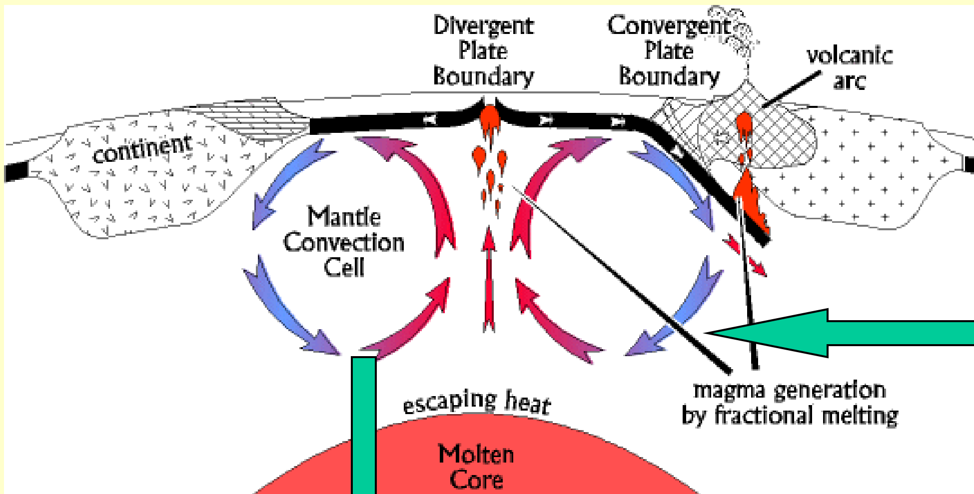
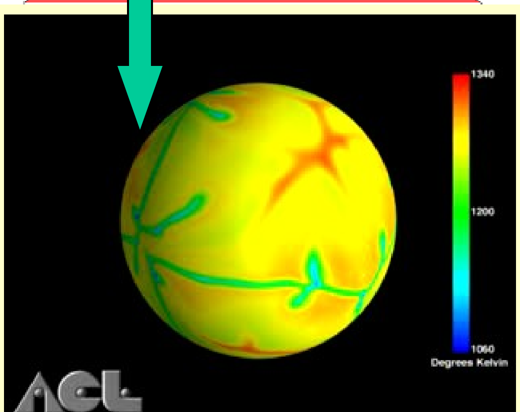
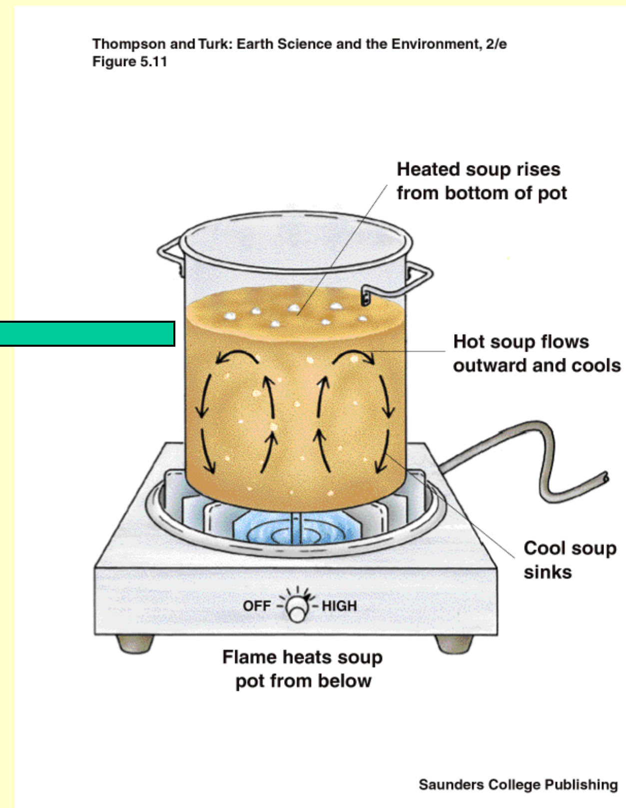
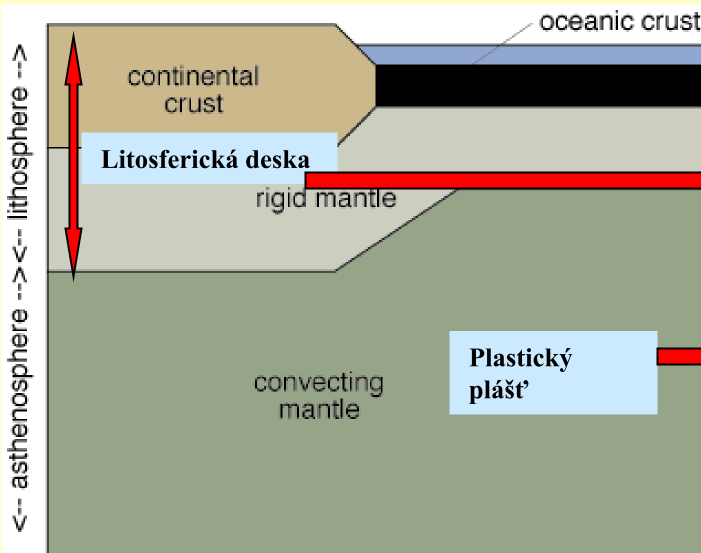
Geologie na konci 20. století přešla od fixistických statických interpretací k dynamickému pojetí vývoje Zemč. Dnes dominující paradigma geologie – tektonika litosferických desek - zdůrazňuje výrazné horizontální přesuny kontinentálních bloků. Za jejich hnací motor je považována tepelná konvekce v plášti Země, která je určována tepelnou výměnou mezi žhavotekutým jádrem Země a poměrně chladným povrchem.







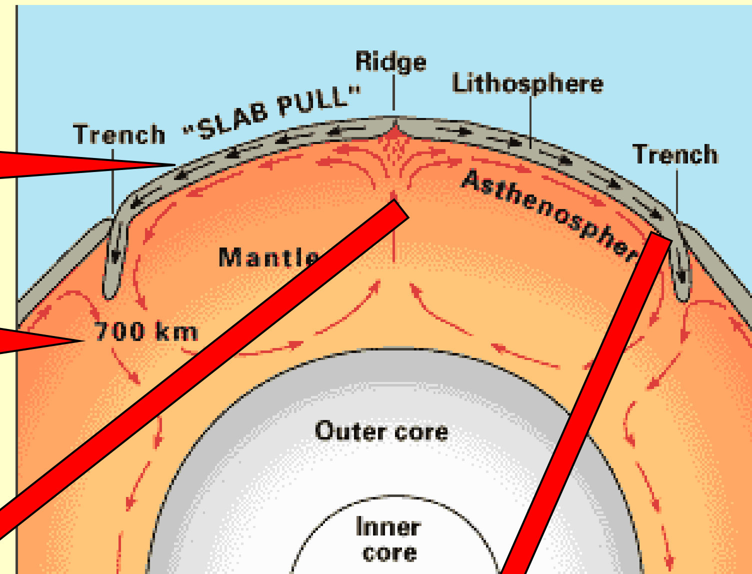
Teorie litosferických desek předpokládá, že konvekční tepelné proudy v plastické části zemského pláště vedou v místech vzestupných tepelných proudů ke vzniku divergentních rozhraní a v místech sestupných tepelných proudů ke vzniku konvergentních rozhraní litosferických desek



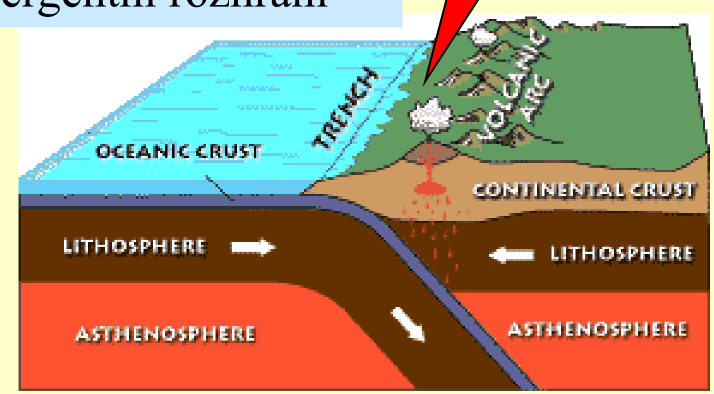
Outer layers of the Earth. Plates are made of crust and rigid upper mantle.

Litosferická deska

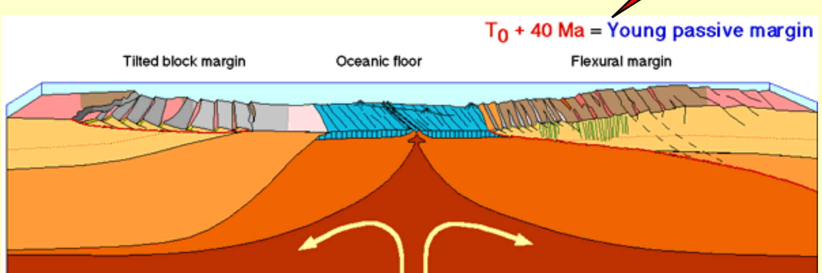
Plastický plášť



Konvergentní rozhraní

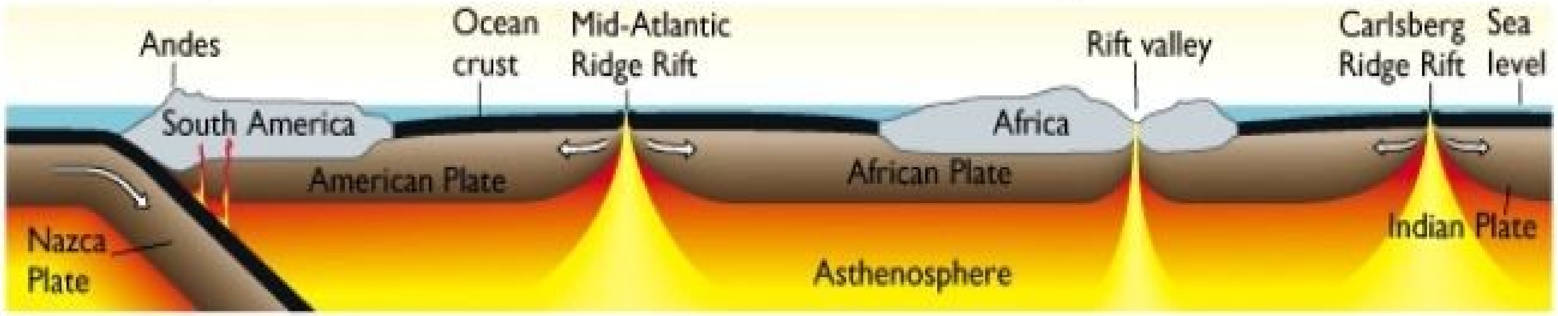


Divergentní rozhraní



Examples of Plate Boundaries

O-C convergent | O-O divergent | C-C divergent | O-O divergent



(a)

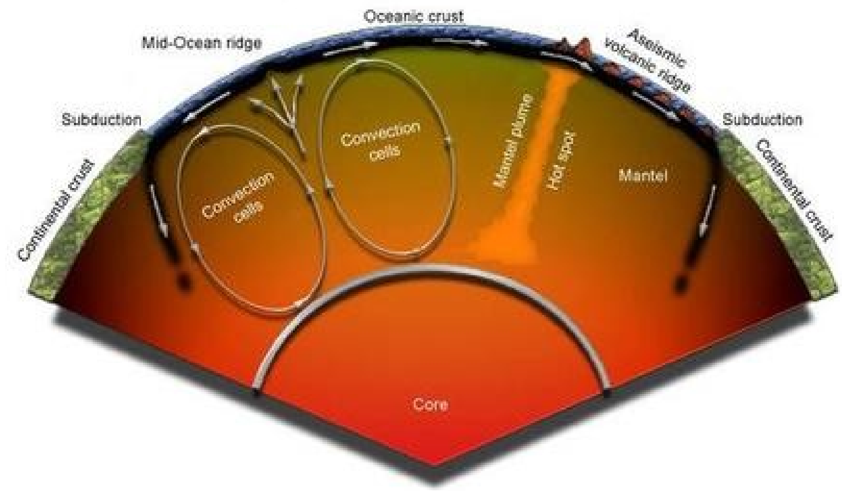
O-O convergent | O-O divergent | O-C convergent

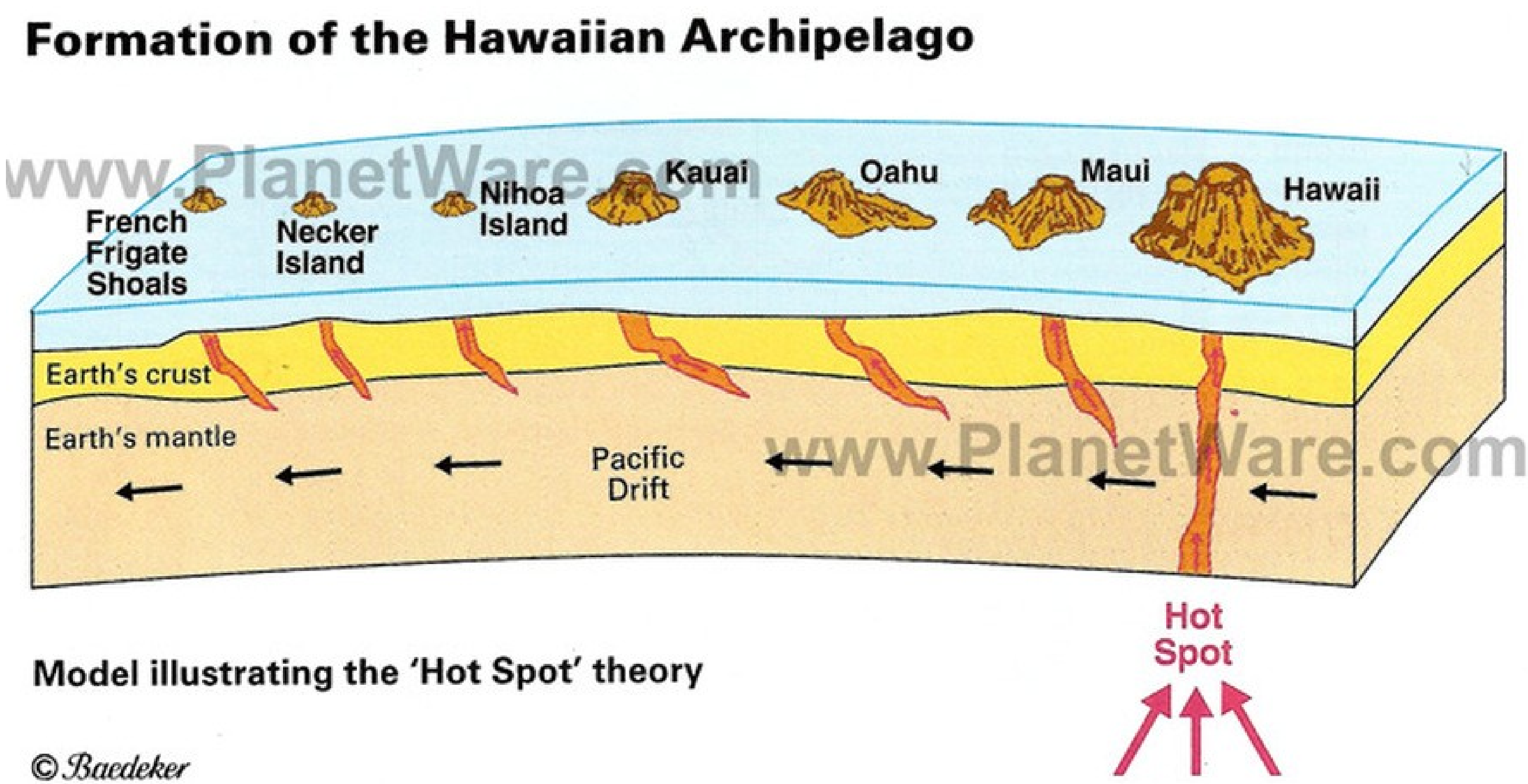
(b)

Fig. 20.8a,b

Mantle plumes

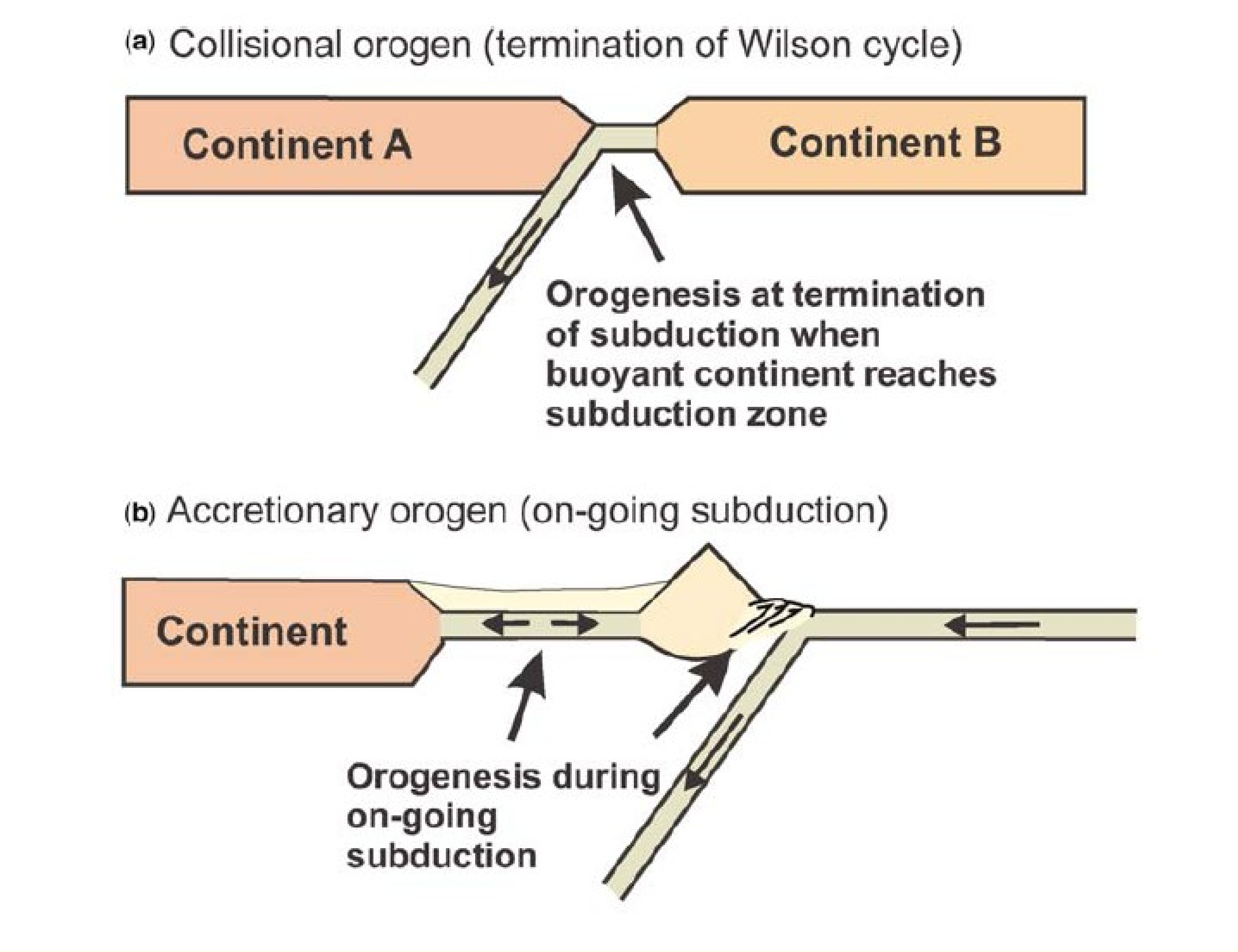
A mantle plume is asumed to exist where super-heated material forms at the core-mantle boundary and rises through the Earth's mantle. Independent of mantle convection.



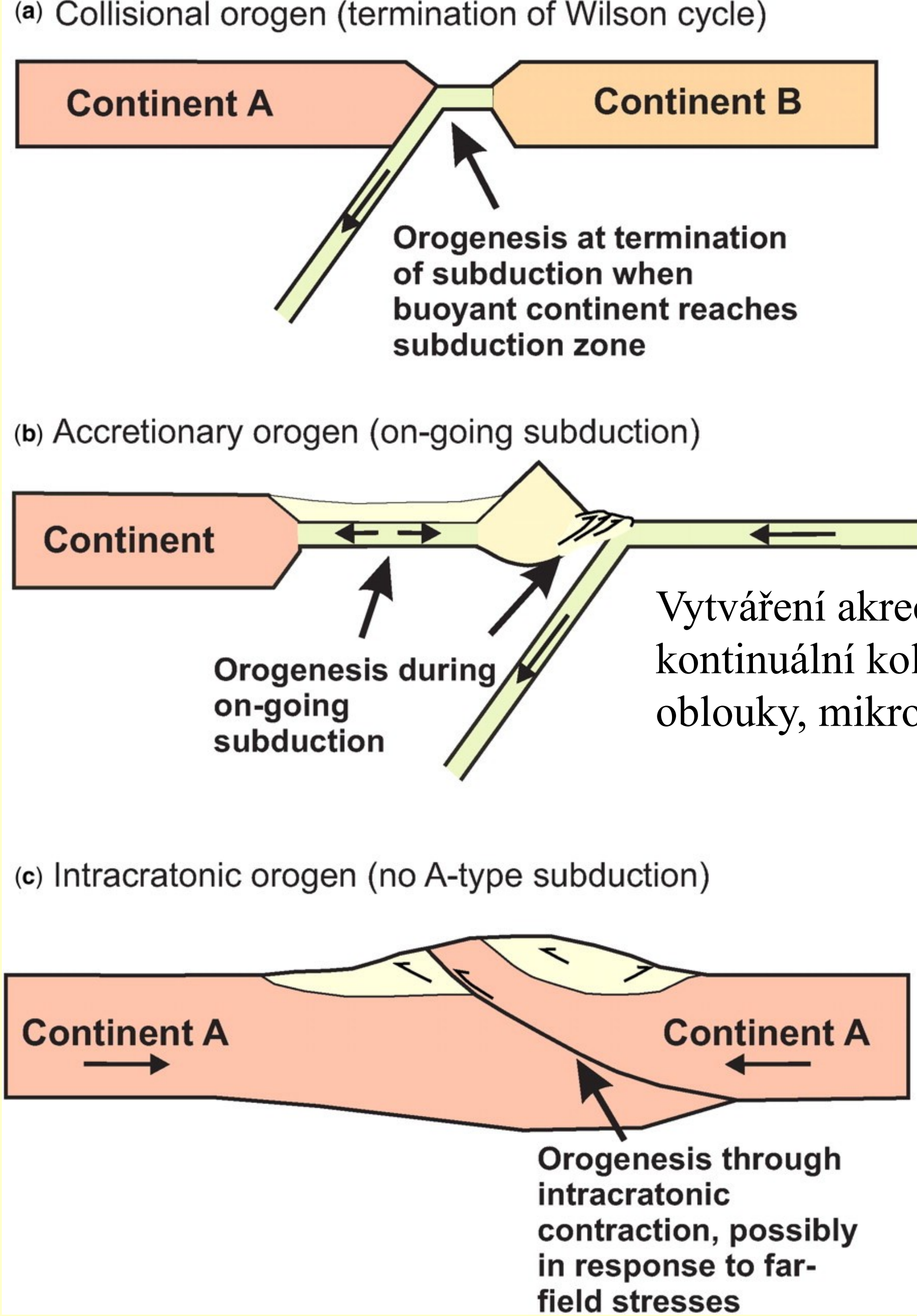


Continent grow by orogenies

Orogens form at **convergent plate boundaries**. **Accretionary orogens** form at **intraoceanic** and **continental margin convergent plate boundaries** over a **long period of time**, and **collisional orogens** include those formed through **continent continent** collision. A special form of collisional orogens are **intracratonic orogens** which lie within a continent, **away from an active plate margin. Accretionary** and continent continent **collisional** orogens lie at plate margins and form through the **subduction of oceanic lithosphere**, with the **former forming at sites of continuing subduction** and the **latter at the termination of subduction**.



Vytváření akrečních prizmat, kontinuální kolize s ostrovními oblouky, mikrok



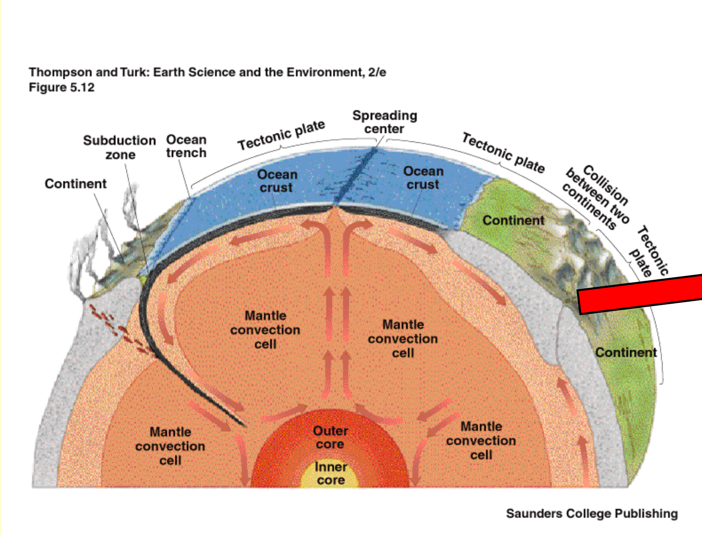
Vytváření akrečních prizmat, kontinuální kolize s ostrovními oblouky, mikrokontinenty

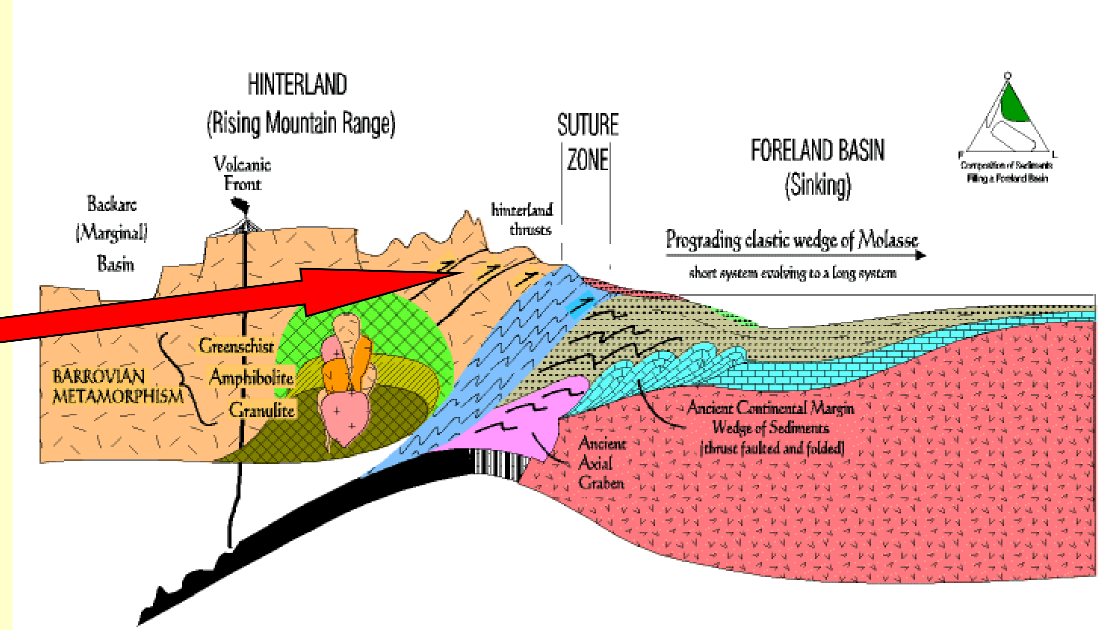
Fig. 3. Schematic cross-sections through (a) collisional, (b) accretionary and (c) intracratonic orogens.

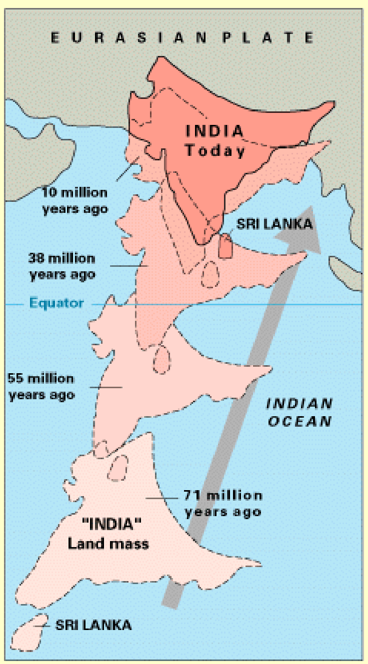
Collisional and intracratonic orogens

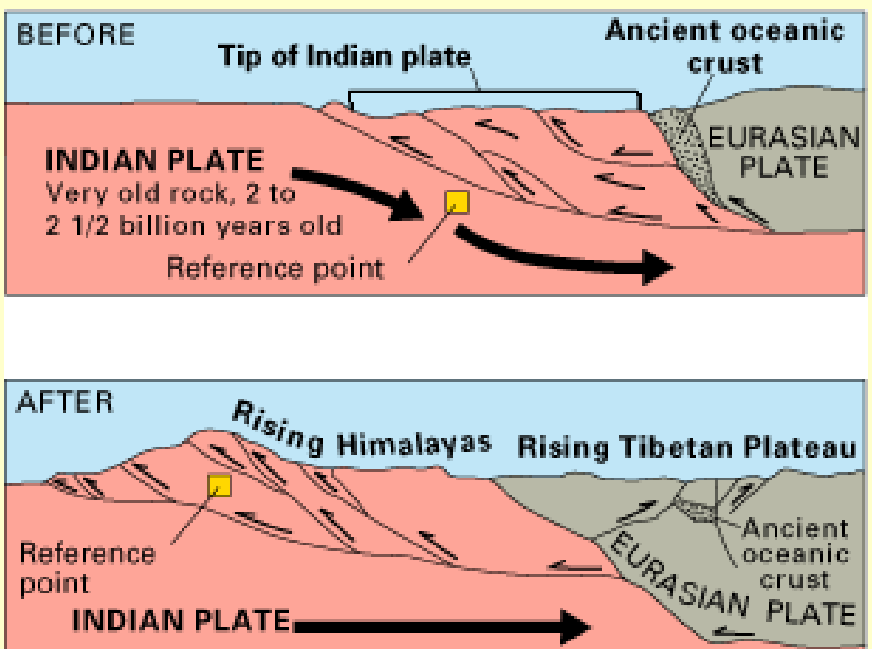
Collisional orogens form through **continent continent collision**. A **special form** of collisional orogens are **intracratonic orogens** which lie within a continent, away from an active plate margin

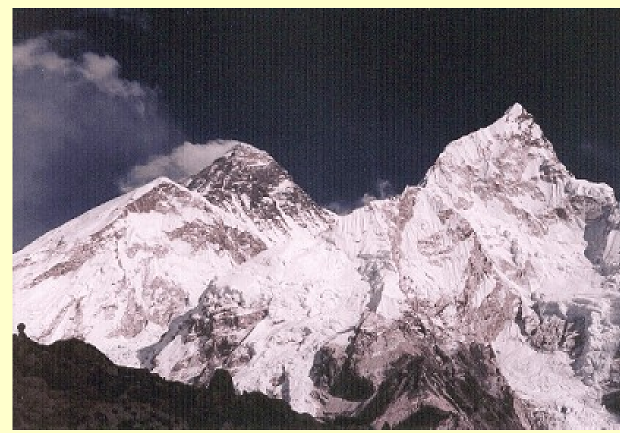
Konvergentní rozhraní představují místa vrásnění, vulkanické činnosti, vzniku pohoří a kolize kontinentů nebo akreční orogeny











Collisiom of India with Tibet shortened Tibet core more than 1000km

Cimmerides

Paleozoic Asia margin

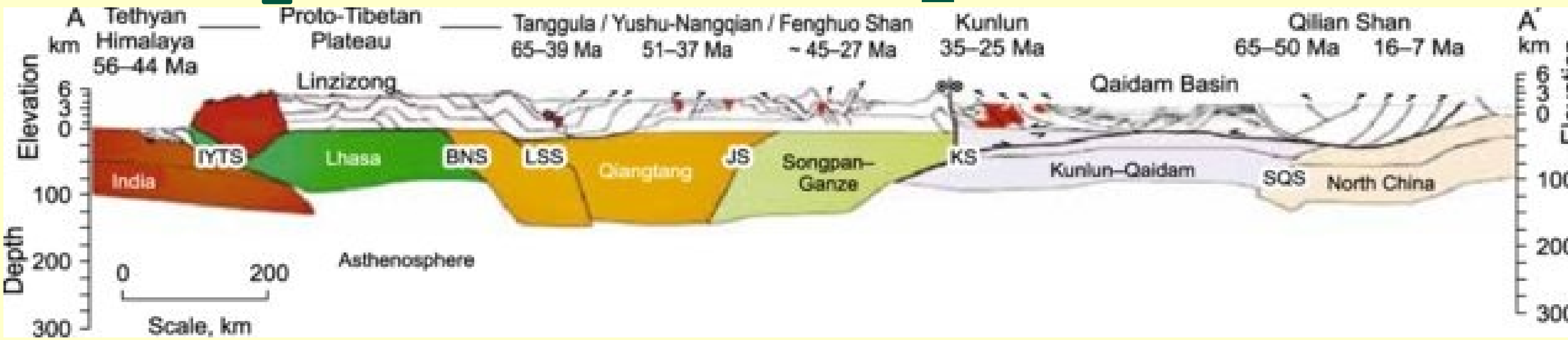
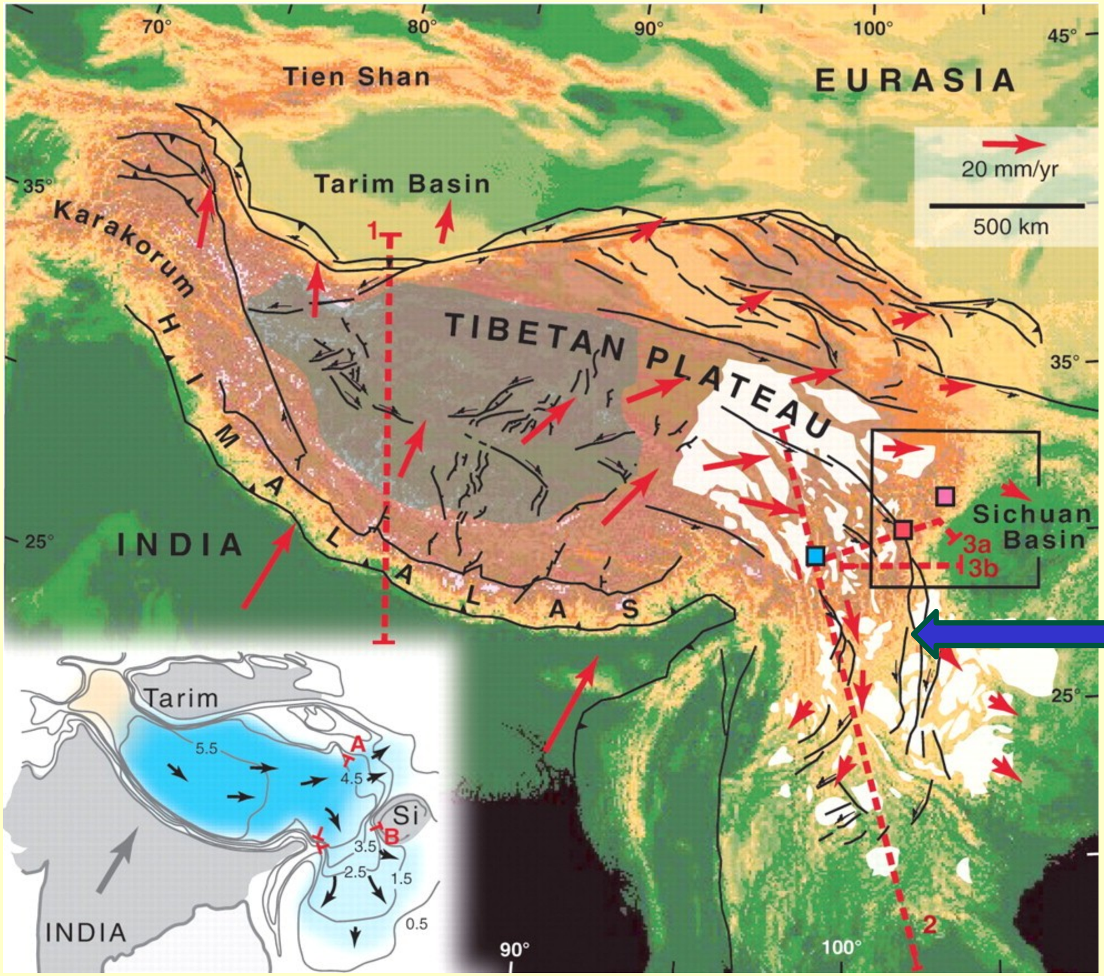


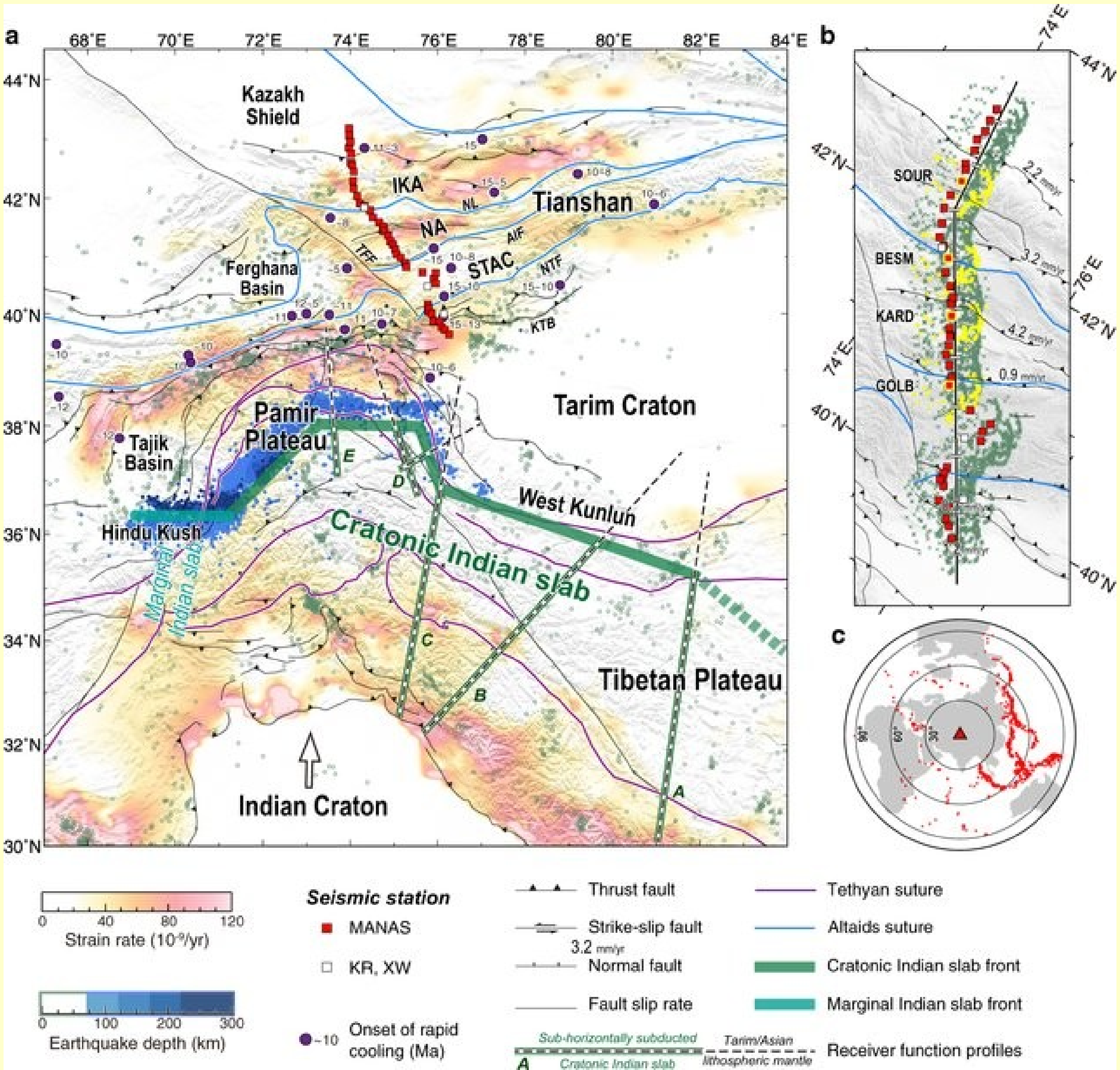
Fig. 14. Schematic cross-section across Tibet supposing a homogeneous thickening of 40% of the whole Qiangtang and Songpan-Ganze lithospheres (from (Goussin, 2019)). The age of the Ultra-K magmatism is mentioned above IYTS, Indus Yarlung Thrust system; BNS, Bangong suture; LSS, Longmucuo-Shuanghu suture; JS, Jinsha suture; KS, Kunlun suture, SQS, South Qilian suture.



It is the **world's highest and largest plateau** above sea level, with an area of 2,500,000 square kilometres (970,000 sq mi).[13] With an **average elevation** exceeding **4,500 metres**

Lateral Tibetan escape

Intracratonic orogen



The **Tianshan** is a type-example of ongoing lithospheric **deformation in an intra-continental setting**. It formed during the **Paleozoic accretion** and was rejuvenated in the **Cenozoic**, which might be a far-field **response to the India-Asia collision**.

Cimmerian Hindikush, Pamir and VariscanTian Shan

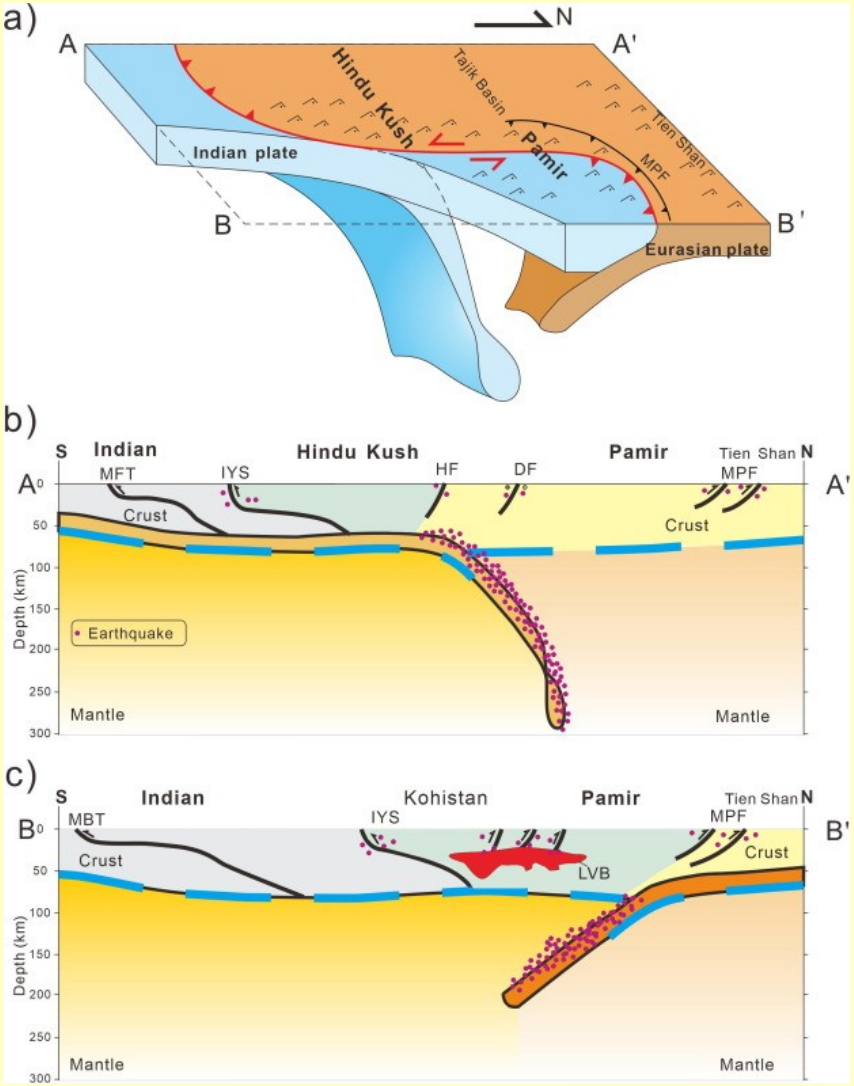
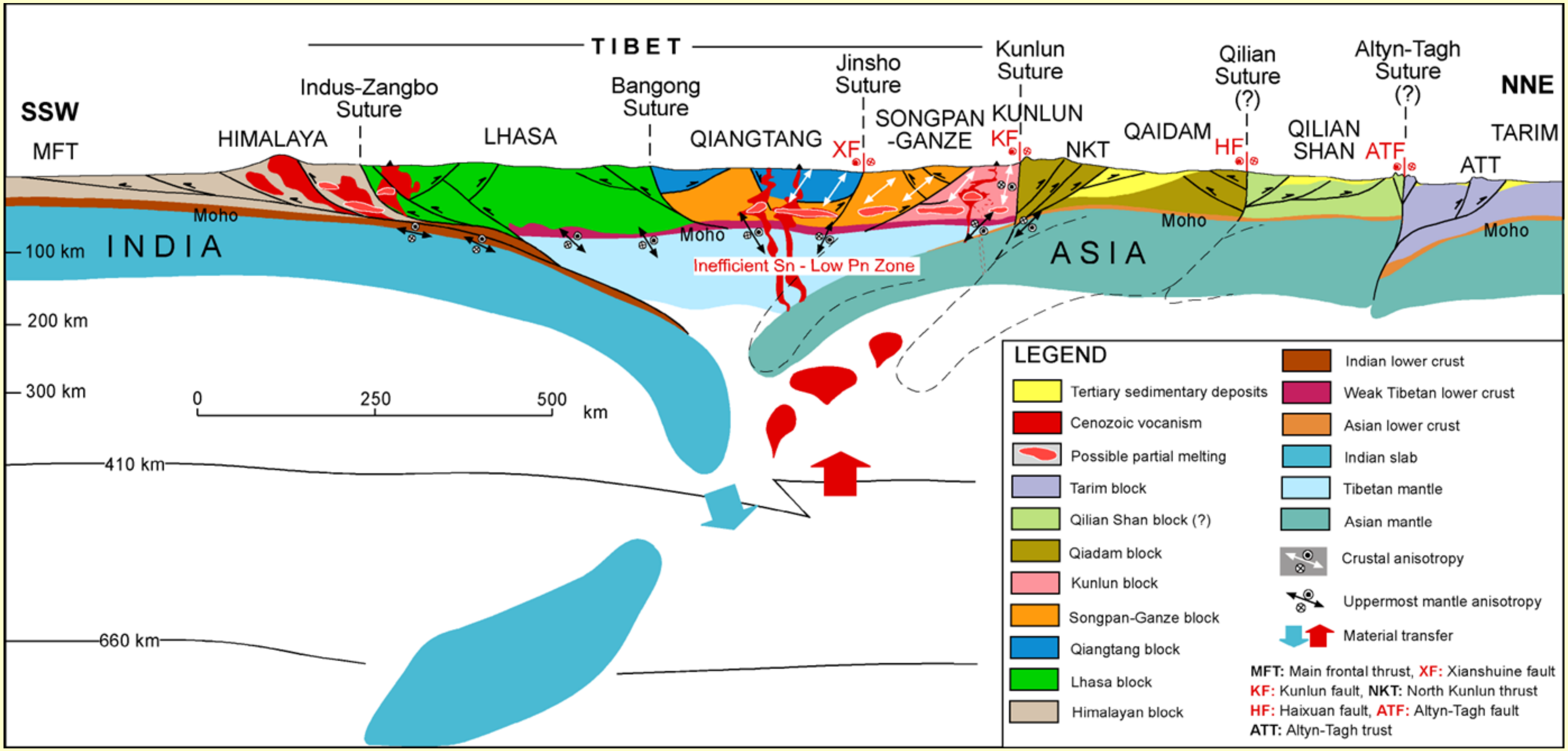


Fig. 11. Double-sided subduction pattern in the Pamir Hindu Kush of the western Himalayan syntaxis. (a) 3D model shows the spatial configuration of Pamir-Hindu Kush. The left-strike fault (red line) regulated the motion of two plates. (b) In Hindu Kush region, Indian plate subducted into Eurasian plate. (c) In Pamir region, Eurasian plate subducted into Indian plate.

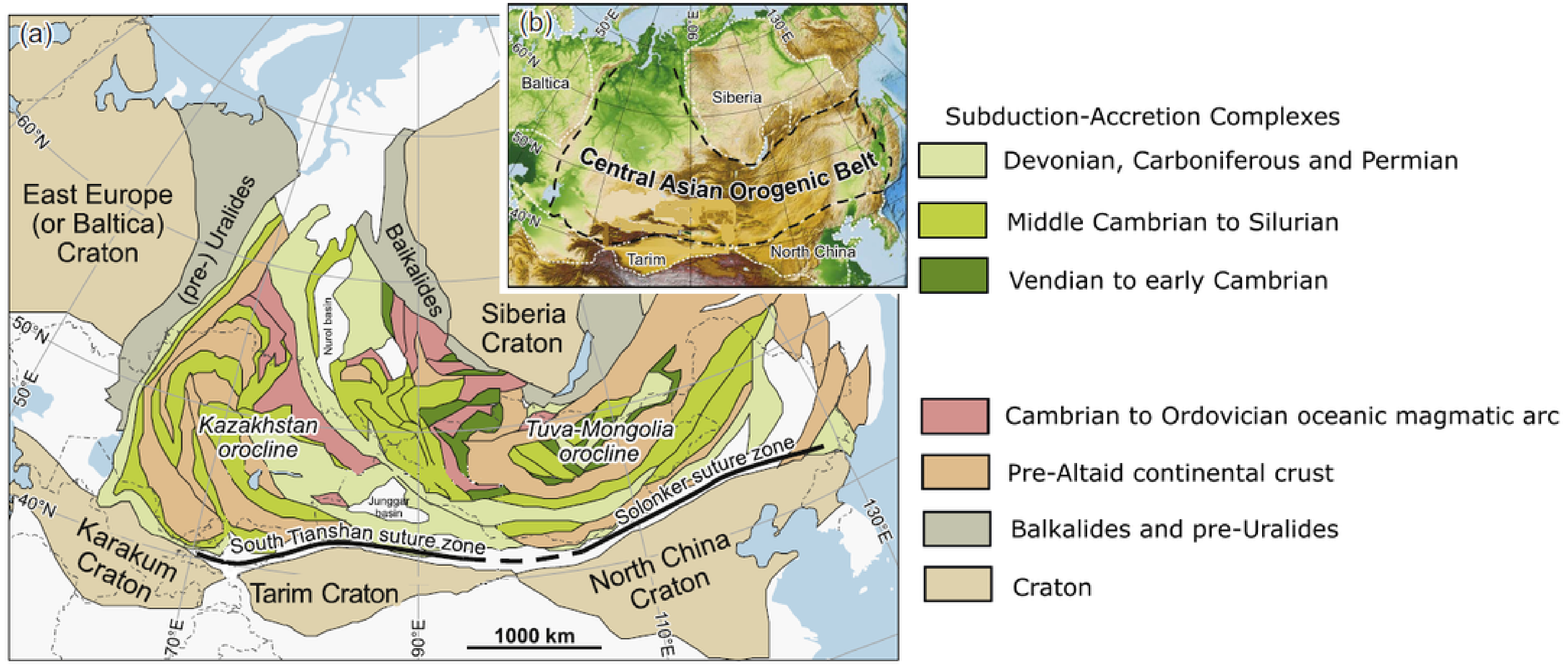


TIBET
SSW
NNE
MFT
HIMALAYA
Indus-Zangbo Suture
LHASA
Bangong Suture
QIANGTANG
Jinsho Suture
XF
SONGPAN -GANZE
Kunlun Suture
KUNLUN
KF
NKT
QAIDAM
Qilian Suture (?)
HF
QILIAN SHAN
Altyn-Tagh Suture (?)
ATF
ATT
TARIM
Moho
INDIA
Moho
Inefficient Sn - Low Pn Zone
ASIA
Moho
Moho
100 km
200 km
300 km
410 km
660 km
0
250
500
km
LEGEND
Tertiary sedimentary deposits
Cenozoic vocanism
Possible partial melting
Tarim block
Qilian Shan block (?)
Qiadam block
Kunlun block
Songpan-Ganze block
Qiangtang block
Lhasa block
Himalayan block
Indian lower crust
Weak Tibetan lower crust
Asian lower crust
Indian slab
Tibetan mantle
Asian mantle
Crustal anisotropy
Uppermost mantle anisotropy
Material transfer
MFT: Main frontal thrust, XF: Xianshuine fault
KF: Kunlun fault, NKT: North Kunlun thrust
HF: Haixuan fault, ATF: Altyn-Tagh fault
ATT: Altyn-Tagh trust

Accretionary orogens

Deformation, metamorphism and crustal growth took place in an environment of **on-going plate convergence**. Accretionary orogens form at sites of **subduction of oceanic lithosphere** and consist of **magmatic arcs** systems along with **material accreted from the downgoing plate and eroded from the upper plate**. As subduction continues, island arcs, microcontinnets, continental fragments, arc-related basins, accretionary complexes, seamounts, continental fragments and ophiolites. and oceanic material may gradually accrete onto the continental margin.
Outstanding examples of accretionary orogens is **Central Asian Orogenic Belt. The Circum-Pacific region** provides another outstanding examples of accretionary orogens during long lasting subduction of the ocean**.**

The **Central Asian Orogenic Belt** (CAOB)is one of the world's largest Phanerozoic accretionary orogens which originated in **Paleoasian ocean** between the East European, Siberian m Karakum, Tarim and North China cratons



Evolution of the Kazakh continent (orocline)

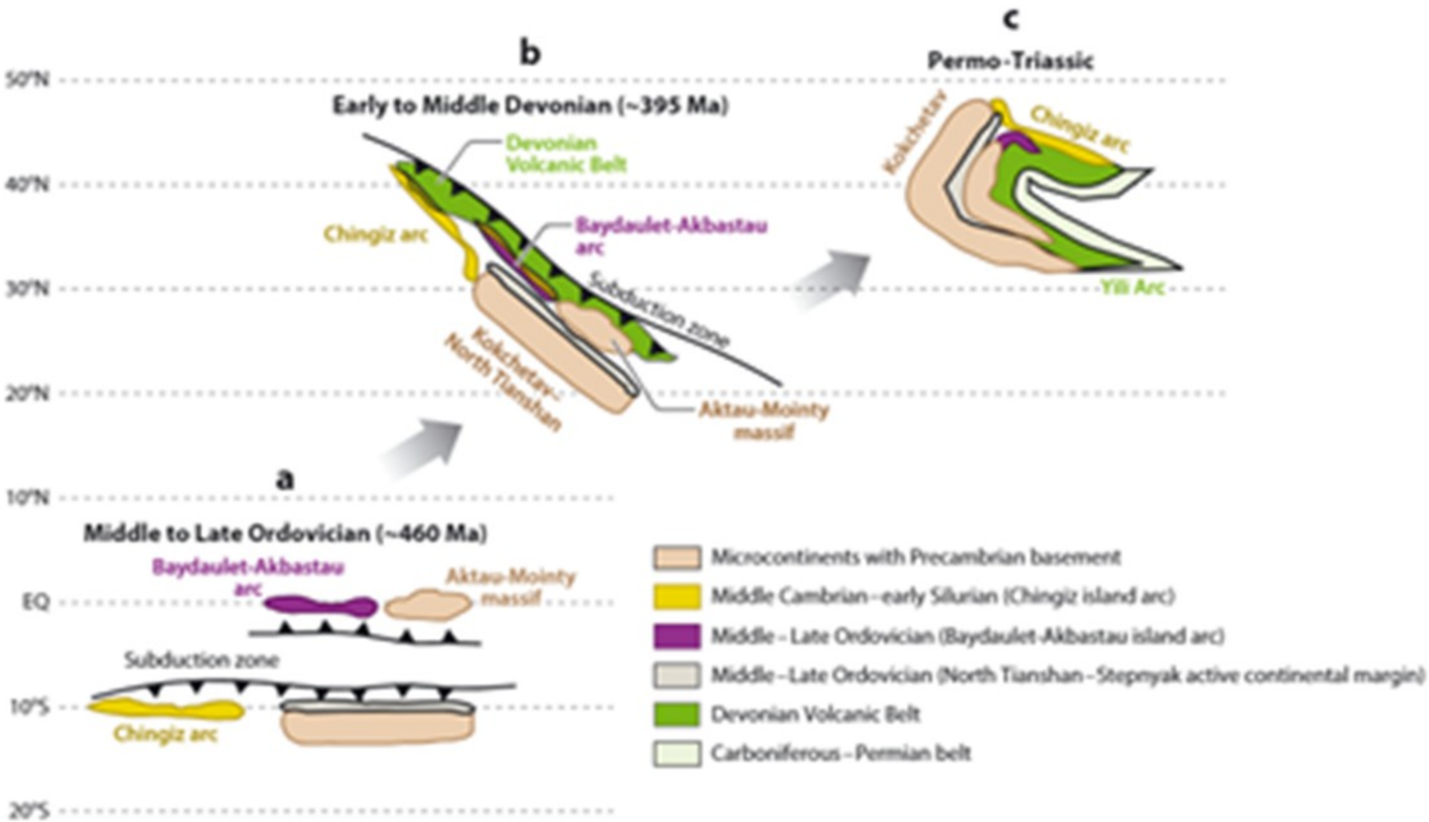
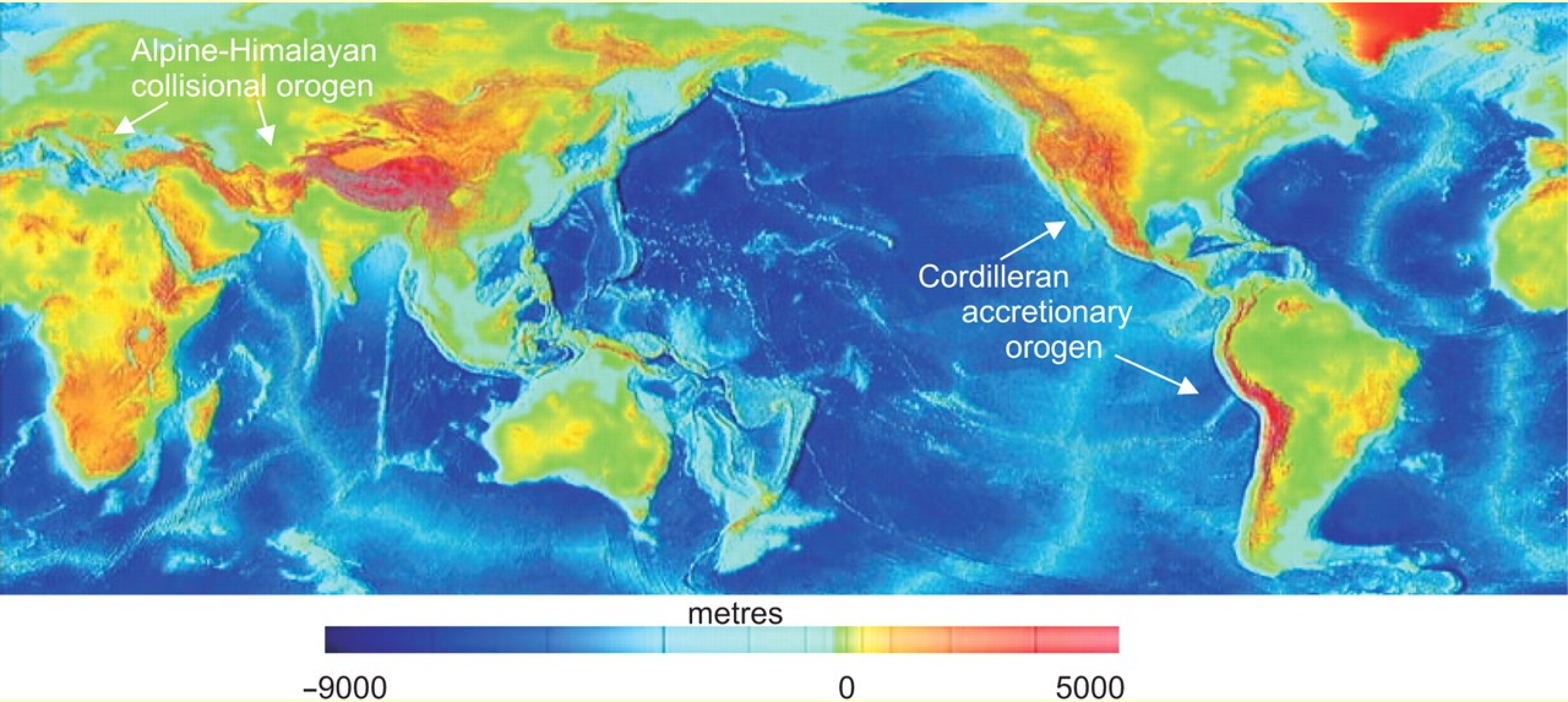


Figure 6

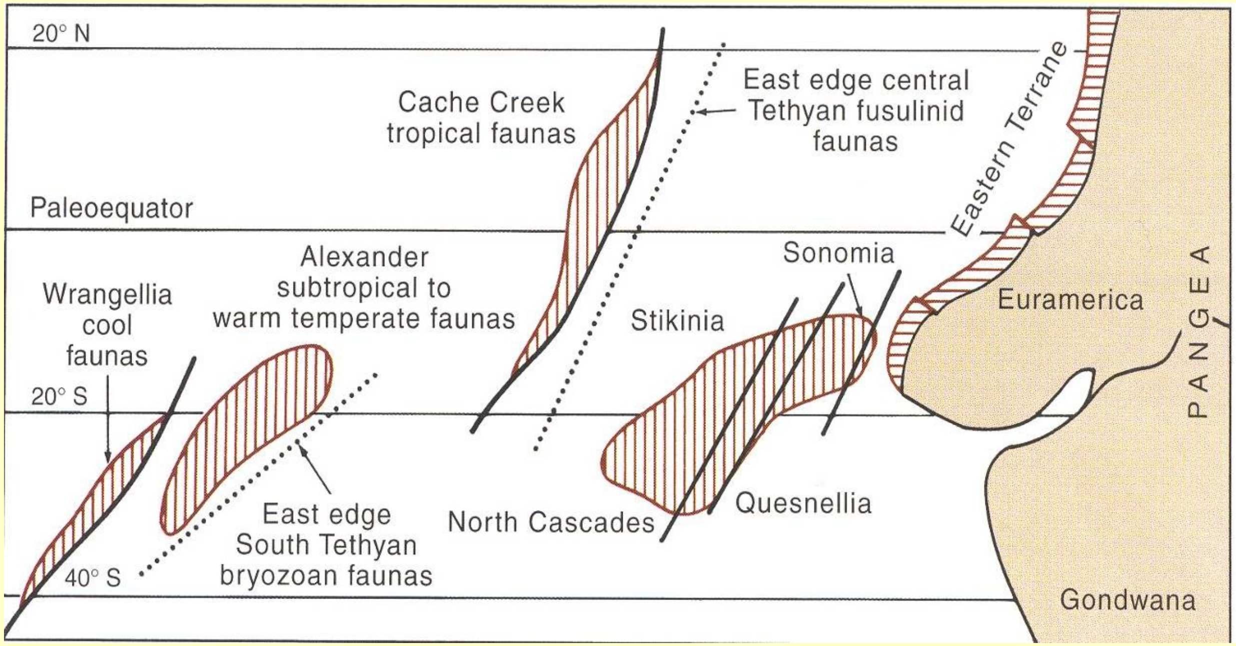
Orocline formation in the Kazakhstan part of the western Central Asian Orogenic Belt in the Paleozoic. (*a*) Middle to Late Ordovician (~460 Ma). (*b*) Early to Middle Devonian (~395 Ma). (*c*) Permo-Triassic. Figure modified after Bazhenov et al. (2012), with permission from Elsevier.

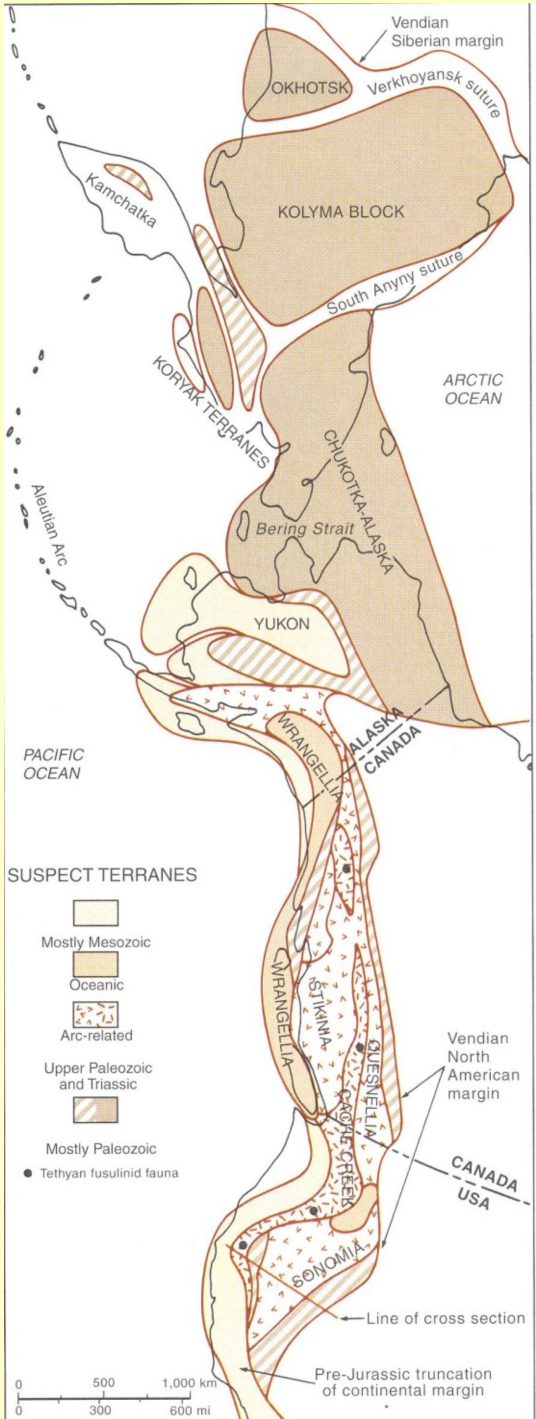


The accretionary orogens of North and South American Cordillera are archetypical examples

The Canadian Cordillera west of the Rockies is largely composed of displaced terranes, as are the easternmost sections of Siberia.

Origins of these terranes are best Determined by the **biogeographic affinities** of the fossils in their sedimentary rocks.





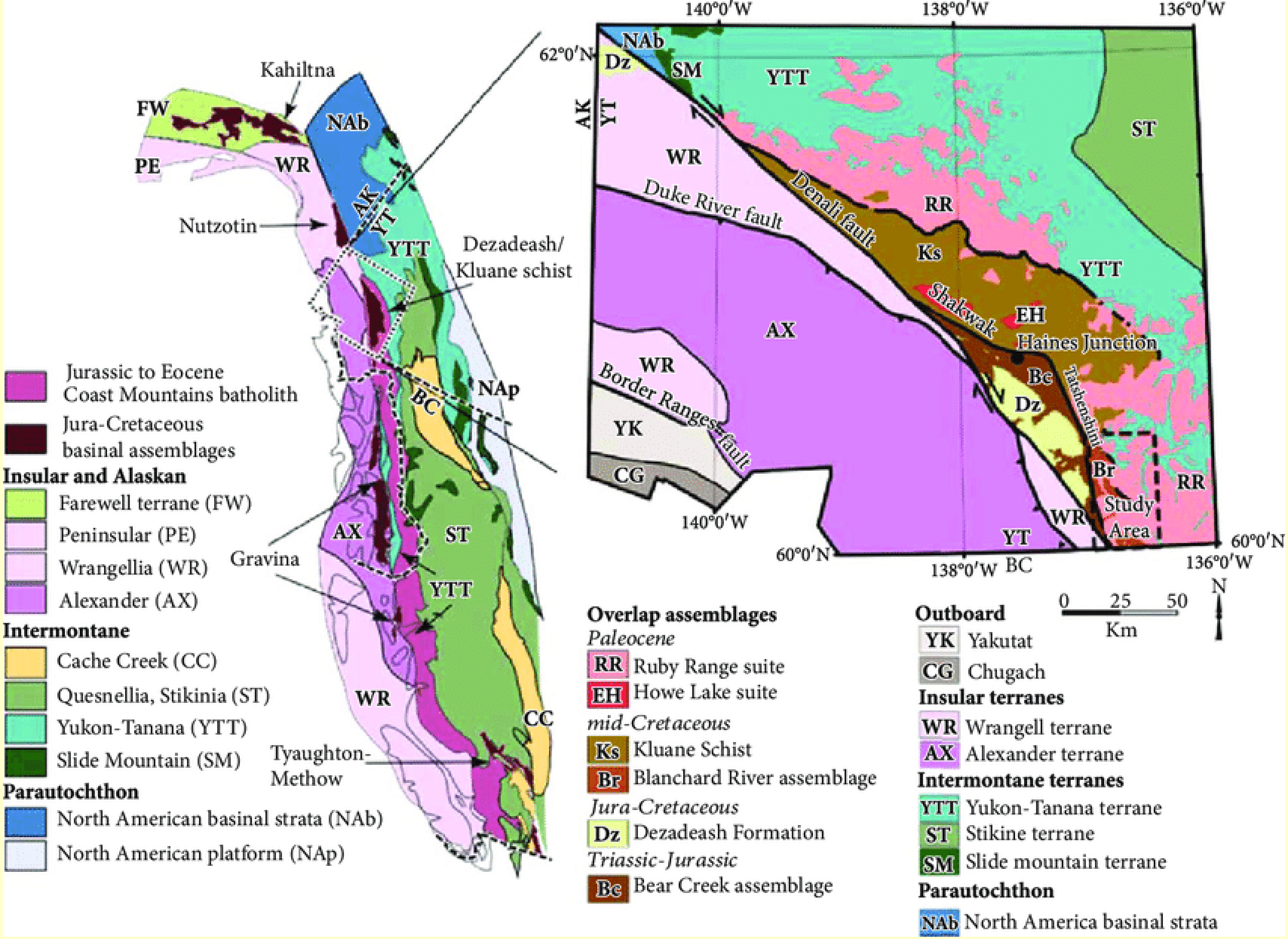
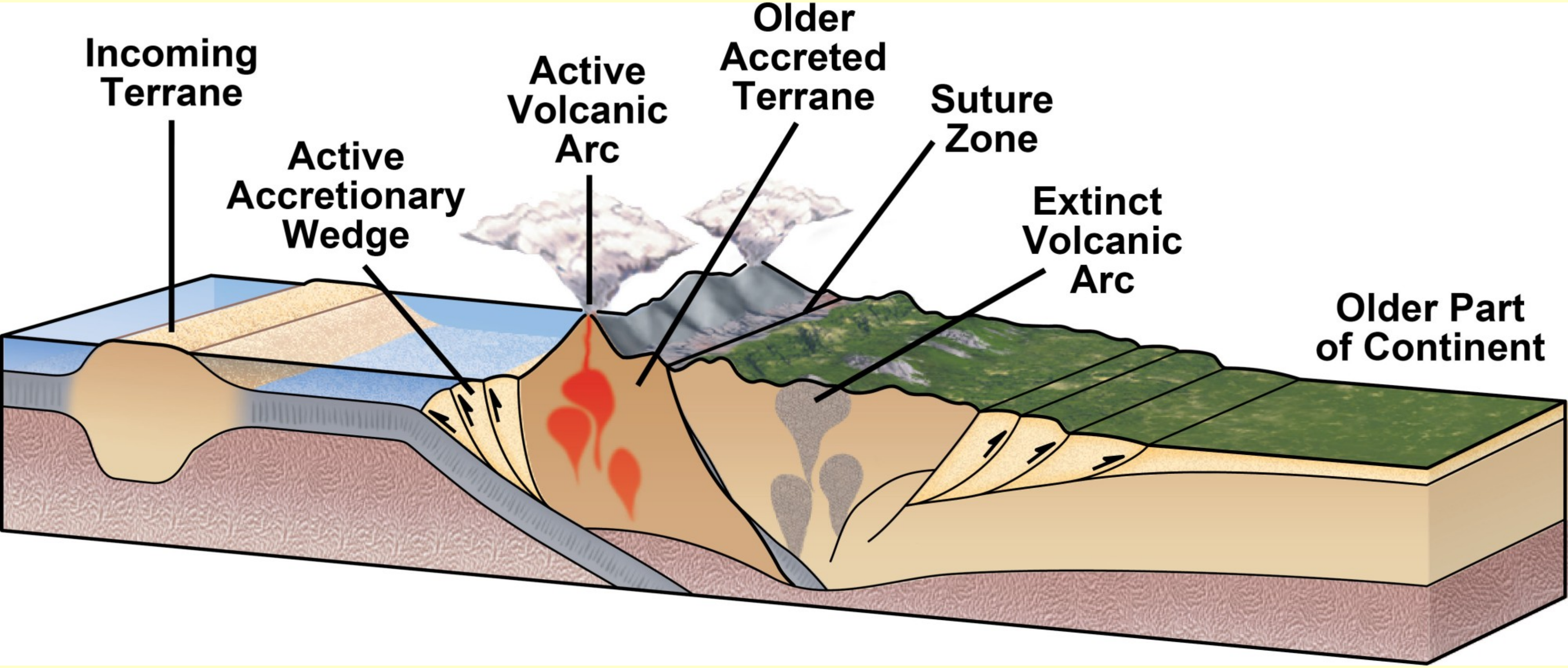
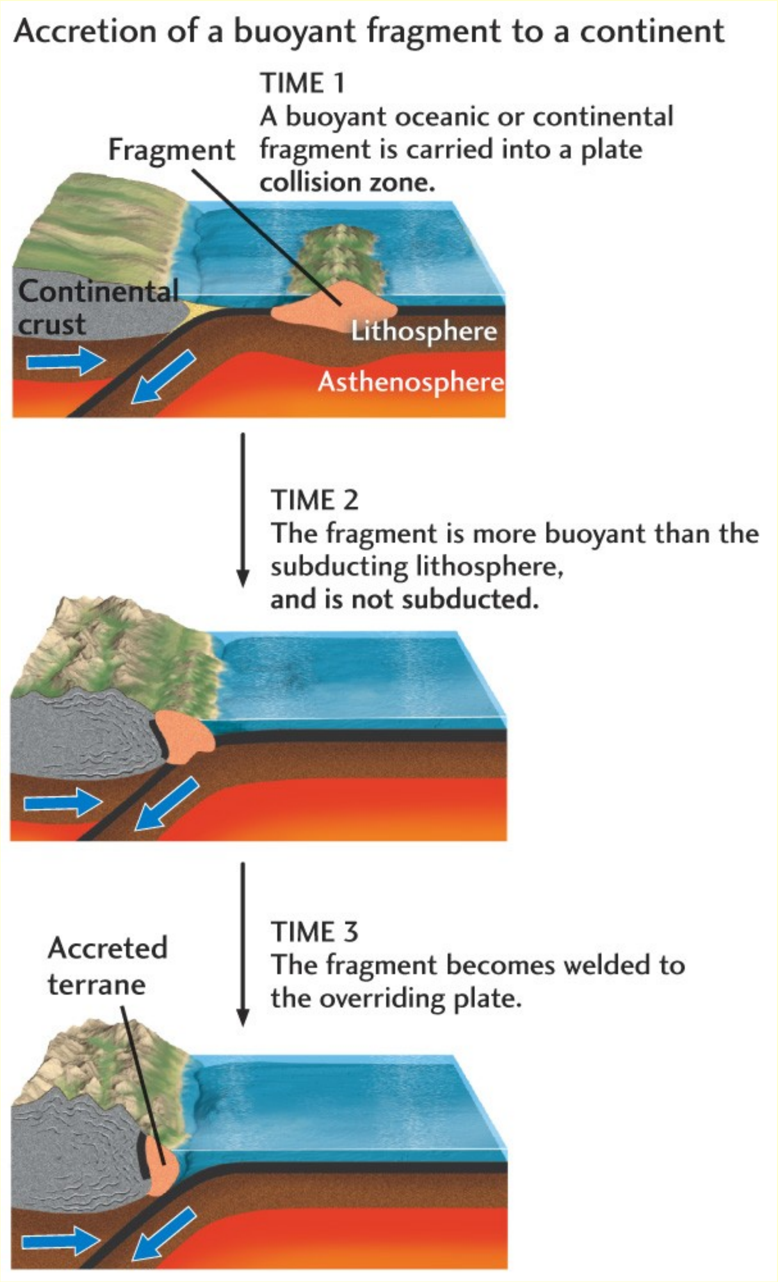


Figure 1: Terrane map of the western **Canadian and Alaskan Cordillera** including the Coast Mountains batholith. Jura-Cretaceous basinal assemblages are highlighted from southwestern BC into Alaska.

Terrane in geology is **defined as a fault-bounded block** containing rocks that have a **distinct** geologic history compared **with contiguous blocks,**



How Continents Grow



How Continents Grow:

Accretion of continental fragments

Fig. 20.12a

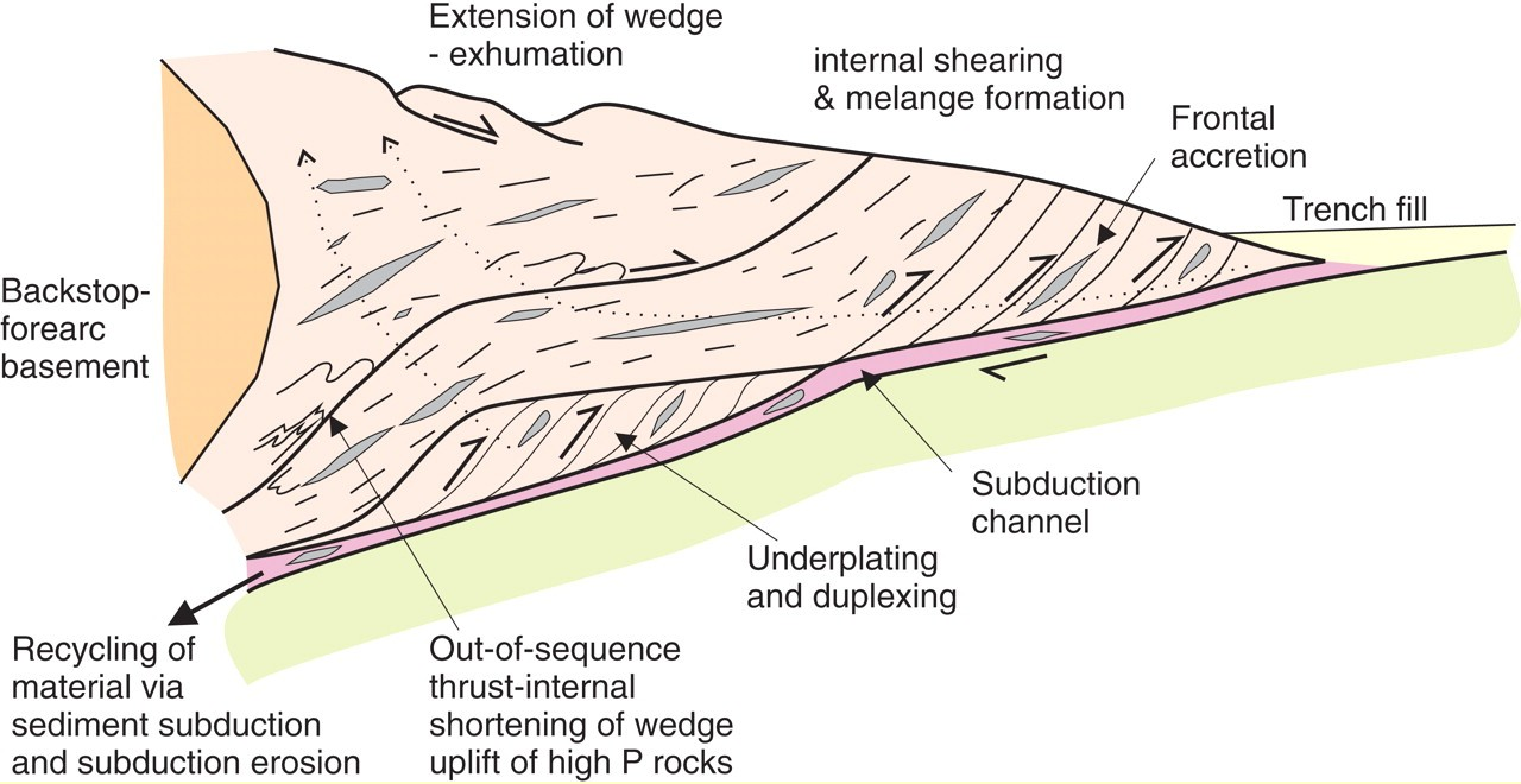
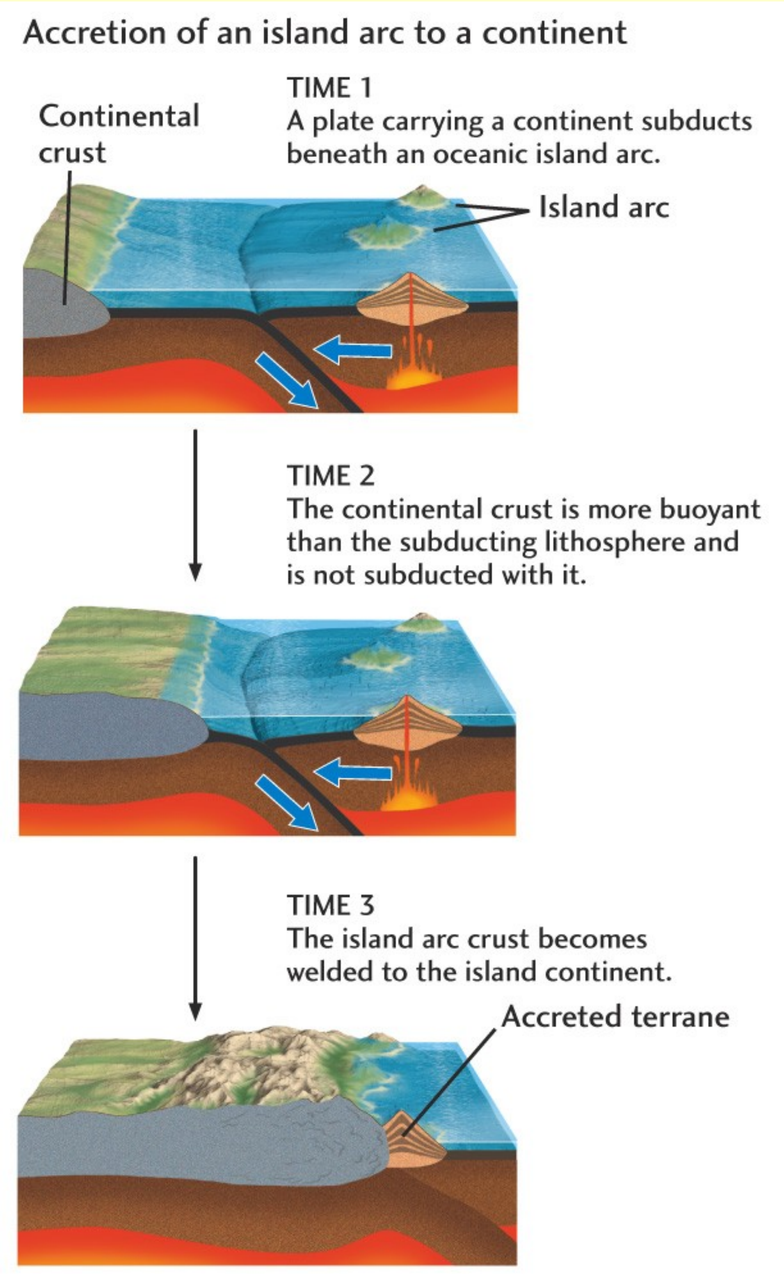


Fig. 9. Schematic section of accretionary prism showing sediment accretion through frontal accretion and basal accretion, and internal deformation of the wedge through contraction and extension (adapted from Kusky et al. 1997b). Particle paths are simplified net vectors and are drawn relative to backstop (see van Gool & Cawood 1994). Backstop is arc basement, and is composed of magmatic arc igneous rock or ophiolitic material.

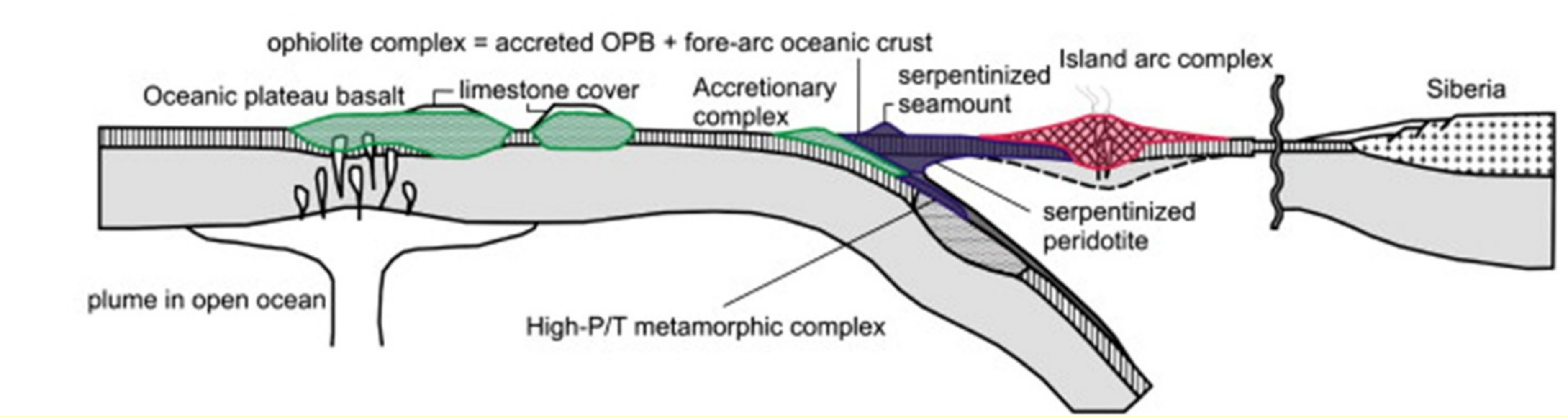


How Continents Grow:

Accretion of island arcs

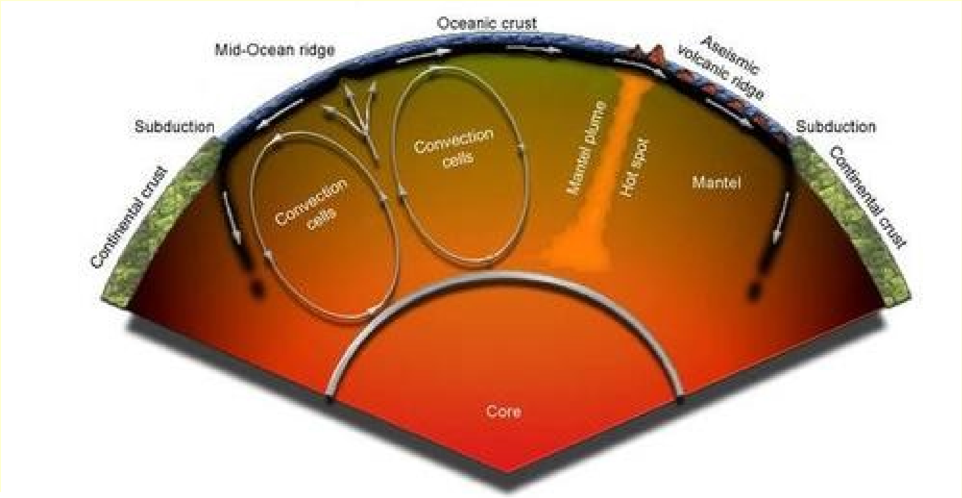
Fig. 20.12b

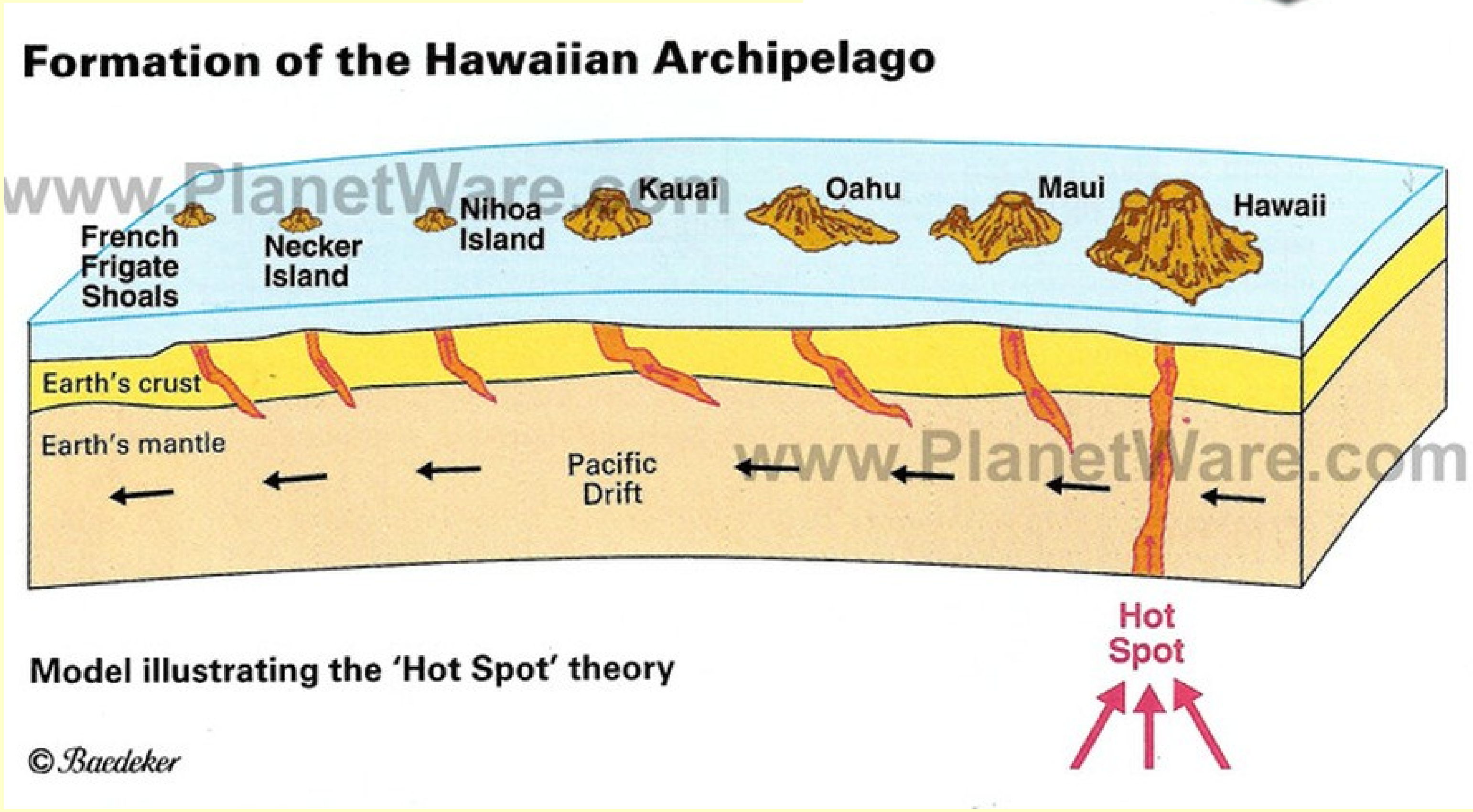
Mantle plumes

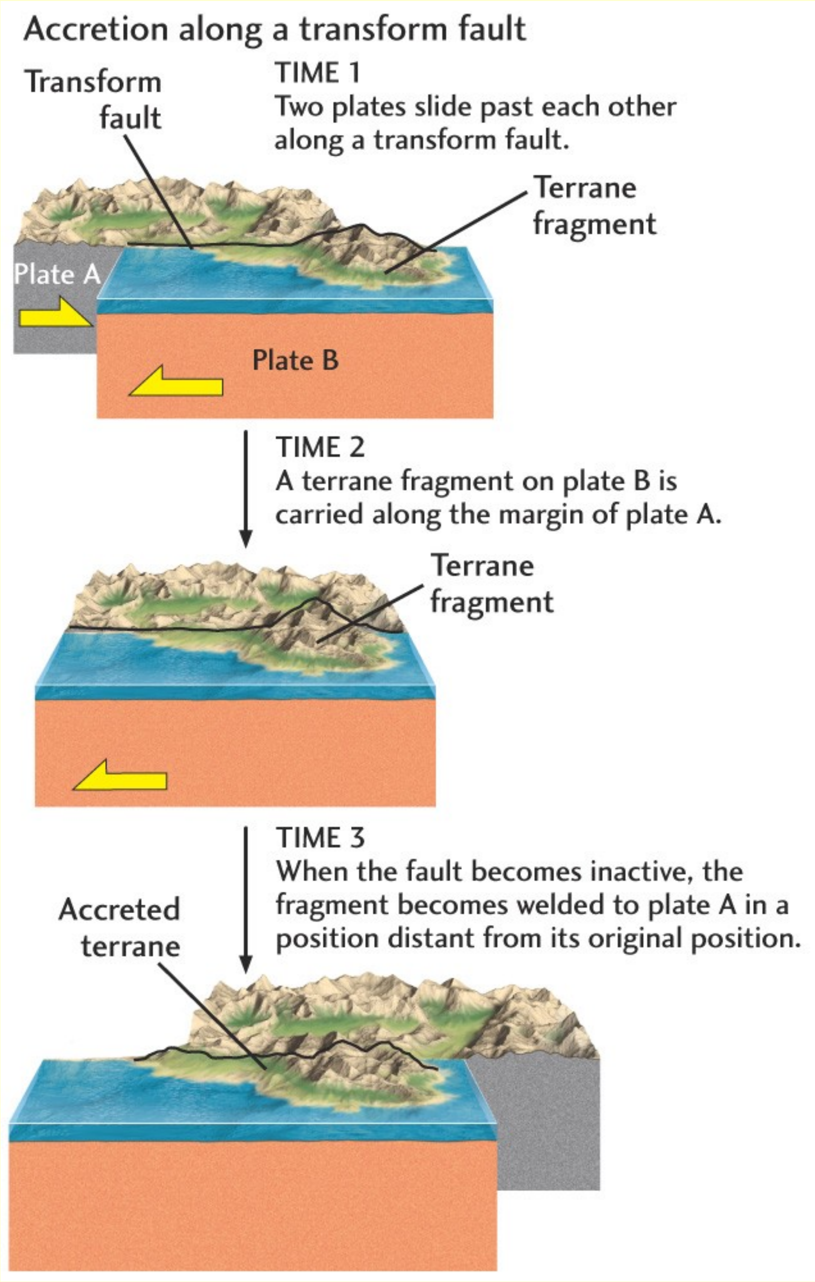


Mantle plumes

A mantle plume is asumed to exist where super-heated material forms at the core-mantle boundary and rises through the Earth's mantle. Independent of mantle convection.







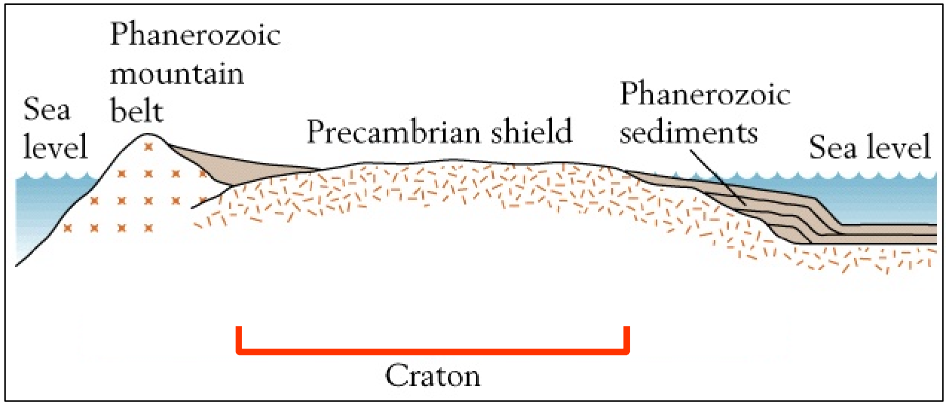
How Continents Grow:

Accretion along transform faults

Fig. 20.12c

Precambrian rocks

- **<u>Cratons</u>** are the large, stable, interior regions of continents that *have not undergone major deformation since Precambrian or early Phanerozoic time*
- Most Precambrian rocks are confined to cratons, where they may be exposed in a "**<u>Precambrian shield</u>**"



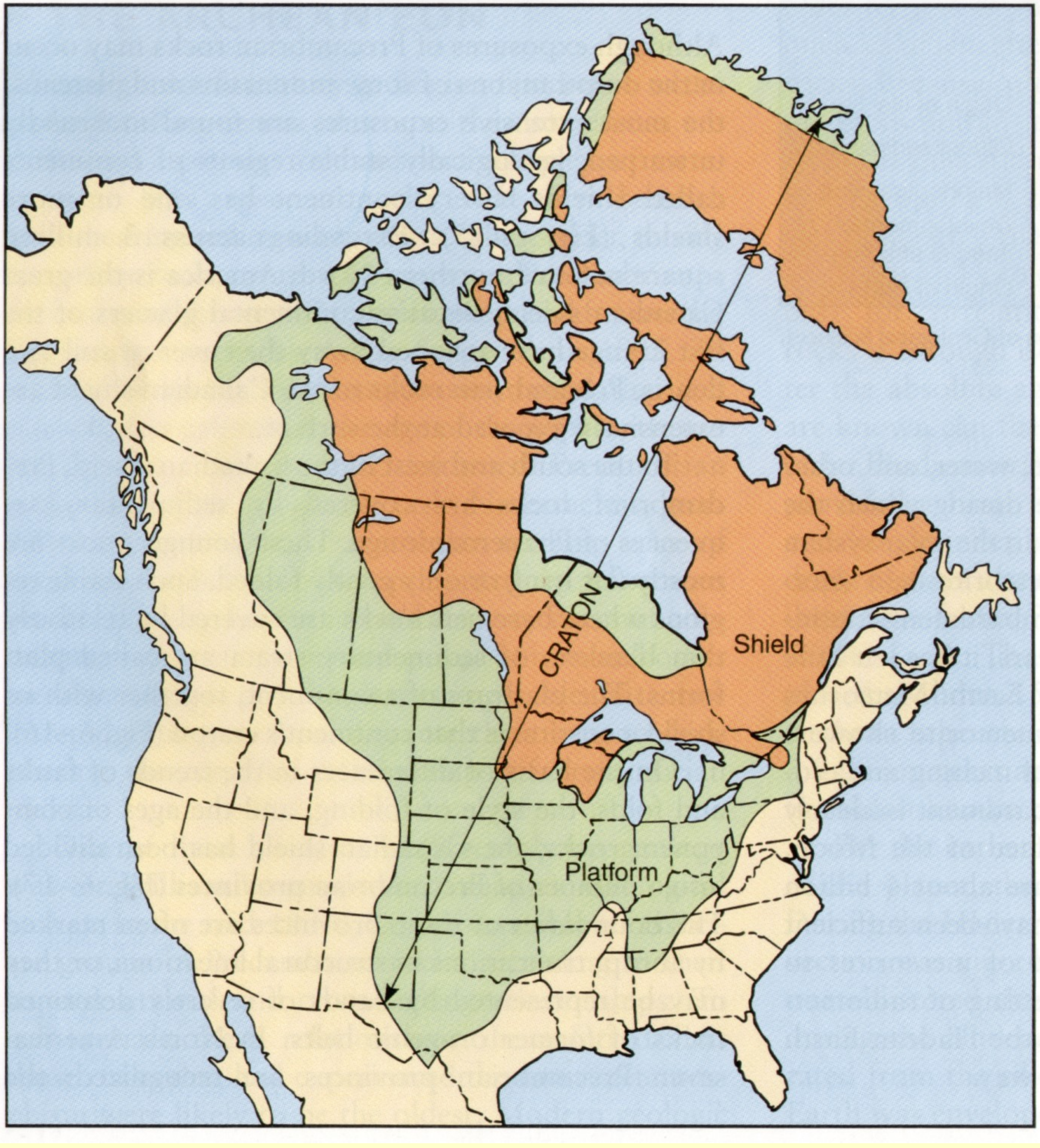


FIGURE 6–16 North American craton, shield, and platform. What is the difference between shield and platform?

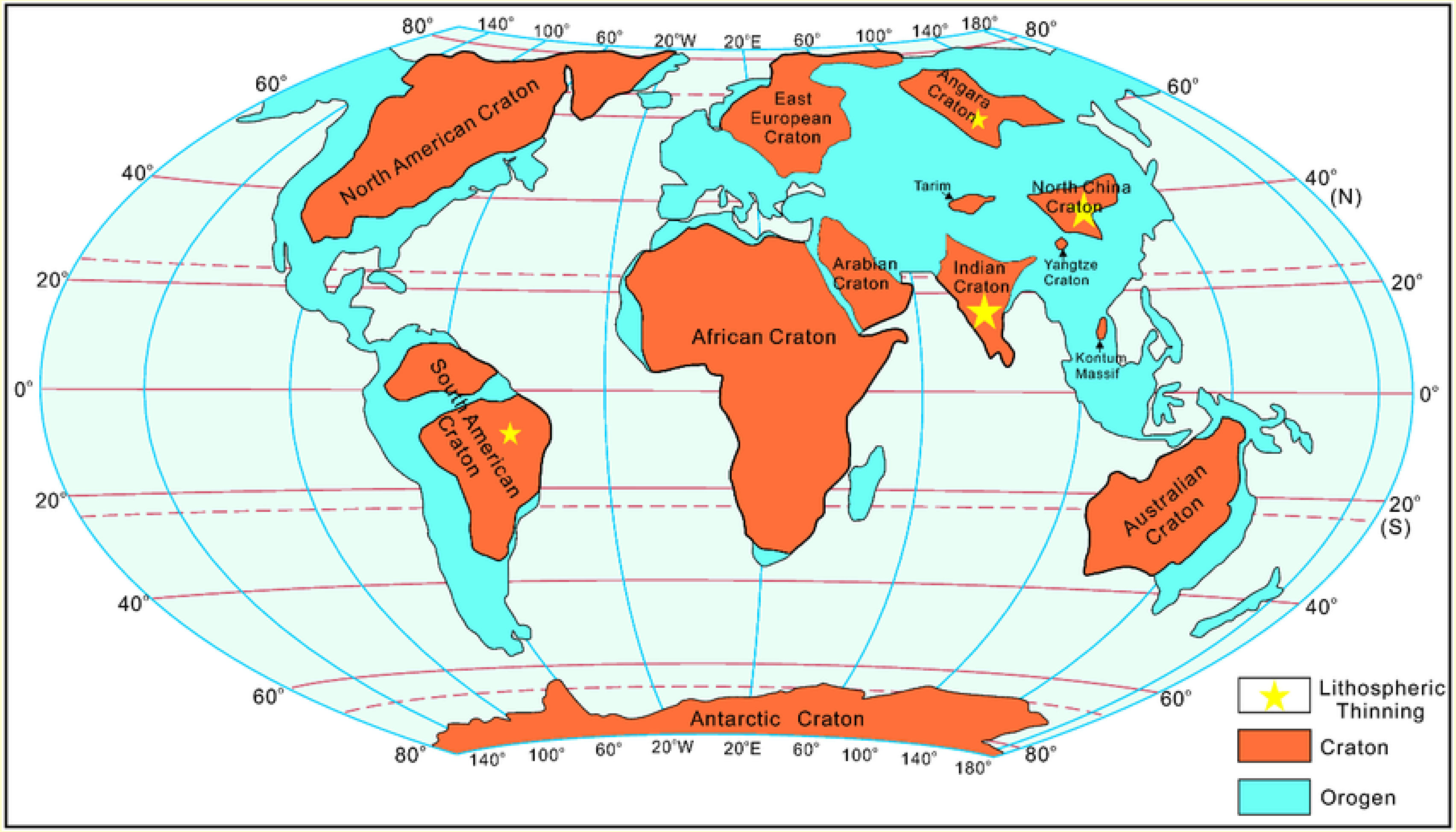


Figure 1 Distribution of the global Precambrian cratons. Modified from Sengor (1999), Wu et al. (2014).

Hlavní etapy vrásnění v prvohorách - čtvrtohorách

Časová škála

245 Ma

Prvohory

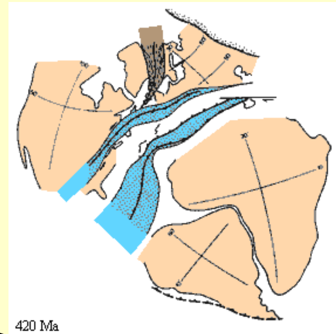
mladší: perm, karbon

starší: devon, silur, ordovik, kambrium

545 Ma

Prekambrium

Vrásnění

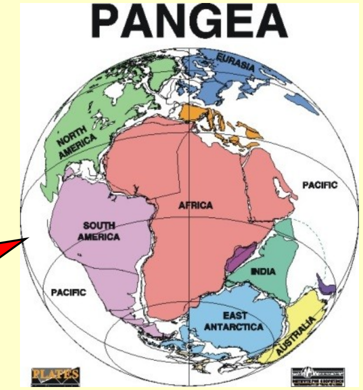


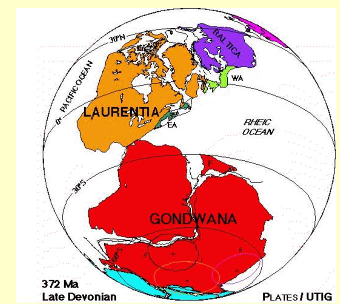
Variské vrásnění

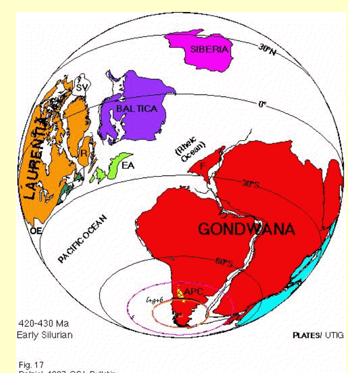
Vznik Pangei

Kaledonské vrásnění

Paleogeografie







Časová škála | **Vrásnění** | **Paleogeografie**

Čtvrtohory		
Třetihory	**Neogén**	1,8 Ma
	Paleogén	
D r u h o h o r y	**Křída**	65 Ma
	Jura	
	Trias	245 Ma

Alpinské vrásnění s. str.

Kimerské vrásnění

Alpinské vrásnění sensu lato