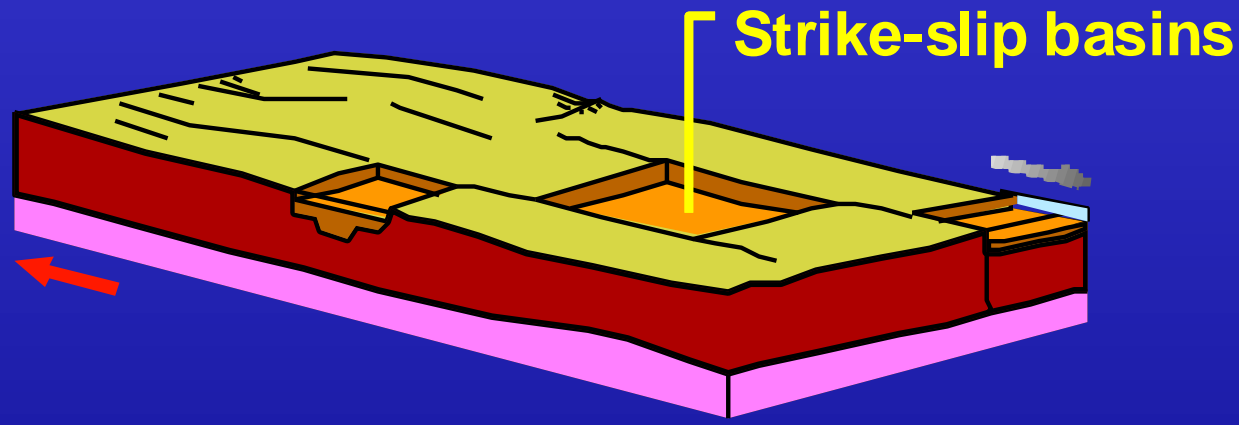


# Tectonic setting of sedimentary basins

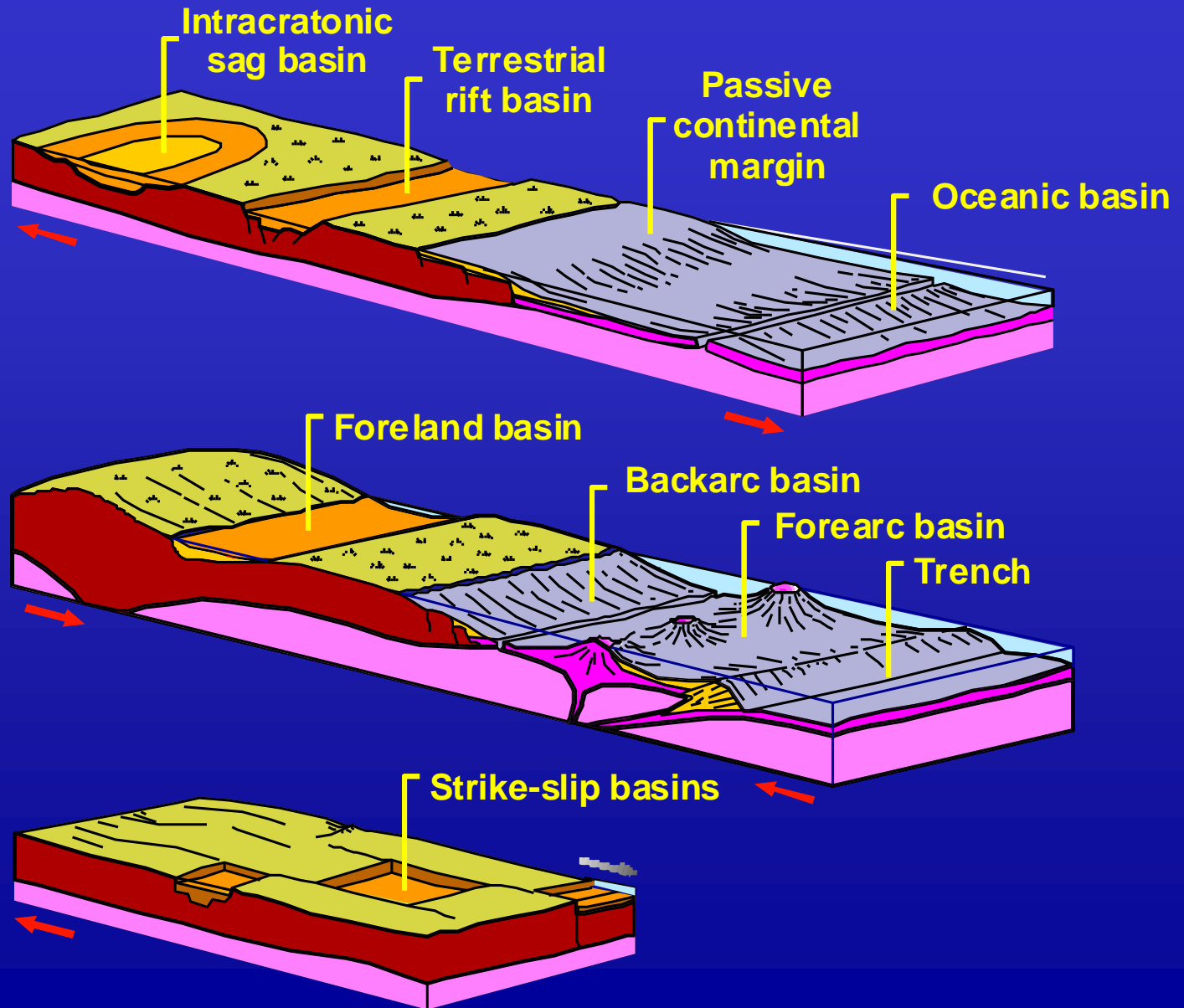




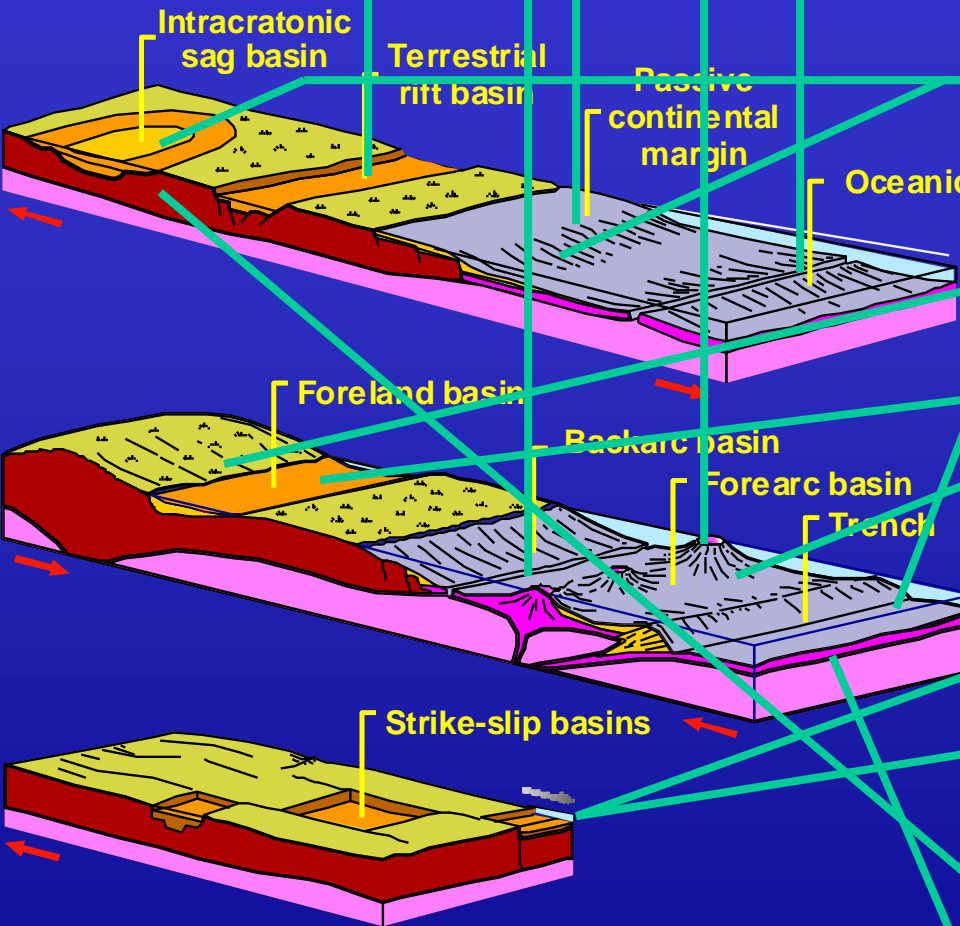
# Tectonic setting of sedimentary basins



# Tectonic setting of sedimentary basins



# Basin Heat flow



## EXTENSIONAL BASINS

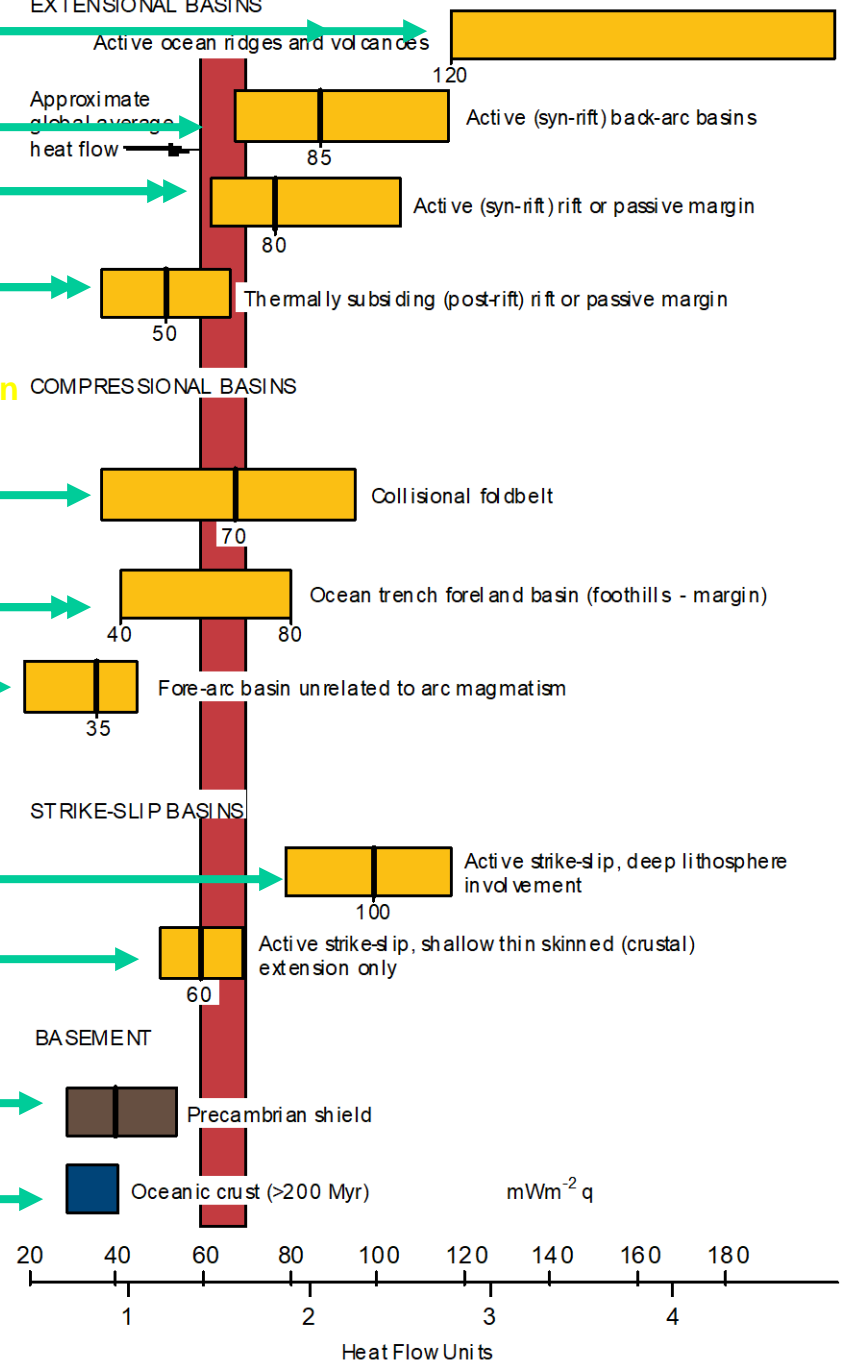
Active ocean ridges and volcanoes

Approximate global average heat flow

## COMPRESSIONAL BASINS

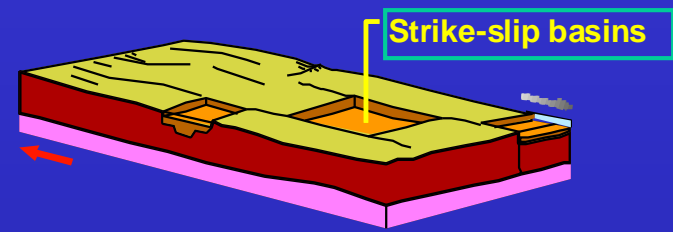
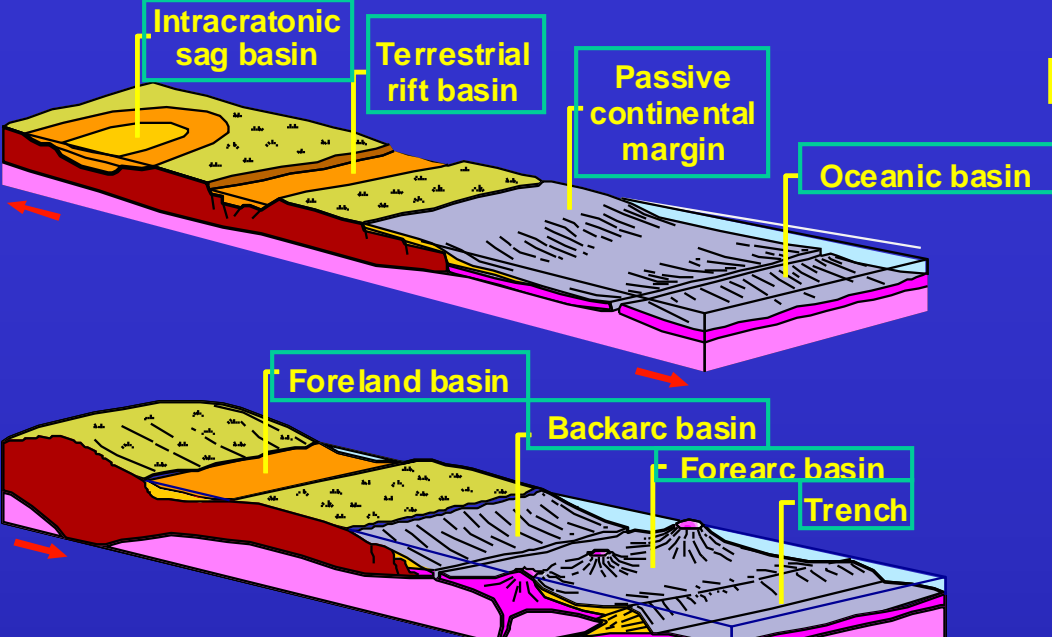
## STRIKE-SLIP BASINS

## BASEMENT



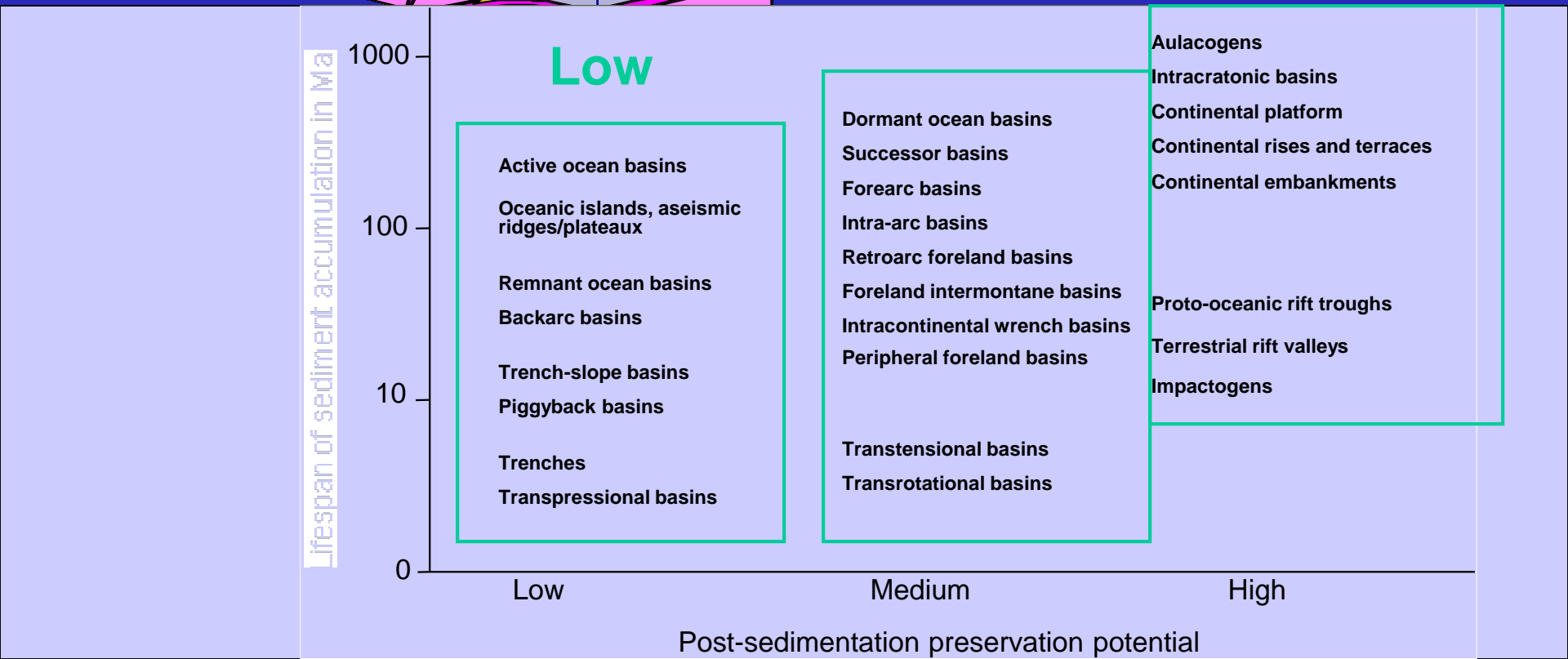


# Basin preservation potential

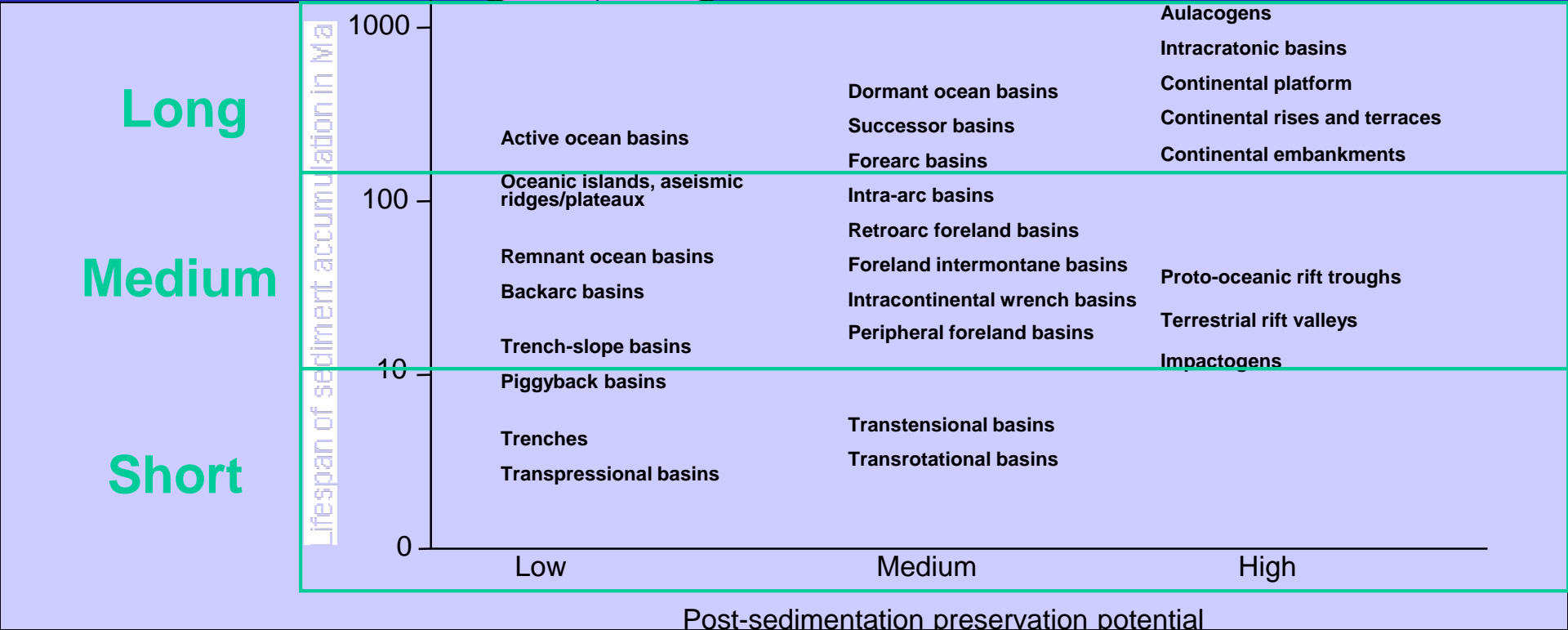
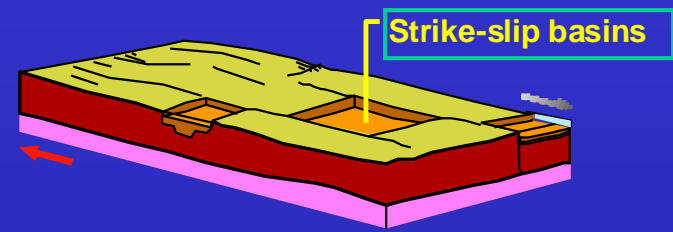
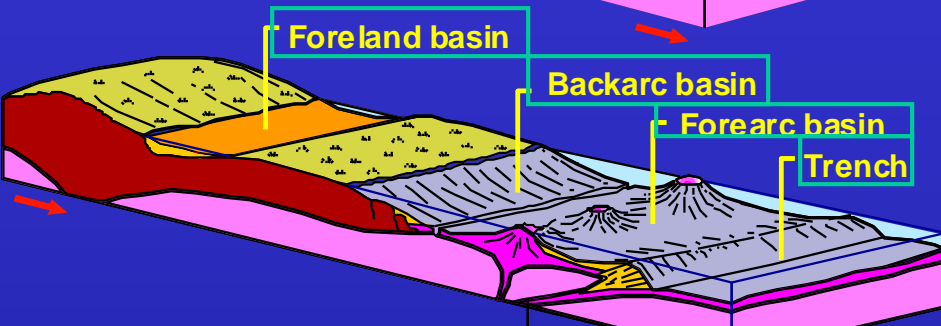
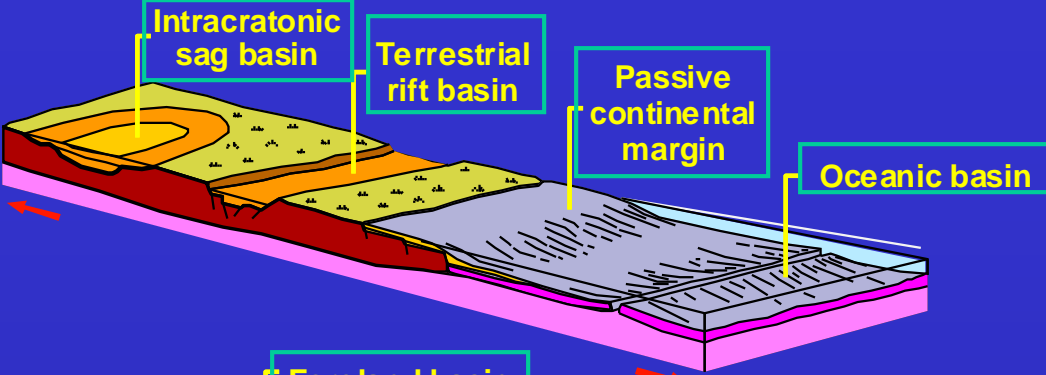


Medium

High

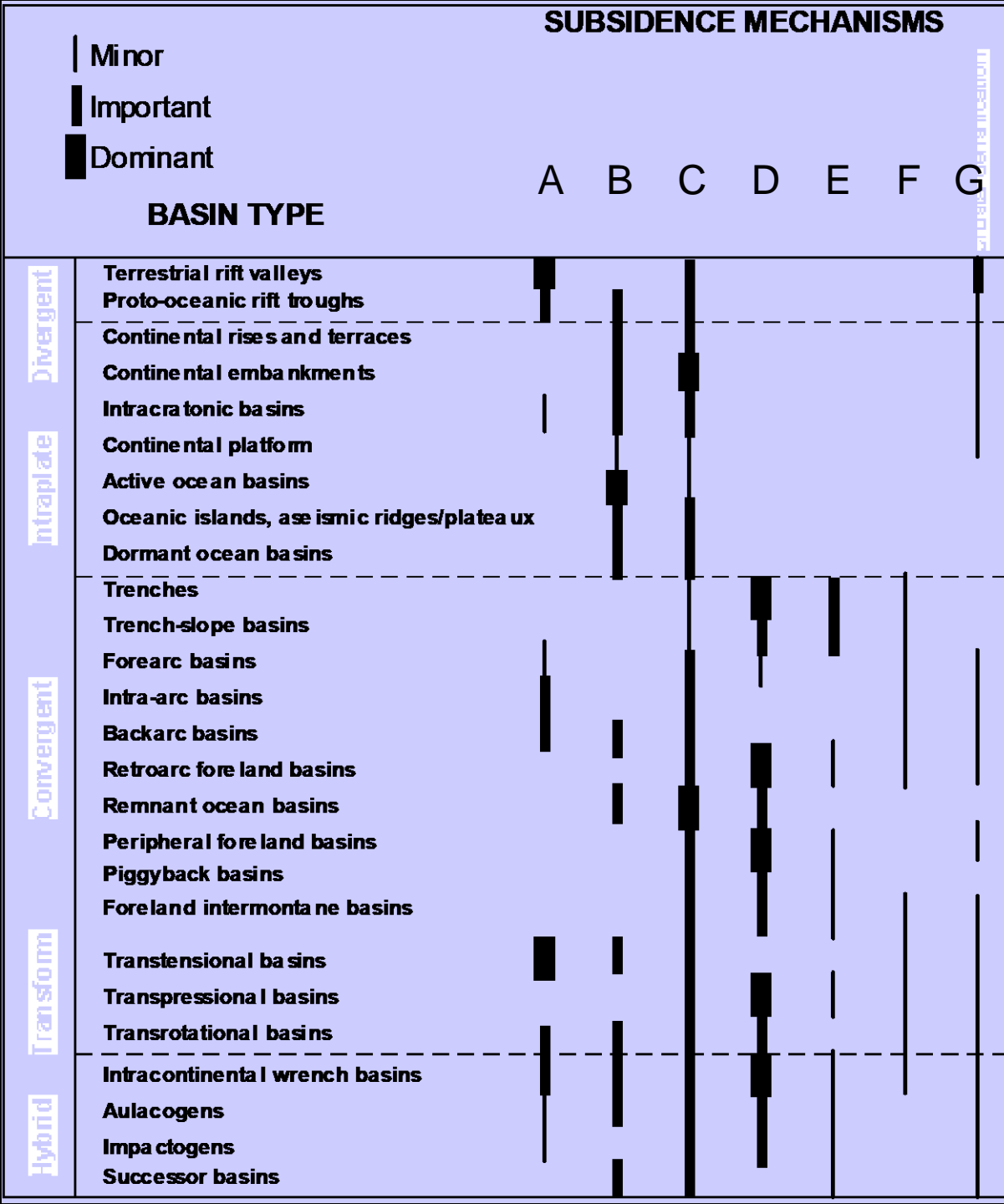


# Basin lifespan



# Subsidence mechanism

- A. Crustal thinning
- B. Mantle-lithosphere thickening
- C. Sedimentary and volcanic loading
- D. Tectonic loading
- E. Subcrustal loading
- F. Asthenospheric flow
- G. Crustal densification





# Subsidence mechanism

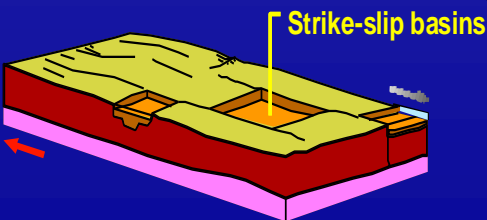
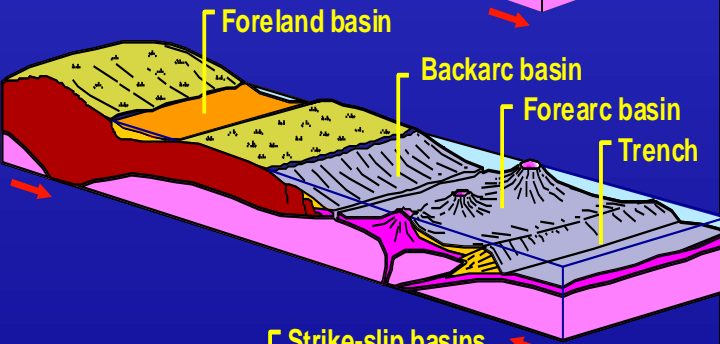
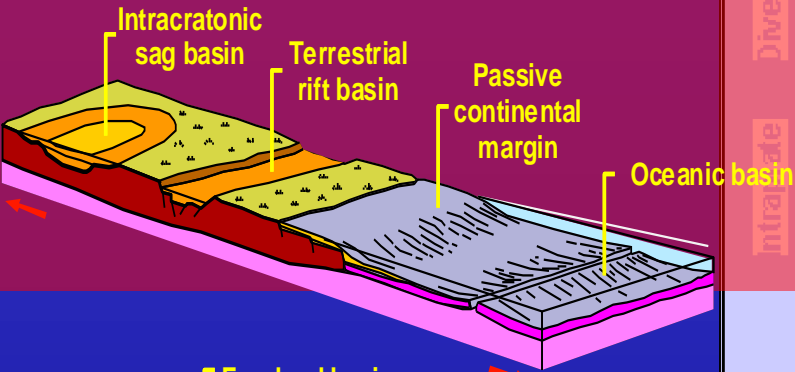
## SUBSIDENCE MECHANISMS

- Minor
- Important
- Dominant

- A. Crustal thinning
- B. Mantle-lithosphere thickening

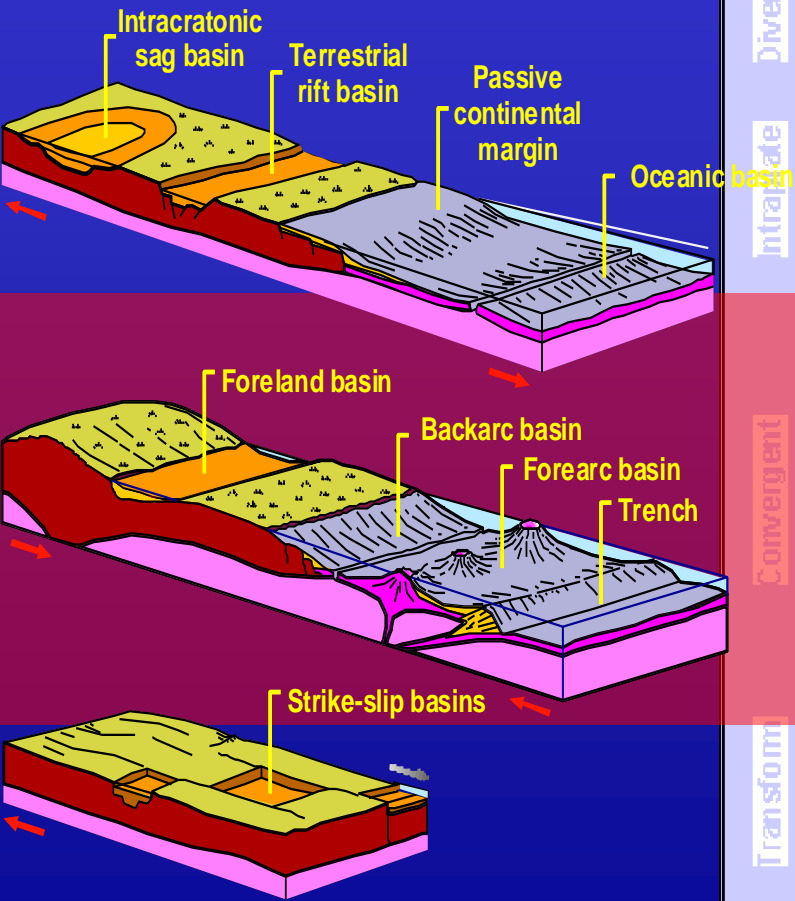
### BASIN TYPE

A B C D E F G



	A	B	C	D	E	F	G
Divergent	Terrestrial rift valleys	Minor	Minor	Minor	Minor	Minor	Minor
	Proto-oceanic rift troughs	Minor	Minor	Minor	Minor	Minor	Minor
	Continental rises and terraces	Minor	Minor	Minor	Minor	Minor	Minor
	Continental embankments	Minor	Minor	Minor	Minor	Minor	Minor
	Intracratonic basins	Minor	Minor	Minor	Minor	Minor	Minor
	Continental platform	Minor	Minor	Minor	Minor	Minor	Minor
	Active ocean basins	Minor	Minor	Minor	Minor	Minor	Minor
Intra-plate	Oceanic islands, aseismic ridges/plateaux	Minor	Minor	Minor	Minor	Minor	Minor
	Dormant ocean basins	Minor	Minor	Minor	Minor	Minor	Minor
	Trenches	Minor	Minor	Minor	Minor	Minor	Minor
	Trench-slope basins	Minor	Minor	Minor	Minor	Minor	Minor
	Forearc basins	Minor	Minor	Minor	Minor	Minor	Minor
	Intra-arc basins	Minor	Minor	Minor	Minor	Minor	Minor
	Backarc basins	Minor	Minor	Minor	Minor	Minor	Minor
Convergent	Retroarc foreland basins	Minor	Minor	Minor	Minor	Minor	Minor
	Remnant ocean basins	Minor	Minor	Minor	Minor	Minor	Minor
	Peripheral foreland basins	Minor	Minor	Minor	Minor	Minor	Minor
	Piggyback basins	Minor	Minor	Minor	Minor	Minor	Minor
	Foreland intermontane basins	Minor	Minor	Minor	Minor	Minor	Minor
	Transensional basins	Minor	Minor	Minor	Minor	Minor	Minor
	Transpressional basins	Minor	Minor	Minor	Minor	Minor	Minor
Transform	Transrotational basins	Minor	Minor	Minor	Minor	Minor	Minor
	Intracontinental wrench basins	Minor	Minor	Minor	Minor	Minor	Minor
	Hybrid	Aulacogens	Minor	Minor	Minor	Minor	Minor
Impactogens		Minor	Minor	Minor	Minor	Minor	Minor
Successor basins		Minor	Minor	Minor	Minor	Minor	Minor

# Subsidence mechanism



## SUBSIDENCE MECHANISMS

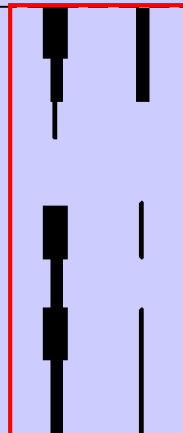
- Minor
- Important
- Dominant

- D. Tectonic loading
- E. Subcrustal loading

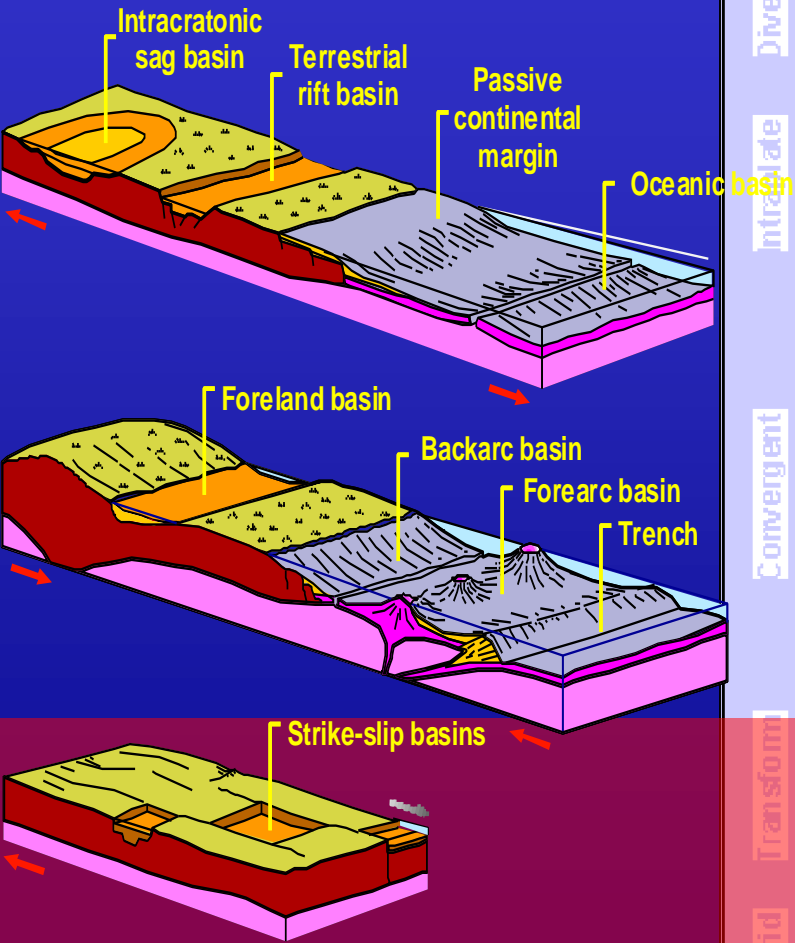
## BASIN TYPE

A B C D E F G

	A	B	C	D	E	F	G
Divergent	Terrestrial rift valleys	Minor	Minor	Minor	Minor	Minor	Minor
	Proto-oceanic rift troughs	Minor	Minor	Minor	Minor	Minor	Minor
	Continental rises and terraces	Minor	Minor	Minor	Minor	Minor	Minor
	Continental embankments	Minor	Minor	Minor	Minor	Minor	Minor
	Intracratonic basins	Minor	Minor	Minor	Minor	Minor	Minor
	Continental platform	Minor	Minor	Minor	Minor	Minor	Minor
Intra-plate	Active ocean basins	Minor	Minor	Minor	Minor	Minor	Minor
	Oceanic islands, aseismic ridges/plateaux	Minor	Minor	Minor	Minor	Minor	Minor
	Dormant ocean basins	Minor	Minor	Minor	Minor	Minor	Minor
	Trenches	Minor	Minor	Minor	Minor	Minor	Minor
Convergent	Trench-slope basins	Minor	Minor	Minor	Minor	Minor	Minor
	Forearc basins	Minor	Minor	Minor	Minor	Minor	Minor
	Intra-arc basins	Minor	Minor	Minor	Minor	Minor	Minor
	Backarc basins	Minor	Minor	Minor	Minor	Minor	Minor
	Retroarc foreland basins	Minor	Minor	Minor	Minor	Minor	Minor
	Remnant ocean basins	Minor	Minor	Minor	Minor	Minor	Minor
	Peripheral foreland basins	Minor	Minor	Minor	Minor	Minor	Minor
	Piggyback basins	Minor	Minor	Minor	Minor	Minor	Minor
	Foreland intermontane basins	Minor	Minor	Minor	Minor	Minor	Minor
	Foreland intermontane basins	Minor	Minor	Minor	Minor	Minor	Minor
Transform	Transensional basins	Minor	Minor	Minor	Minor	Minor	Minor
	Transpressional basins	Minor	Minor	Minor	Minor	Minor	Minor
	Transrotational basins	Minor	Minor	Minor	Minor	Minor	Minor
Hybrid	Intracontinental wrench basins	Minor	Minor	Minor	Minor	Minor	Minor
	Aulacogens	Minor	Minor	Minor	Minor	Minor	Minor
	Impactogens	Minor	Minor	Minor	Minor	Minor	Minor
Successor basins	Minor	Minor	Minor	Minor	Minor	Minor	



# Subsidence mechanism



## SUBSIDENCE MECHANISMS

- Minor
- Important
- Dominant

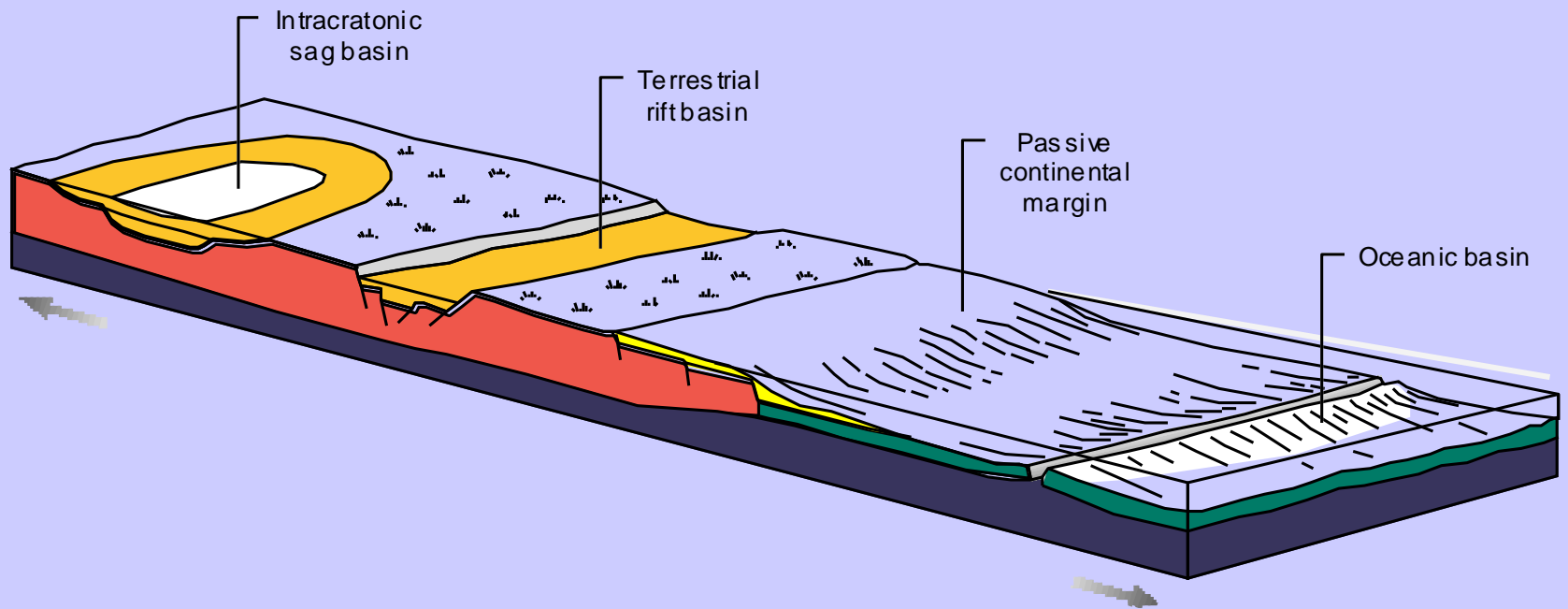
Multiple mechanisms

### BASIN TYPE

A B C D E F G

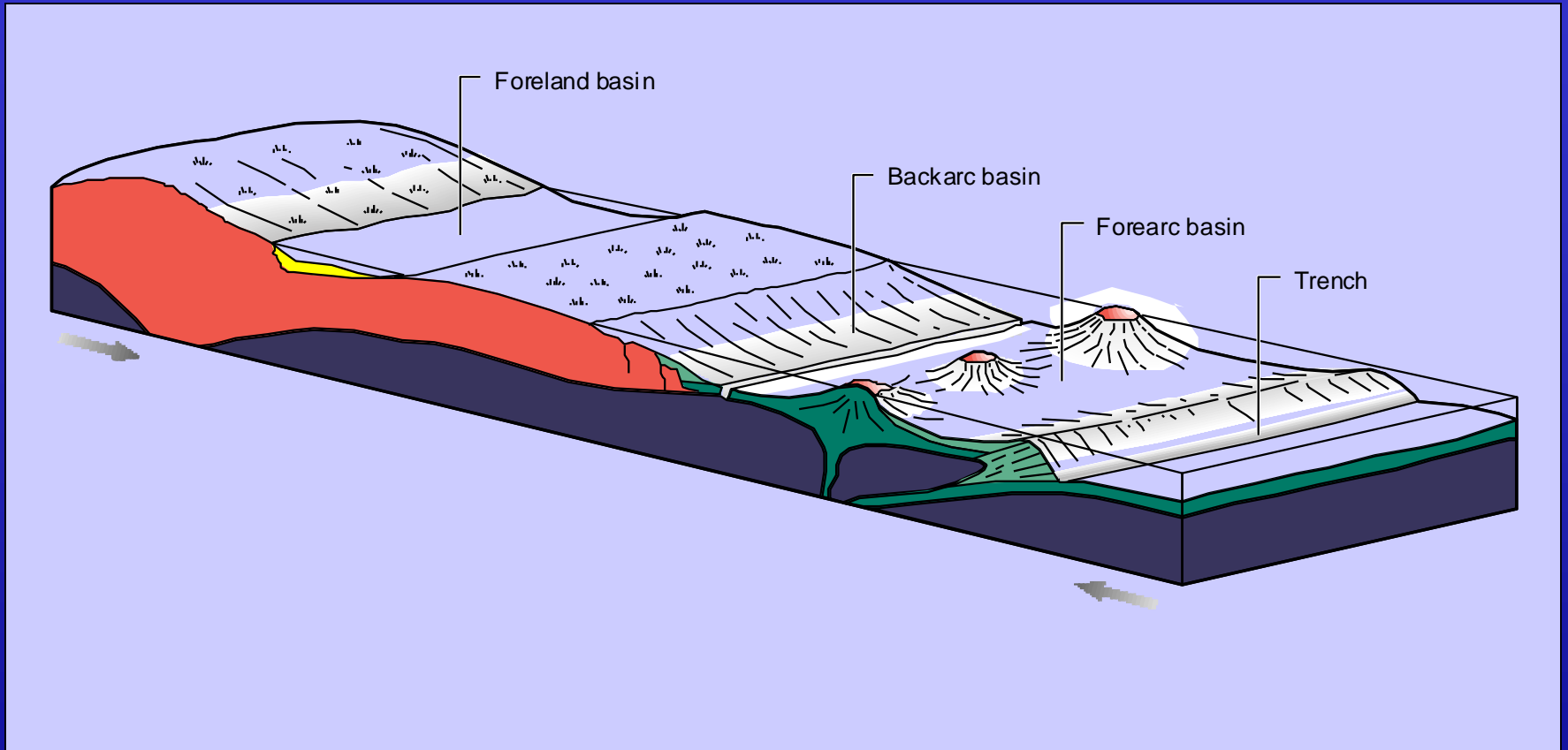
	A	B	C	D	E	F	G
Divergent	Terrestrial rift valleys	Minor	Minor	Minor	Minor	Minor	Minor
	Proto-oceanic rift troughs	Minor	Minor	Minor	Minor	Minor	Minor
	Continental rises and terraces	Minor	Minor	Minor	Minor	Minor	Minor
	Continental embankments	Minor	Minor	Minor	Minor	Minor	Minor
	Intracratonic basins	Minor	Minor	Minor	Minor	Minor	Minor
	Continental platform	Minor	Minor	Minor	Minor	Minor	Minor
	Active ocean basins	Minor	Minor	Minor	Minor	Minor	Minor
Intra-plate	Oceanic islands, aseismic ridges/plateaux	Minor	Minor	Minor	Minor	Minor	Minor
	Dormant ocean basins	Minor	Minor	Minor	Minor	Minor	Minor
	Trenches	Minor	Minor	Minor	Minor	Minor	Minor
	Trench-slope basins	Minor	Minor	Minor	Minor	Minor	Minor
	Forearc basins	Minor	Minor	Minor	Minor	Minor	Minor
	Intra-arc basins	Minor	Minor	Minor	Minor	Minor	Minor
	Backarc basins	Minor	Minor	Minor	Minor	Minor	Minor
	Retroarc foreland basins	Minor	Minor	Minor	Minor	Minor	Minor
	Remnant ocean basins	Minor	Minor	Minor	Minor	Minor	Minor
	Peripheral foreland basins	Minor	Minor	Minor	Minor	Minor	Minor
Convergent	Piggyback basins	Minor	Minor	Minor	Minor	Minor	Minor
	Foreland intermontane basins	Minor	Minor	Minor	Minor	Minor	Minor
	Transensional basins	Minor	Minor	Minor	Minor	Minor	Minor
	Transpressional basins	Minor	Minor	Minor	Minor	Minor	Minor
Transform	Transrotational basins	Minor	Minor	Minor	Minor	Minor	Minor
	Intracontinental wrench basins	Minor	Minor	Minor	Minor	Minor	Minor
	Aulacogens	Minor	Minor	Minor	Minor	Minor	Minor
Hybrid	Impactogens	Minor	Minor	Minor	Minor	Minor	Minor
	Successor basins	Minor	Minor	Minor	Minor	Minor	Minor

# převážně extenzní režim





# převážně kompresní režim

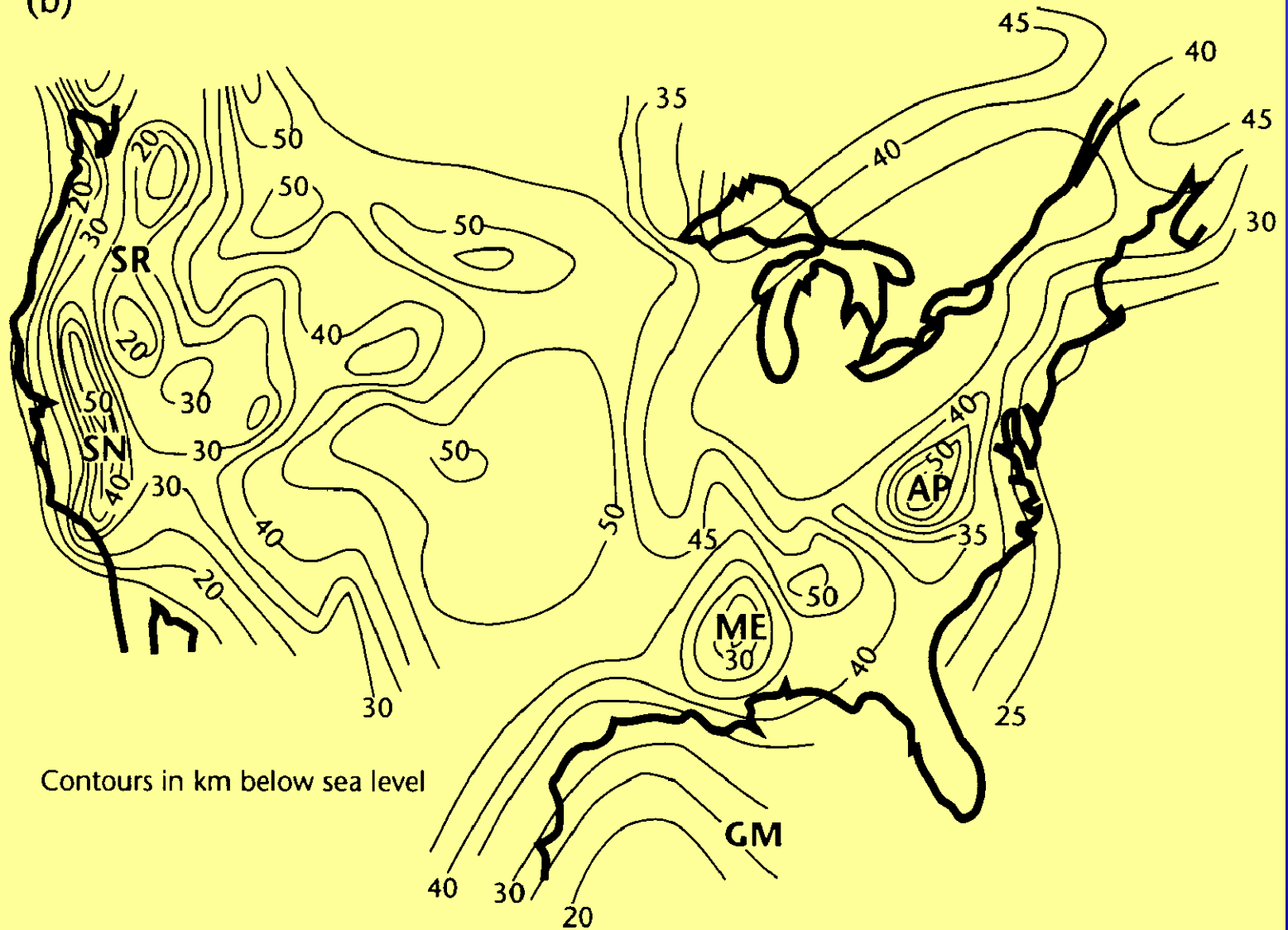


# báze MOHO

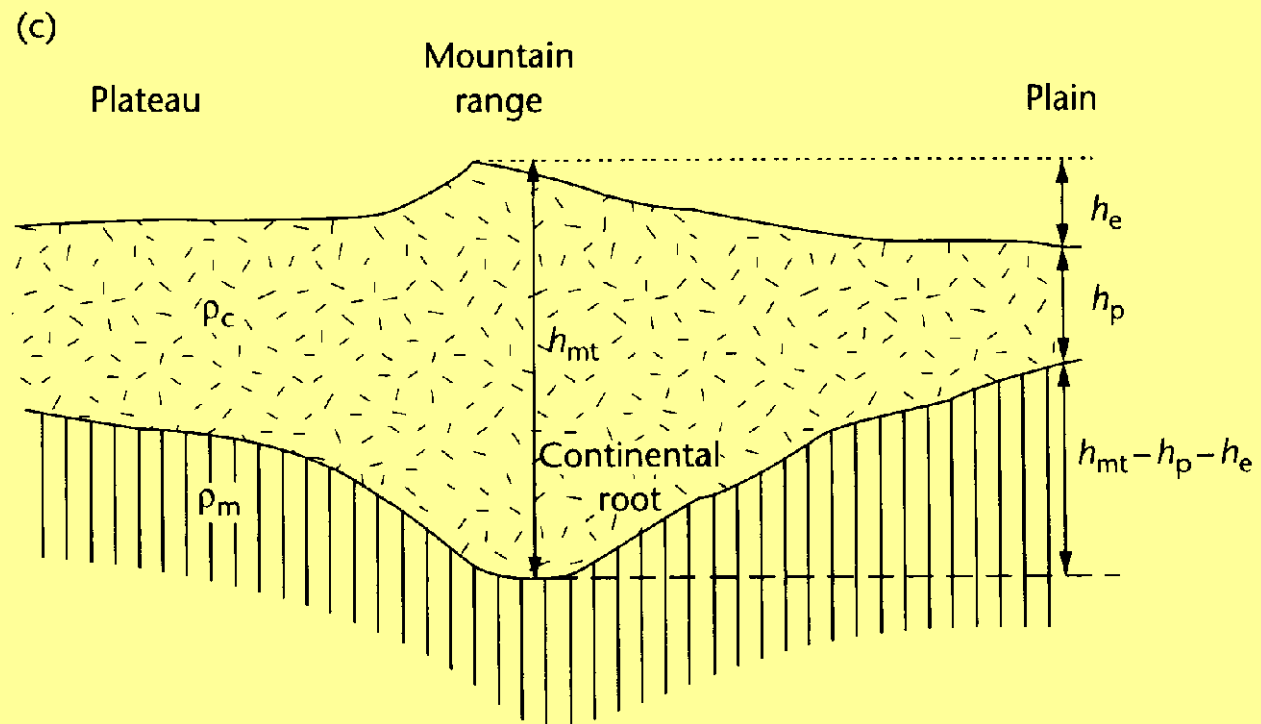
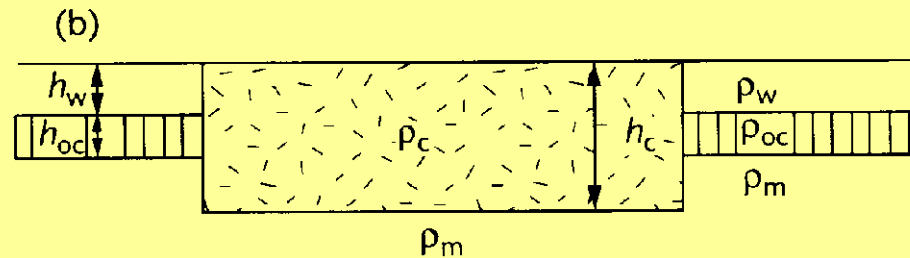
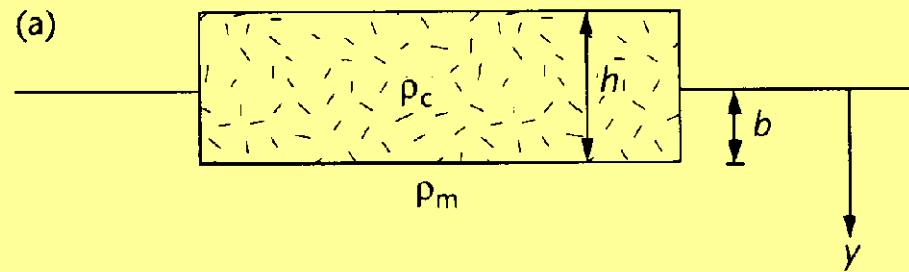


# báze MOHO

(b)



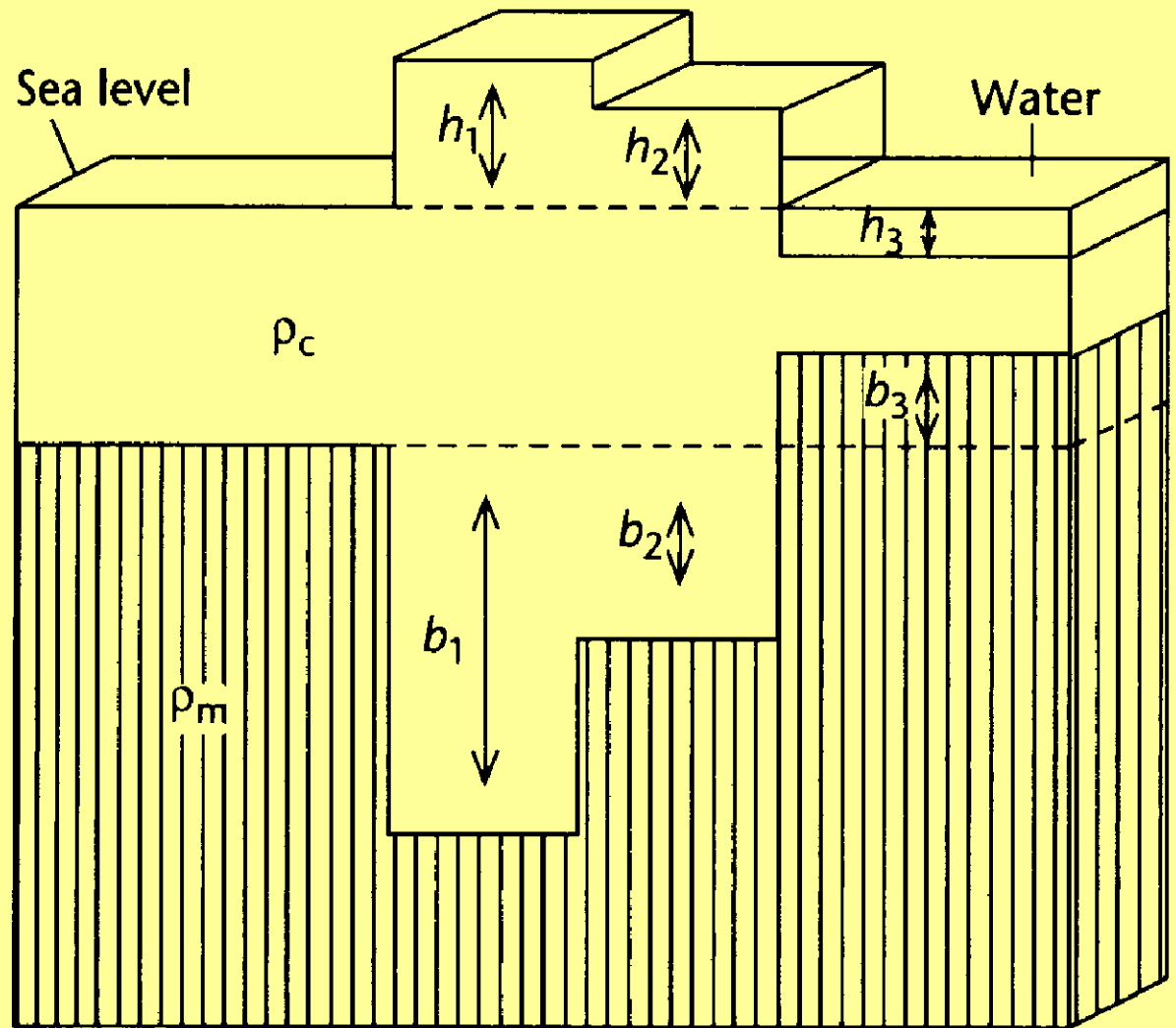
# koncept izostáze



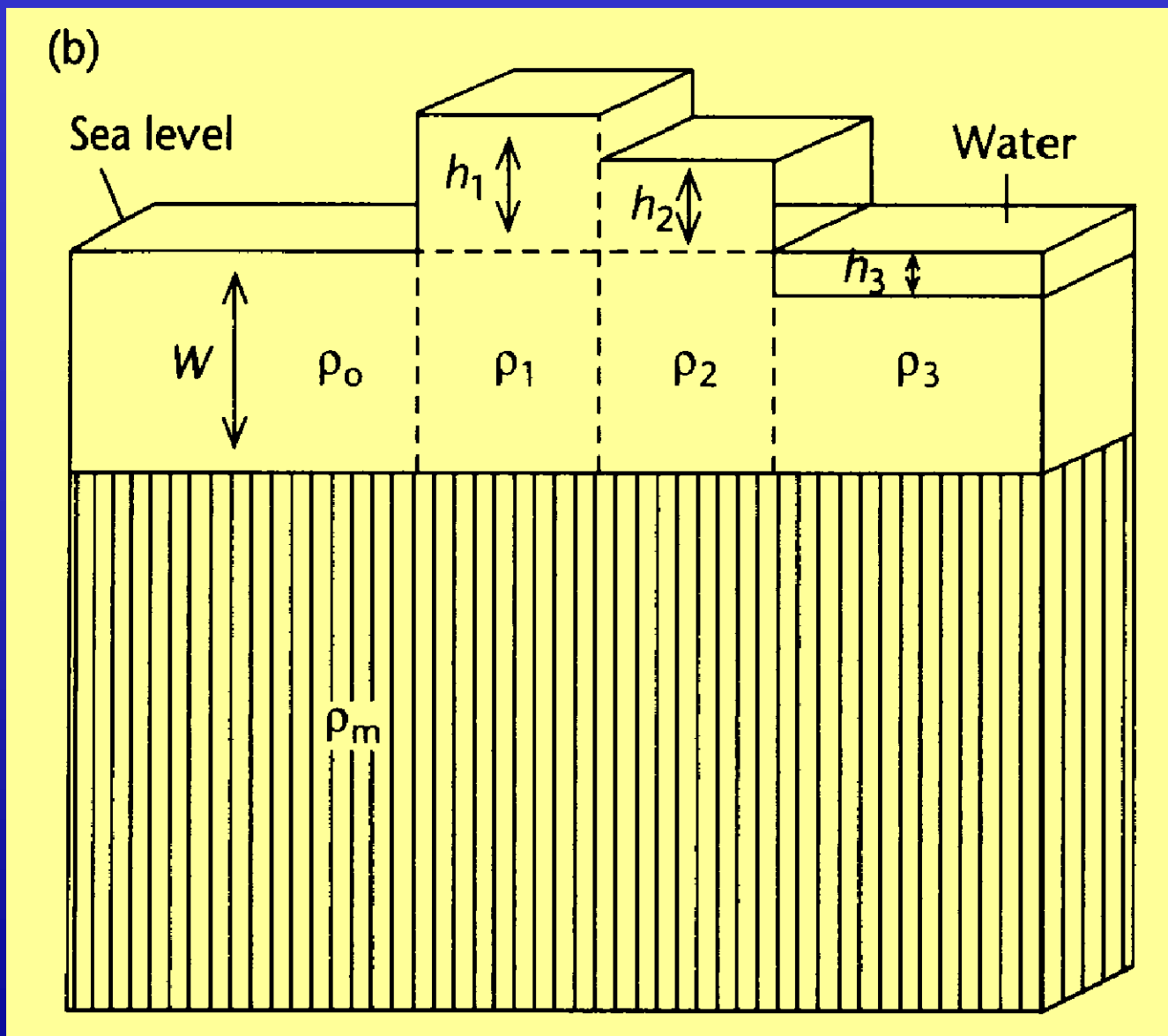


model  
izostáze  
Airy

(a)



model  
izostáze  
Pratt



# stratigrafický záznam není úplný

