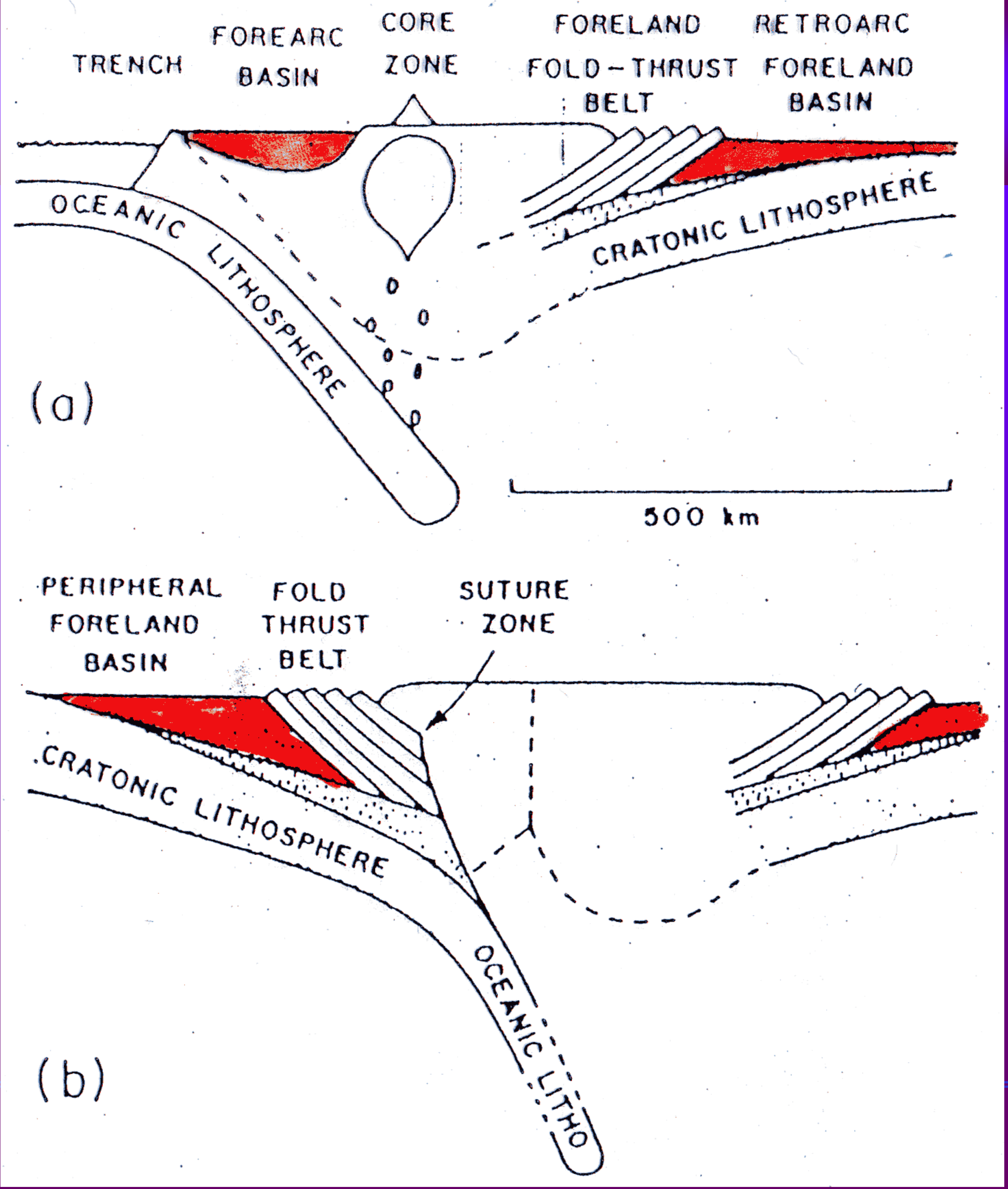
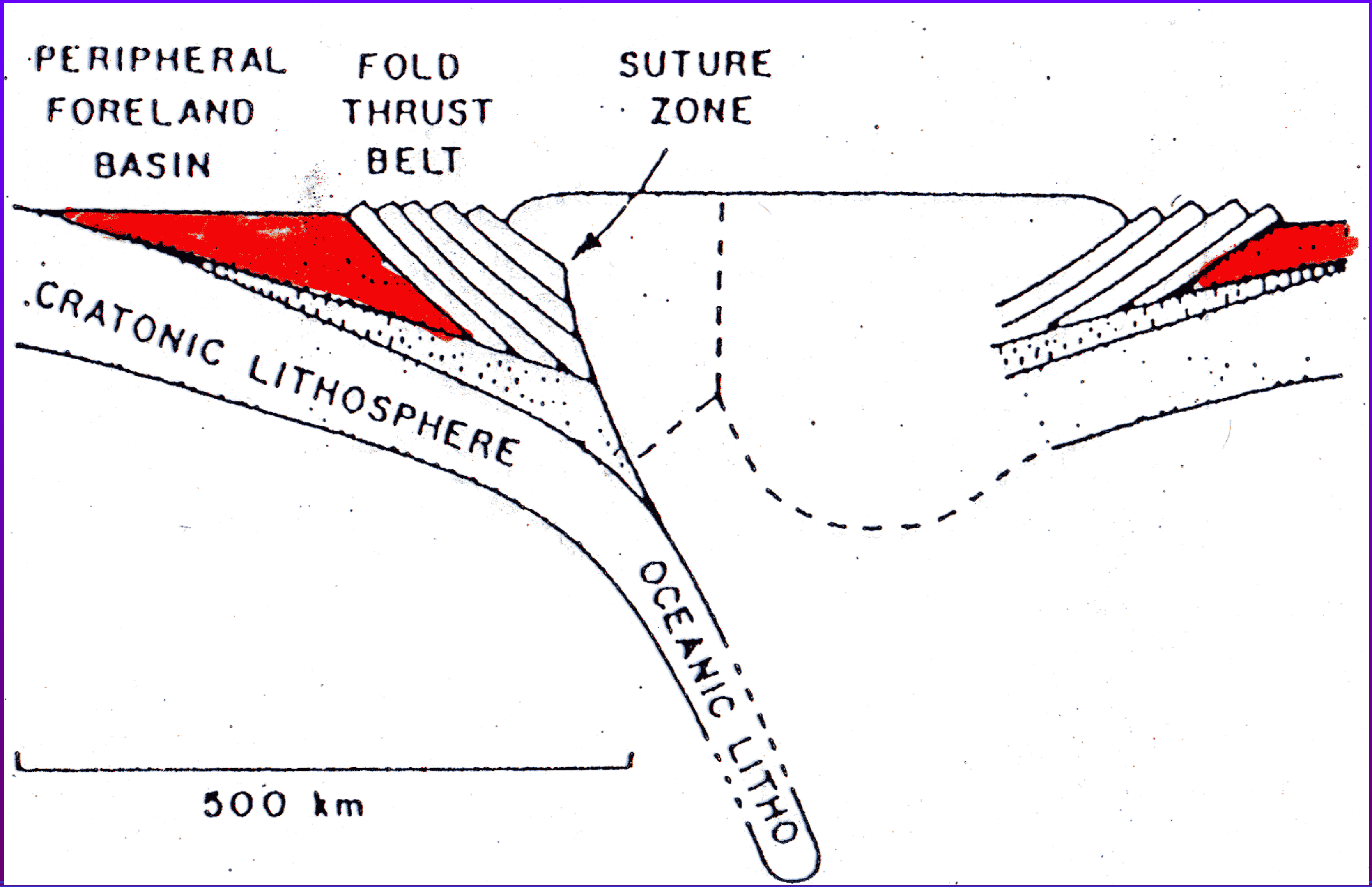
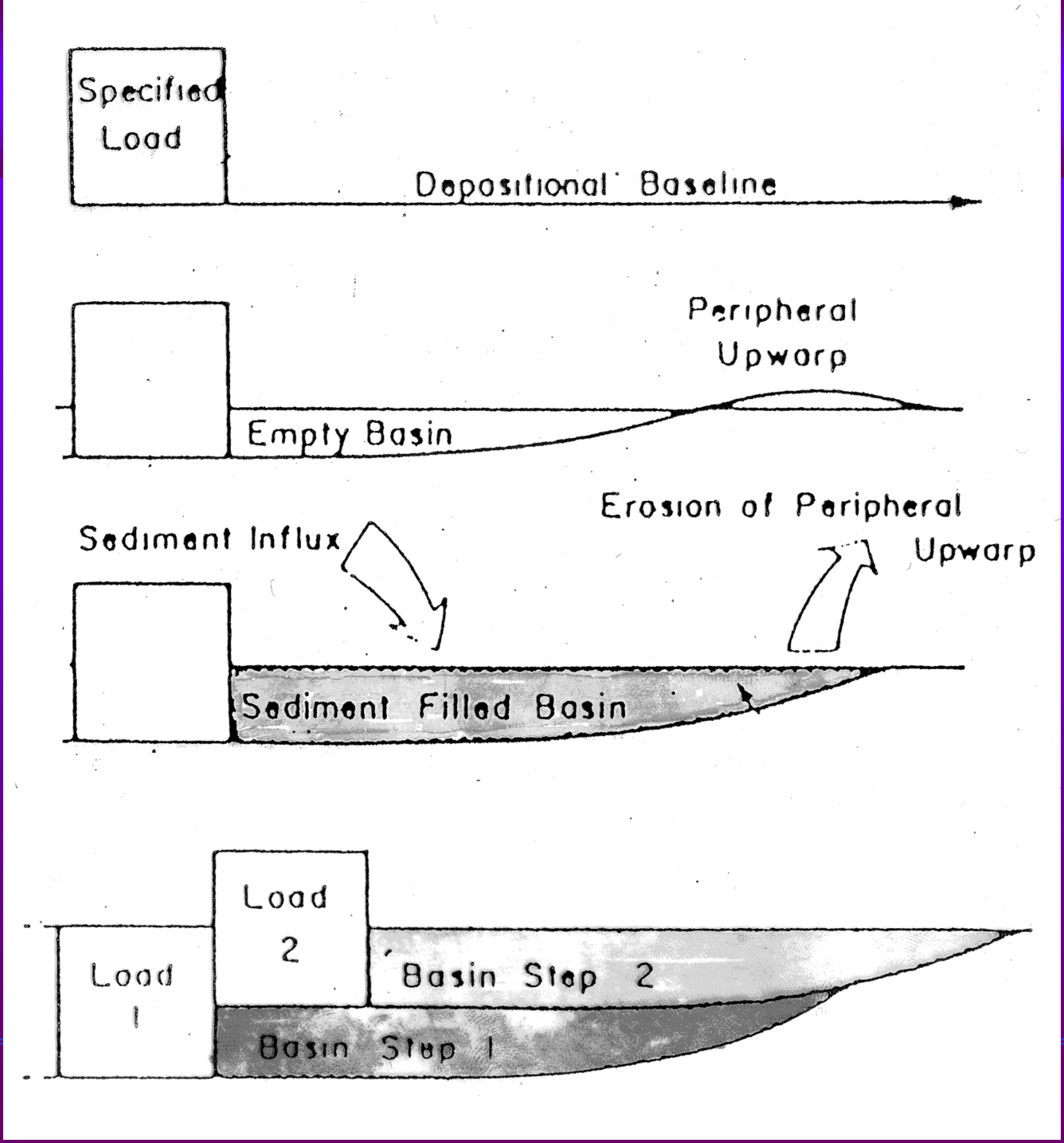
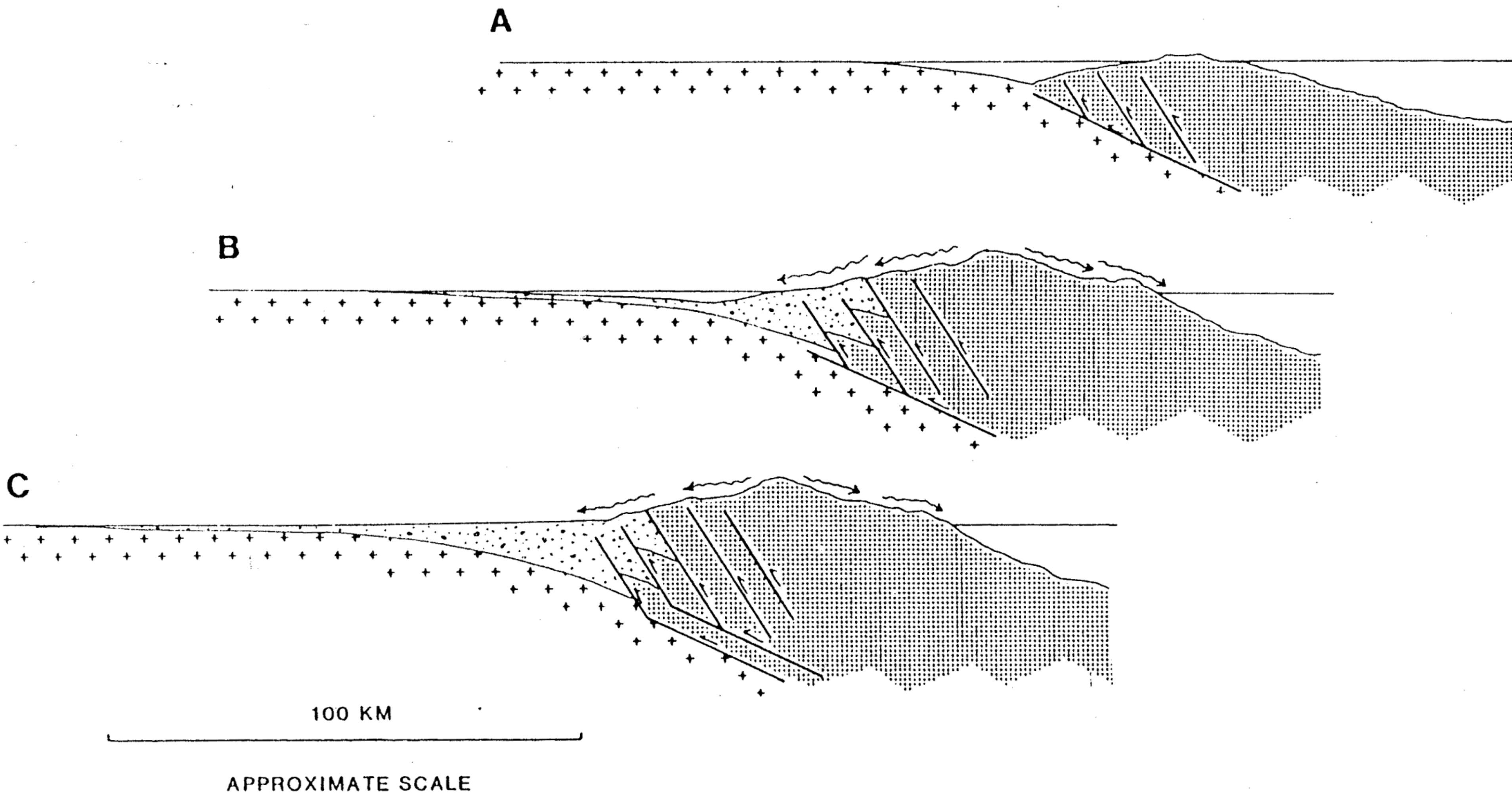
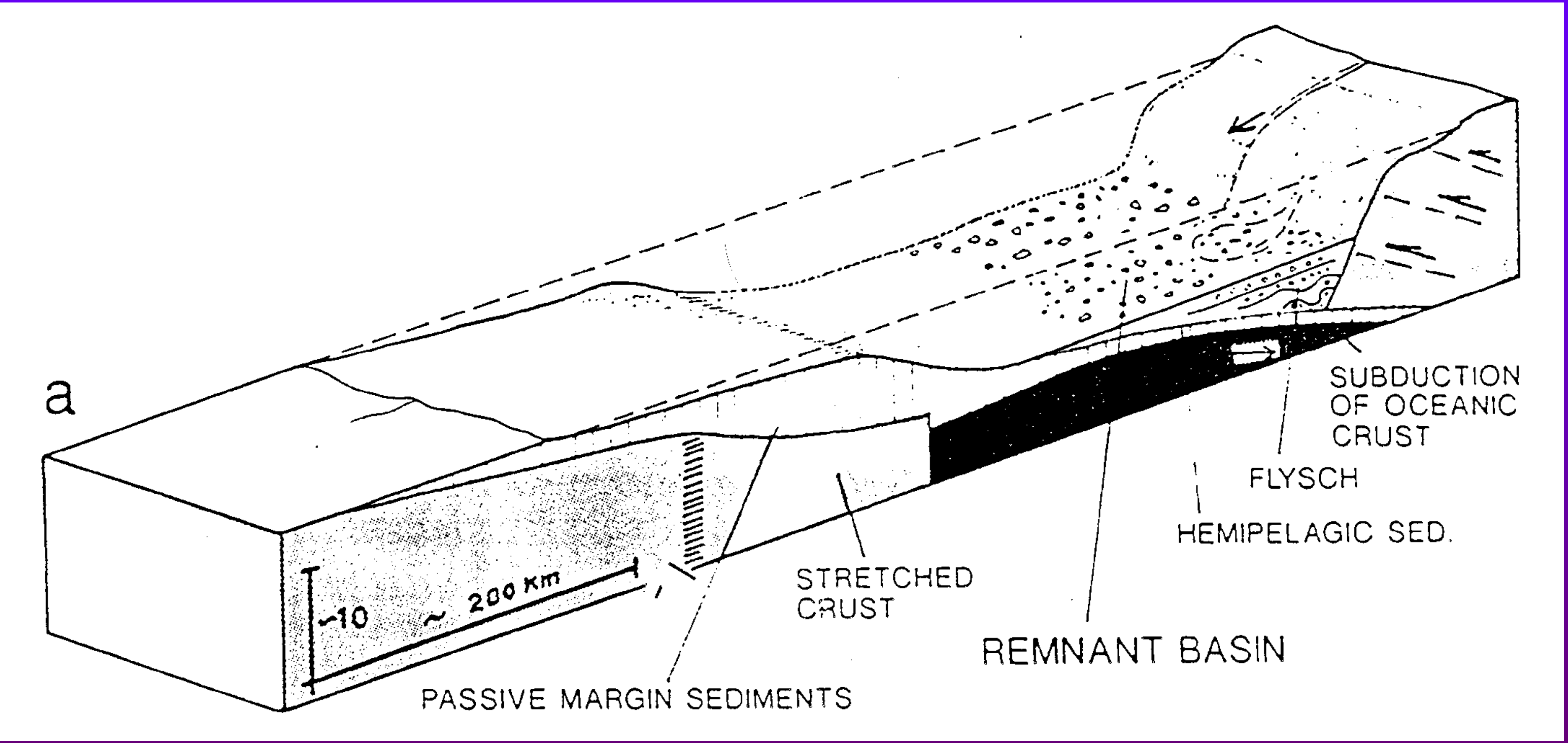
FORELAND BASINS

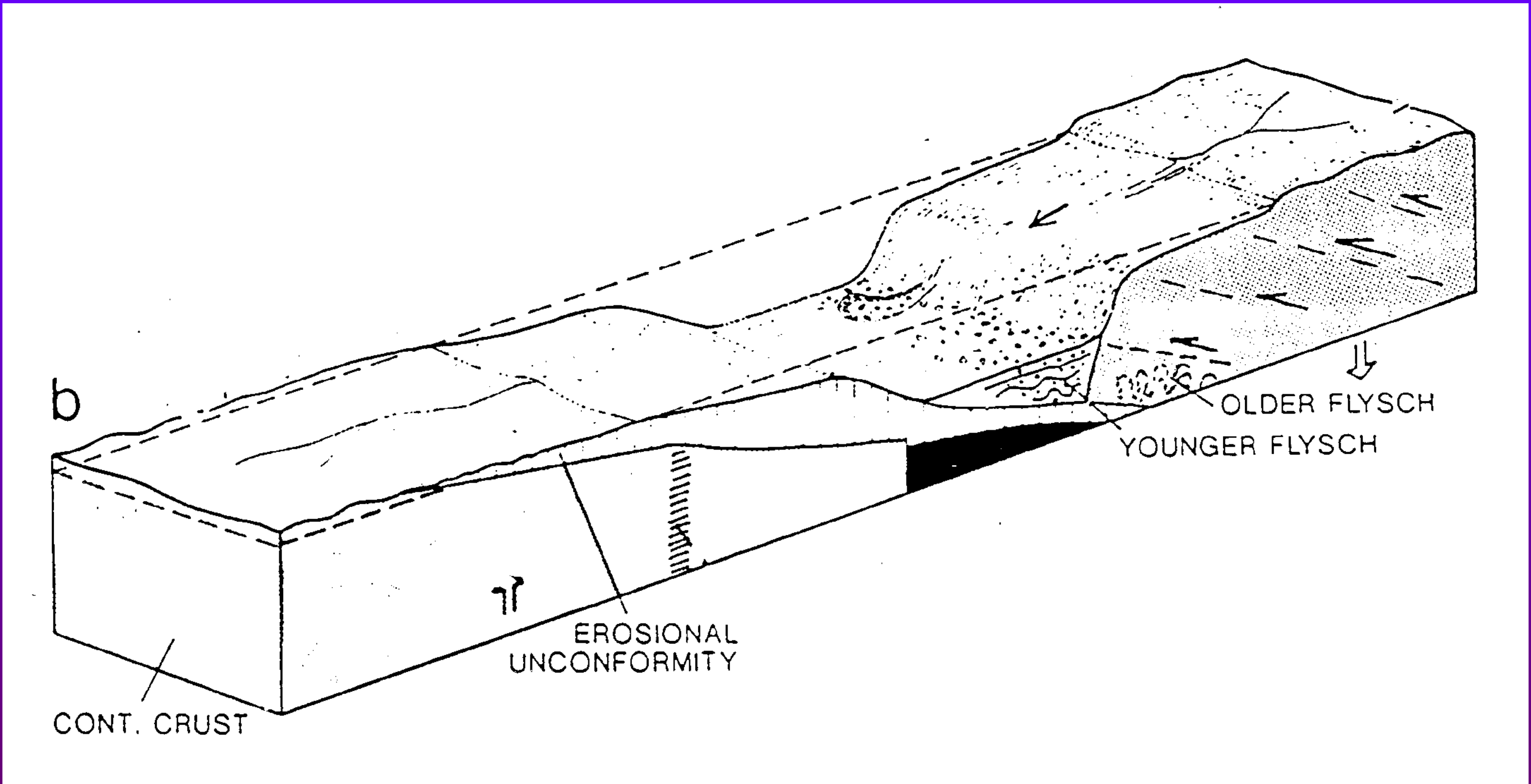

TRENCH
FOREARC BASIN
CORE ZONE
FORELAND FOLD-THRUST BELT
RETROARC FORELAND BASIN
OCEANIC LITHOSPHERE
CRATONIC LITHOSPHERE
(a)
500 km
PERIPHERAL FORELAND BASIN
FOLD THRUST BELT
SUTURE ZONE
CRATONIC LITHOSPHERE
OCEANIC LITHO
(b)

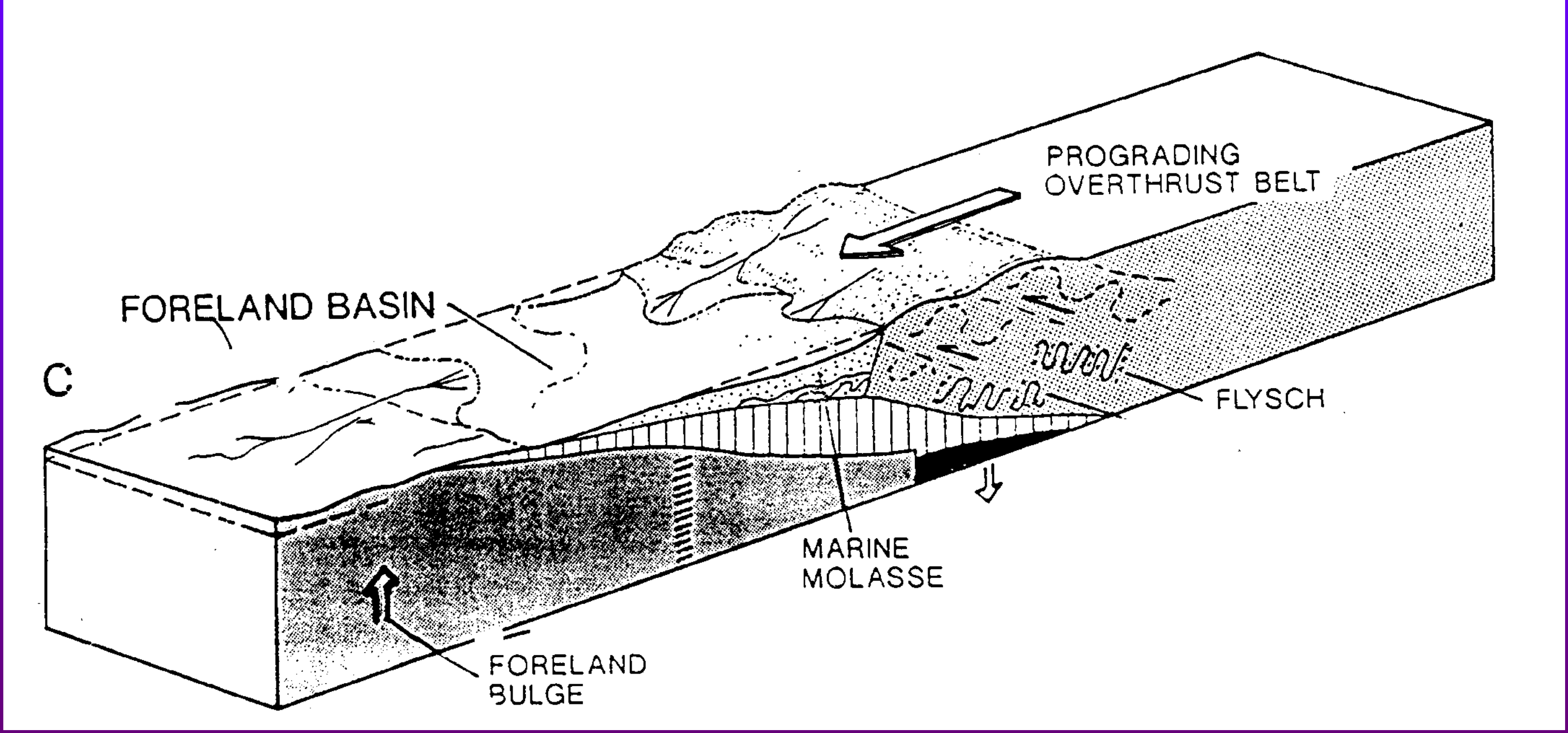

PERIPHERAL
FORELAND
BASIN
FOLD
THRUST
BELT
SUTURE
ZONE
CRATONIC LITHOSPHERE
OCEANIC LITHO
500 km

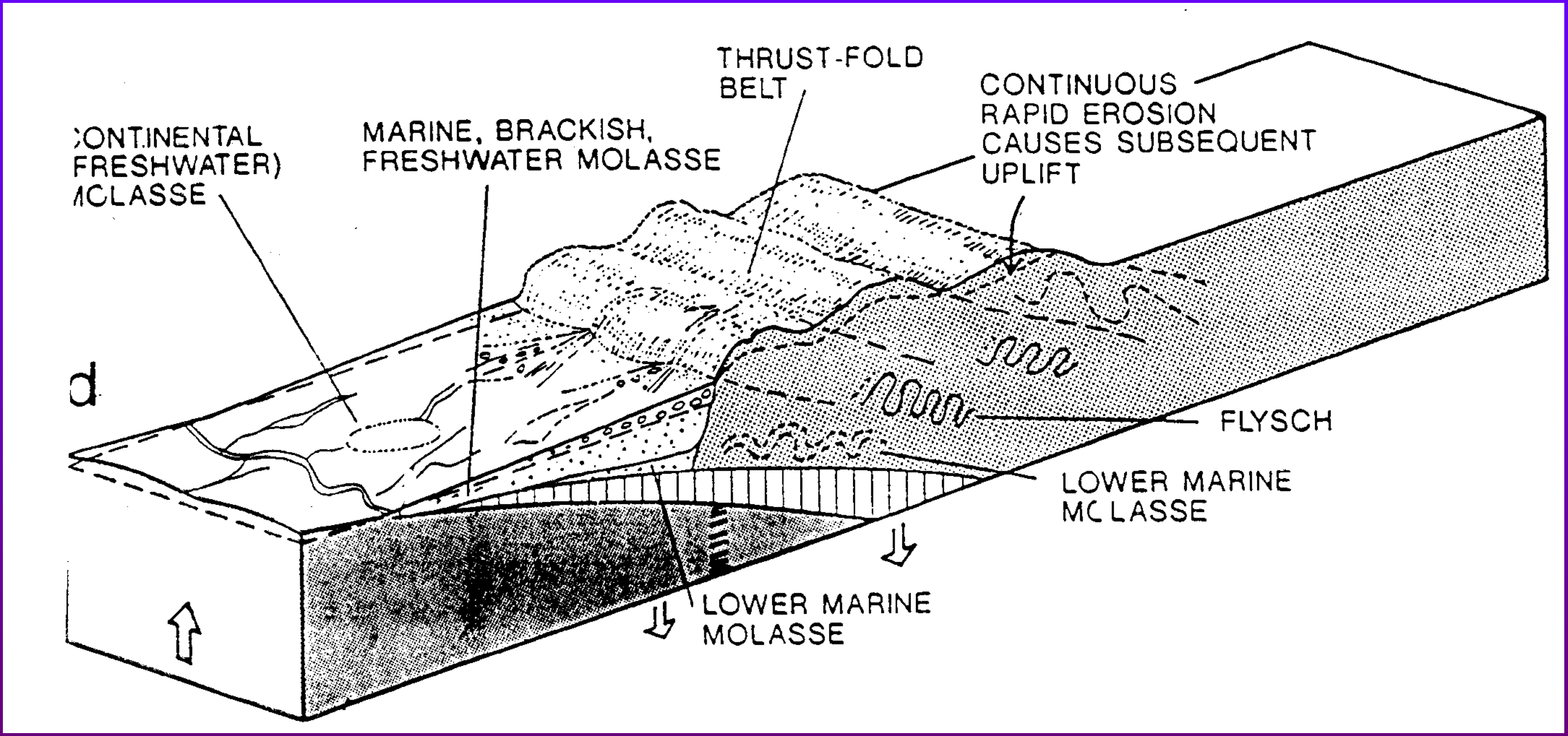

Specified Load
Depositional Baseline
Peripheral Upwarp
Empty Basin
Erosion of Peripheral Upwarp
Sediment Influx
Sediment Filled Basin
Load 2
Load 1
Basin Step 2
Basin Step 1

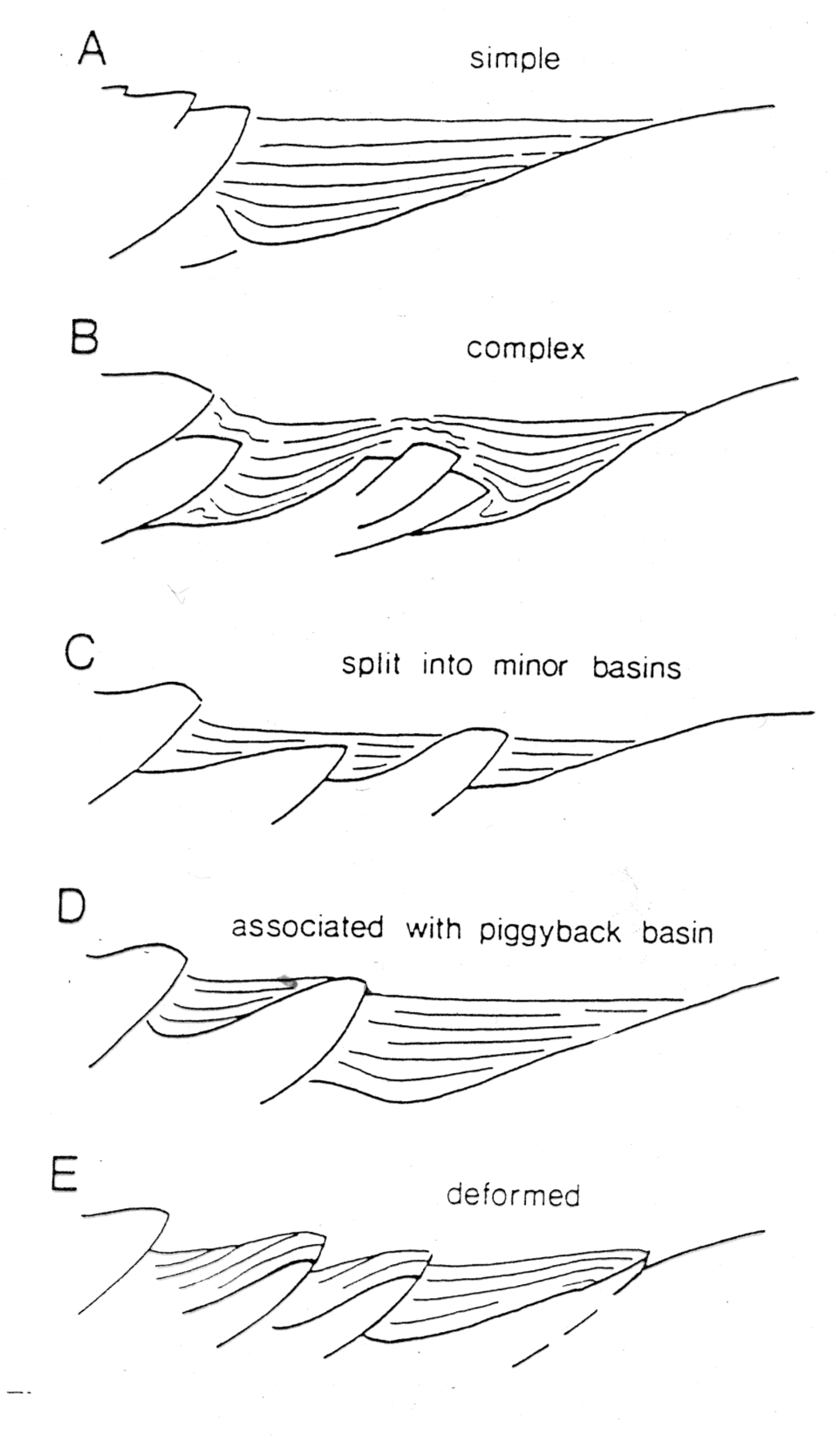

A
B
C
100 KM
APPROXIMATE SCALE

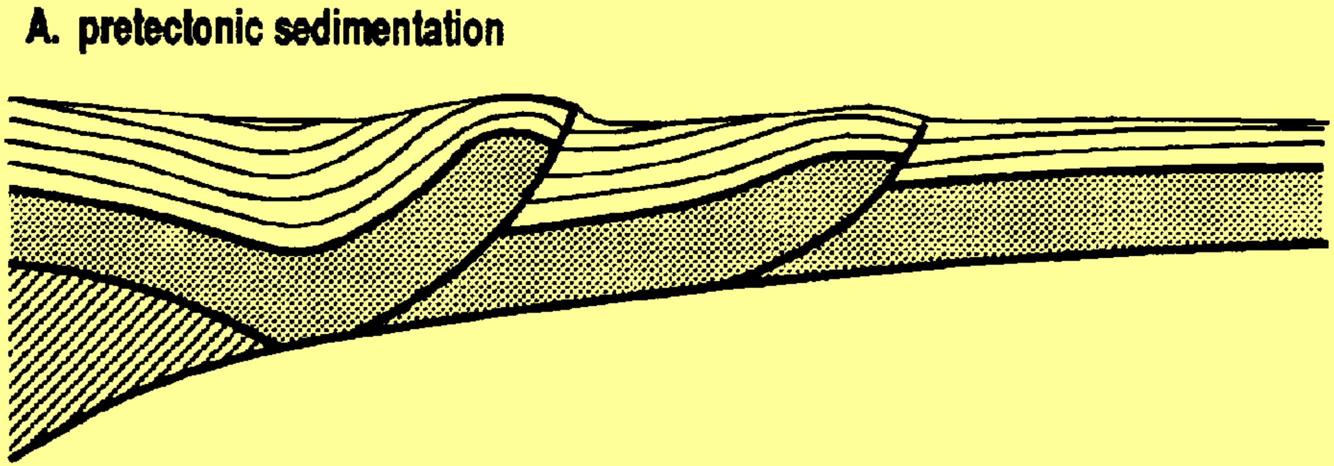

a
~10
~ 200 Km
PASSIVE MARGIN SEDIMENTS
STRETCHED
CRUST
REMNANT BASIN
HEMIPELAGIC SED.
FLYSCH
SUBDUCTION
OF OCEANIC
CRUST

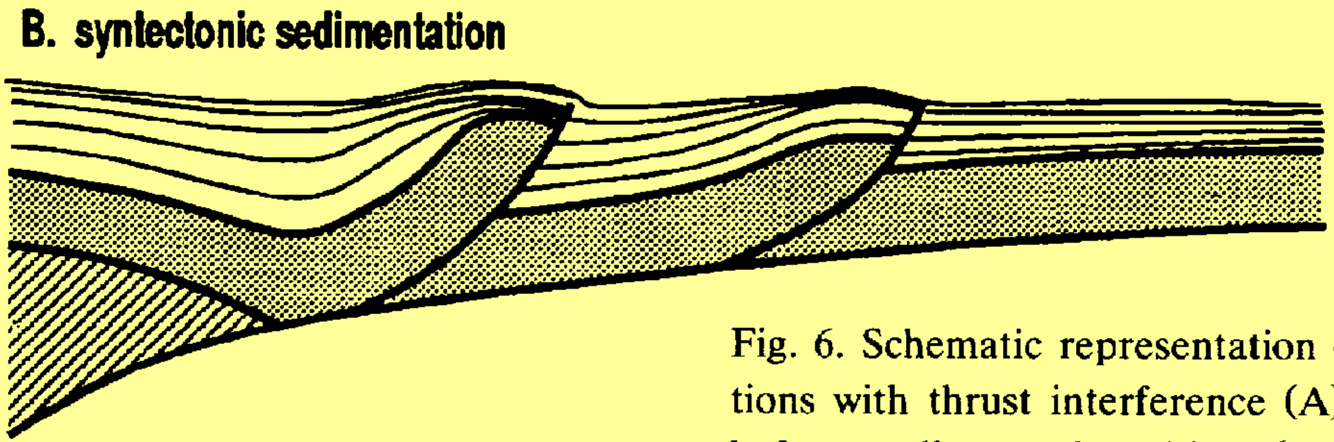

b
OLDER FLYSCH
YOUNGER FLYSCH
EROSIONAL
UNCONFORMITY
CONT. CRUST


C
FORELAND BASIN
PROGRADING
OVERTHRUST BELT
FLYSCH
MARINE
MOLASSE
FORELAND
BULGE


THRUST-FOLD
BELT
CONTINUOUS
RAPID EROSION
CAUSES SUBSEQUENT
UPLIFT
:ONTINENTAL
FRESHWATER)
ИCLASSE
MARINE, BRACKISH,
FRESHWATER MOLASSE
d
FLYSCH
LOWER MARINE
MC LASSE
LOWER MARINE
MOLASSE


A
simple
B
complex
C
split into minor basins
D
associated with piggyback basin
E
deformed





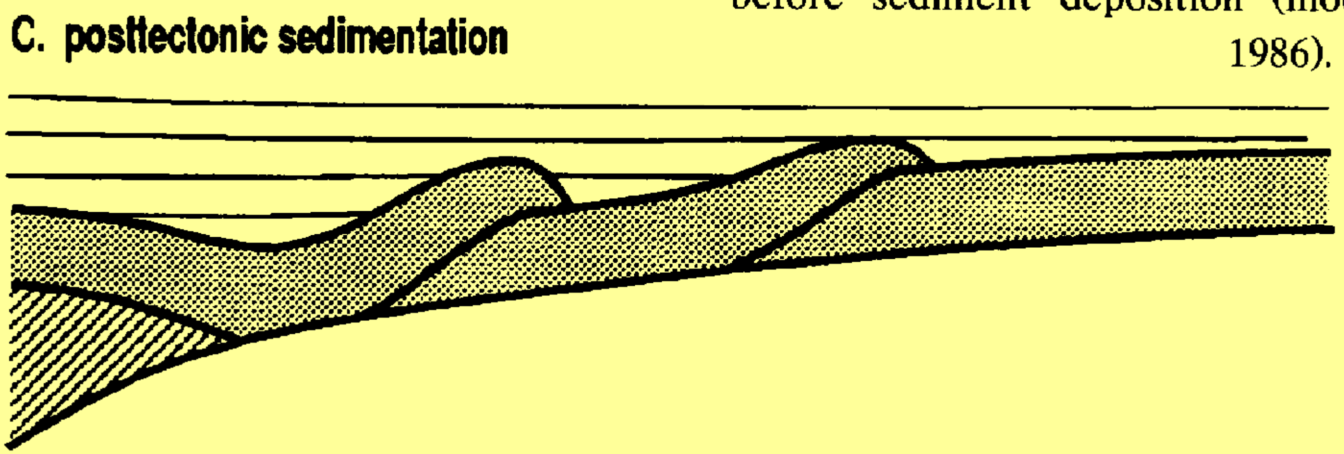


Fig. 6. Schematic representation of possible basin configurations with thrust interference (A) after, (B) during, and (C) before sediment deposition (modified from Ricci Lucchi, 1986).

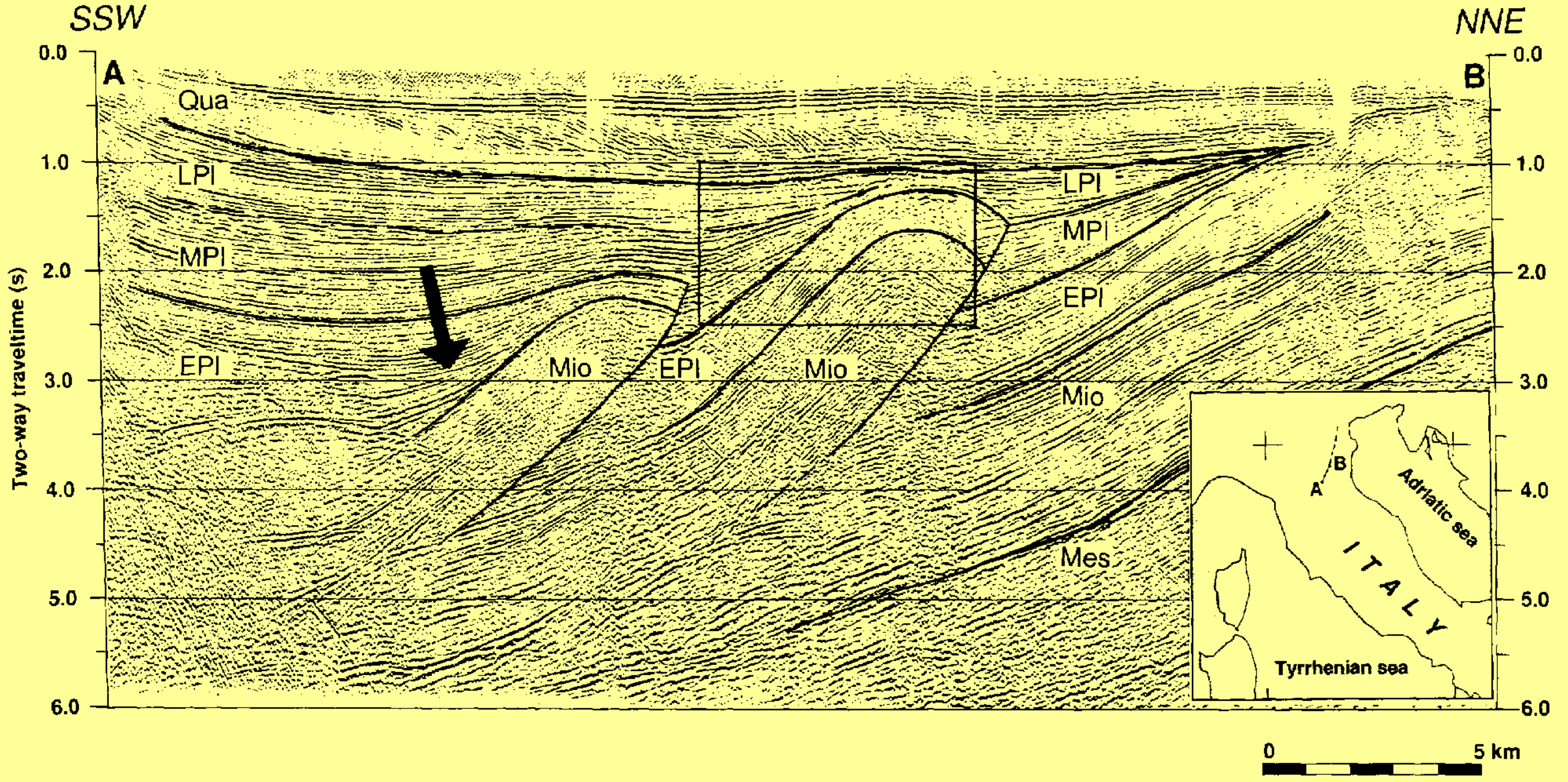
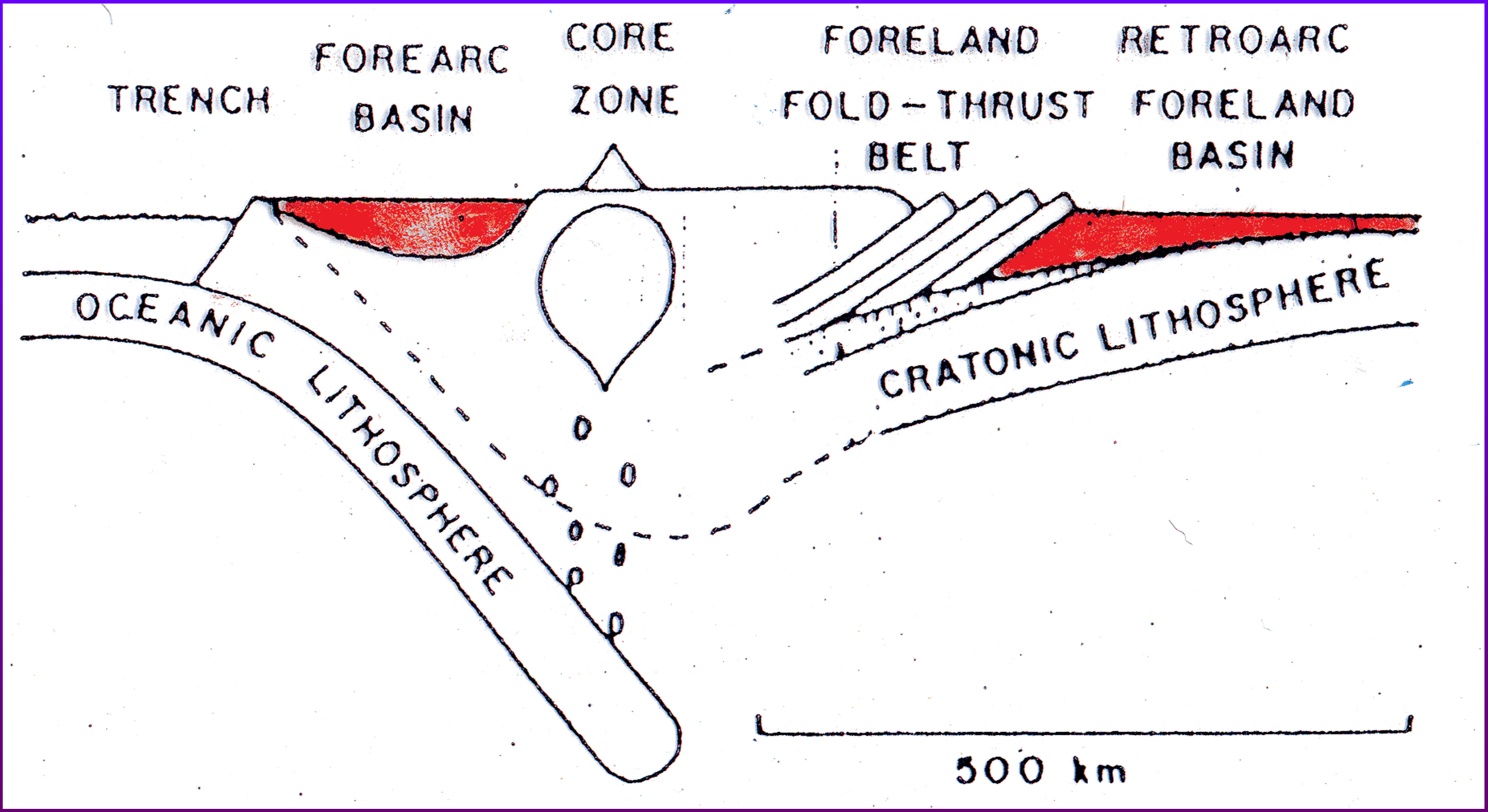
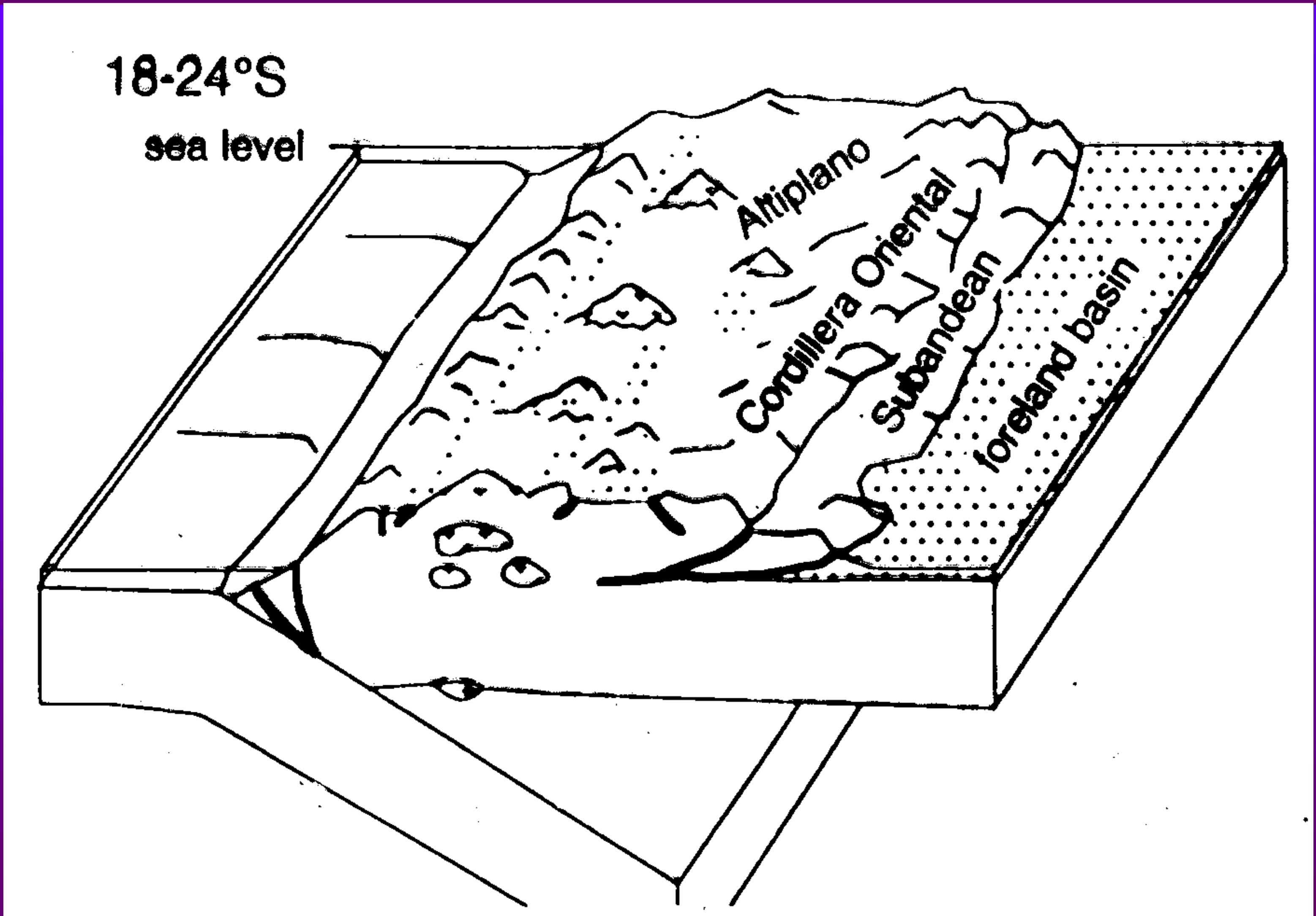
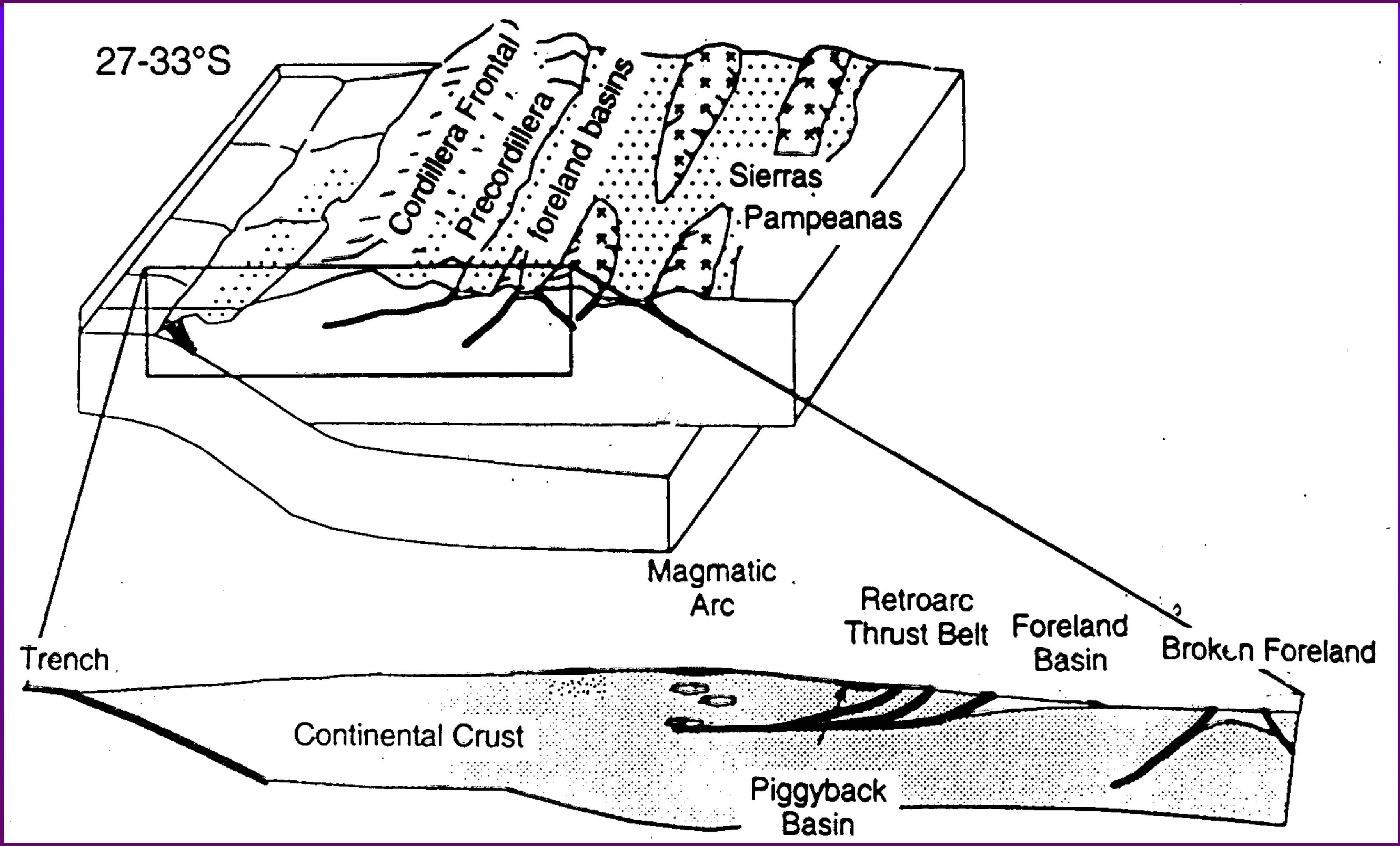
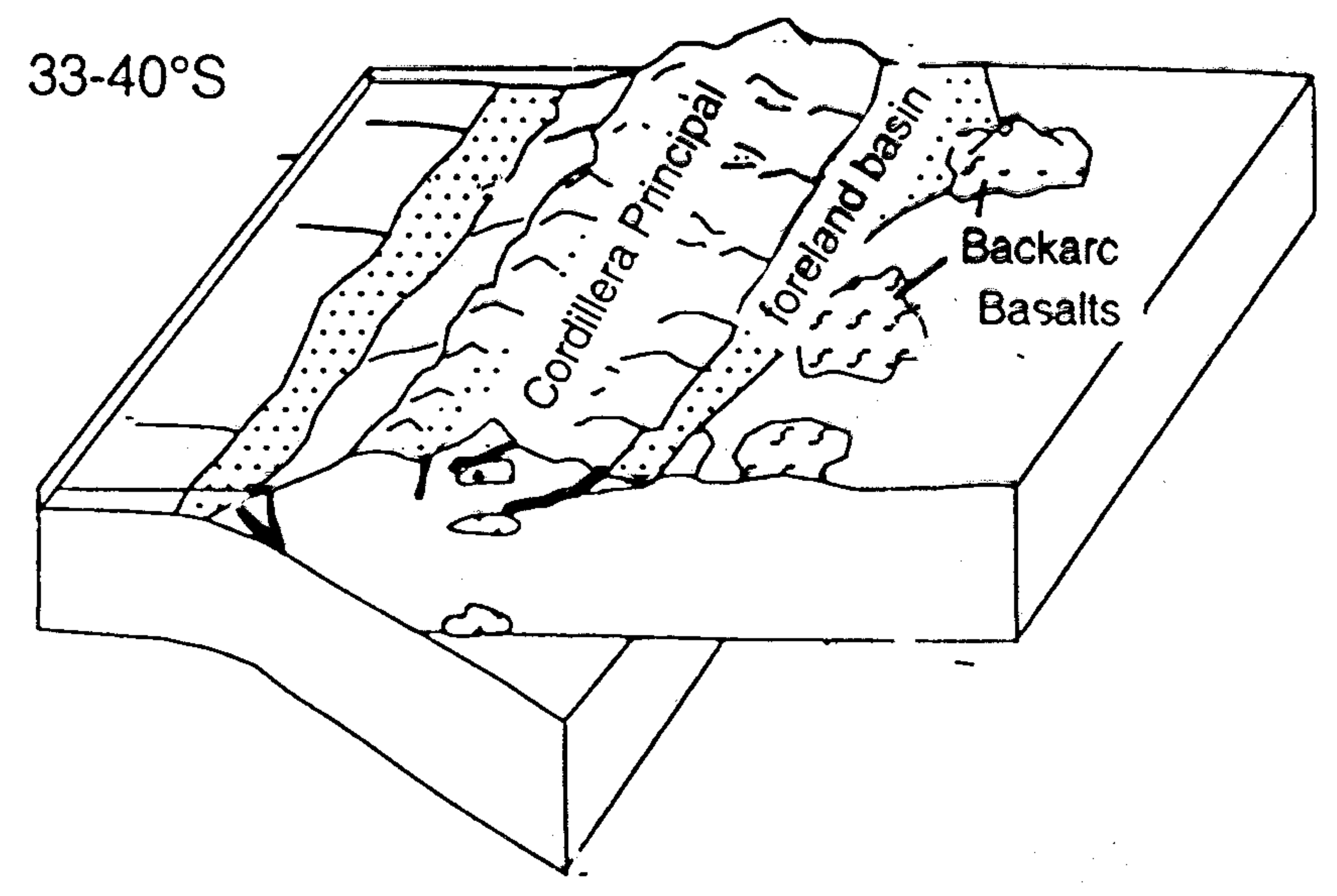


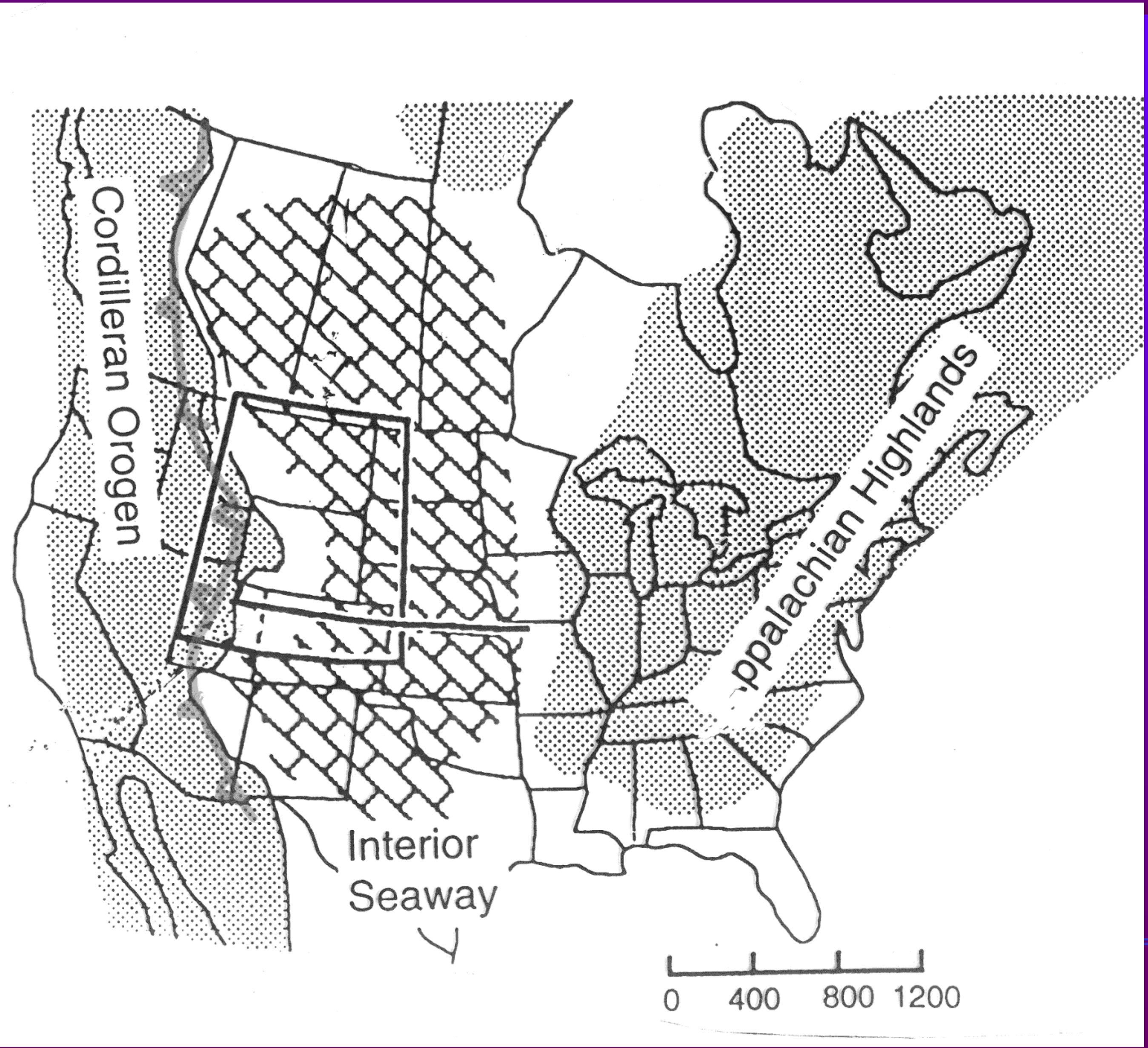
Fig. 10. Migrated seismic reflection profile through Ferrara–Romagna thrust arc, Northern Apennines, Italy. Inset shows location of profile *A–B*. *Mes* = Mesozoic; *Mio* = Miocene; *EPl* = early Pliocene; *MPl* = mid Pliocene; *LPl* = late Pliocene; *Qua* = Quaternary. The Pliocene–Quaternary sediments show angular unconformities formed by tectonic movement (after Pieri, 1989). Arrow points to truncation indicating new thrust activation. Box shows significant wedging of horizons, supporting deep-seated thrust activation.

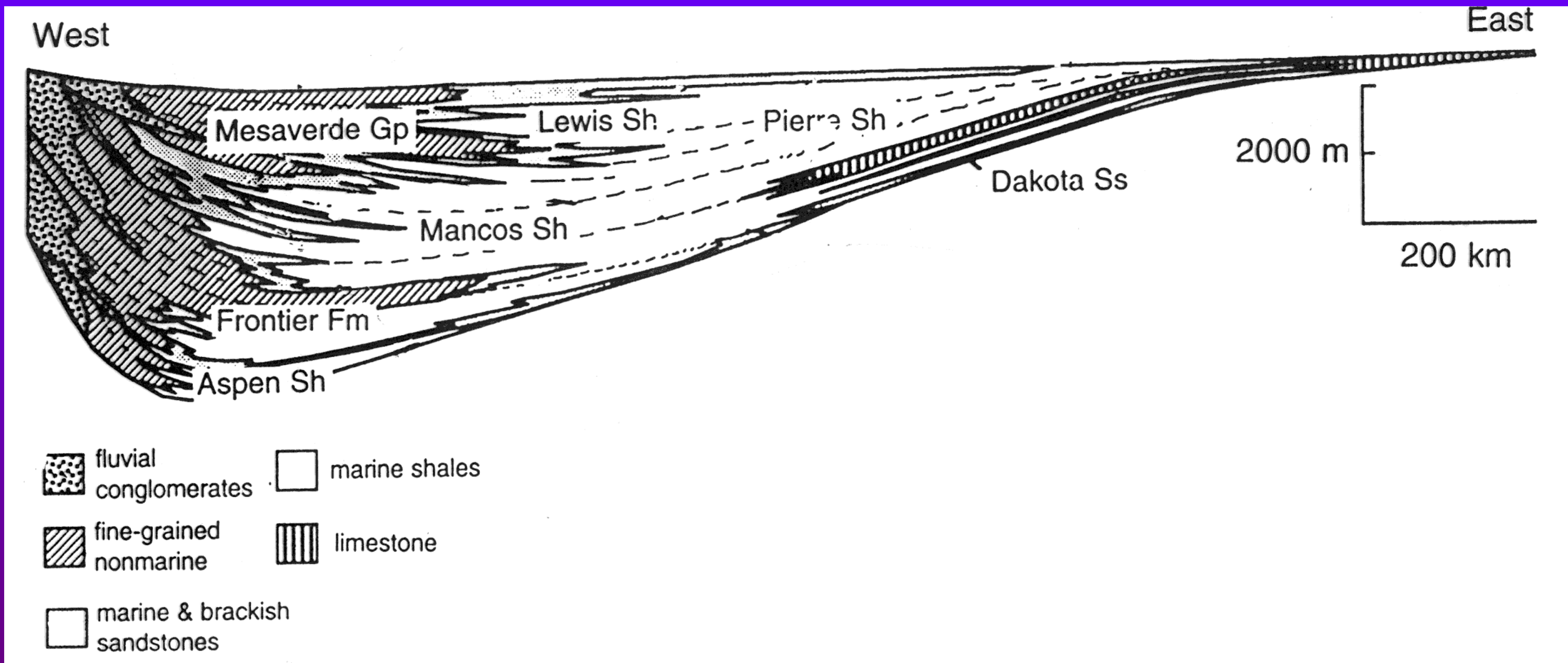

TRENCH
FOREARC BASIN
CORE ZONE
FORELAND FOLD-THRUST BELT
RETROARC FORELAND BASIN
OCEANIC LITHOSPHERE
CRATONIC LITHOSPHERE
500 km


18-24°S
sea level
Altiplano
Cordillera Oriental
Subandean
foreland basin


27-33°S
Cordillera Frontal
Precordillera
foreland basins
Sierras
Pampeanas
Magmatic
Arc
Retroarc
Thrust Belt
Foreland
Basin
Broken Foreland
Trench
Continental Crust
Piggyback
Basin


33-40°S
Cordillera Principal
foreland basin
Backarc
Basalts


Cordilleran Orogen
Appalachian Highlands
Interior
Seaway
0 400 800 1200


West
East
Mesaverde Gp
Lewis Sh
Pierre Sh
Dakota Ss
2000 m
200 km
Mancos Sh
Frontier Fm
Aspen Sh
fluvial conglomerates
marine shales
fine-grained nonmarine
limestone
marine & brackish sandstones

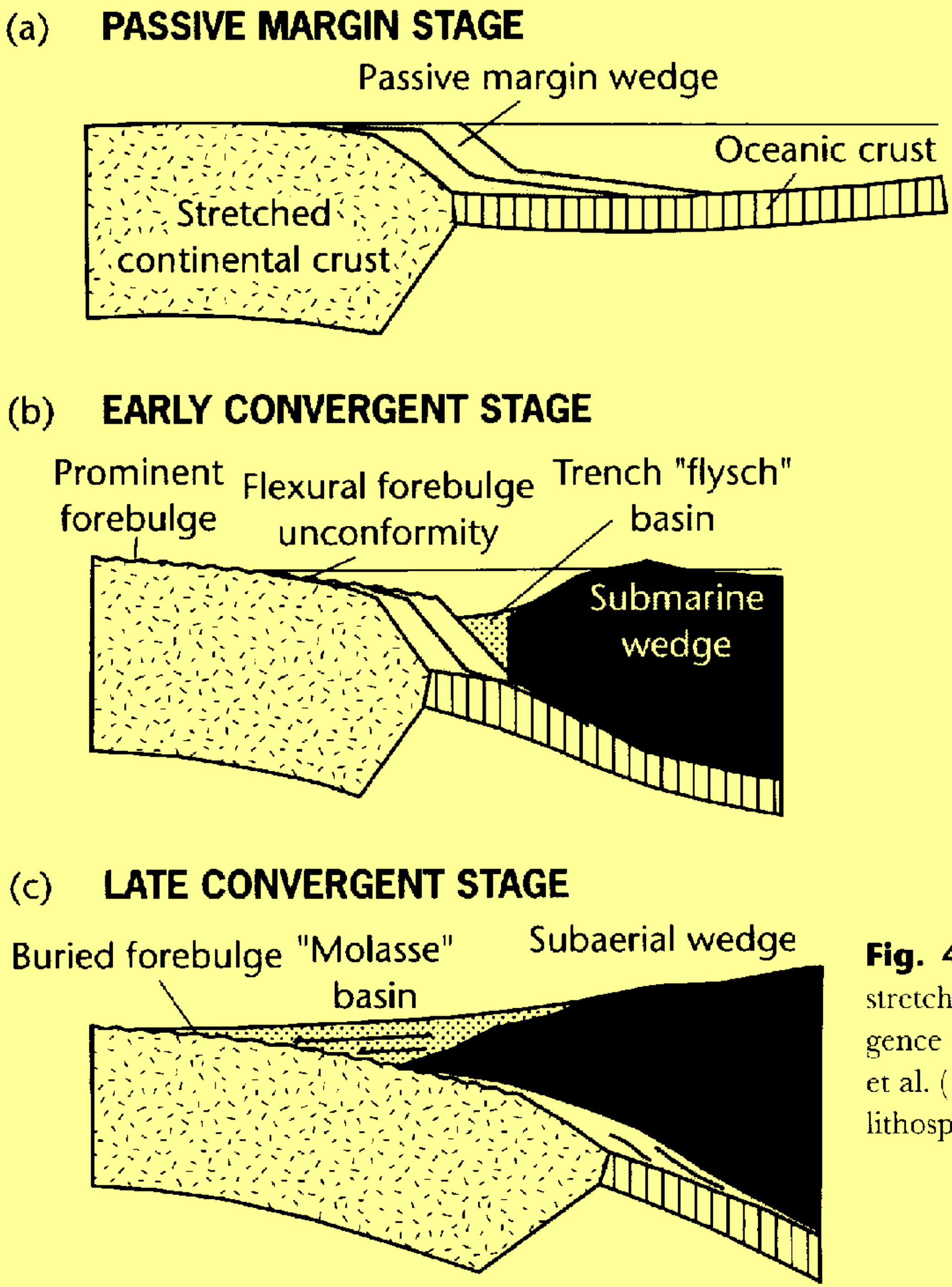
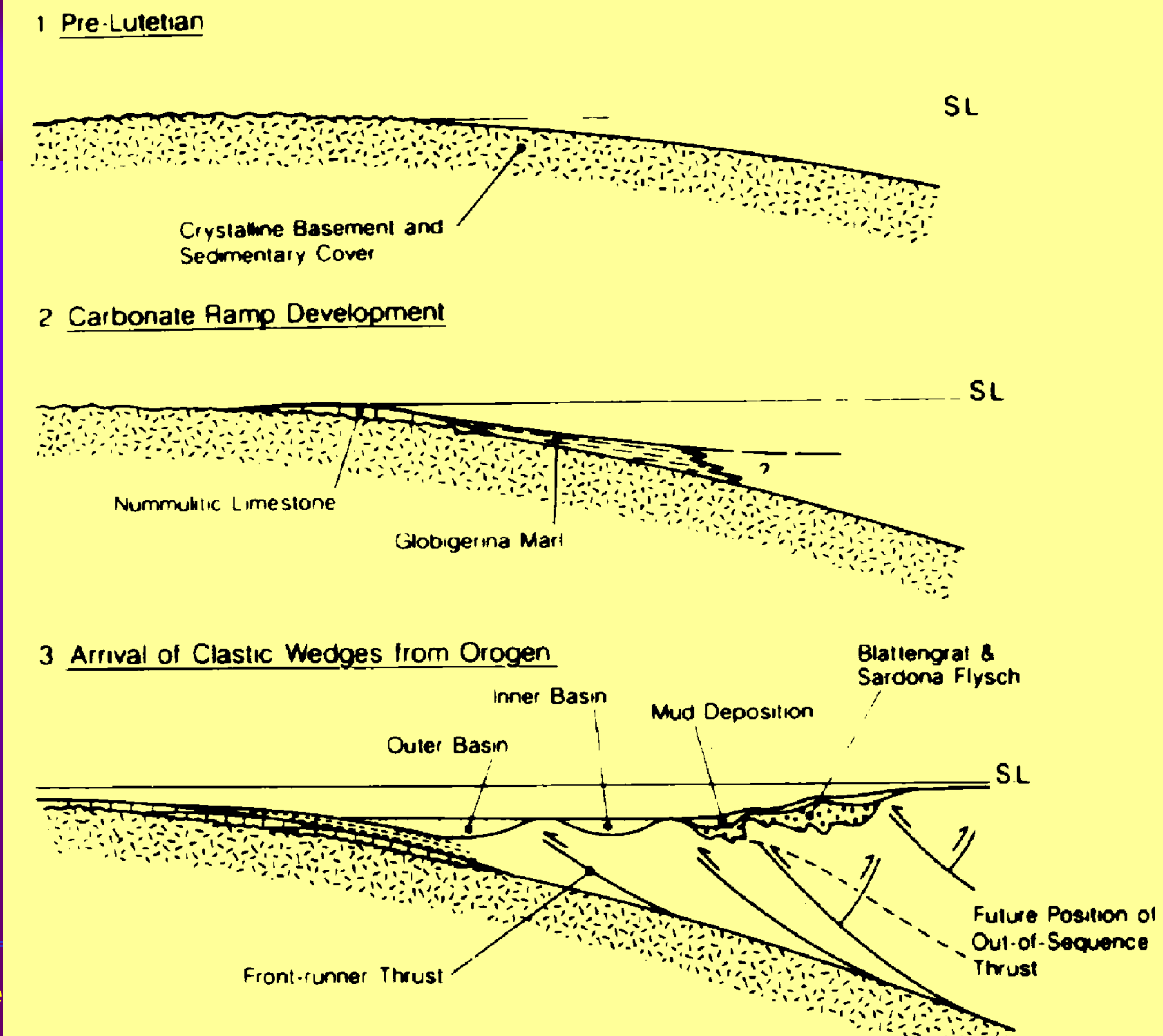


Fig. 4.31 Model involving orogenic loading of a previously stretched continental margin during the early stages of convergence (Stockmal et al. 1986; Watts 1992), modified by Allen et al. (1991). The first orogenic loads are emplaced on a weaker lithosphere at considerable water depths.


1 Pre-Lutetian
SL
Crystalline Basement and
Sedimentary Cover
2 Carbonate Ramp Development
SL
?
Nummulitic Limestone
Globigerina Marl
3 Arrival of Clastic Wedges from Orogen
Blattengrat &
Sardona Flysch
Inner Basin
Mud Deposition
Outer Basin
SL
Future Position of
Out-of-Sequence
Thrust
Front-runner Thrust

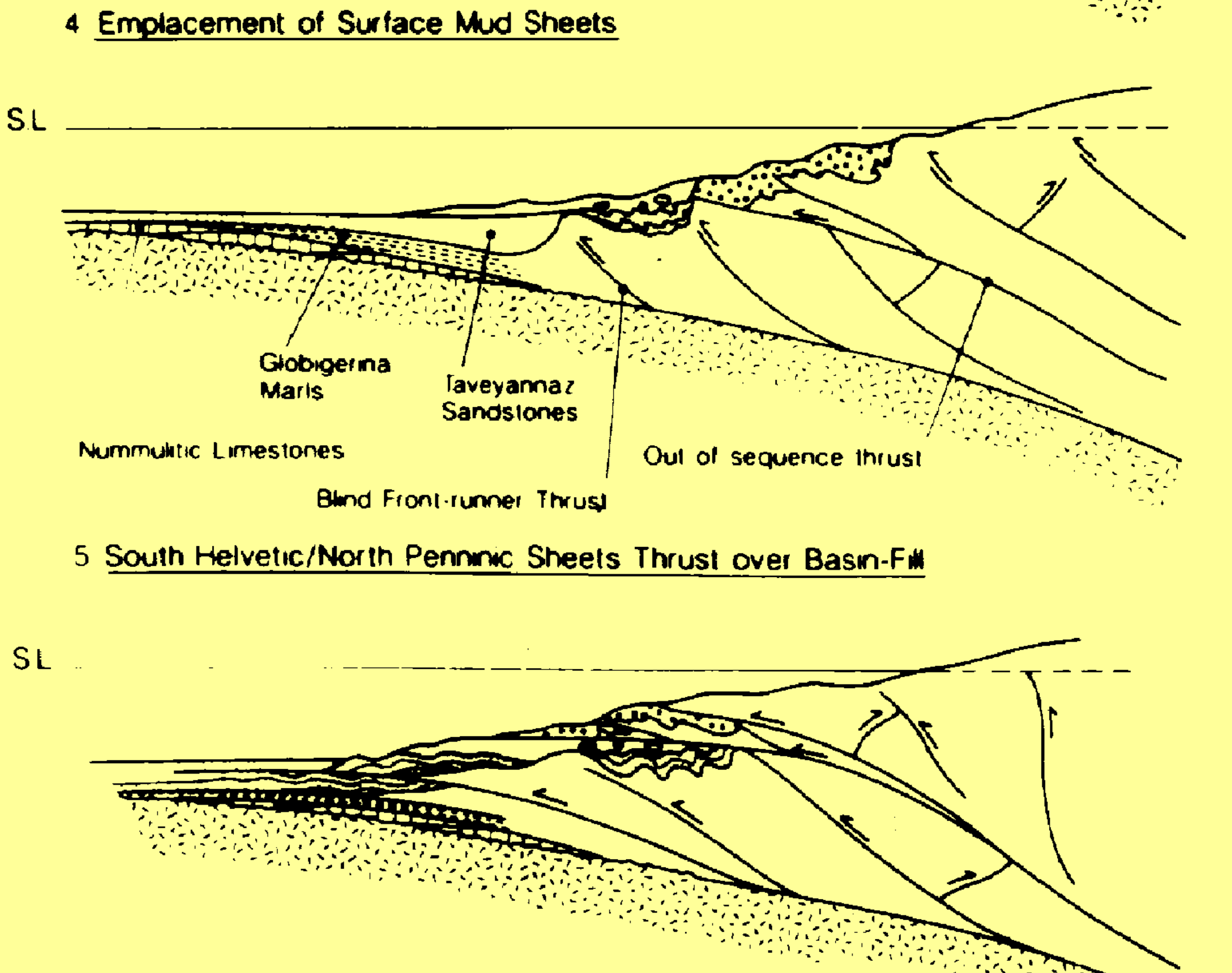


Fig. 11.7 Schematic evolution of North Alpine peripheral foreland basin, Switzerland, from initial uplift and erosion of forebulge on downgoing (European) plate in mid-Eocene (panel 1) to overthrusting from south in Oligocene (panel 5). (Reproduced with permission from Allen et al., 1991.)

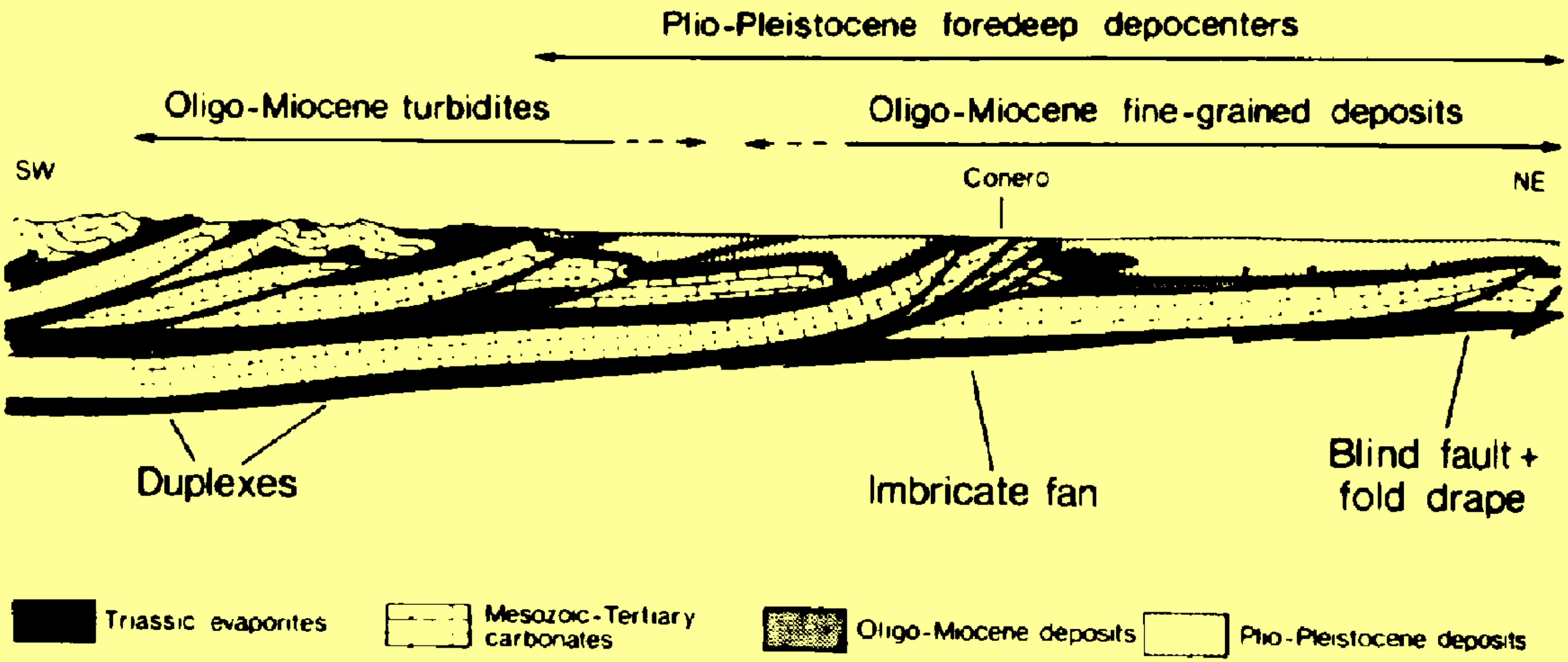


Fig. 11.8 Typical fold-thrust belt and associated foreland basin: Apenninic-Adriatic foredeep, Italy. Foreland basin is of Plio-Pleistocene age, and reaches a maximum depth of 1200 m. Width of section is approximately 100 km. (Reproduced with permission from Ori et al., 1986.)

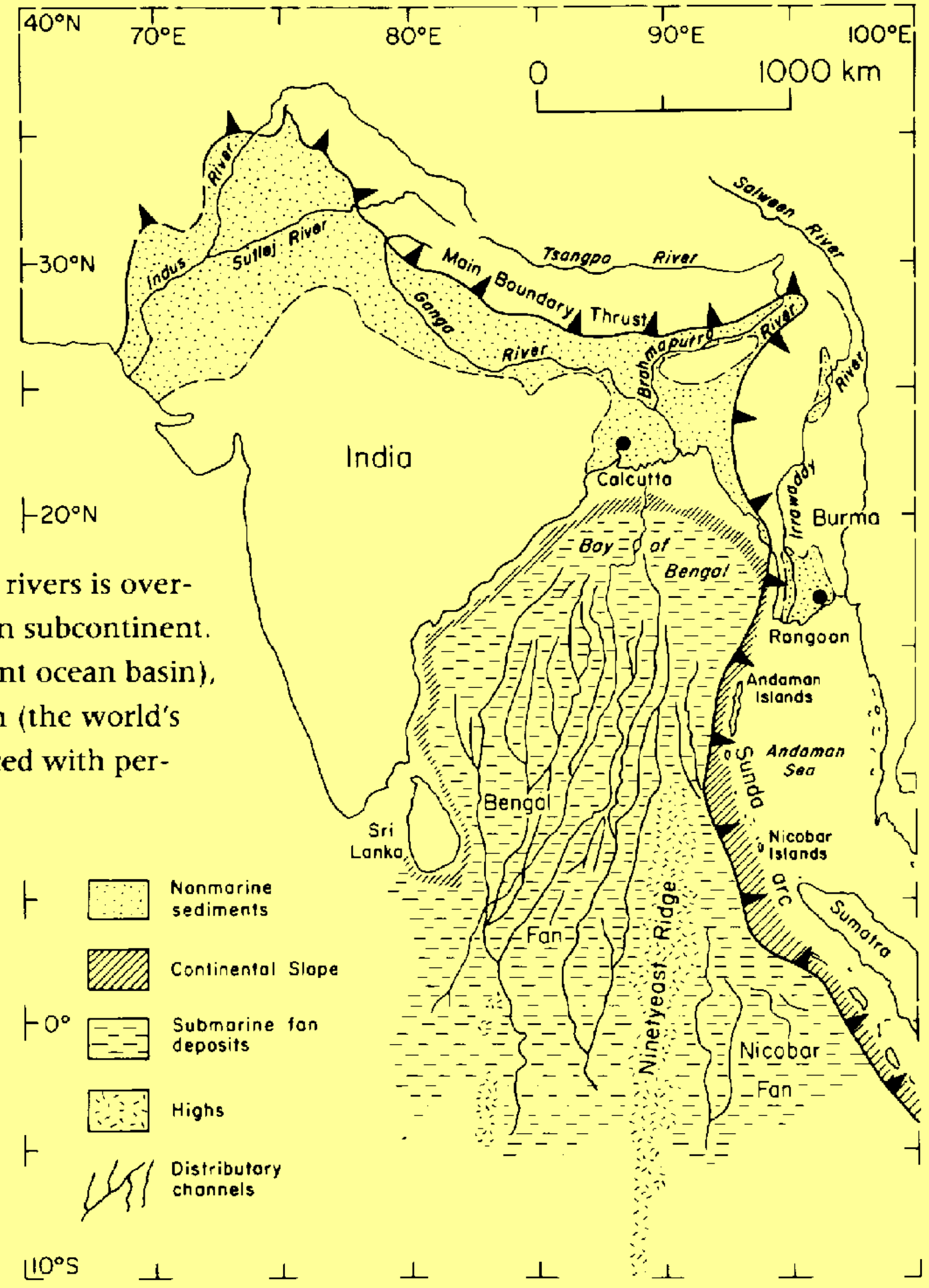


Fig. 11.21 Axial flow of Indus, Ganga, and Brahmaputra rivers is overfilling the peripheral foreland basin of the northern Indian subcontinent. Much of this detritus reaches the Bay of Bengal (a remnant ocean basin), where it contributes to the growth of the giant Bengal fan (the world's largest depositional system; also see Fig. 10.5). (Reproduced with permission from Miall, 1990.)

Foreland basins

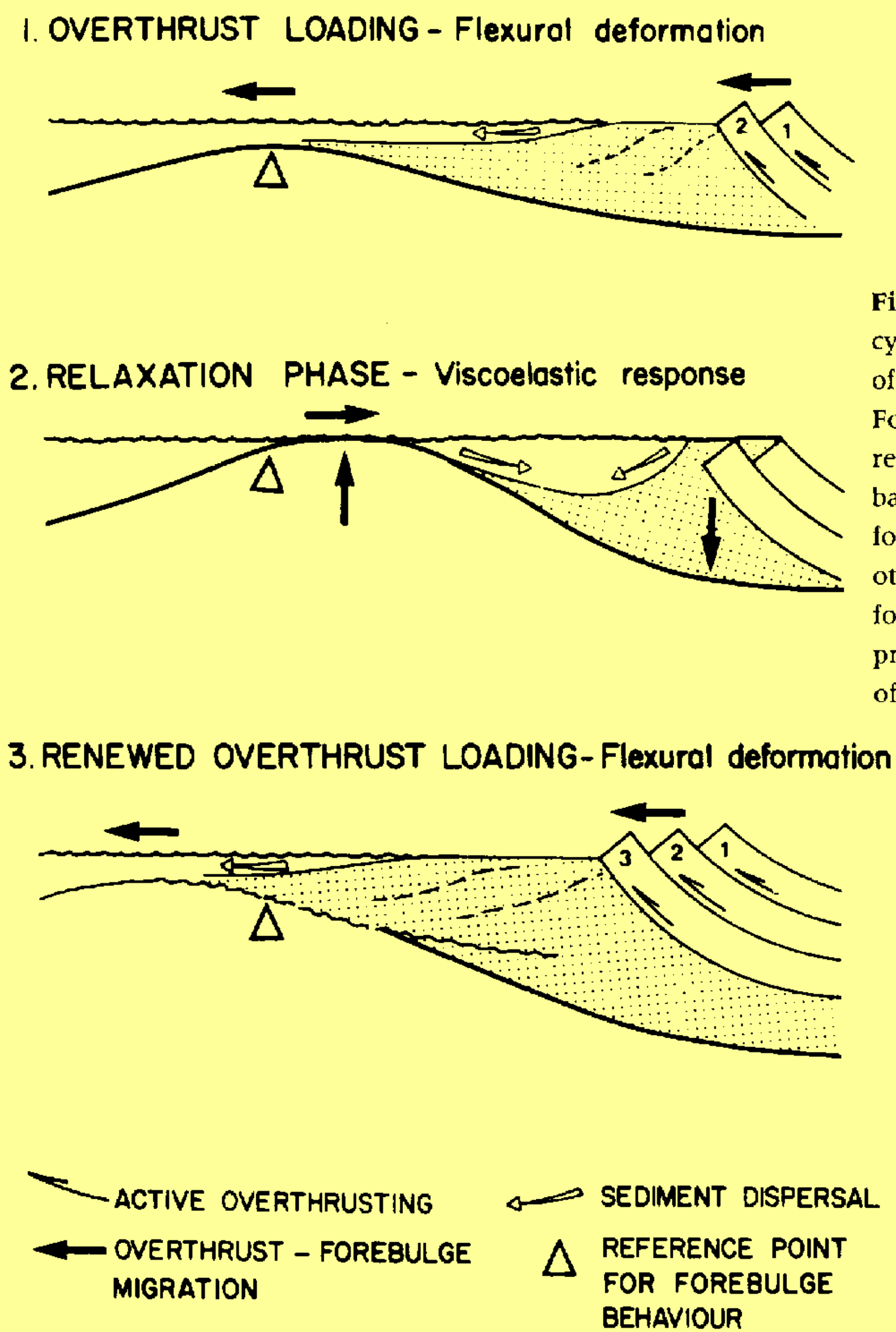


Fig. 11.22 Development and migration of a forebulge in response to cycles of deformation and tectonic quiescence. Forebulge develops as part of the flexural wave generated in the crust by loading (see Fig. 11.5). Following cessation of thrusting, there may be a viscoelastic relaxational response to loading, which leads to deepening and narrowing of the basin. In the case of an elastic crust this phase would not occur. The forebulge may be exposed to erosion, or become a shoal area within an otherwise deeper-marine basin. With renewed crustal shortening, the forebulge migrates cratonward. Subsidence and uplift of the forebulge produce onlap and wedge-out unconformities, respectively, on the flanks of the uplift. (Reproduced with permission from Tankard, 1986.)

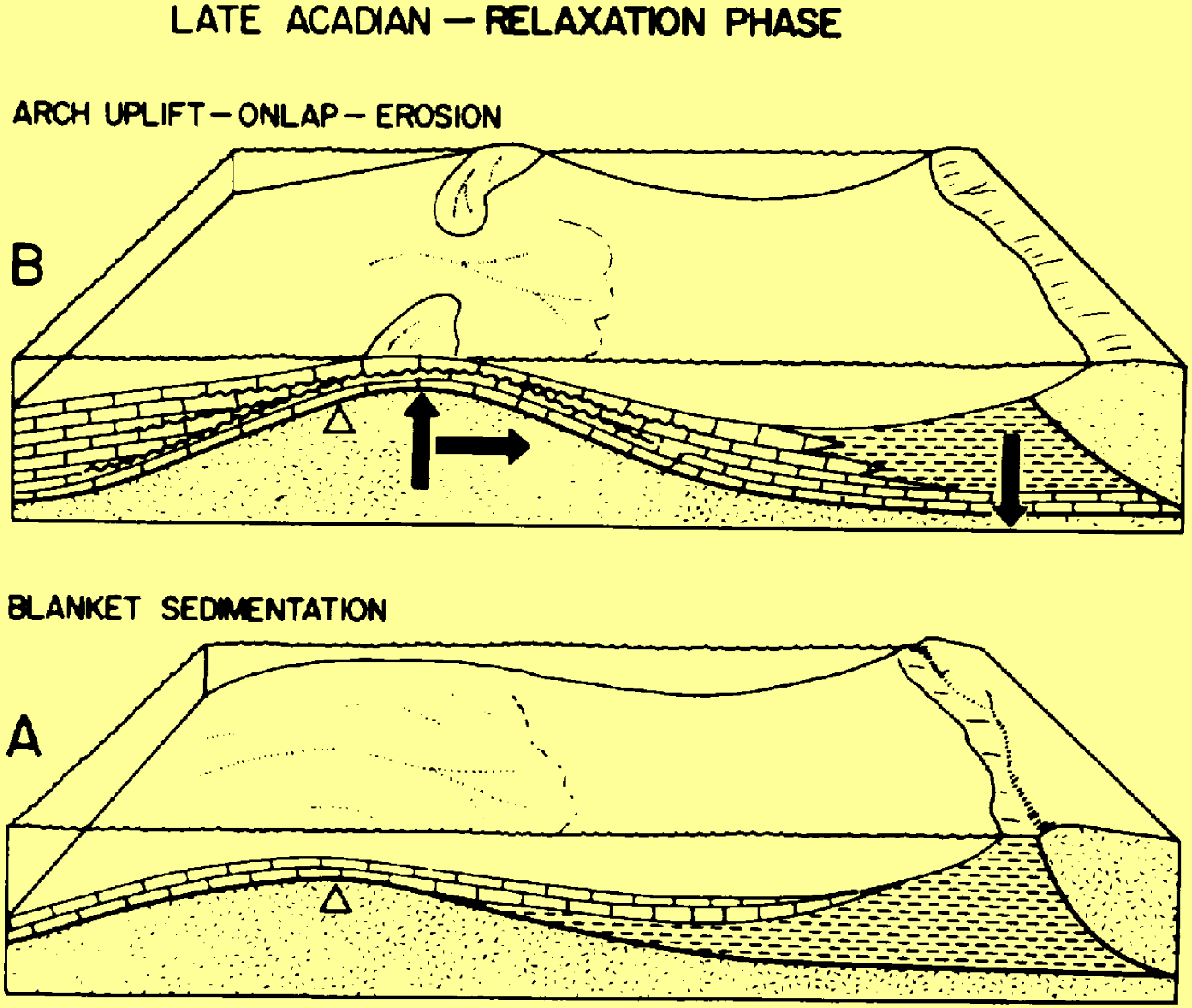
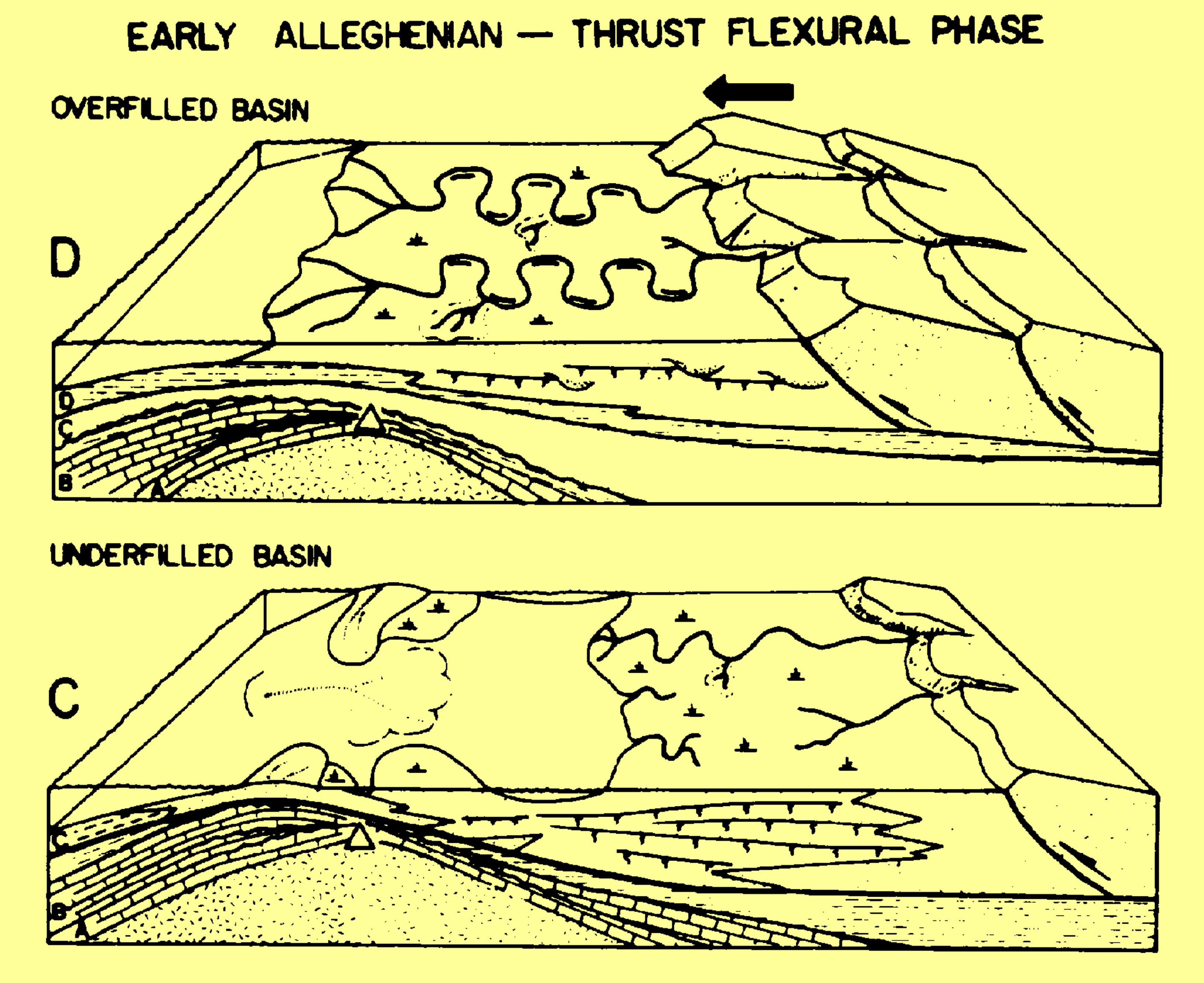


Fig. 11.23 Evolution of Appalachian landscapes during the Acadian (Middle Devonian to Early Mississippian) and Alleghenian (Early Pennsylvanian to Permian) orogenic episodes. (Reproduced with permission from Tankard, 1986.)


EARLY ALLEGHENIAN — THRUST FLEXURAL PHASE
OVERFILLED BASIN
D
D
C
B
A
UNDERFILLED BASIN
C
C
B
A

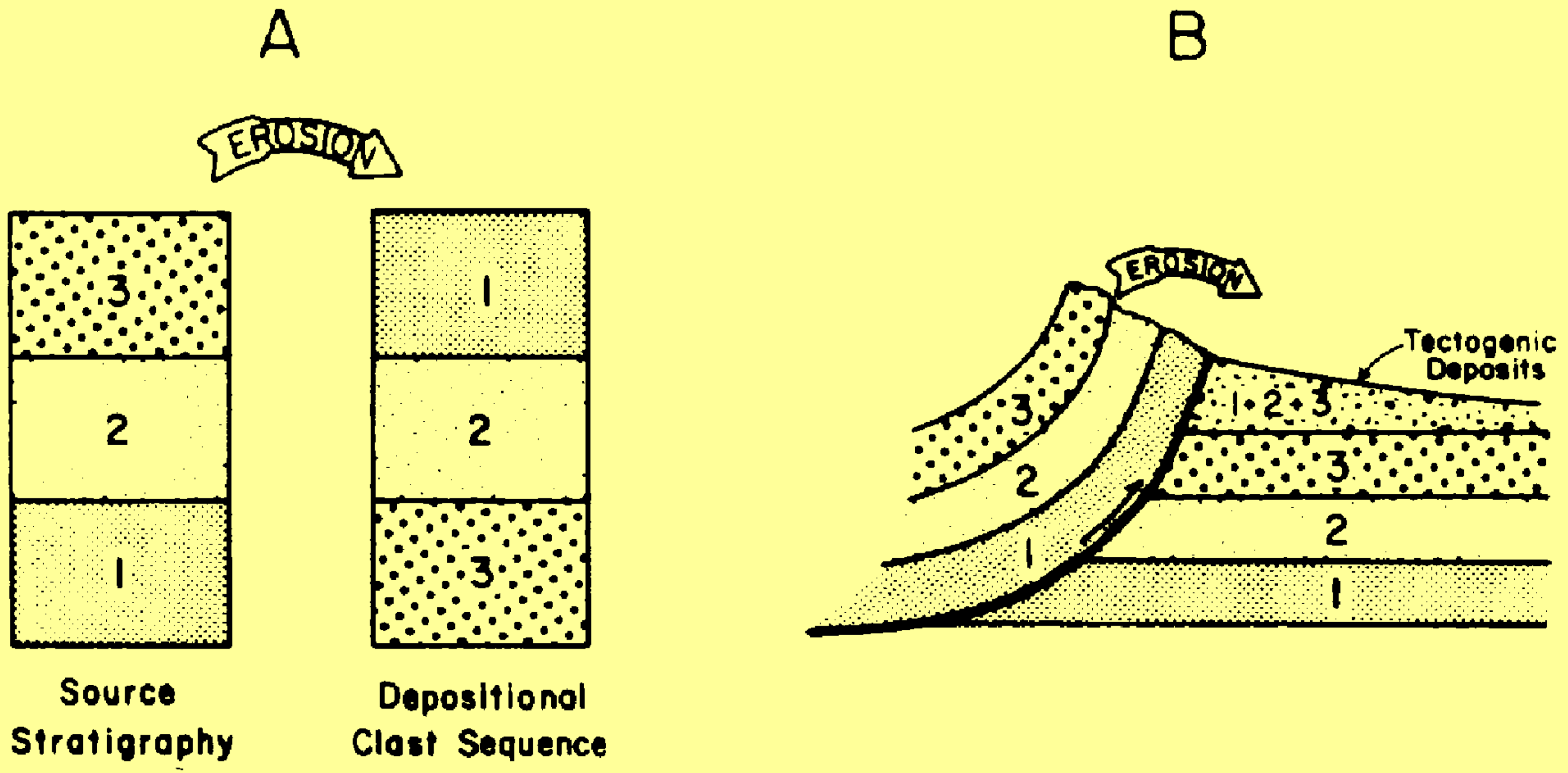


Fig. 11.29 Composition of basin fill in terms of detrital source petrography: A. classic inverted stratigraphy, B. blended compositions. (Reproduced with permission from Steidtmann and Schmitt, 1988.)

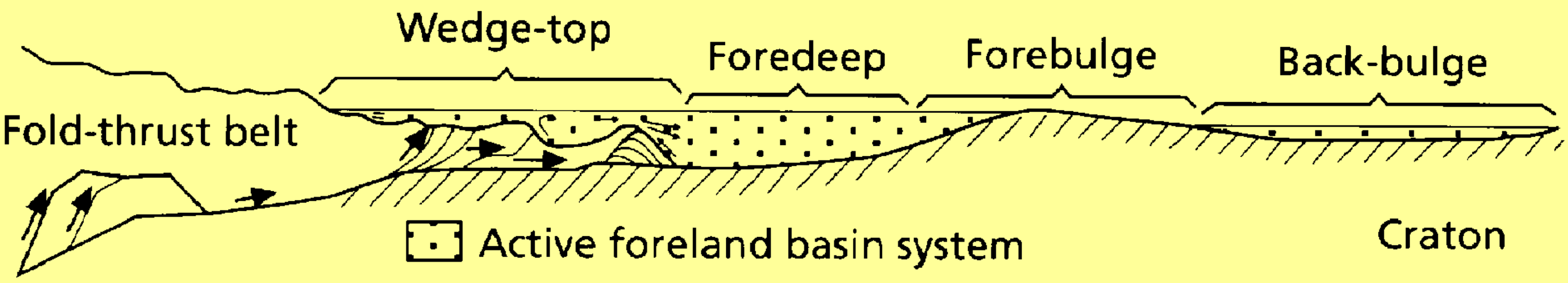


Fig. 28.19 Schematic cross-section of a composite foreland basin system, based on the central Andean foreland basin. (After Horton & DeCelles, 1997.) The origin of the thin saucer-shaped back-bulge depression is poorly known. For wedge-top basins, see Horton (1998).

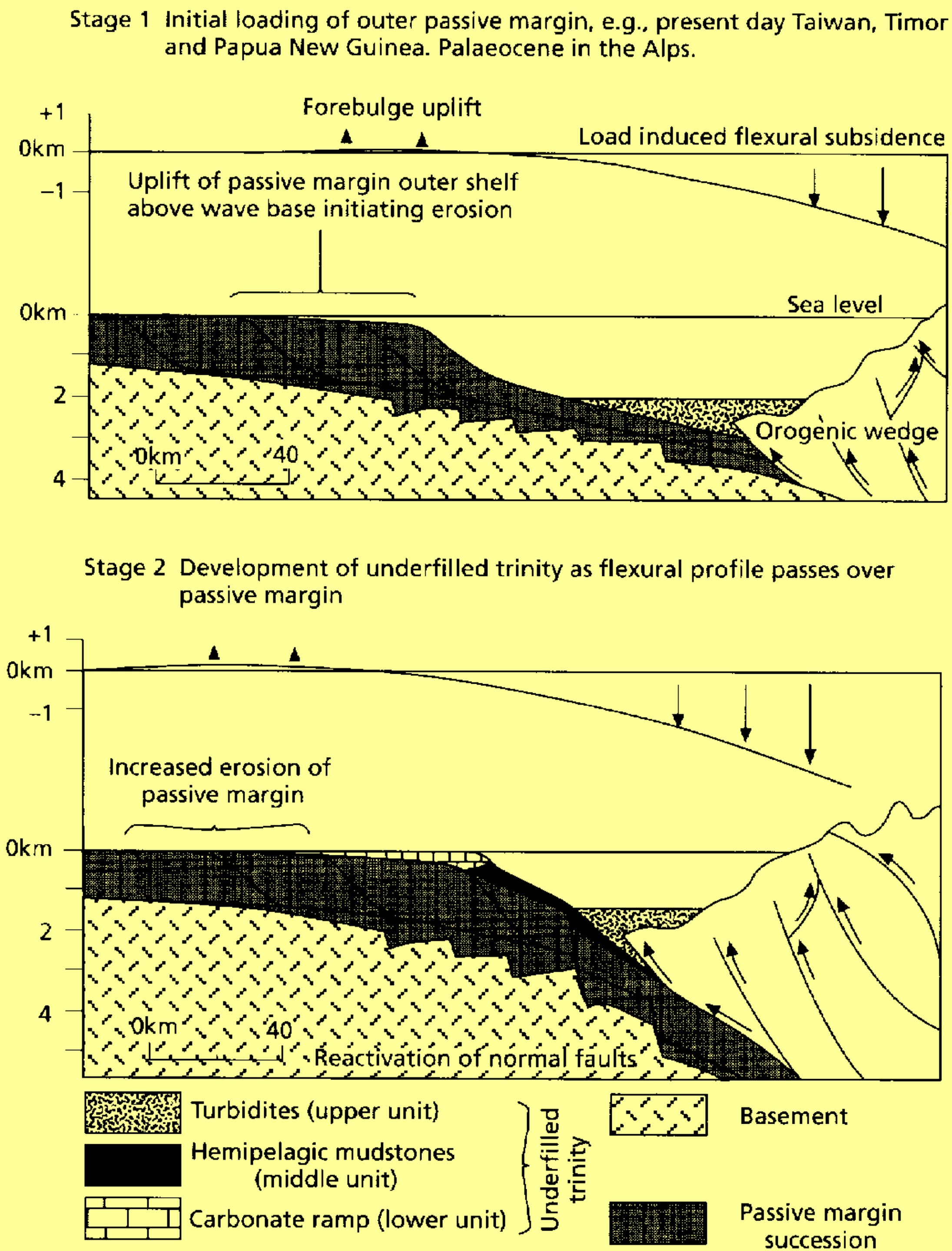
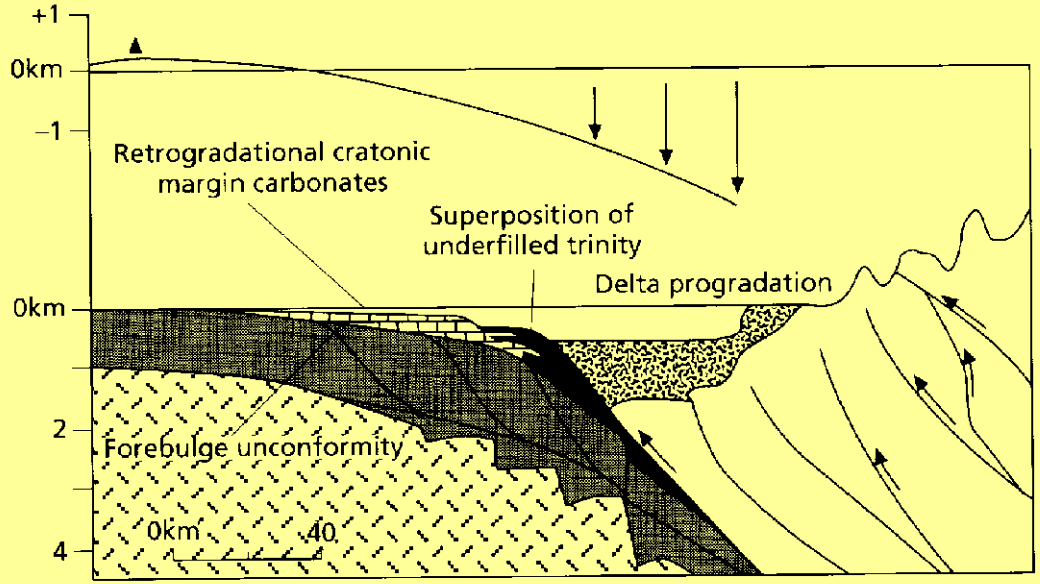
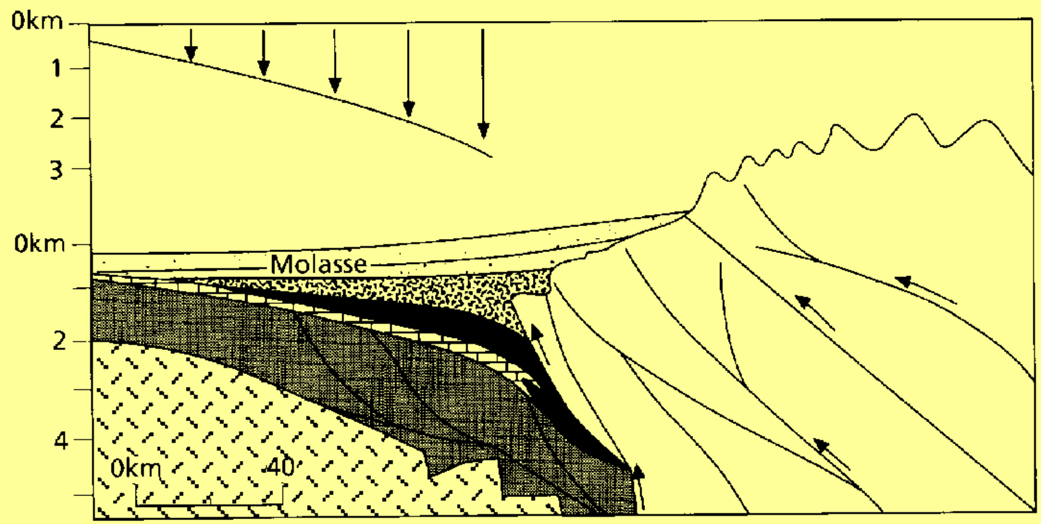


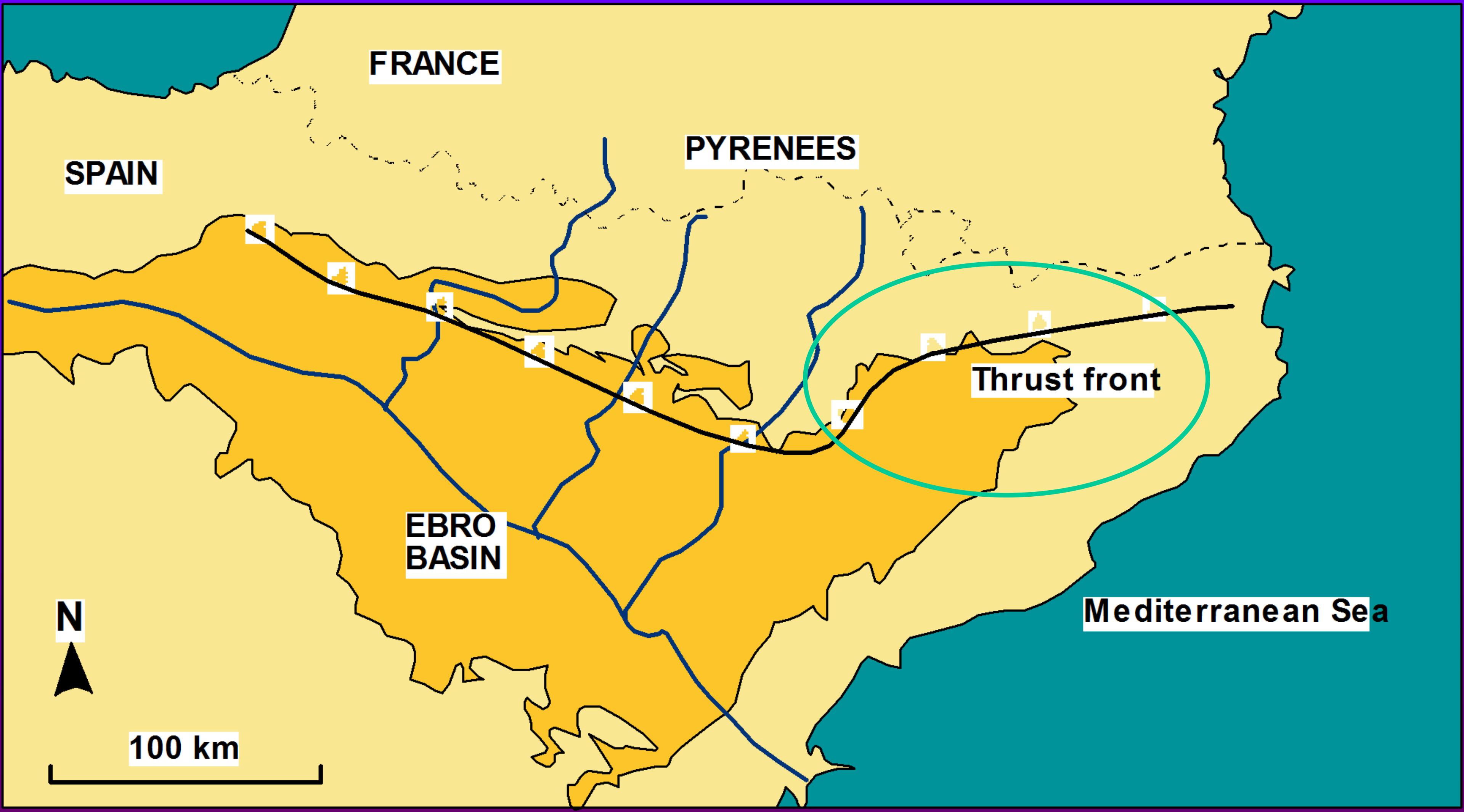
Fig. 28.22 Sketches to show the sequential evolution of an initially marine foreland basin as it narrows and is affected by forebulge migration in response to advance of the orogenic wedge along a thrust front. (After Sinclair, 1997.)

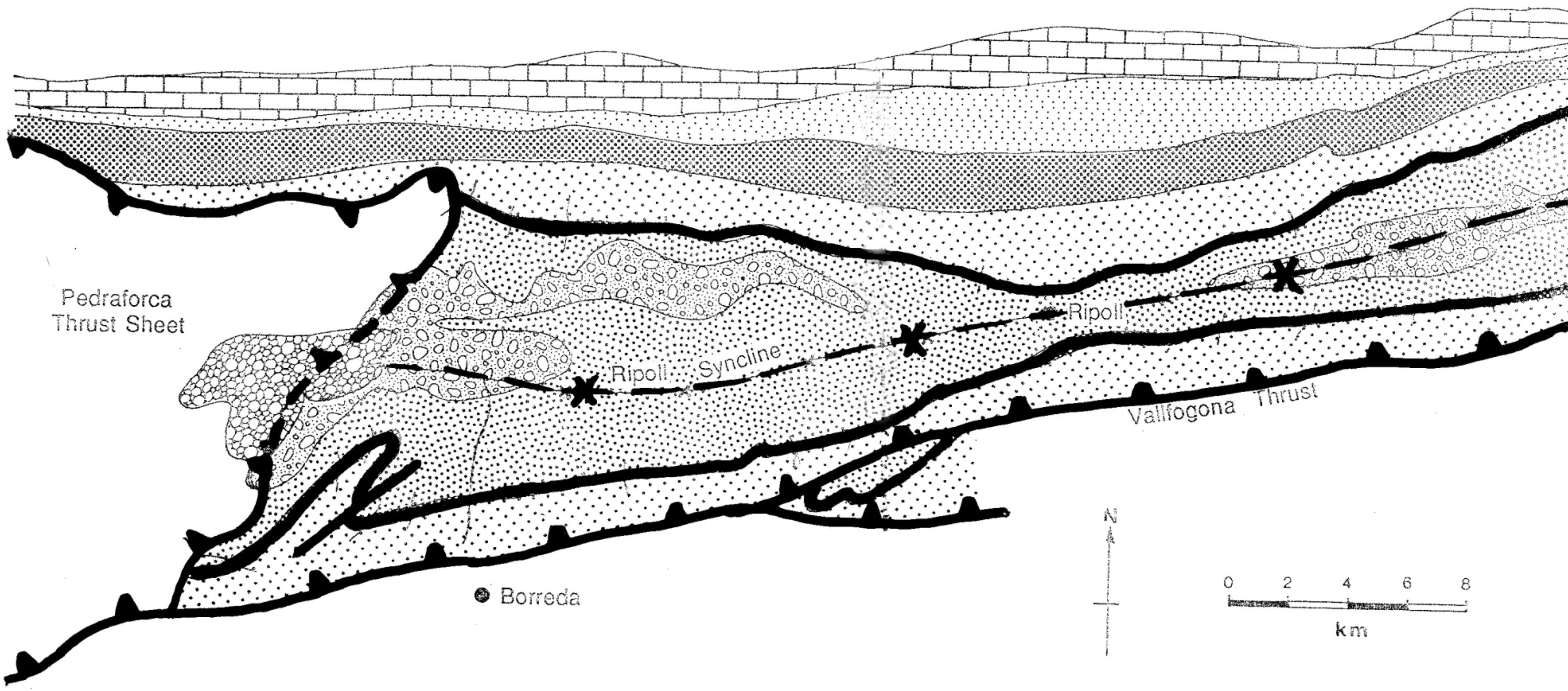
Stage 3 Steady state migration of the underfilled trinity over the craton i.e., rate of thrust front advance equals rate of cratonic onlap



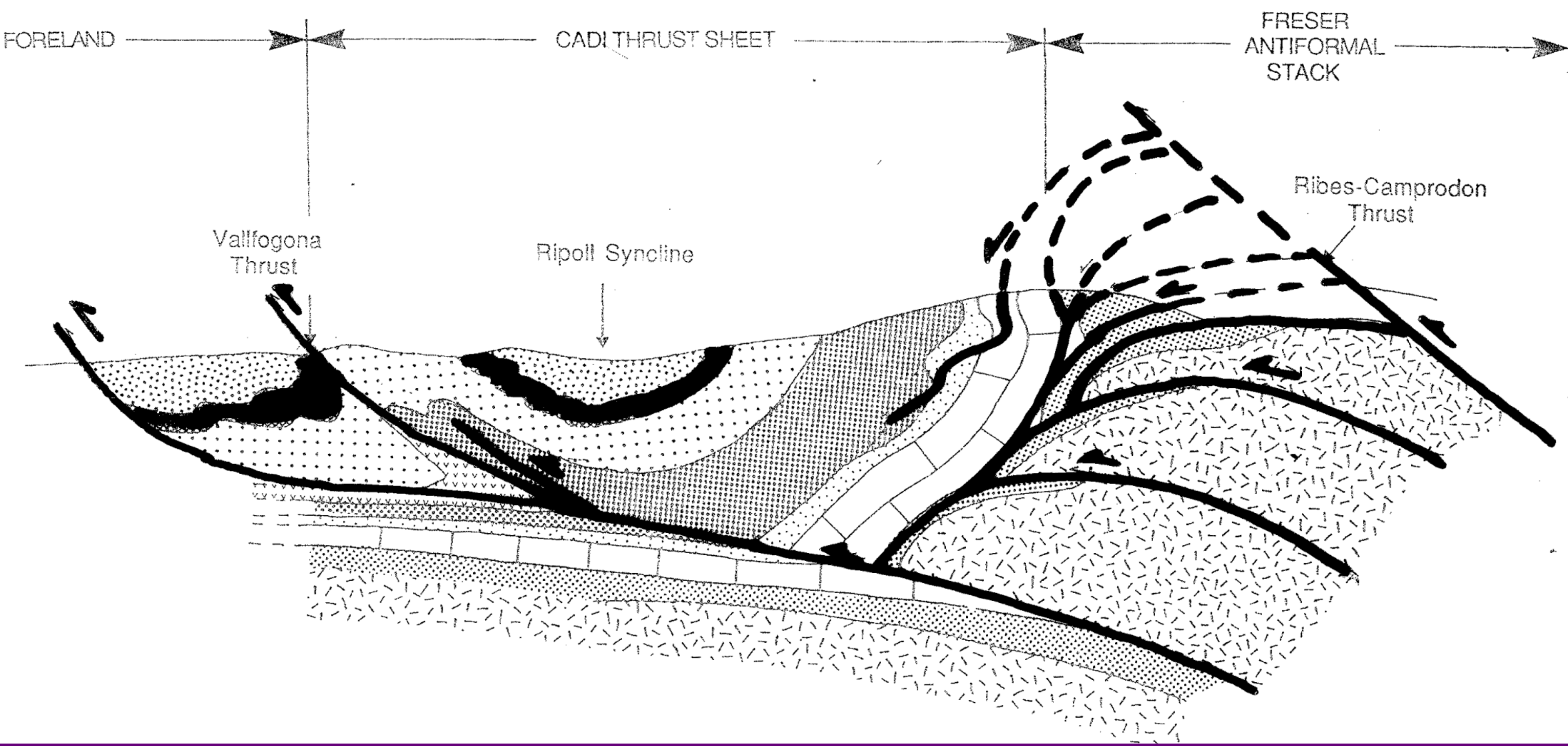
Stage 4 Transition of foreland basin from an underfilled to a filled depositional state. Siliciclastics from orogen fill the basin, smothering the underfilled stratigraphy.



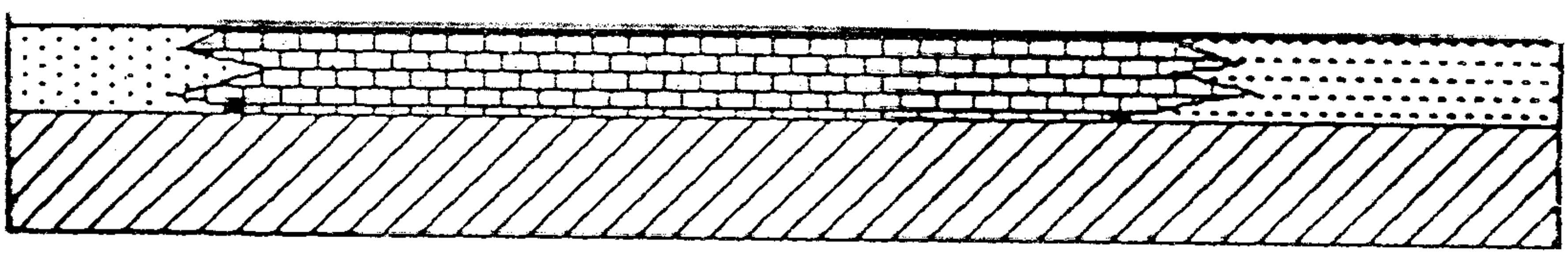

FRANCE
SPAIN
PYRENEES
Thrust front
EBRO
BASIN
Mediterranean Sea
N
100 km



Pedraforca
Thrust Sheet
Ripoll
Syncline
Ripoll
Vallfogona
Thrust
Borreda
N
0
2
4
6
8
km

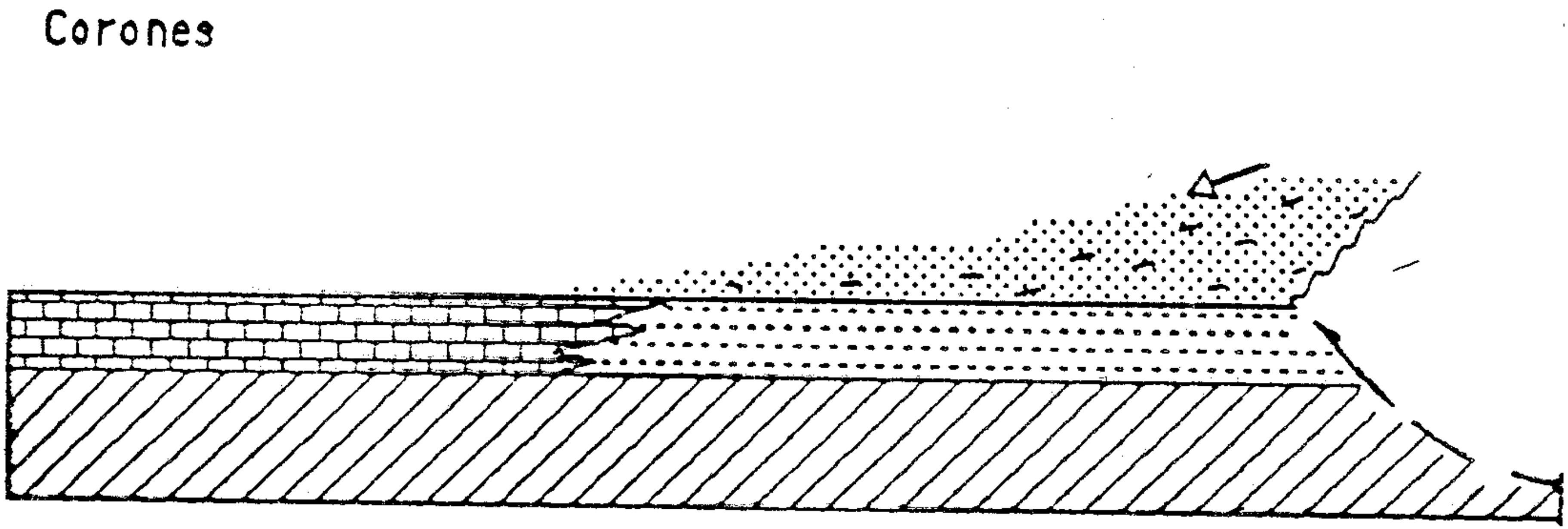

FORELAND
CADI THRUST SHEET
FRESER ANTIFORMAL STACK
Vallfogona Thrust
Ripoll Syncline
Ribes-Camprodon Thrust

Late Palaeocene
marls, limestones, Numulites

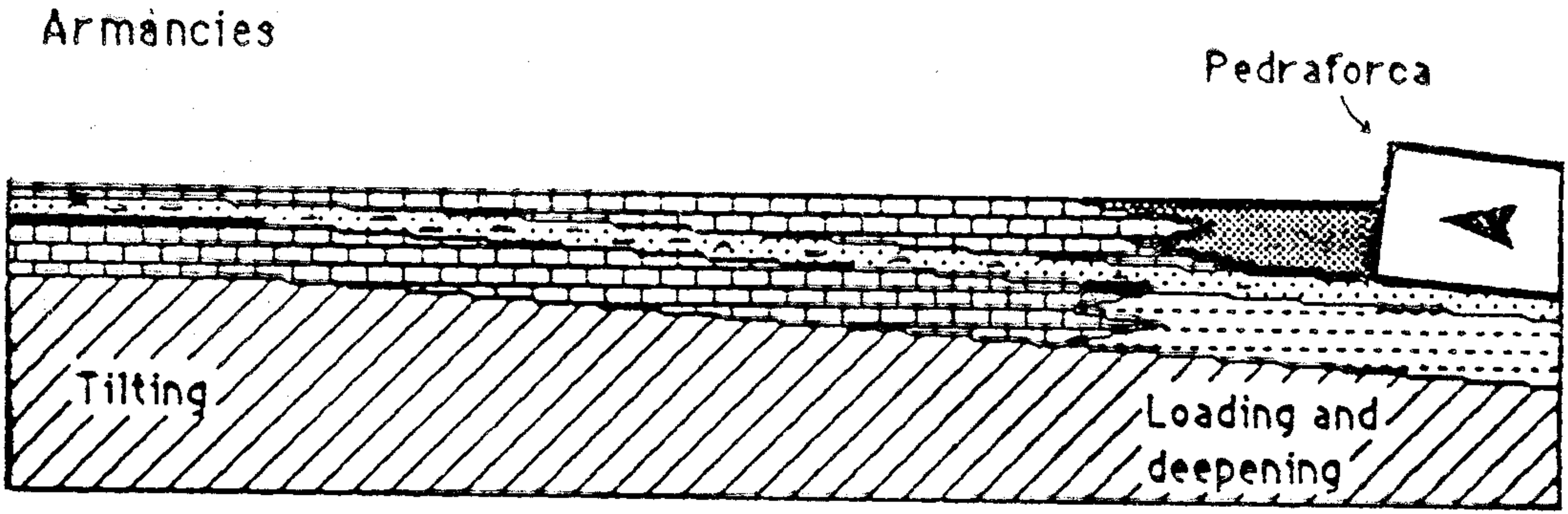


The Cadi sequence (late Thanetian) represents a shallow marine carbonate environment. There appears to be no direct evidence for thrust sheet movement during this time.

Early Eocene, deltaic, fluvial

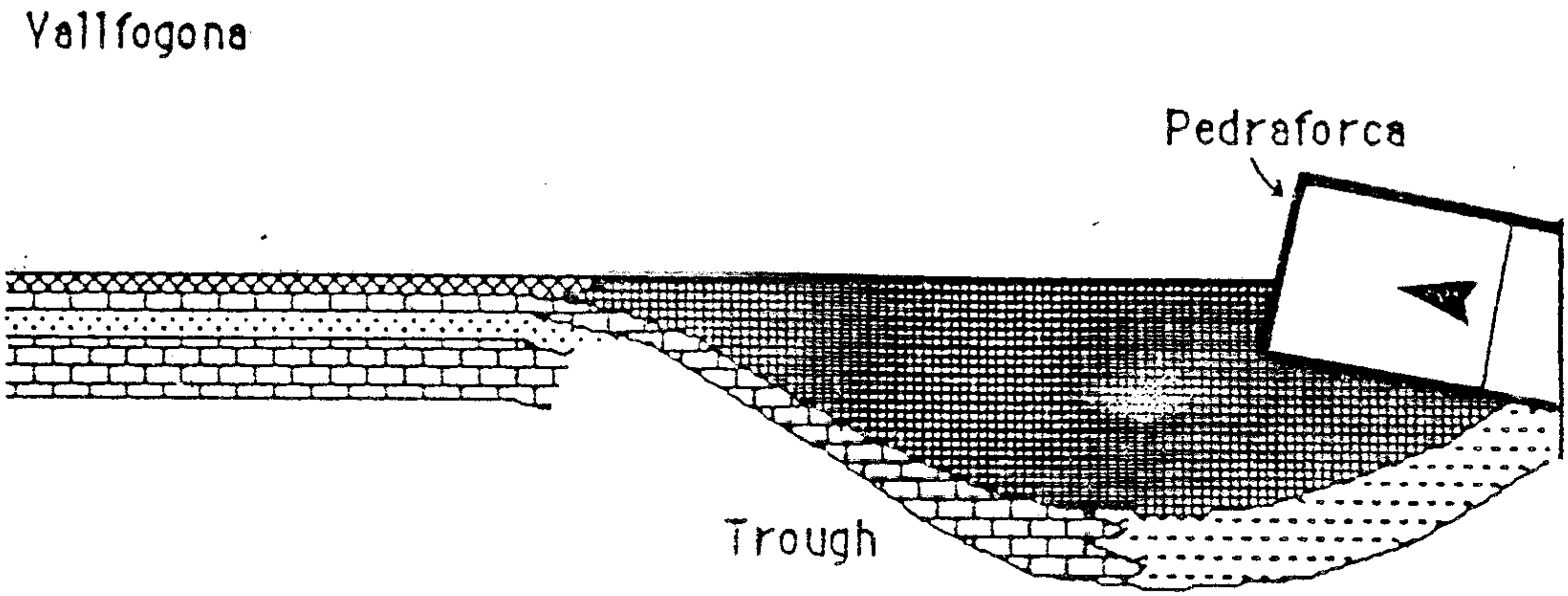


The Corones sequence (Ypresian), comprising deltaic sediments formed as a result of tilting on thrust emplacement in the passive southern margin. This is the first indication of thrust movement within the southern foreland basin. Surficial hydrocarbons are found within this sequence.

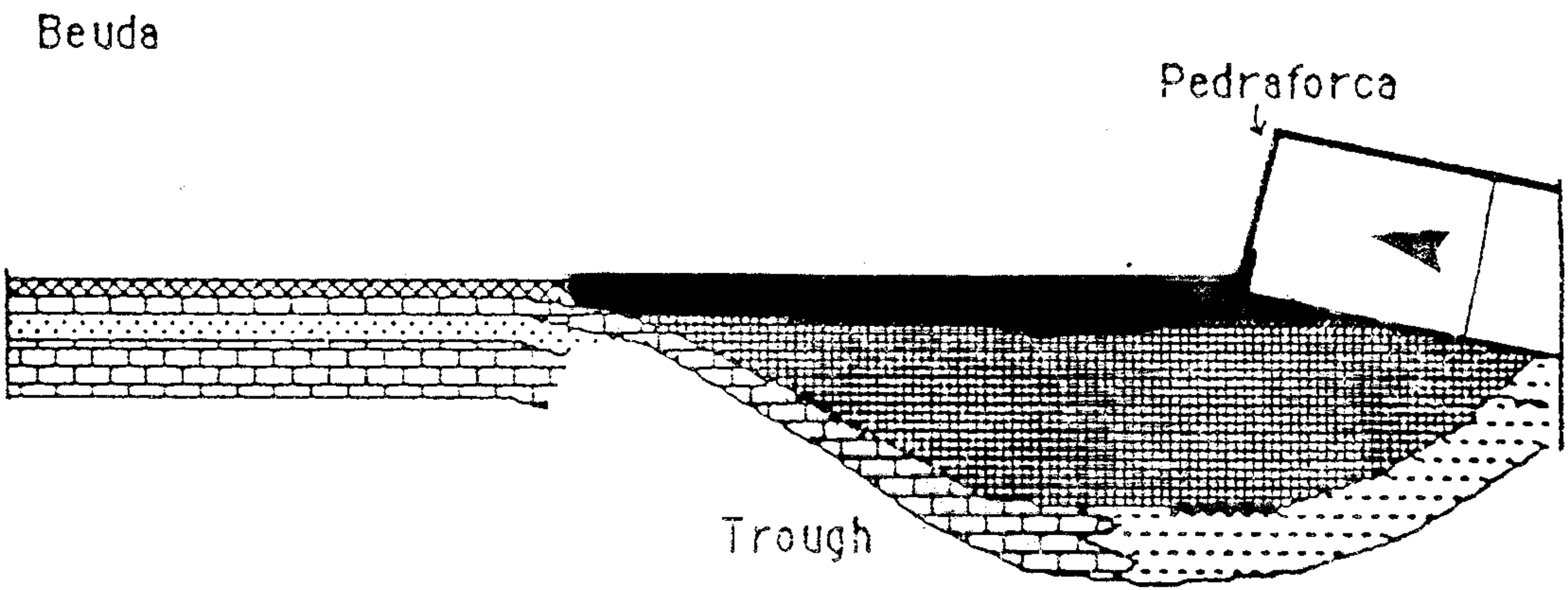


The Armancies sequence (late Ypresian) indicates a sudden deepening to form carbonate turbidites possibly as a result of the loading effect of the emplacement of the Pedraforca and Montgri nappes. The relative sea-level rise associated with the thrust emplacement led to the development of a carbonate platform to the south.

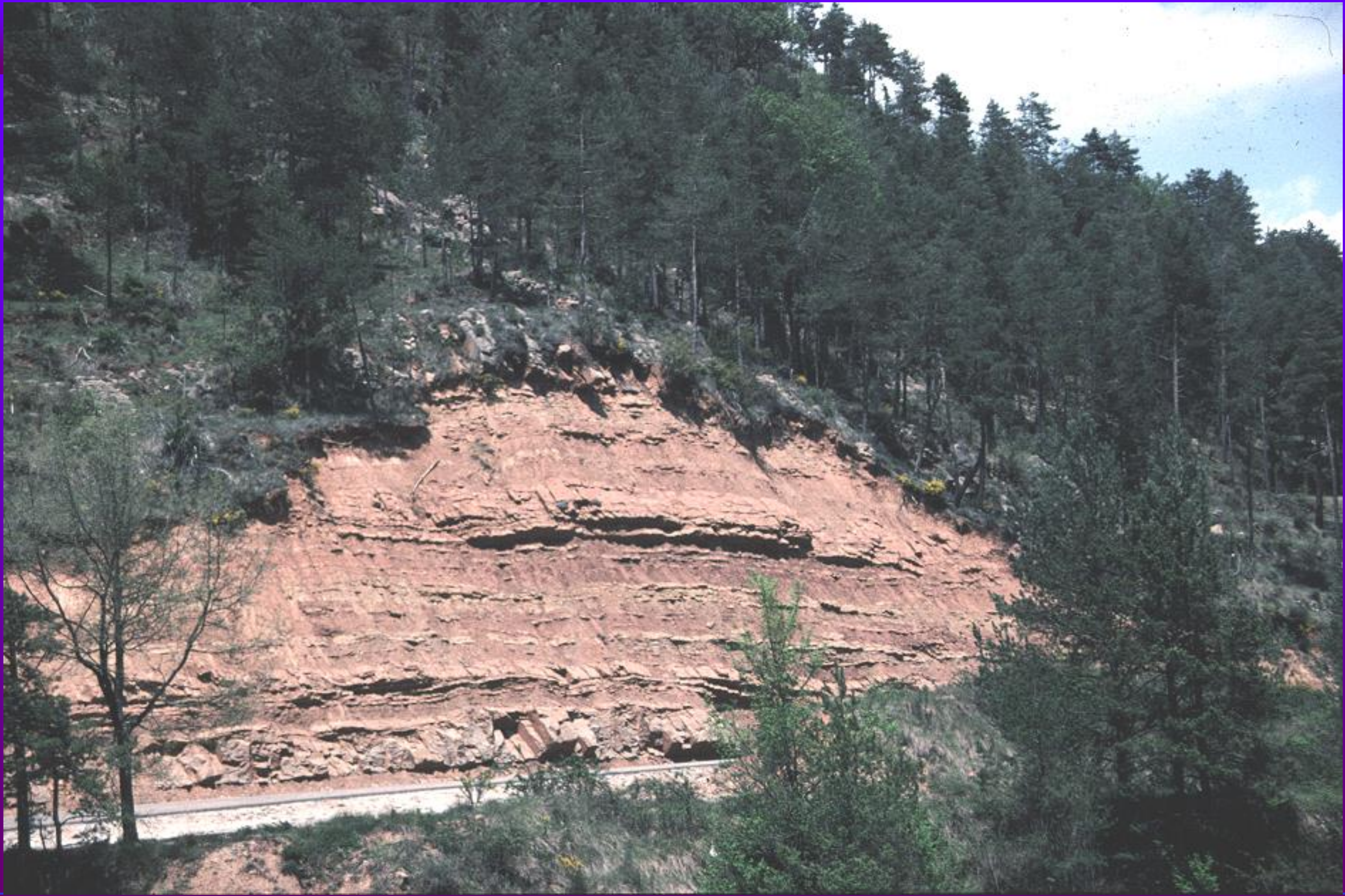
Mid. Eocene

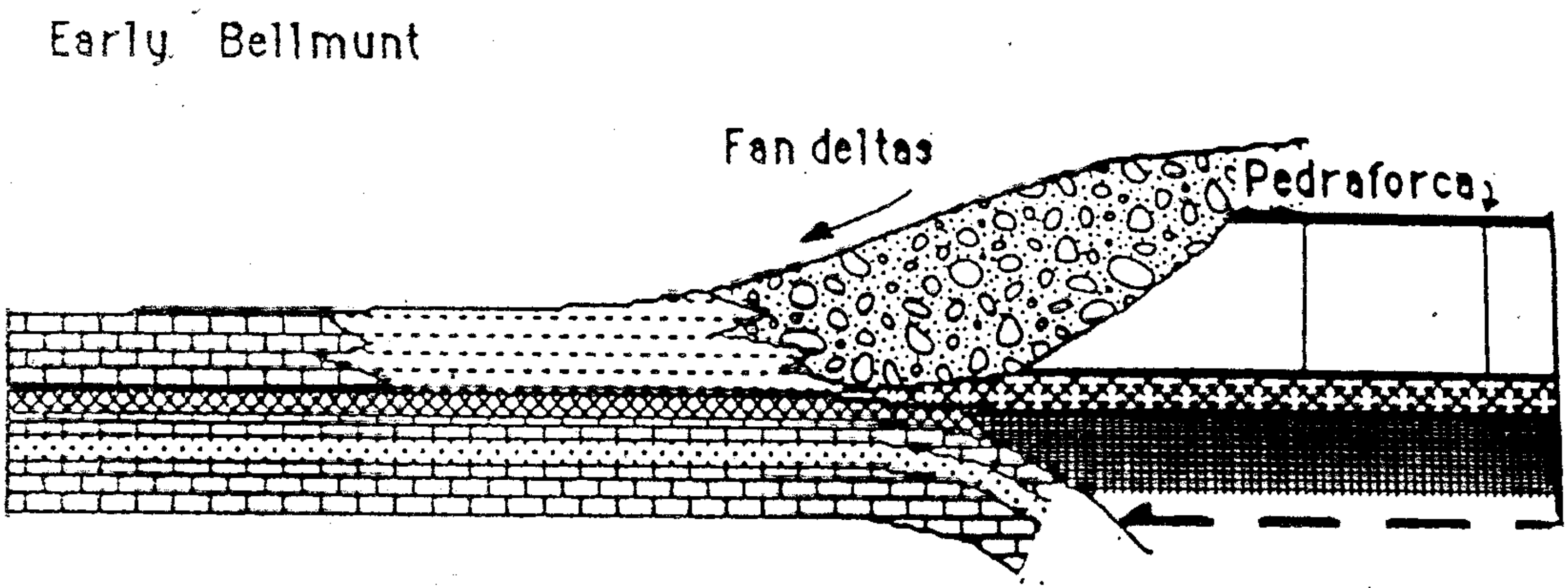


The Vallfogona sequence (early Lutetian) represents a major clastic turbidite input at the front of the encroaching nappes possibly due to further thrusting and loading of the Pedraforca and Montgri thrust sheets. Triassic olistoliths within these turbidites document the emplacement of the Pedraforca thrust sheet.

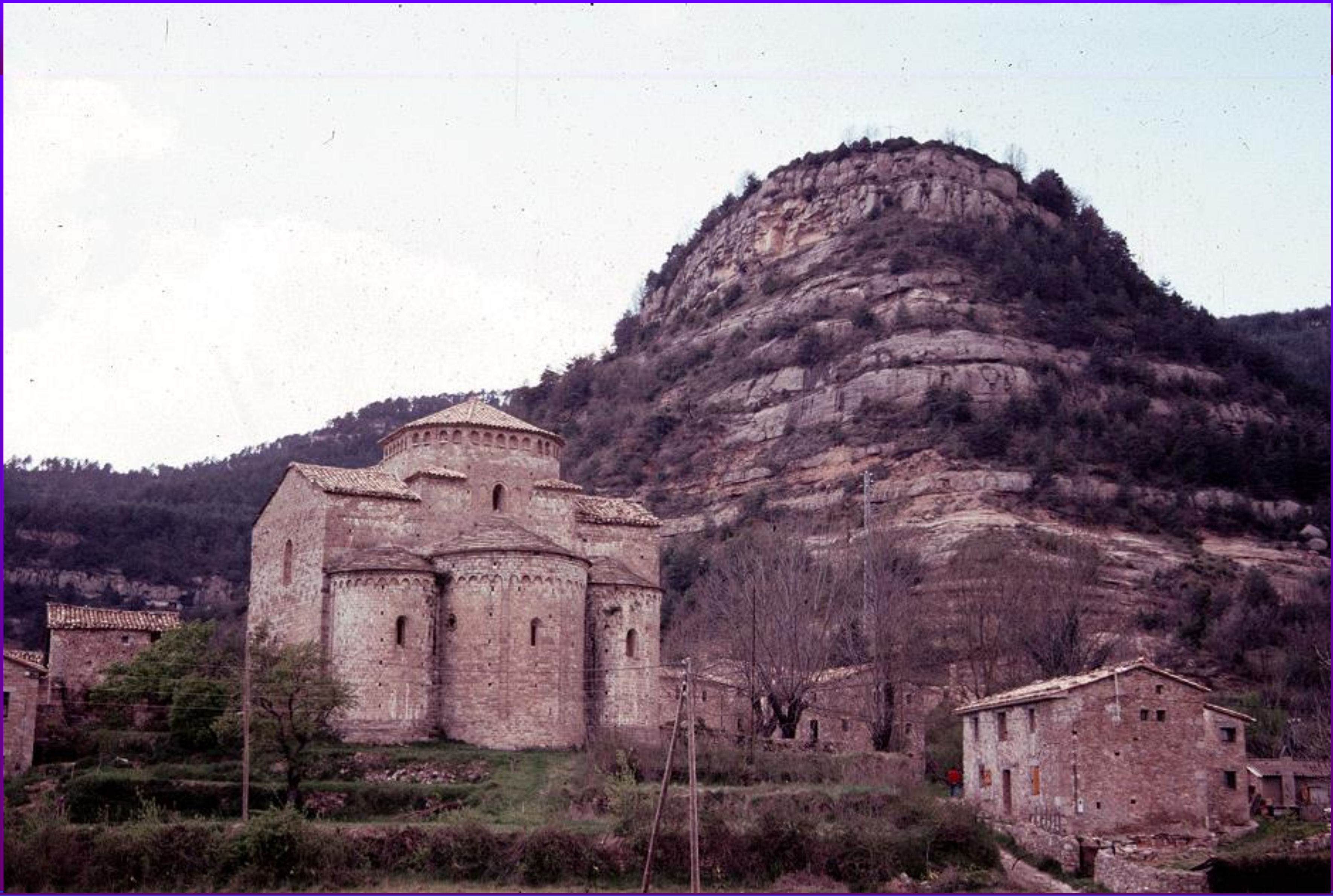


The Beuda (mid-Lutetian)sequence is represented by an evaporitic formation thought to be formed during basin constriction at the final stages of the emplacement of the Pedraforca and Montgri thrust sheets.

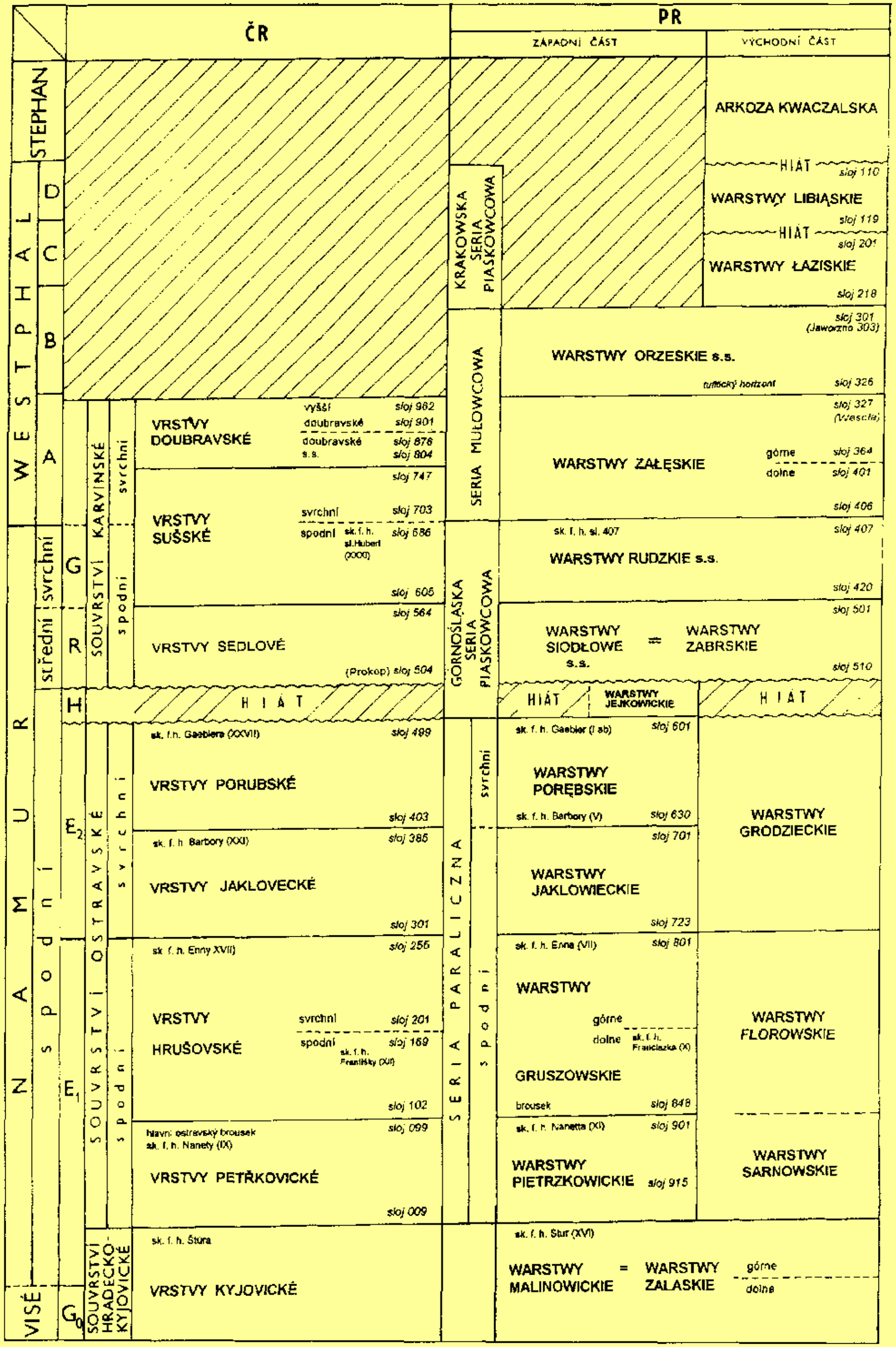


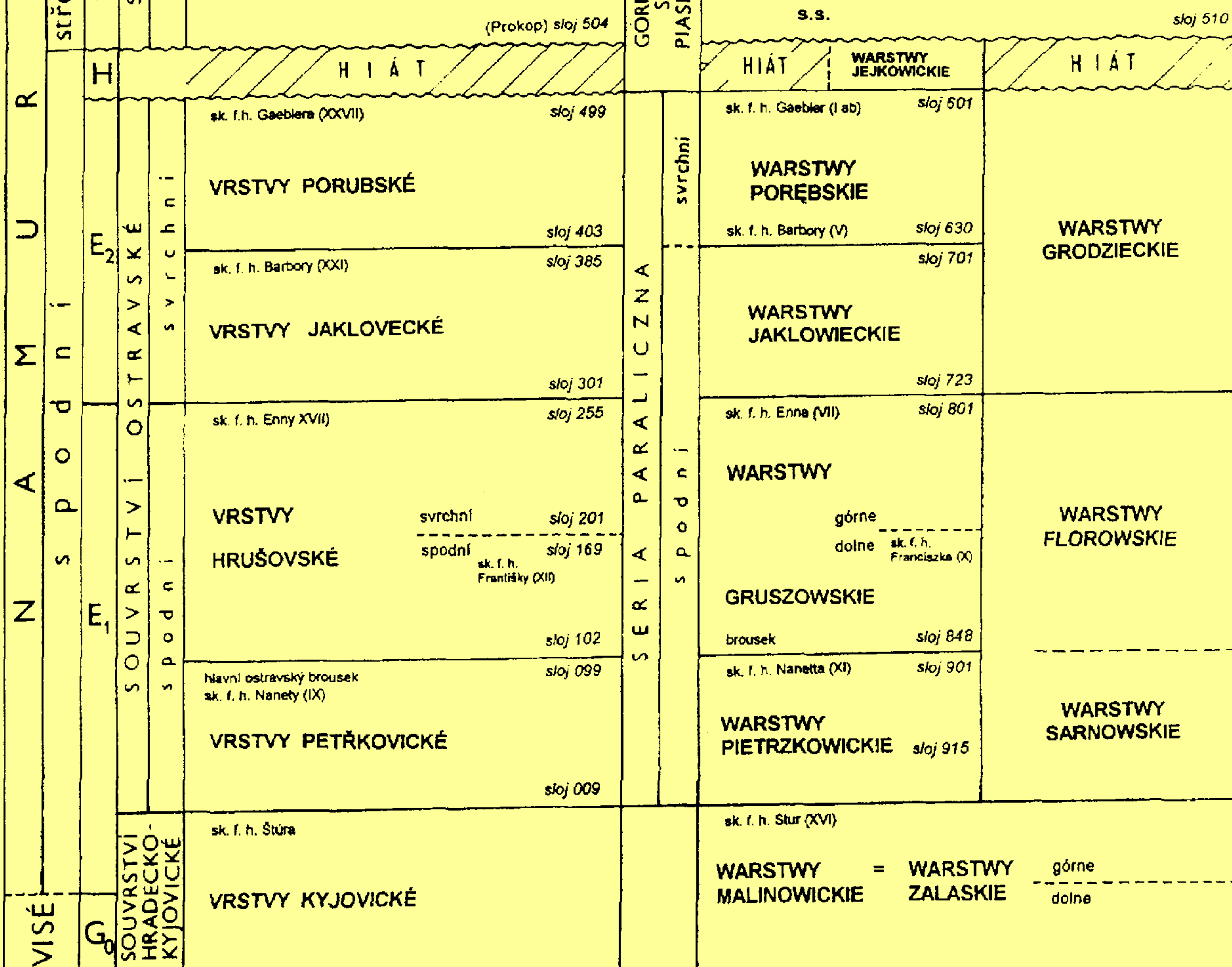


The Bellmunt sequence (late Lutetian) is thought to have formed during the development of the Lower thrust sheets as the Upper Thrust Sheets (Pedraforca and Montrgi) were eroded. The development of the Freser Valley antiformal stack below the Cadi thrust sheet increased clastic input.

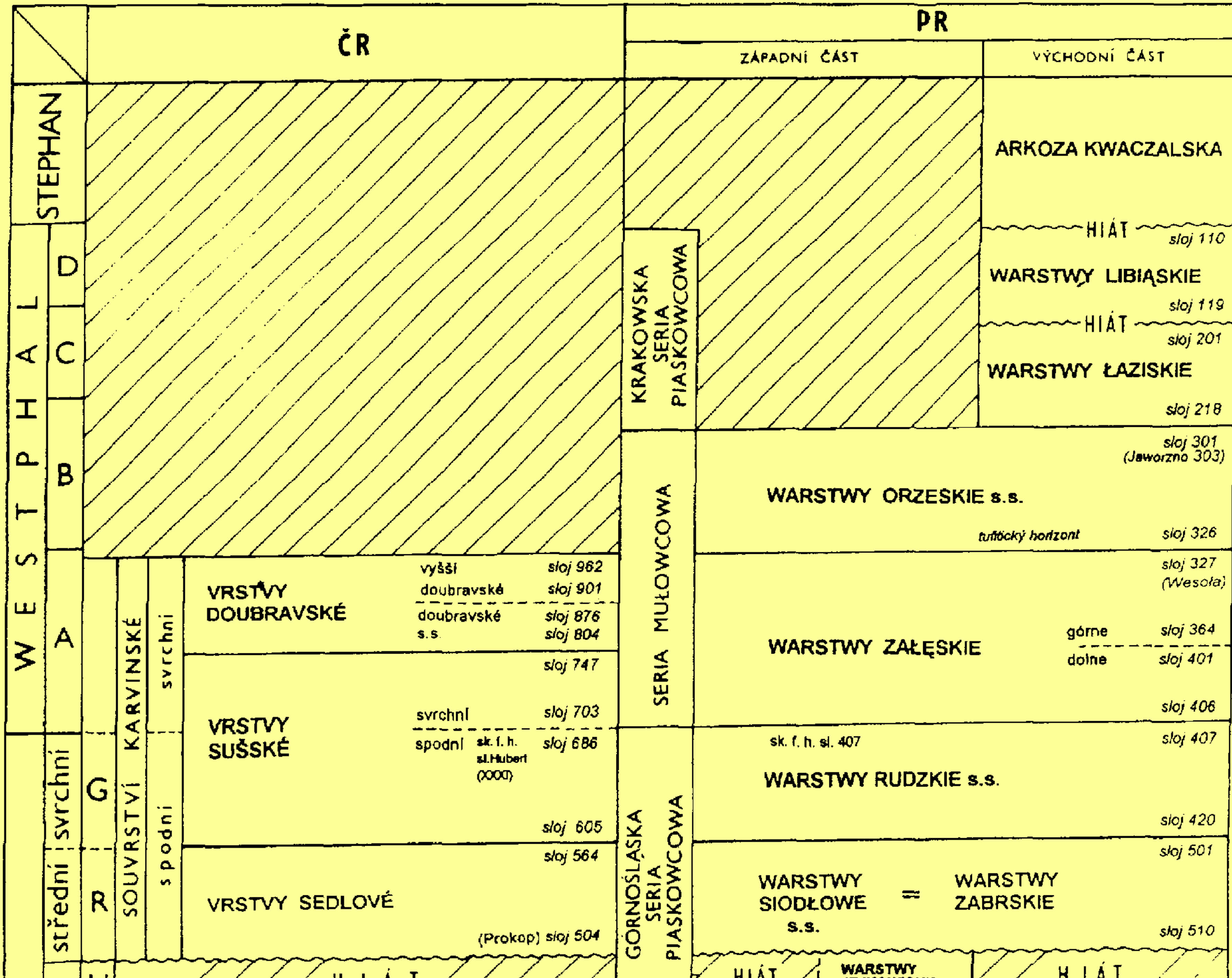


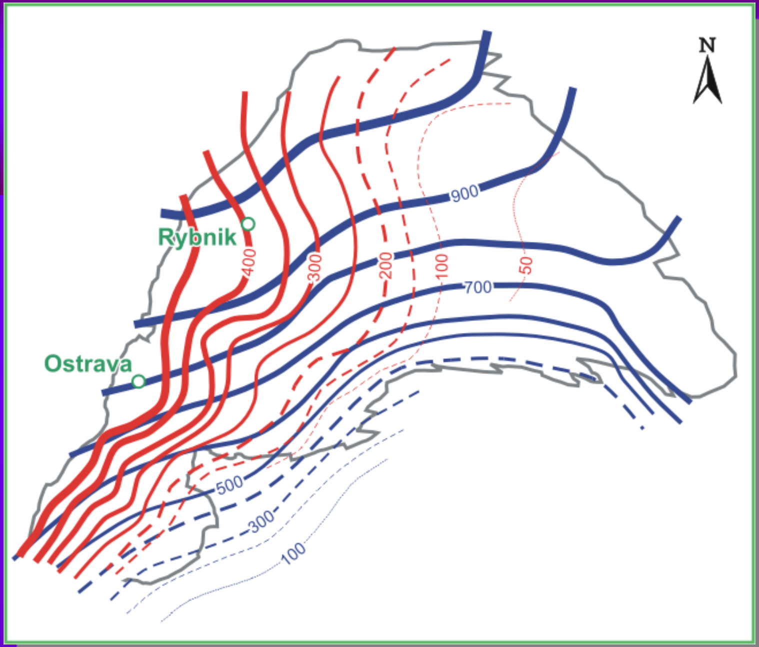
Hornoslezská pánev

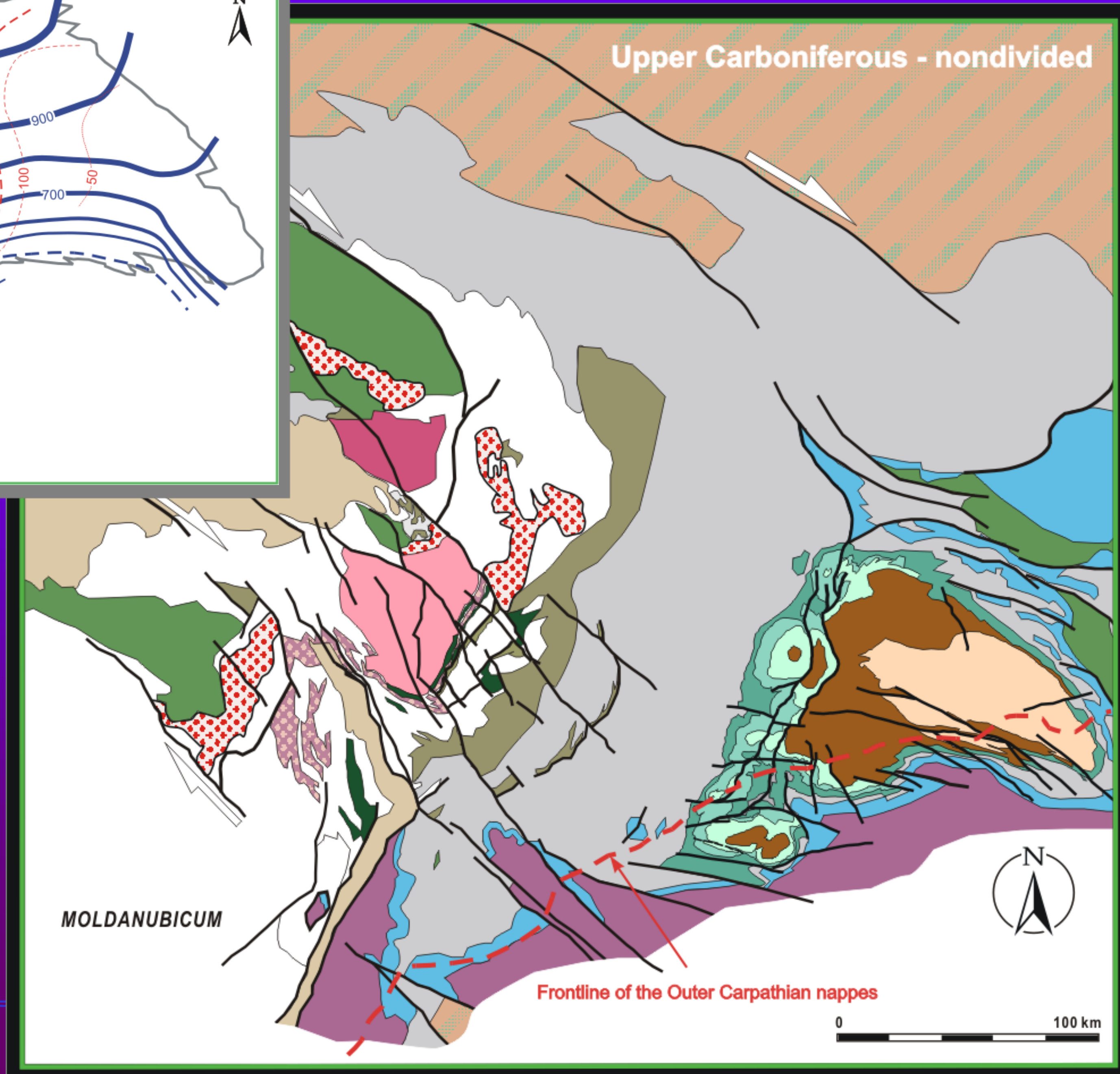




N A M U R
spodní
stř
VISÉ
H
E2
E1
G0
SOUVRSTVÍ OSTRAVSKÉ
SOUVRSTVÍ HRADECKO-KYJOVICKÉ
svrchní
spodní
(Prokop) sloj 504
H I Á T
sk. f.h. Gaeblera (XXVII)
sloj 499
VRSTVY PORUBSKÉ
sloj 403
sk. f. h. Barbory (XXI)
sloj 385
VRSTVY JAKLOVECKÉ
sloj 301
sk. f. h. Enny XVII)
sloj 255
VRSTVY HRUŠOVSKÉ
svrchní
sloj 201
spodní
sloj 169
sk. f. h. Františky (XII)
sloj 102
hlavní ostravský brousek
sk. f. h. Nanety (IX)
sloj 099
VRSTVY PETŘKOVICKÉ
sloj 009
sk. f. h. Štúra
VRSTVY KYJOVICKÉ
SERIA PARALICZNA
svrchni
spodni
s.s.
sloj 510
HIÁT
WARSTWY JEJKOWICKIE
H I Á T
sk. f. h. Gaebler (I ab)
sloj 501
WARSTWY PORĘBSKIE
sk. f. h. Barbory (V)
sloj 630
sloj 701
WARSTWY JAKLOWIECKIE
sloj 723
sk. f. h. Enna (VII)
sloj 801
WARSTWY GRUSZOWSKIE
górne
dolne
sk. f. h. Franciszka (X)
brousek
sloj 848
sk. f. h. Nanetta (XI)
sloj 901
WARSTWY PIETRZKOWICKIE
sloj 915
sk. f. h. Stur (XVI)
WARSTWY MALINOWICKIE = WARSTWY ZALASKIE
górne
dolne
WARSTWY GRODZIECKIE
WARSTWY FLOROWSKIE
WARSTWY SARNOWSKIE


ČR
PR
ZÁPADNÍ ČÁST
VÝCHODNÍ ČÁST
STEPHAN
WESTPHAL
D
C
B
A
ARKOZA KWACZALSKA
HIÁT
słoj 110
WARSTWY LIBIĄSKIE
słoj 119
HIÁT
słoj 201
WARSTWY ŁAZISKIE
słoj 218
KRAKOWSKA SERIA PIASKOWCOWA
słoj 301
(Jaworzno 303)
WARSTWY ORZESKIE s.s.
tufitický horizont
słoj 326
SERIA MUŁOWCOWA
słoj 327
(Wesoła)
WARSTWY ZAŁĘSKIE
górne
słoj 364
dolne
słoj 401
słoj 406
sk. f. h. sł. 407
słoj 407
WARSTWY RUDZKIE s.s.
słoj 420
słoj 501
WARSTWY SIODŁOWE s.s.
=
WARSTWY ZABRSKIE
słoj 510
GÓRNOŚLĄSKA SERIA PIASKOWCOWA
NAMUR
svrchní
střední
G
R
SOUVRSTVÍ KARVINSKÉ
svrchní
spodní
VRSTVY DOUBRAVSKÉ
vyšší doubravské
doubravské s.s.
sloj 962
sloj 901
sloj 876
sloj 804
sloj 747
VRSTVY SUŠSKÉ
svrchní
sloj 703
spodní
sk. f. h. sl.Hubert (XXXI)
sloj 686
sloj 605
sloj 564
VRSTVY SEDLOVÉ
(Prokop) sloj 504





Foreland basins


karvinské souvrství
N
aluviální vějíře
fluviální sedim.
fluviální a jezerní
jezerní
osa vyklenování
okraj pánve
transport klastik - hlavní
- vedlejší
0
50km