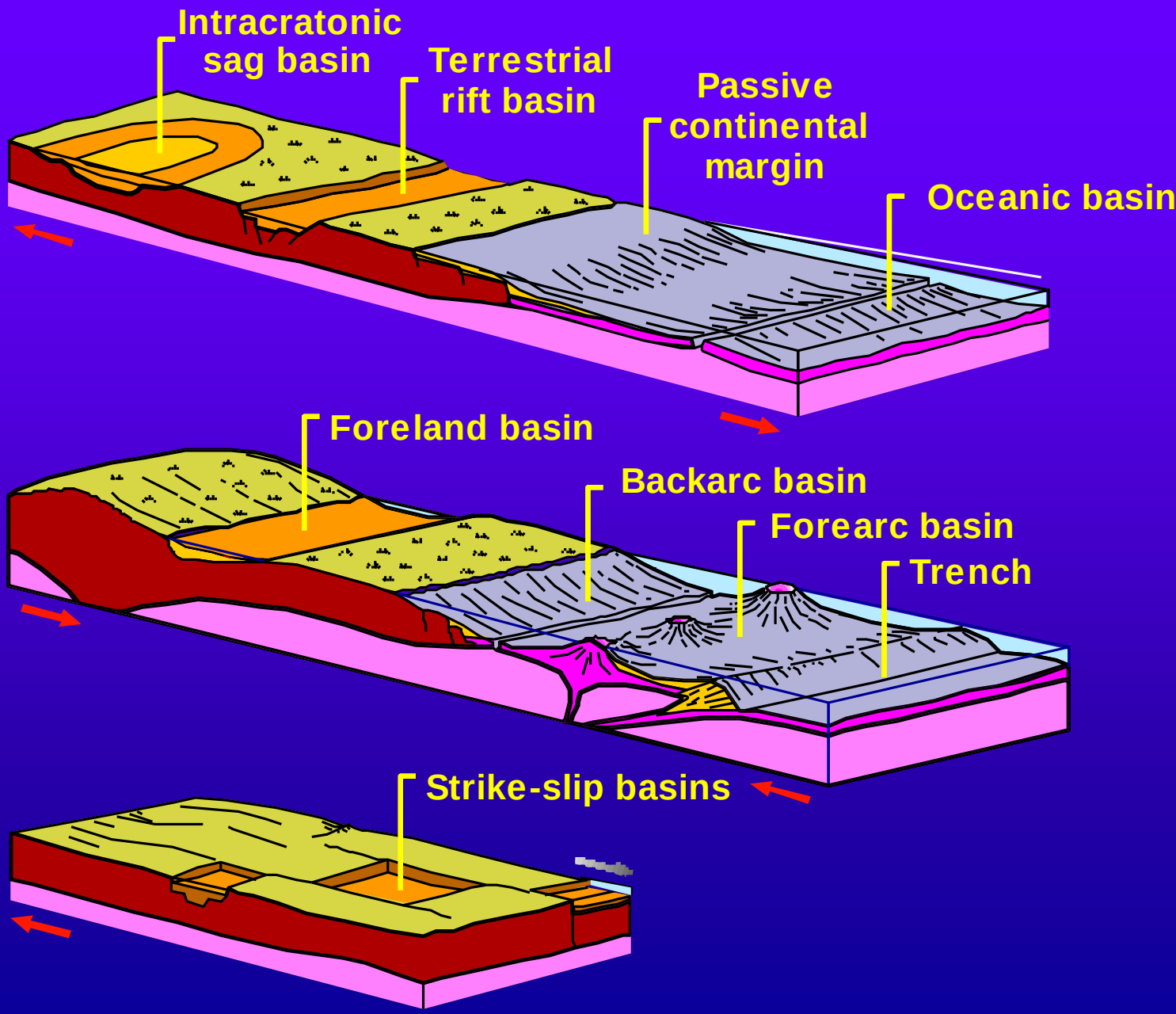
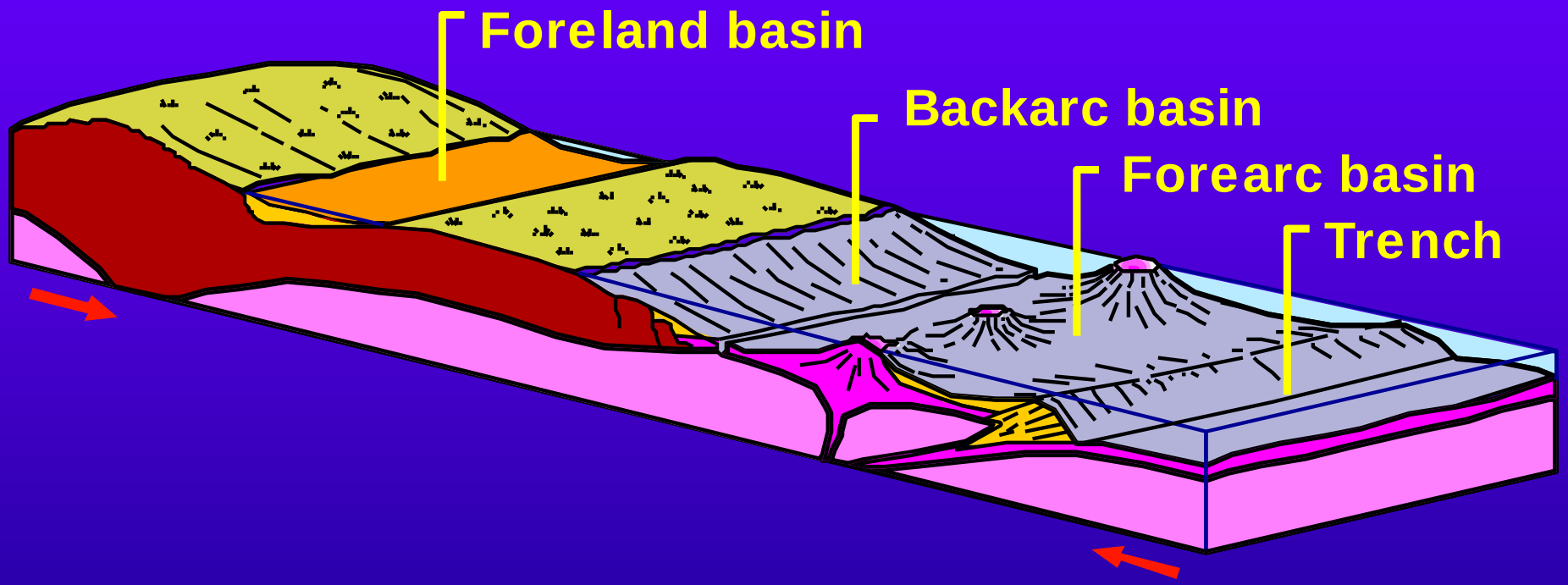
Arc-trench systems

TRENCHES

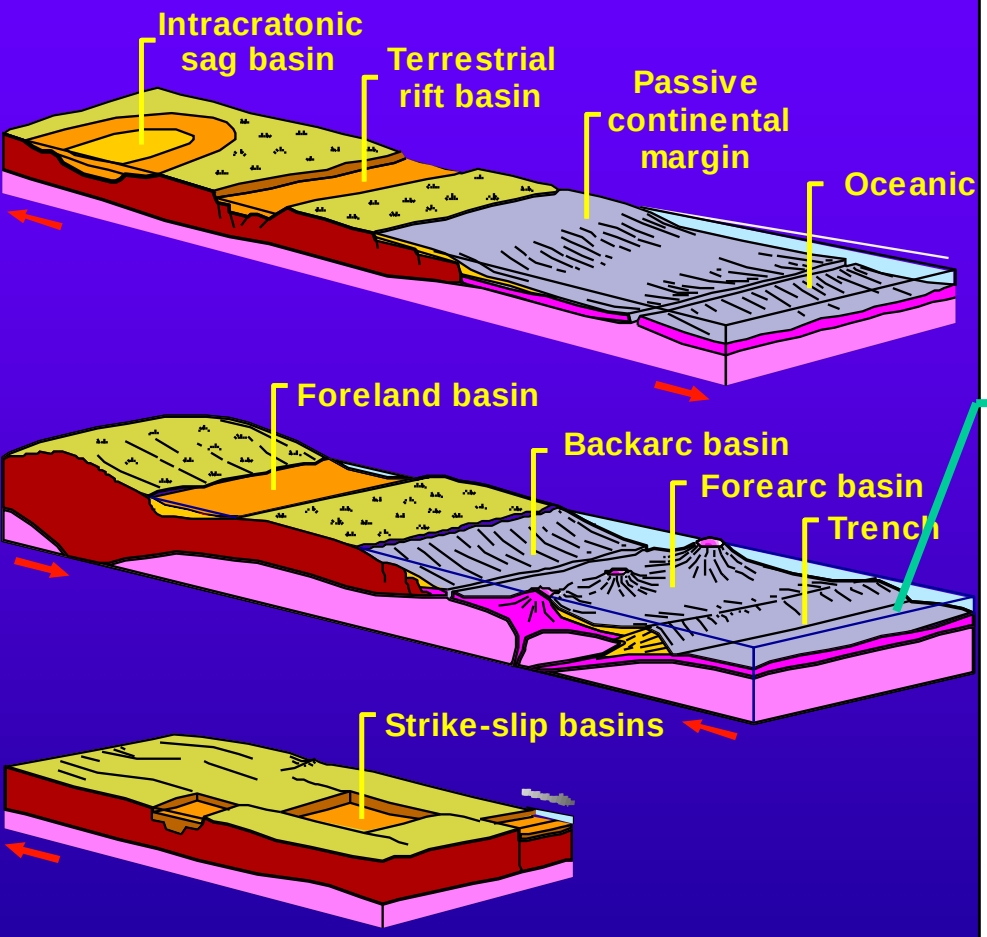
Tectonic setting of sedimentary basins

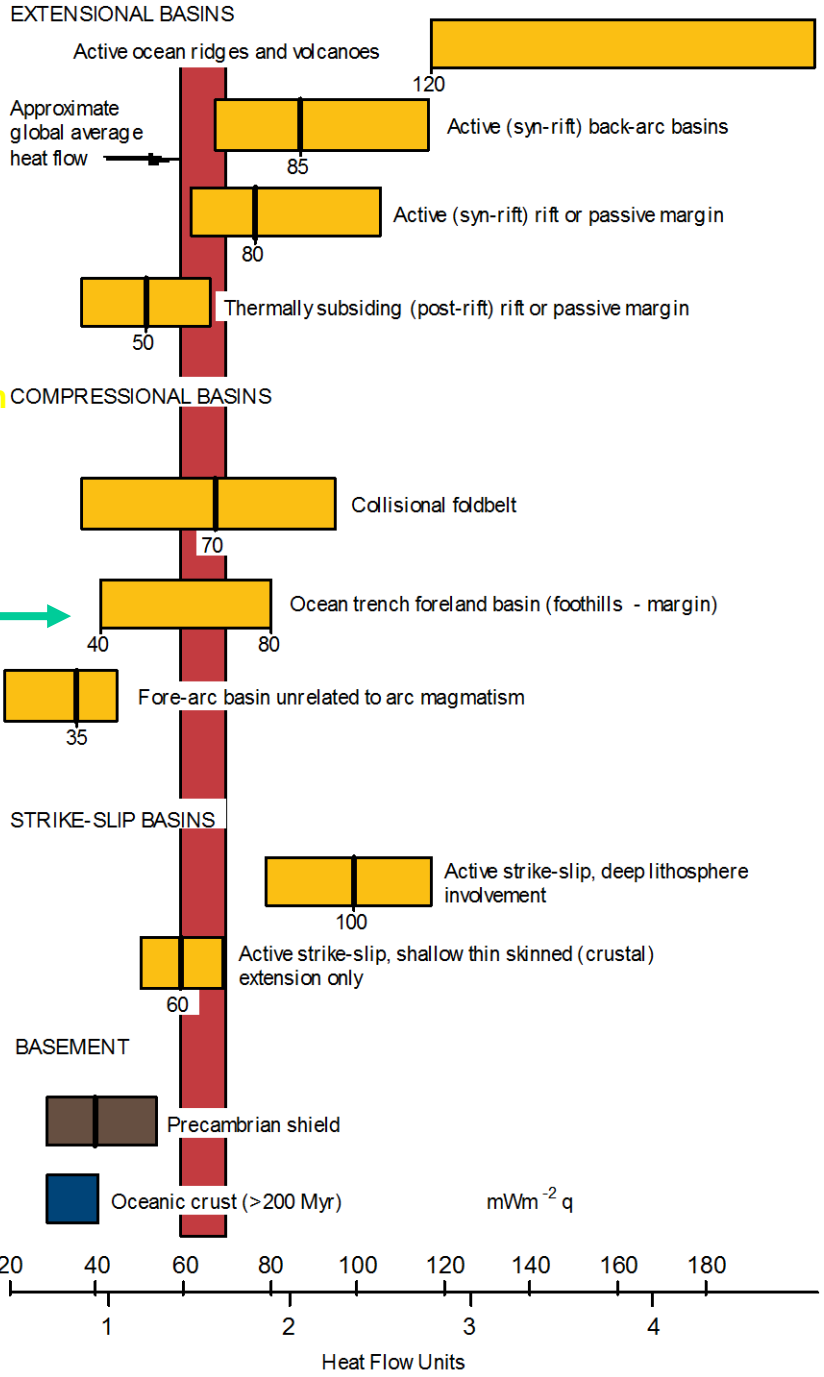


Tectonic setting of sedimentary basins

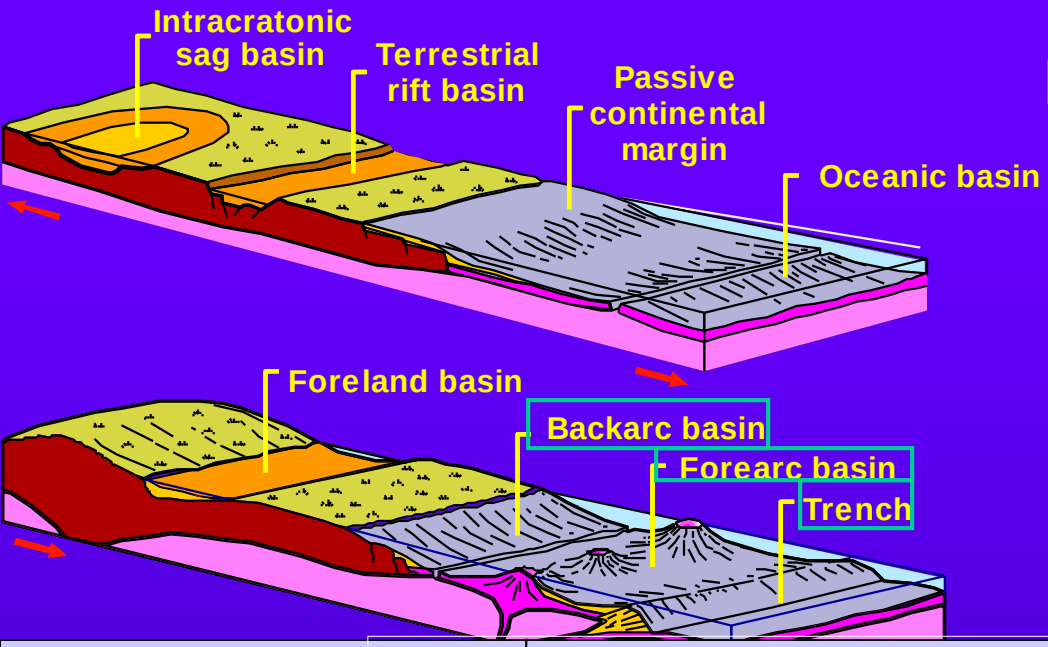


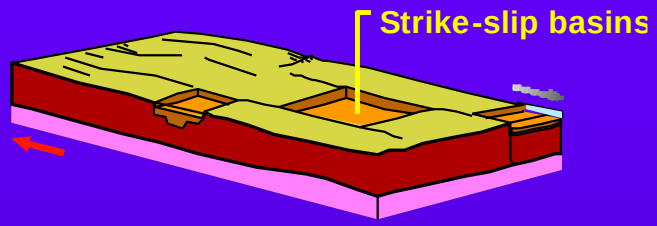
Basin Heat flow





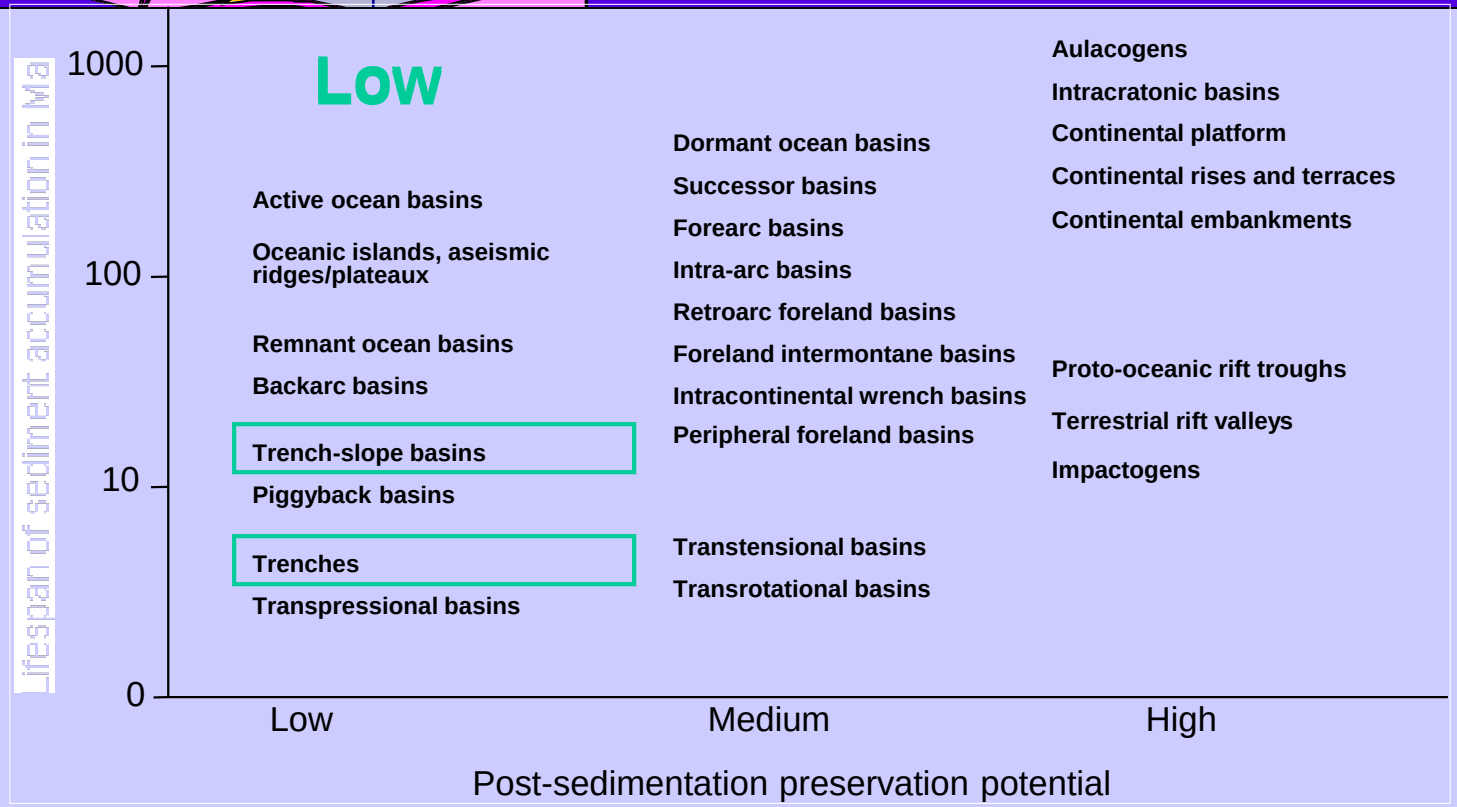
Basin preservation potential



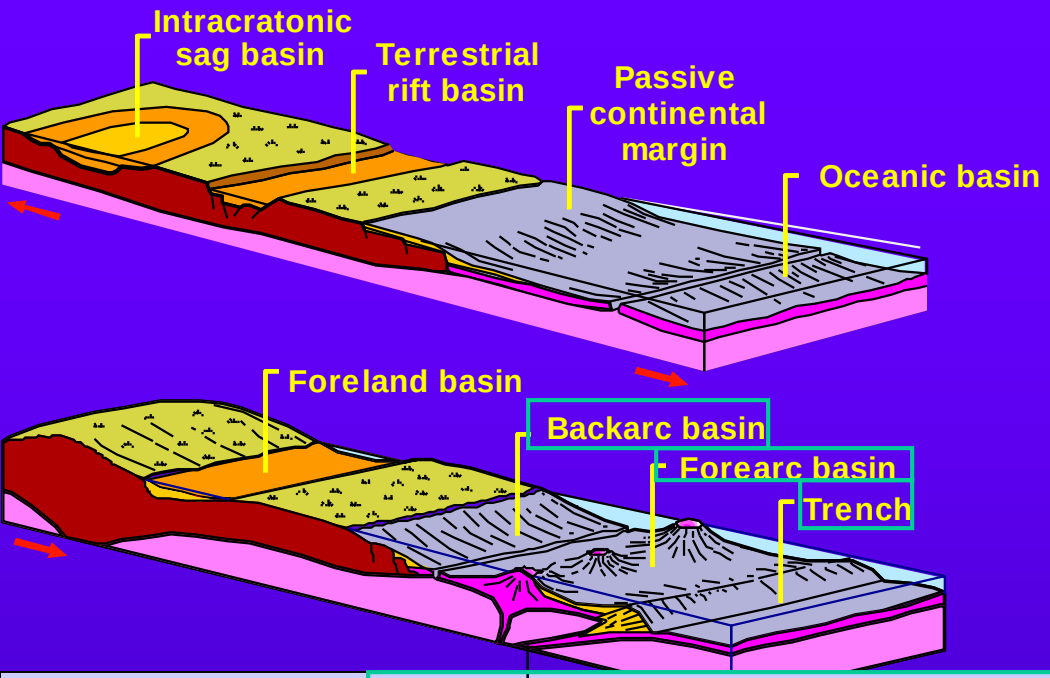


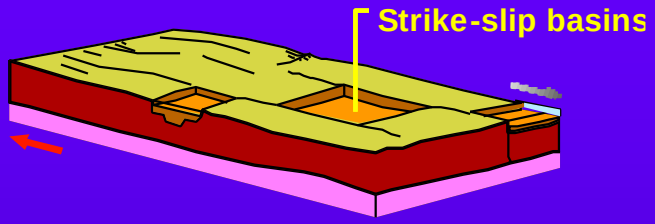
Medium

High



Basin lifespan





Long

Medium

Short

Lifespan of sedimentary accumulation in Ma

1000

100

10

0

Active ocean basins

Oceanic islands, aseismic ridges/plateaux

Remnant ocean basins

Backarc basins

Trench-slope basins

Piggyback basins

Trenches

Transpressional basins

Dormant ocean basins

Successor basins

Forearc basins

Intra-arc basins

Retroarc foreland basins

Foreland intermontane basins

Intracontinental wrench basins

Peripheral foreland basins

Transtensional basins

Transrotational basins

Aulacogens

Intracratonic basins

Continental platform

Continental rises and terraces

Continental embankments

Proto-oceanic rift troughs

Terrestrial rift valleys

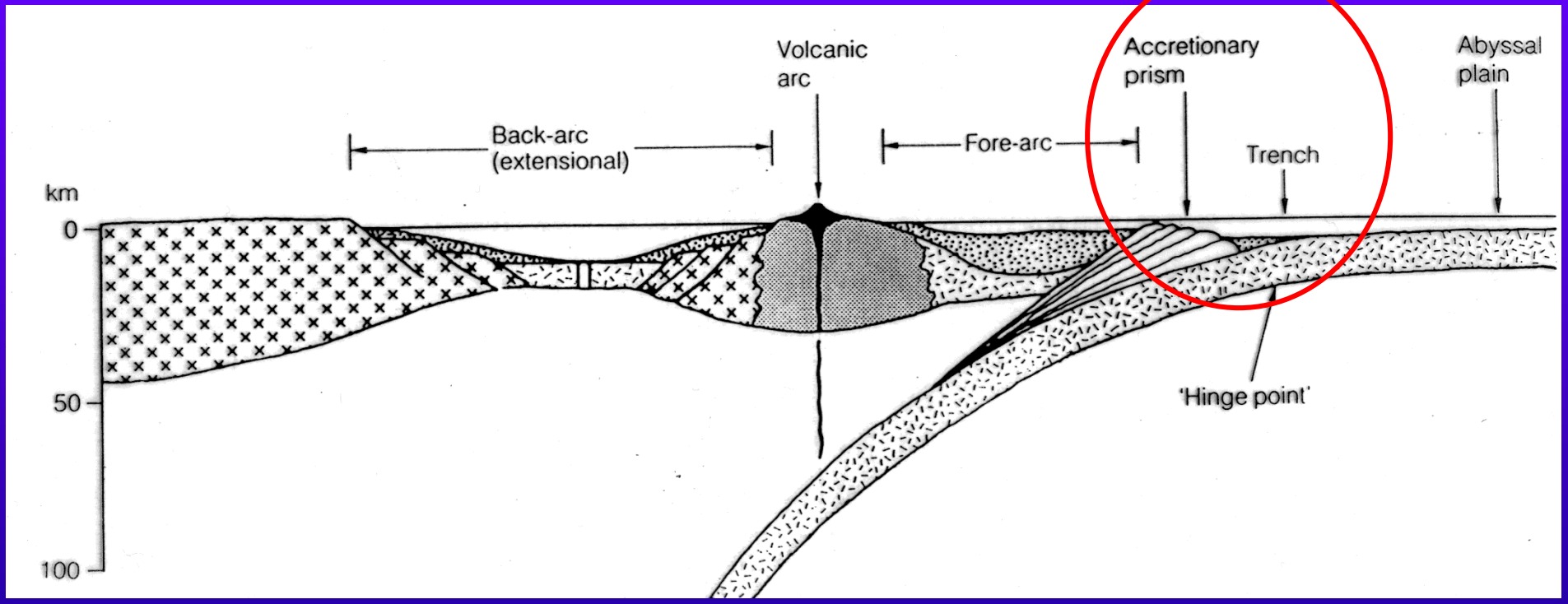
Impactogens

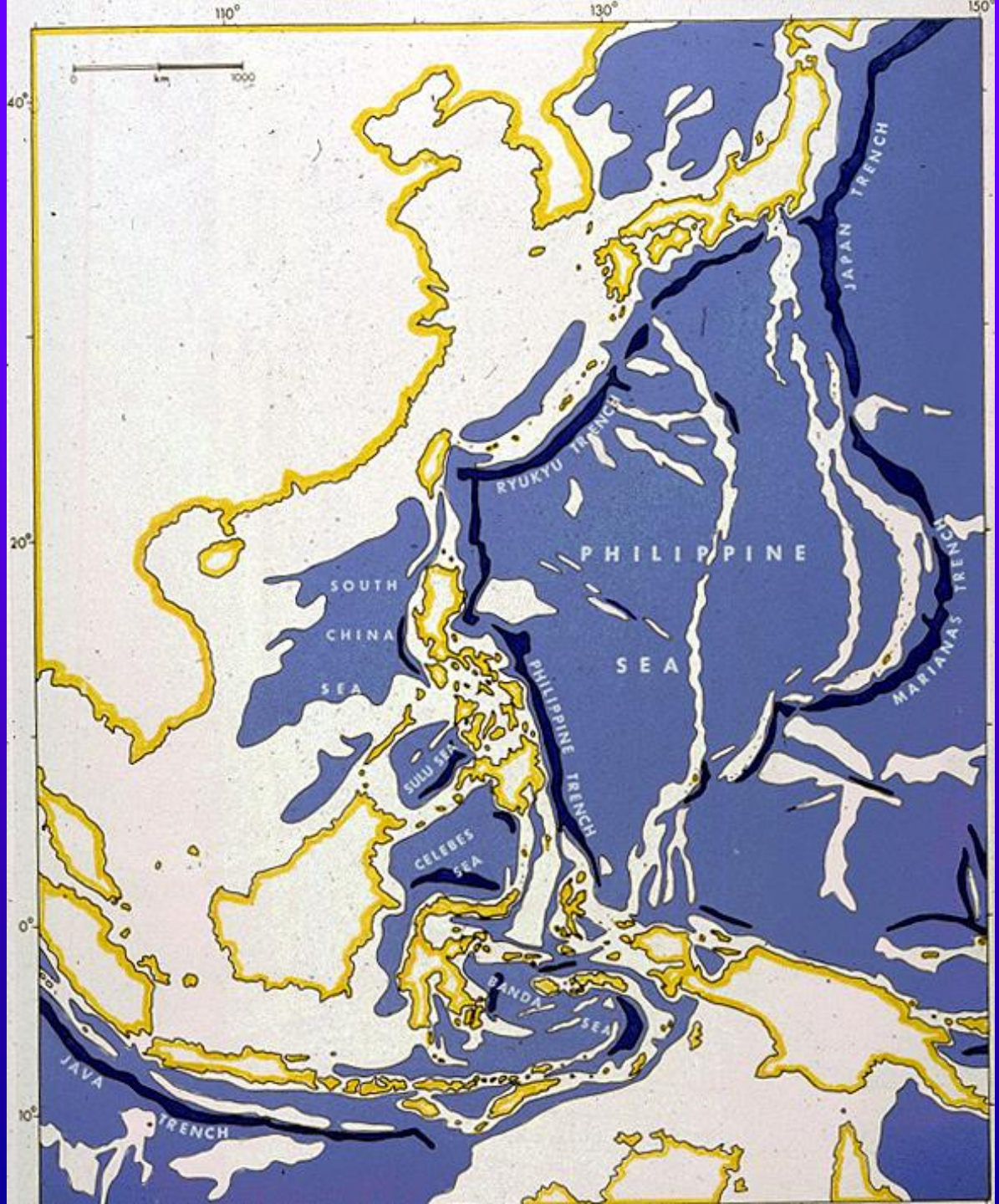
Low

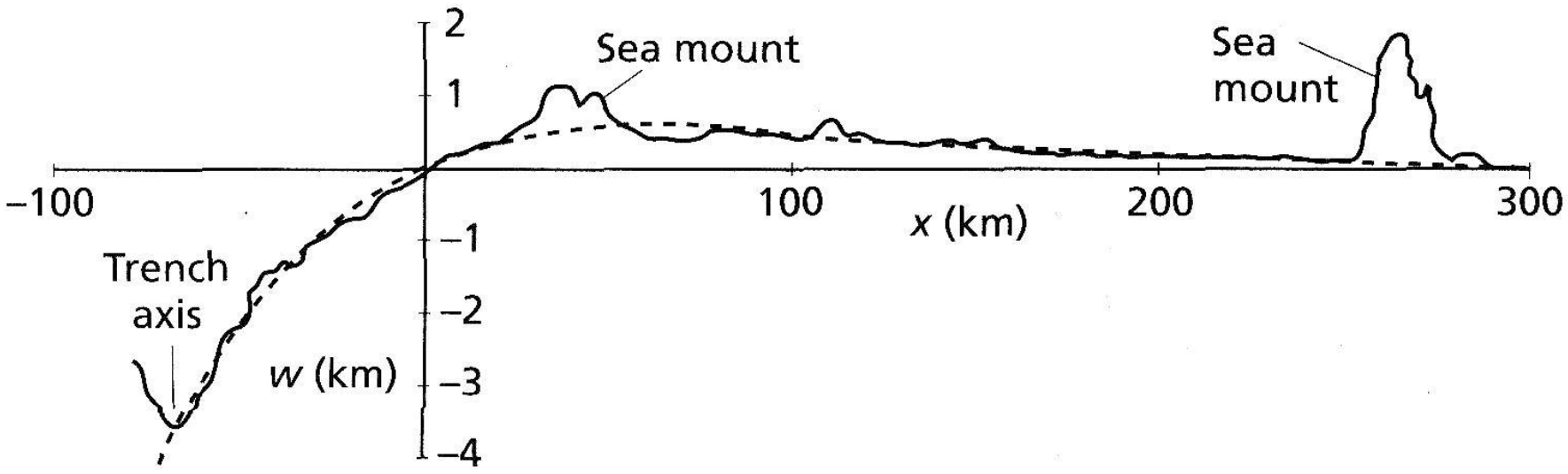
Medium

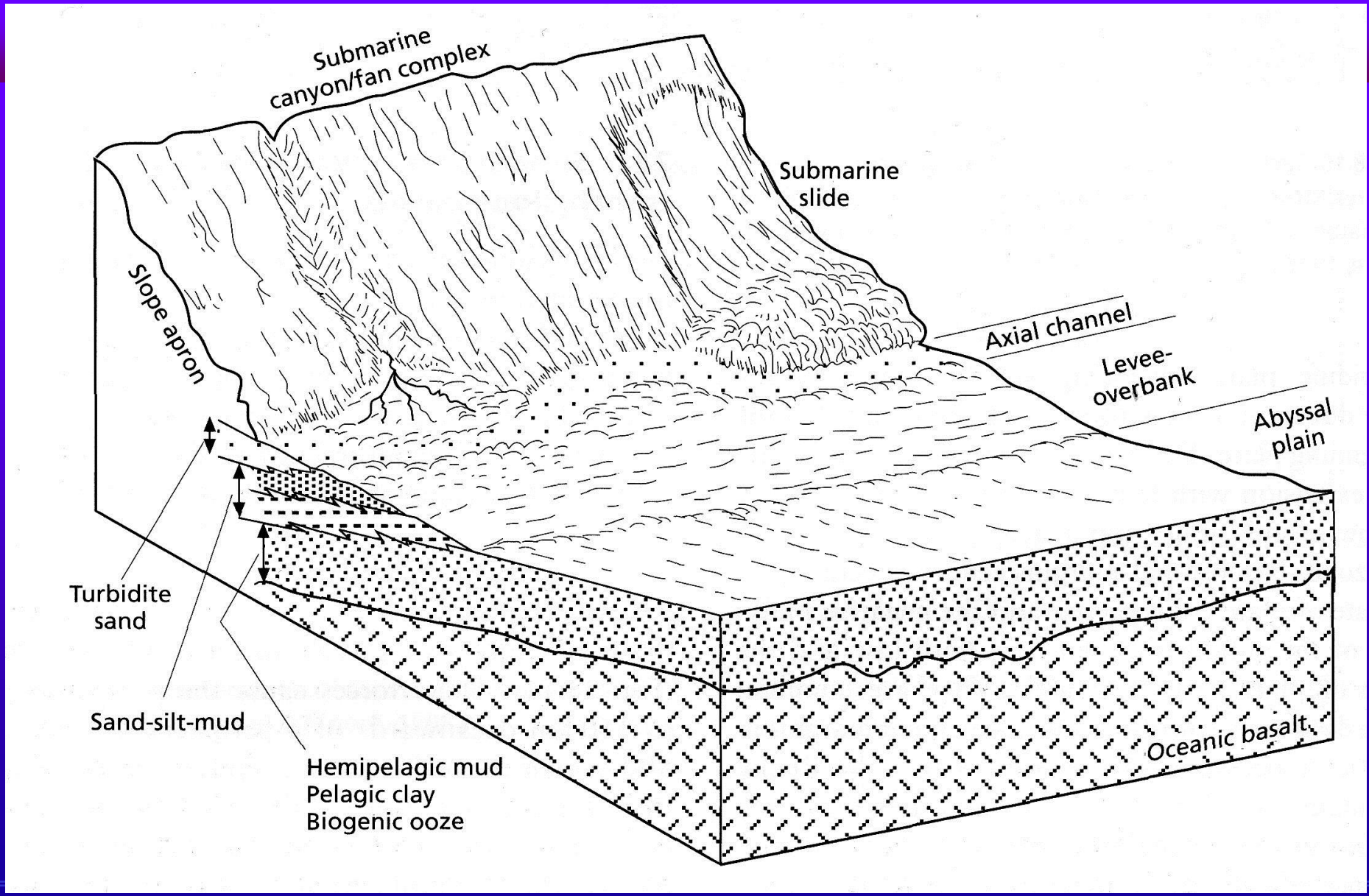
High

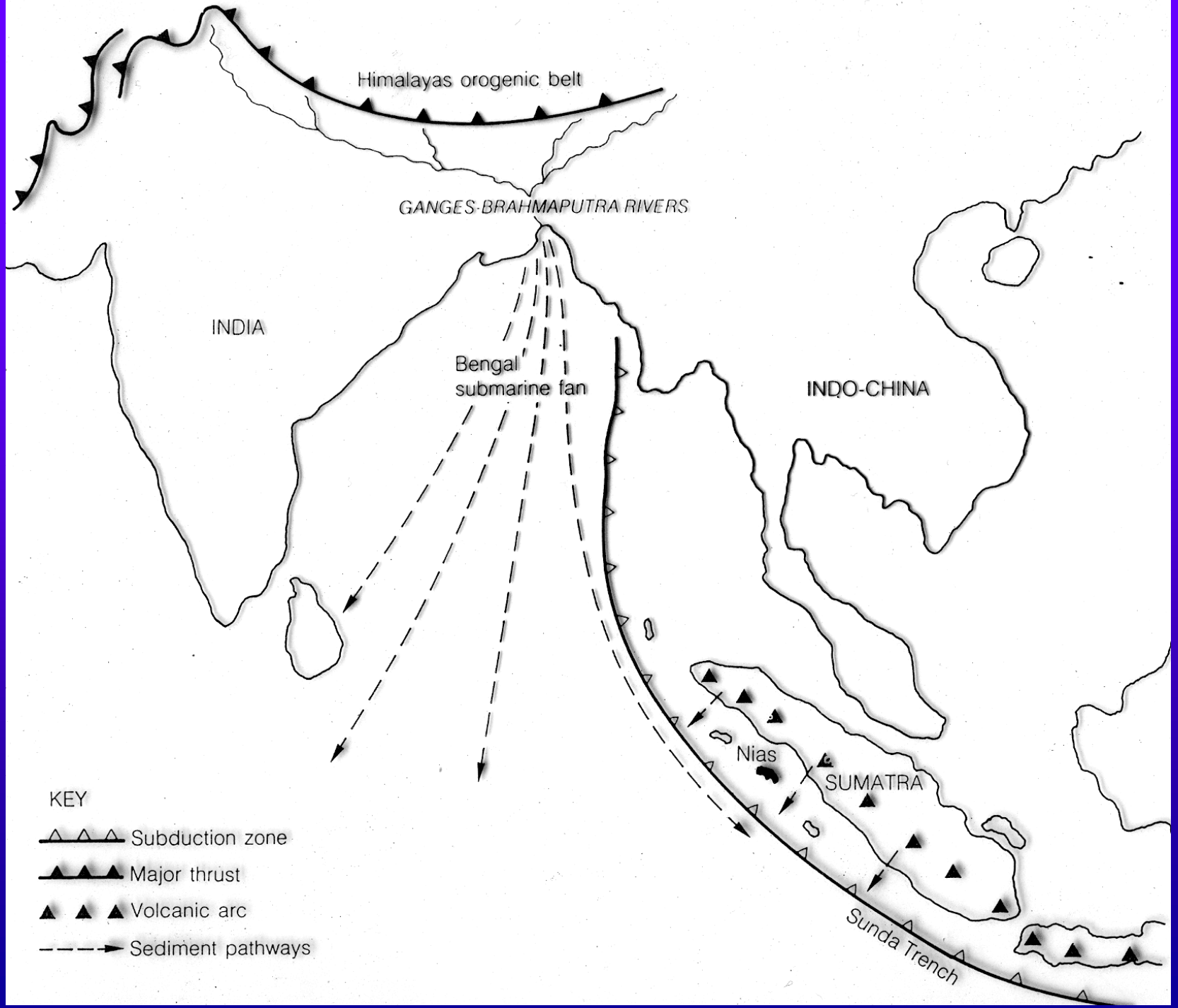
Post-sedimentation preservation potential

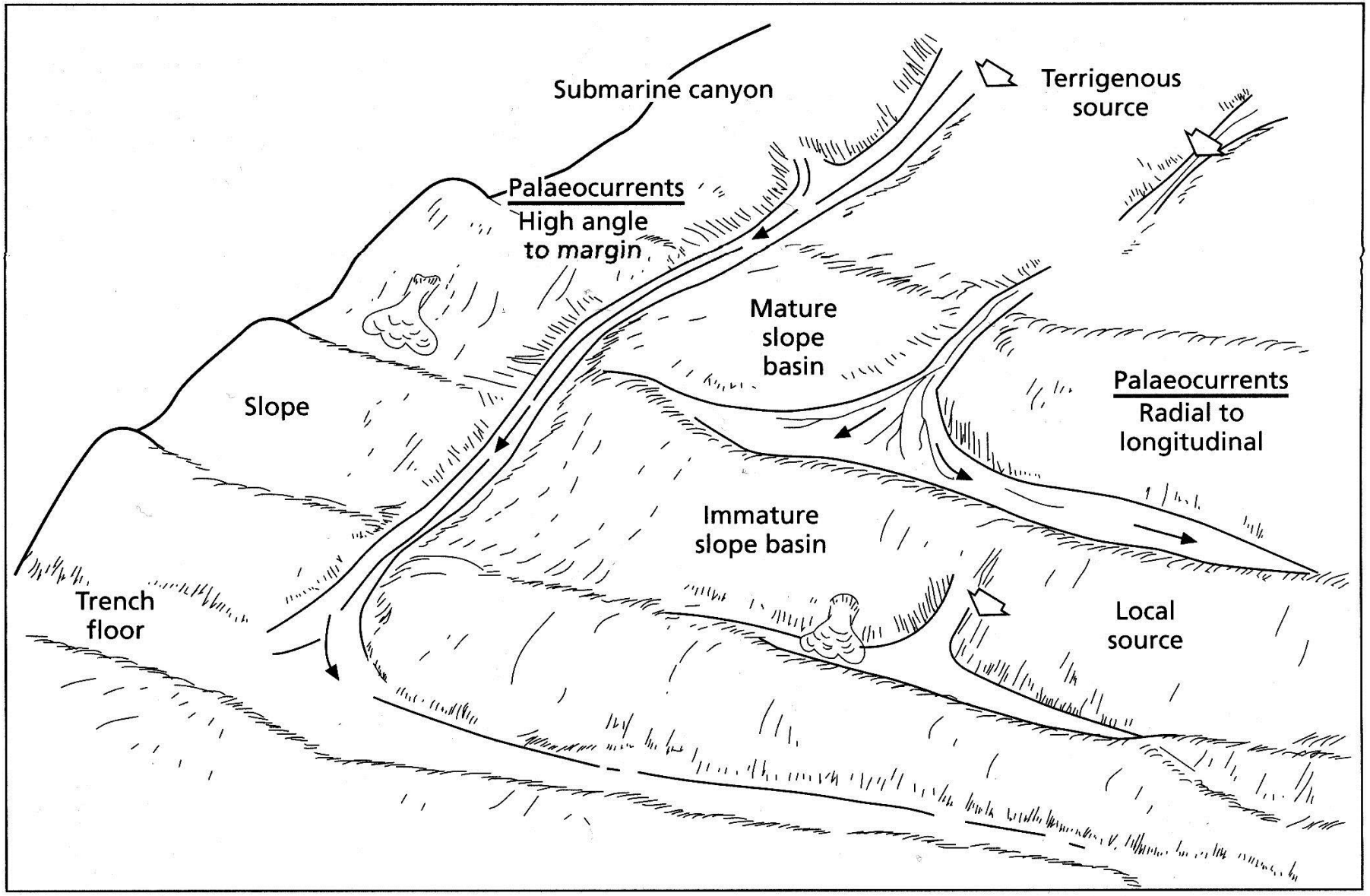

Volcanic arc
Accretionary prism
Abyssal plain
Back-arc (extensional)
Fore-arc
Trench
km
0
50
100
'Hinge point'

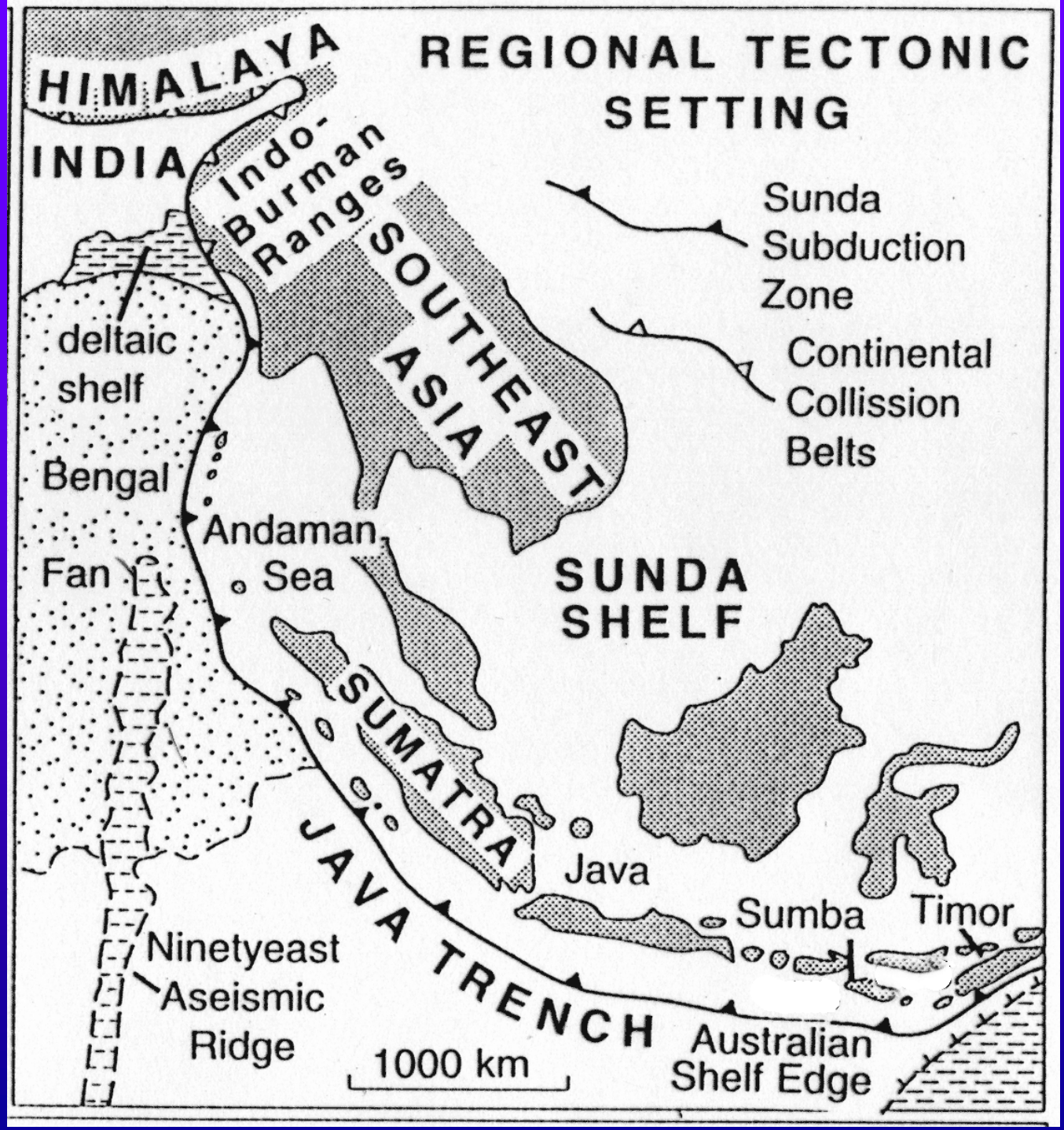

110°
130°
150°
0
km
1000
40°
20°
0°
10°
JAPAN TRENCH
RYUKYU TRENCH
PHILIPPINE
SEA
MARIANAS TRENCH
SOUTH
CHINA
SEA
PHILIPPINE TRENCH
SULU SEA
CELEBES
SEA
BANDA
SEA
JAVA
TRENCH

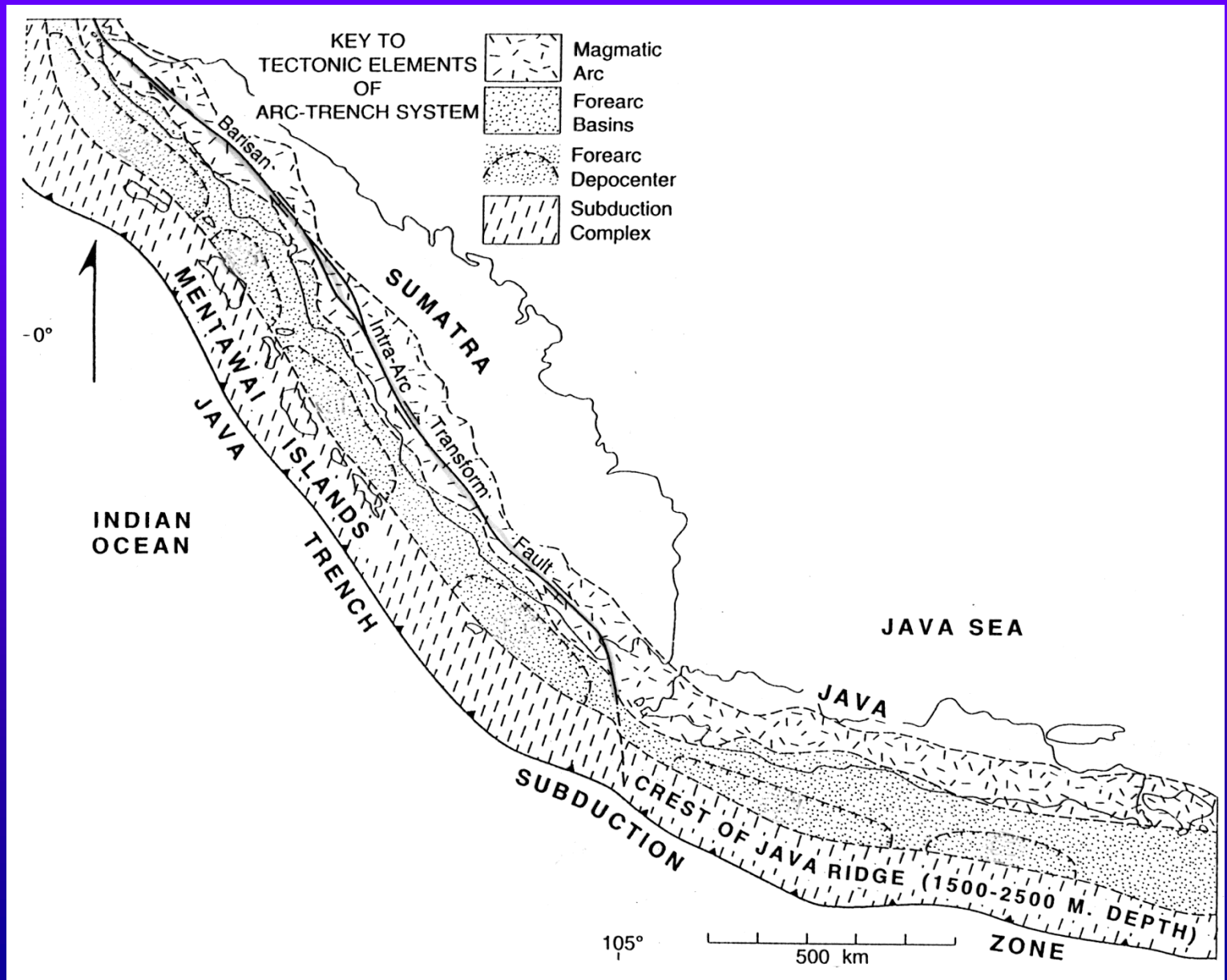

2
1
Sea mount
Sea
mount
−100
100
200
300
x (km)
−1
−2
−3
−4
w (km)
Trench
axis

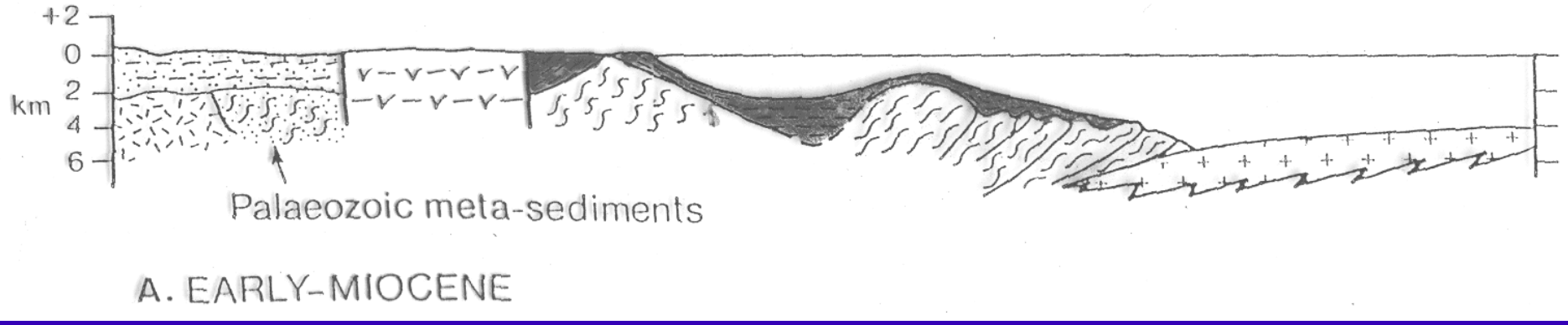

Submarine canyon/fan complex
Submarine slide
Slope apron
Axial channel
Levee-overbank
Abyssal plain
Turbidite sand
Sand-silt-mud
Hemipelagic mud
Pelagic clay
Biogenic ooze
Oceanic basalt

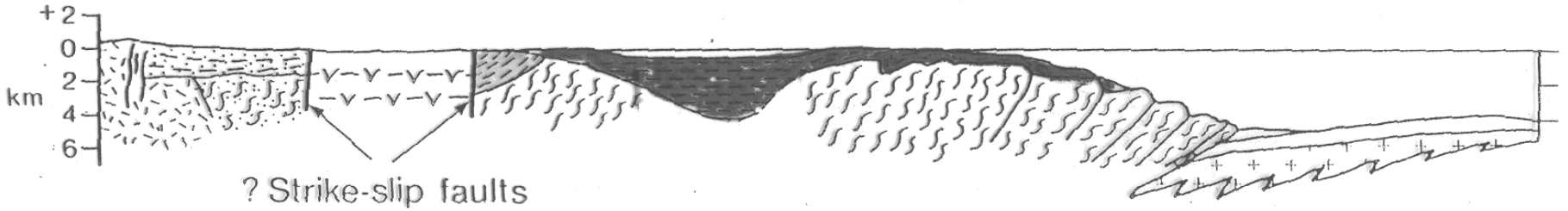

Himalayas orogenic belt
GANGES-BRAHMAPUTRA RIVERS
INDIA
Bengal
submarine fan
INDO-CHINA
Nias
SUMATRA
Sunda Trench
KEY
Subduction zone
Major thrust
Volcanic arc
Sediment pathways


Submarine canyon
Terrigenous source
Palaeocurrents
High angle to margin
Mature slope basin
Slope
Palaeocurrents
Radial to longitudinal
Immature slope basin
Trench floor
Local source

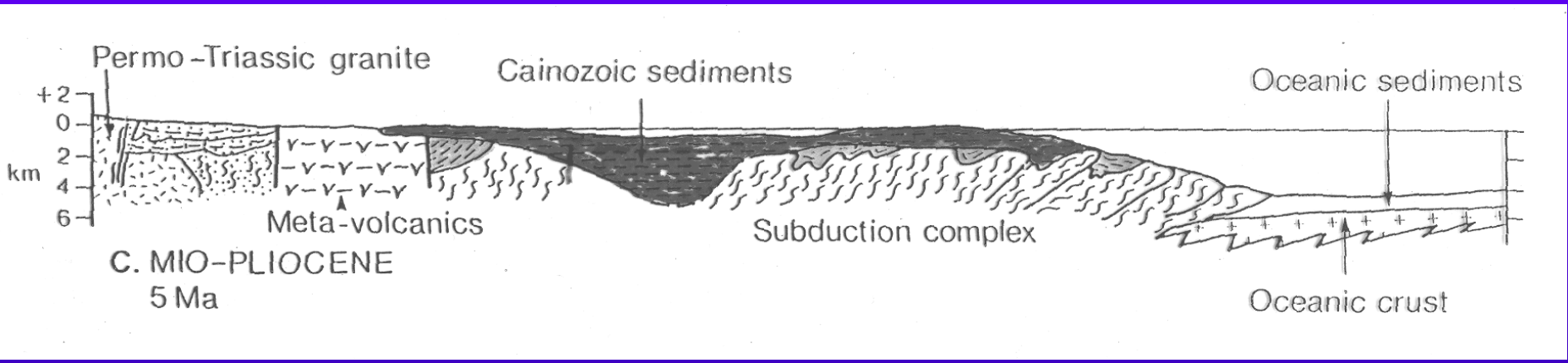

REGIONAL TECTONIC SETTING
HIMALAYA
INDIA
Indo-Burman Ranges
SOUTHEAST ASIA
Sunda Subduction Zone
Continental Collission Belts
deltaic shelf
Bengal Fan
Andaman Sea
SUNDA SHELF
SUMATRA
JAVA TRENCH
Java
Sumba
Timor
Ninetyeast Aseismic Ridge
1000 km
Australian Shelf Edge

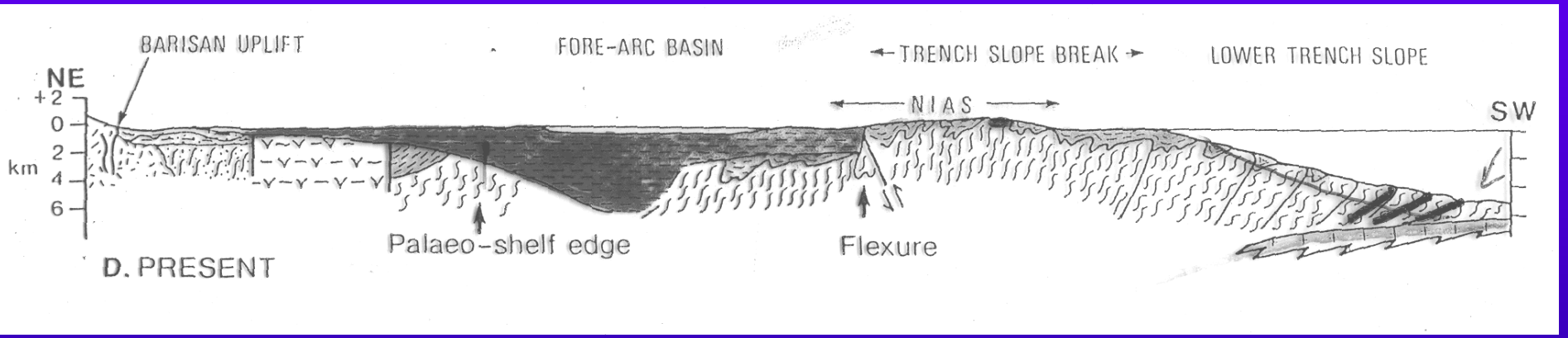

KEY TO
TECTONIC ELEMENTS
OF
ARC-TRENCH SYSTEM
Magmatic Arc
Forearc Basins
Forearc Depocenter
Subduction Complex
Barisan
SUMATRA
Intra-Arc
Transform
Fault
MENTAWAI ISLANDS
JAVA TRENCH
INDIAN OCEAN
JAVA SEA
JAVA
SUBDUCTION ZONE
CREST OF JAVA RIDGE (1500-2500 M. DEPTH)
0°
105°
500 km

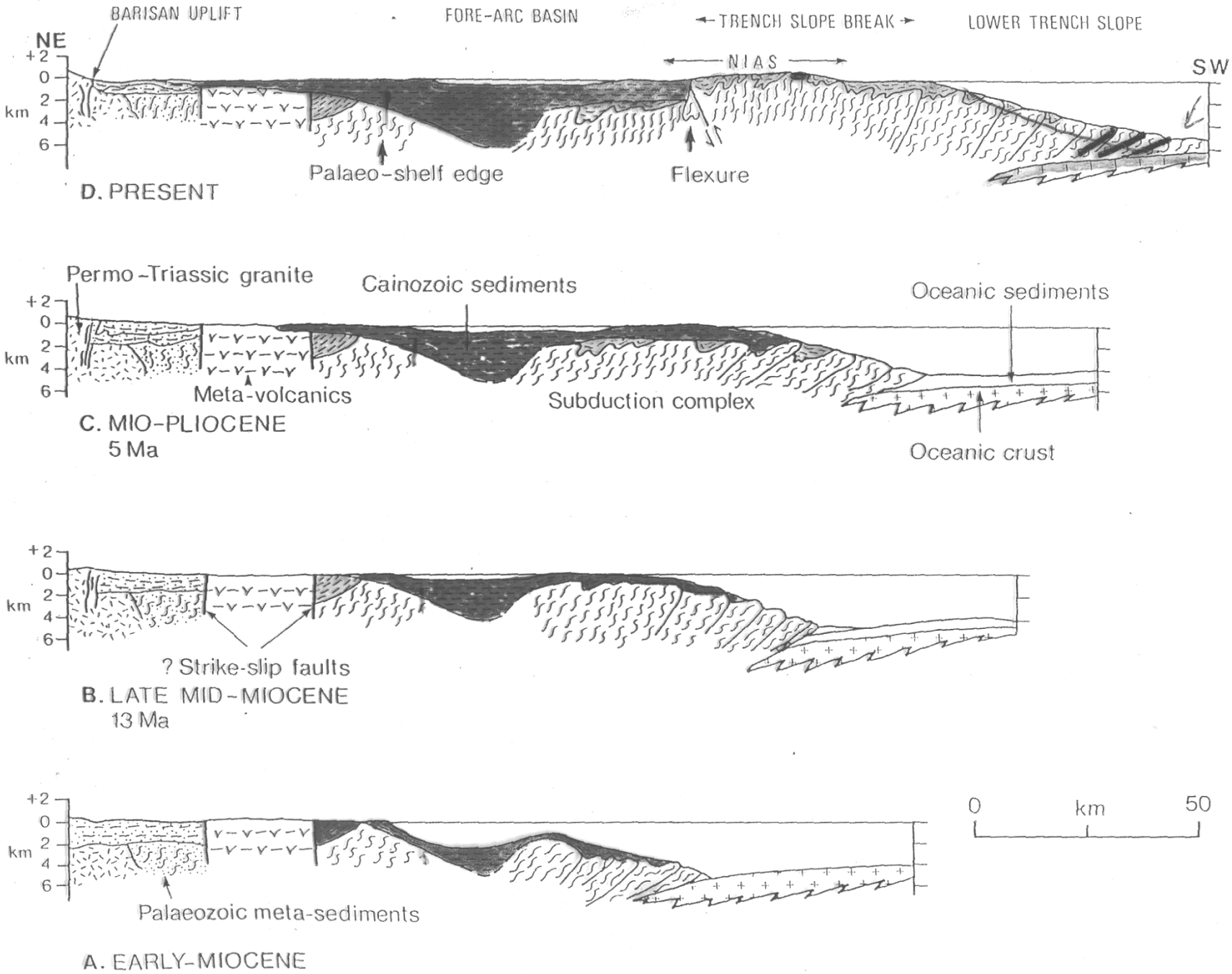

+2
0
km
2
4
6
Palaeozoic meta-sediments
A. EARLY-MIOCENE



B. LATE MID-MIOCENE
13 Ma

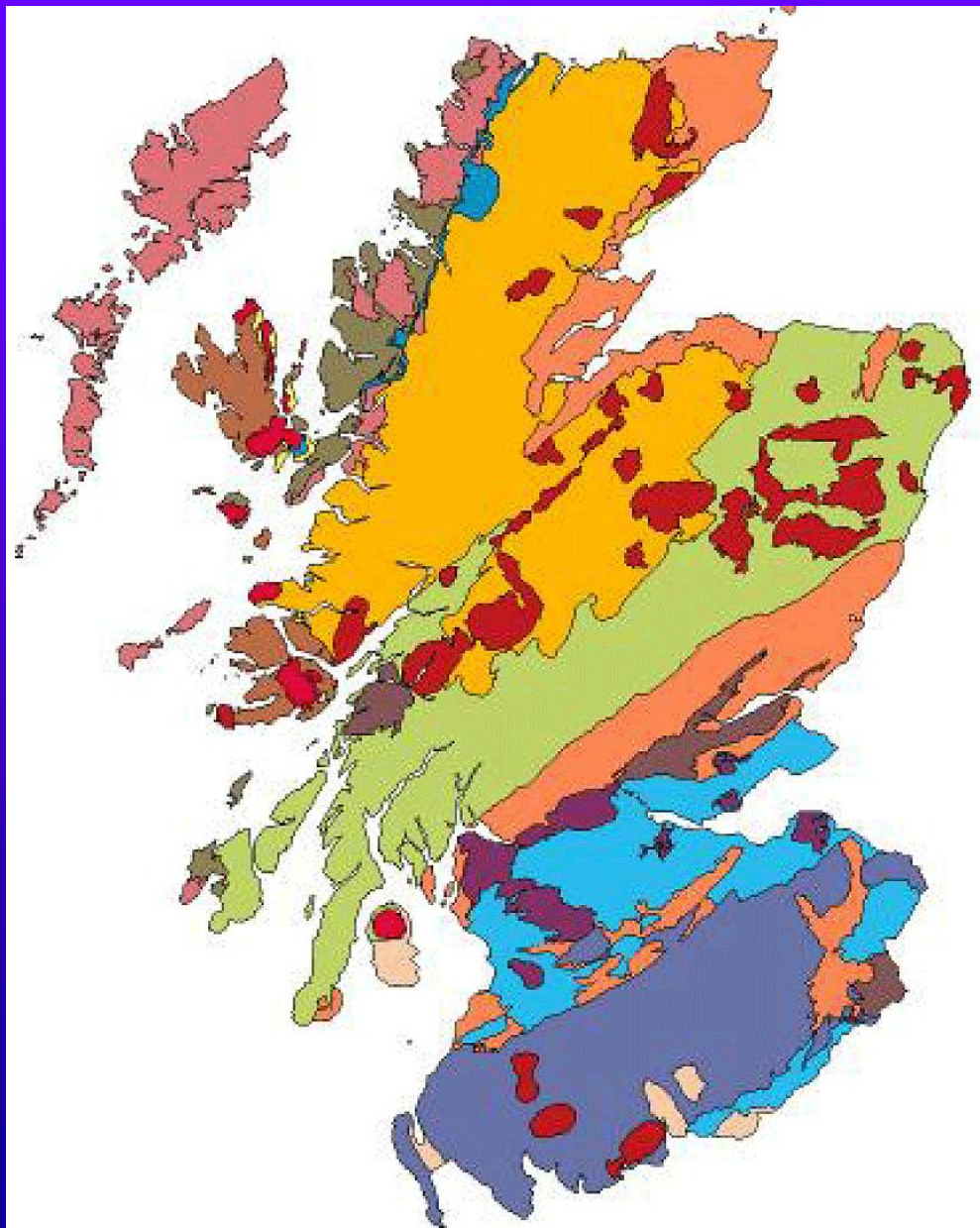

Permo-Triassic granite
Cainozoic sediments
Oceanic sediments
+2
0
2
4
6
km
Meta-volcanics
Subduction complex
C. MIO-PLIOCENE
5 Ma
Oceanic crust

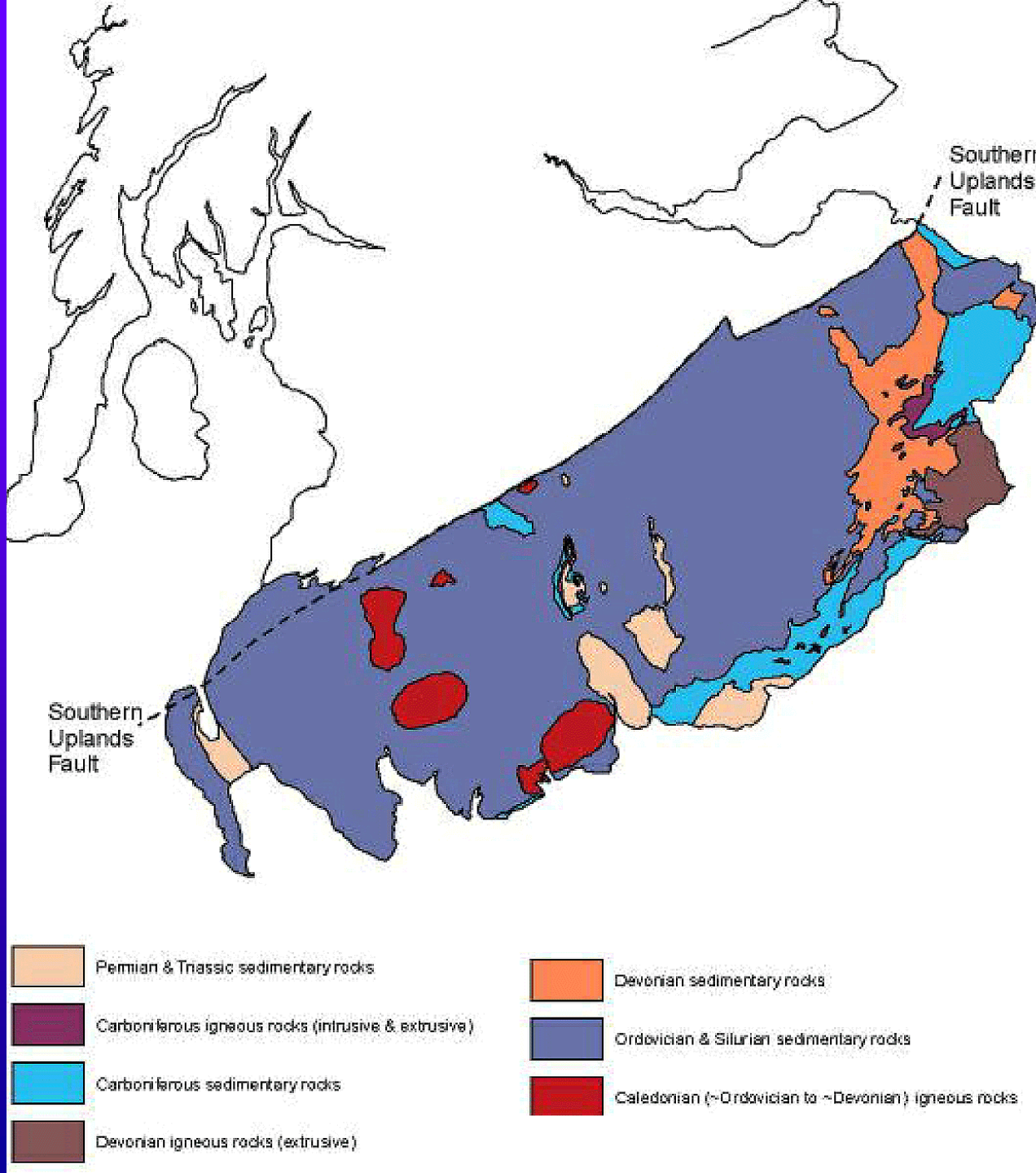

BARISAN UPLIFT
FORE-ARC BASIN
TRENCH SLOPE BREAK
LOWER TRENCH SLOPE
NIAS
NE
SW
+2
0
2
4
6
km
Palaeo-shelf edge
Flexure
D. PRESENT


BARISAN UPLIFT
FORE-ARC BASIN
TRENCH SLOPE BREAK
LOWER TRENCH SLOPE
NE
SW
NIAS
+2
0
2
4
6
km
Palaeo-shelf edge
Flexure
D. PRESENT
Permo-Triassic granite
Cainozoic sediments
Oceanic sediments
Meta-volcanics
Subduction complex
Oceanic crust
C. MIO-PLIOCENE
5 Ma
? Strike-slip faults
B. LATE MID-MIOCENE
13 Ma
Palaeozoic meta-sediments
A. EARLY-MIOCENE
0
km
50

Southern Scotland in Early Palaeozoic

- Scotland lay on the northwestern side of the Iapetus Ocean.
- The area now occupied by Southern Scotland and northern England were areas of deep marine sedimentation.



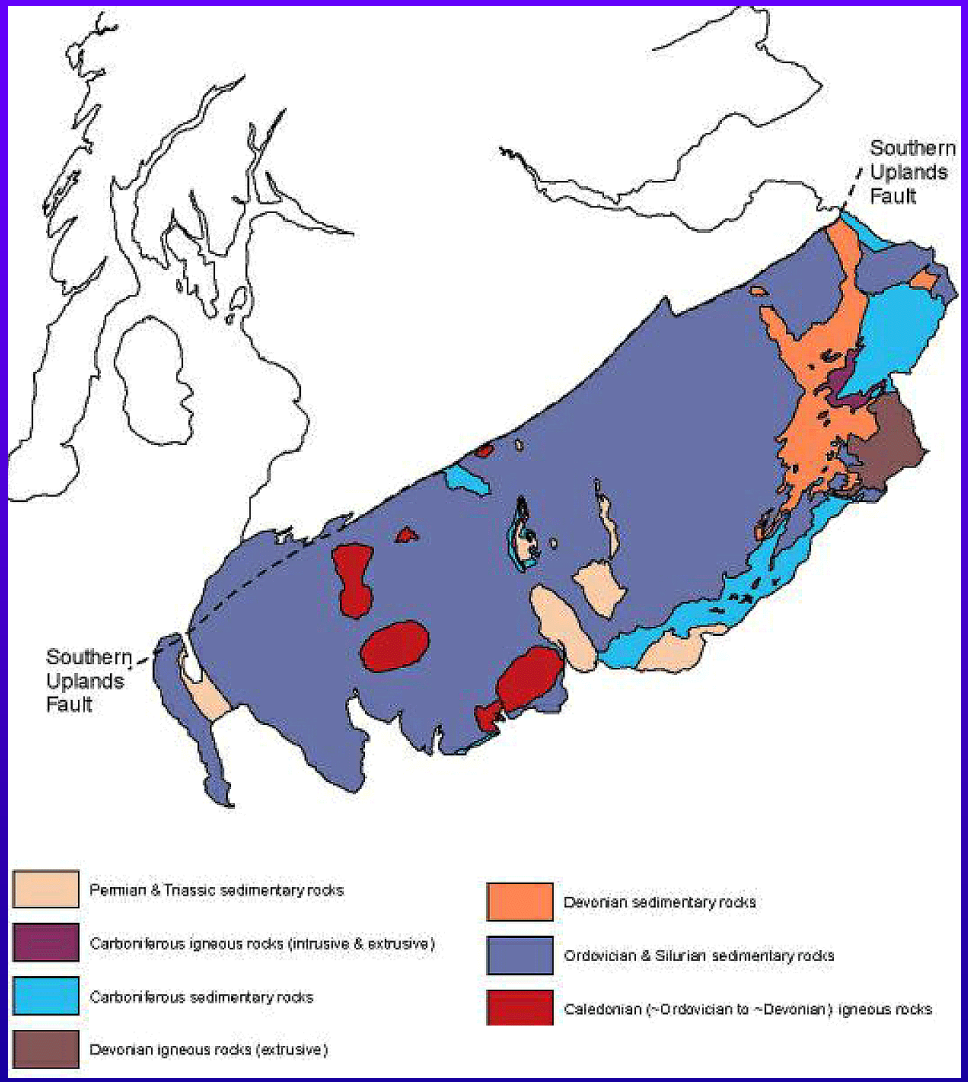

Southern Uplands Fault
Southern Uplands Fault
Permian & Triassic sedimentary rocks
Carboniferous igneous rocks (intrusive & extrusive)
Carboniferous sedimentary rocks
Devonian igneous rocks (extrusive)
Devonian sedimentary rocks
Ordovician & Silurian sedimentary rocks
Caledonian (~Ordovician to ~Devonian) igneous rocks

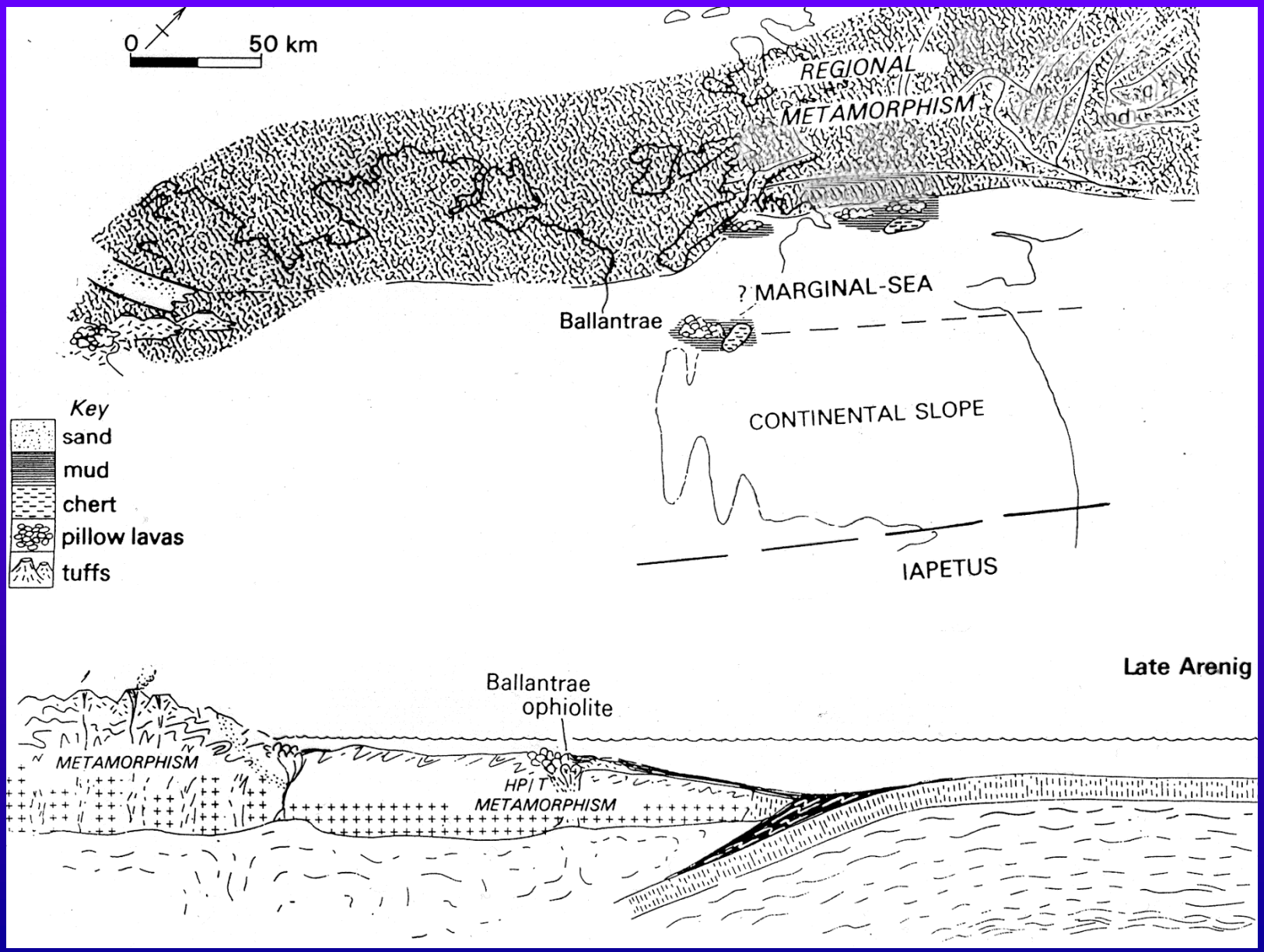
Lithologies and Stratigraphy

- Middle and Upper Ordovician to early Silurian

- cherts
- black shales
- turbidites

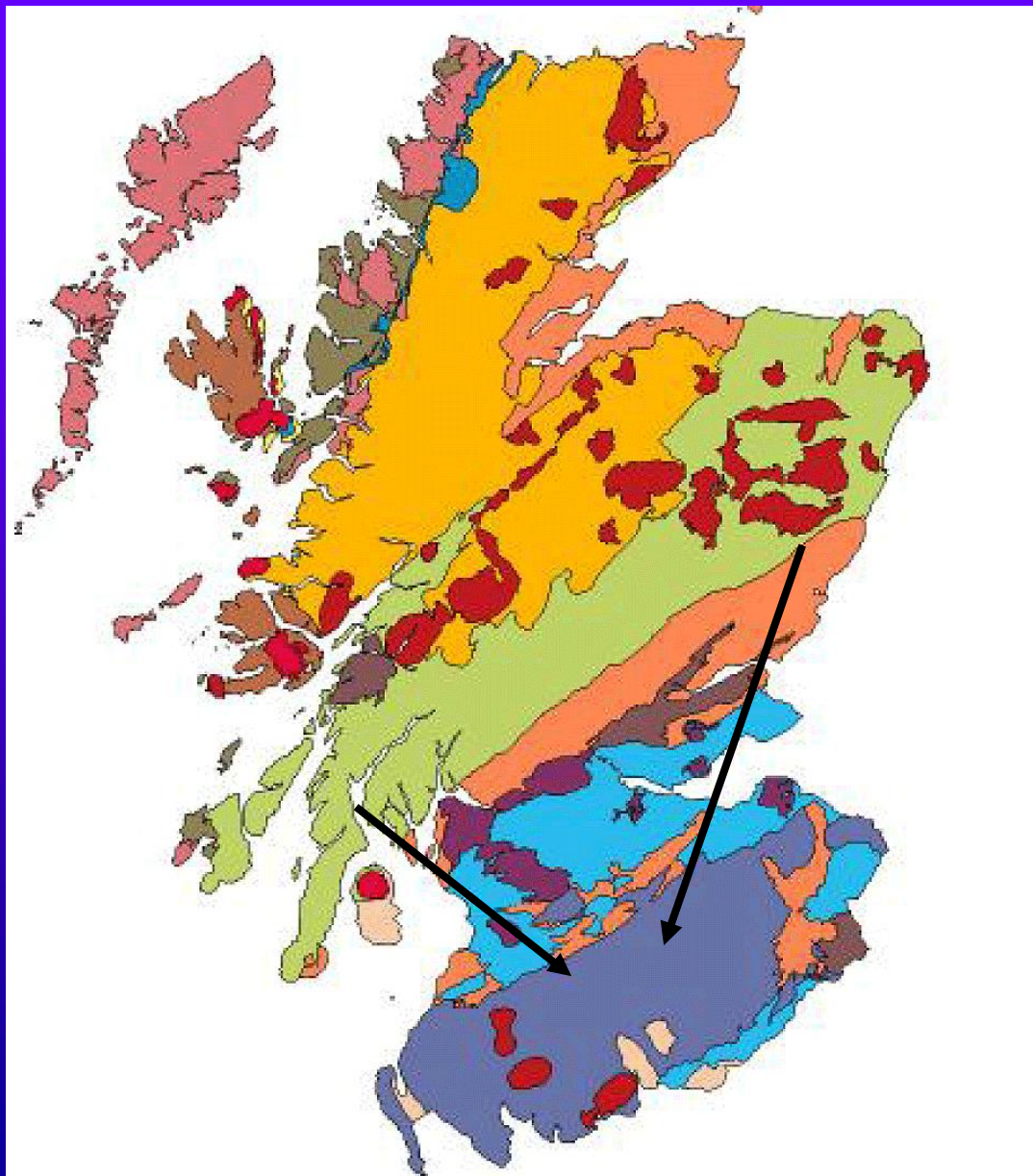
- trend of becoming coarser upwards (more turbidites)




0
50 km
REGIONAL
METAMORPHISM
Ballantrae
? MARGINAL-SEA
CONTINENTAL SLOPE
IAPETUS
Key
sand
mud
chert
pillow lavas
tuffs
Late Arenig
Ballantrae
ophiolite
METAMORPHISM
HP/T
METAMORPHISM

Palaeogeography: S Uplands

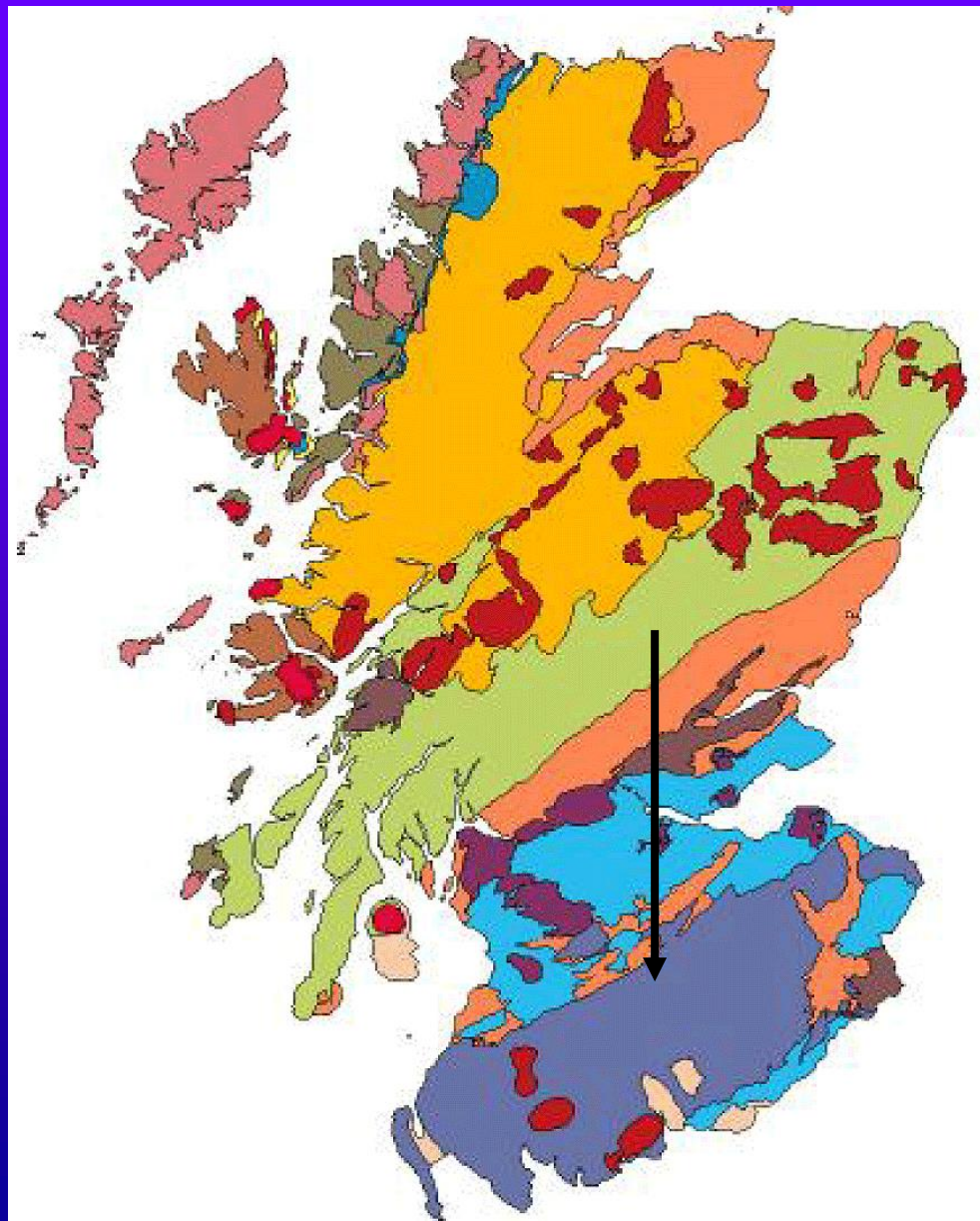
- Palaeocurrents.
- Flutes and grooves on the bases of the turbidites generally suggest flow towards the SW or SE.

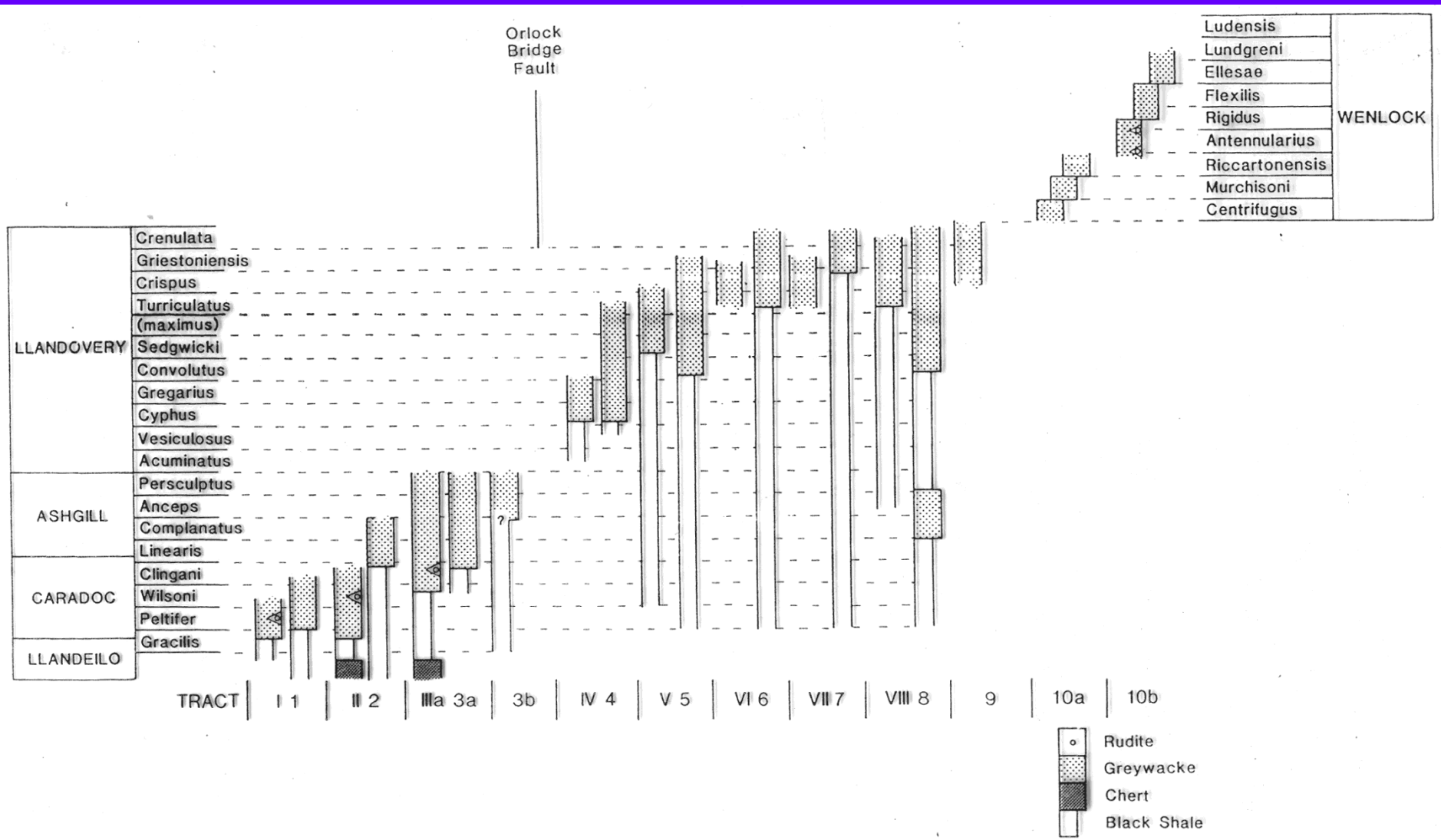


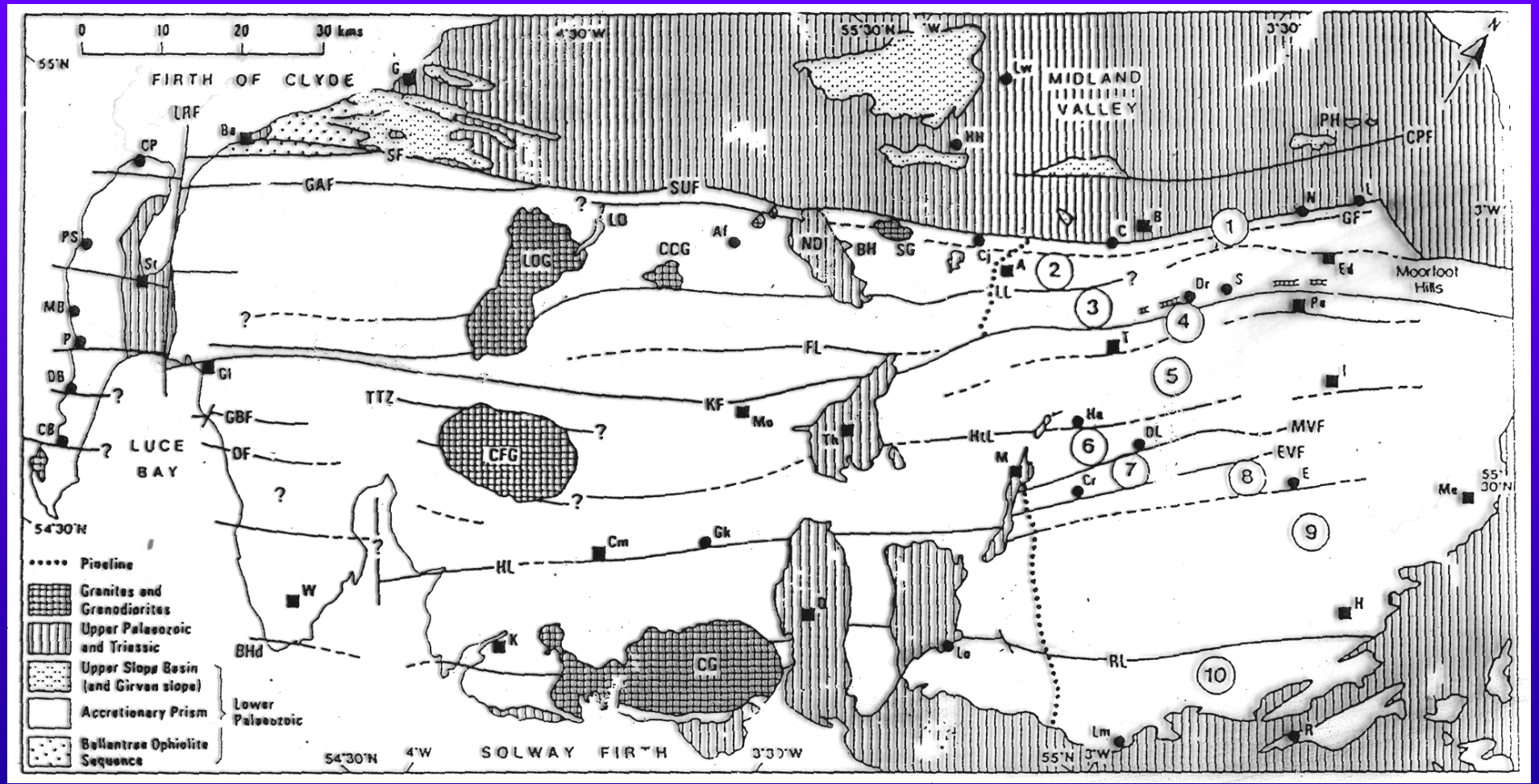
Palaeogeography: S Uplands

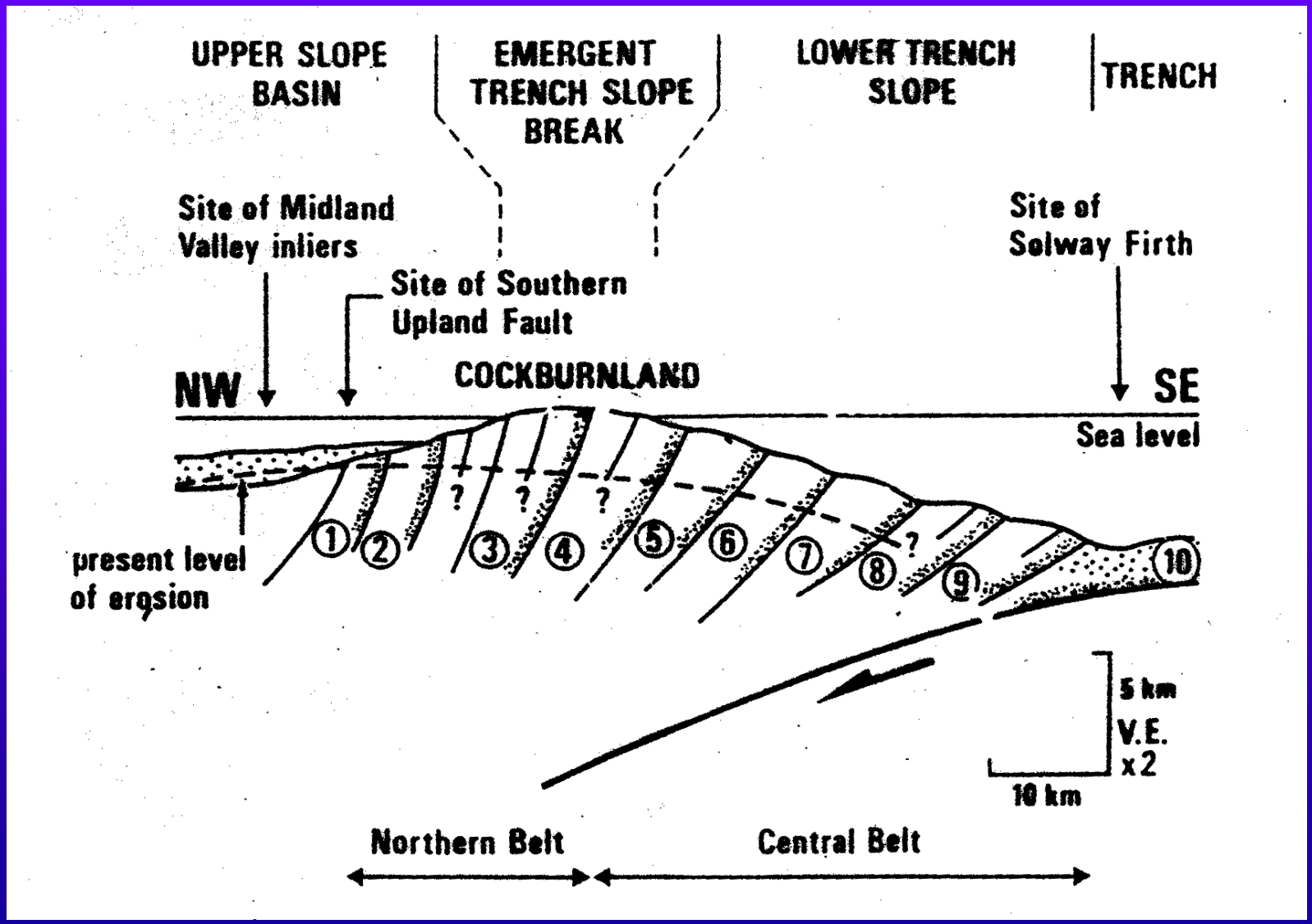
Provenance

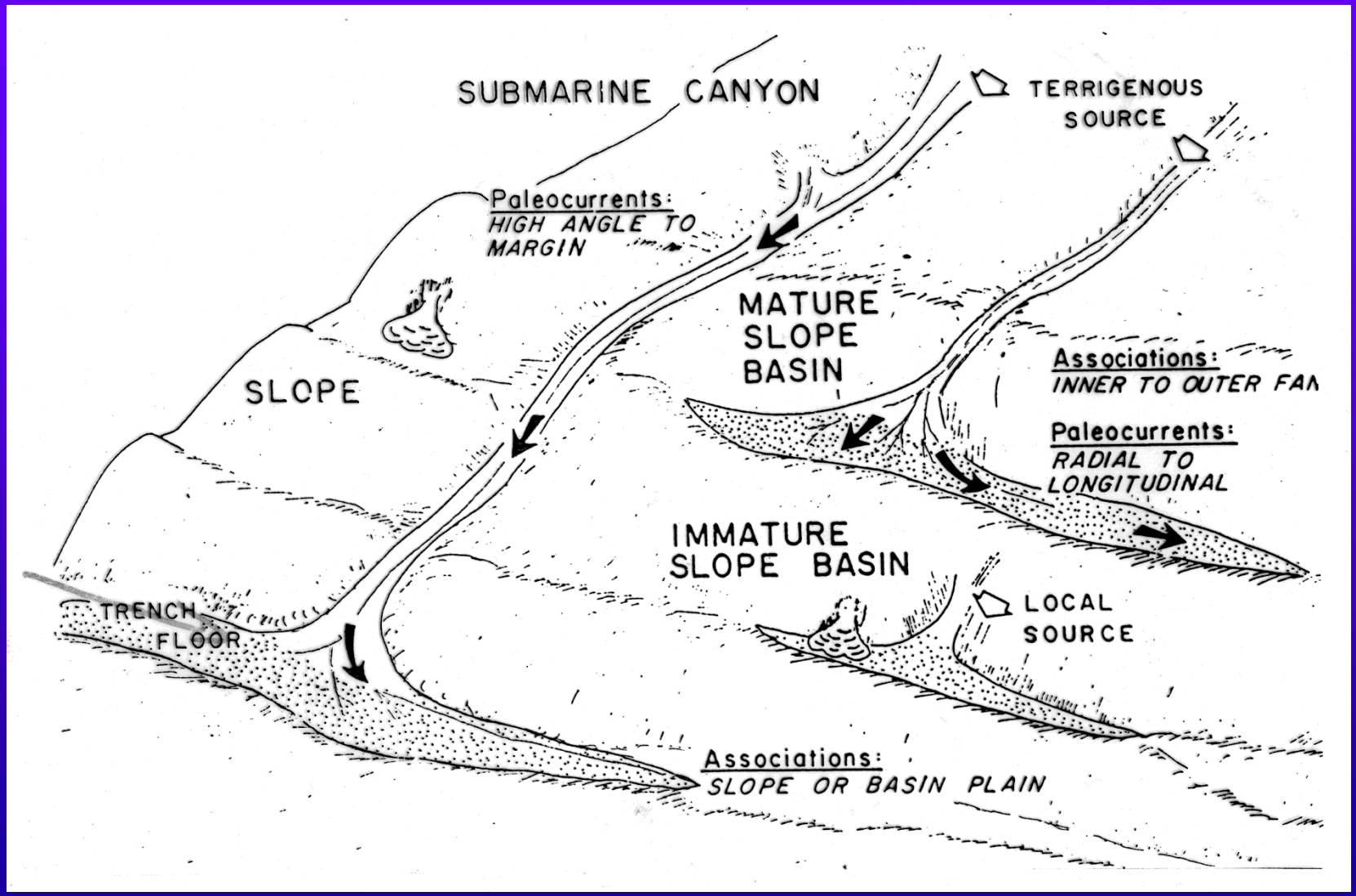
- Turbidites contain a lot of lithic fragments
- Source of igneous and metamorphic rocks from the Dalradian to north




Orlock
Bridge
Fault
Ludensis
Lundgreni
Ellesae
Flexilis
Rigidus
Antennularius
Riccartonensis
Murchisoni
Centrifugus
WENLOCK
LLANDOVERY
Crenulata
Griestoniensis
Crispus
Turriculatus
(maximus)
Sedgwicki
Convolutus
Gregarius
Cyphus
Vesiculosus
Acuminatus
ASHGILL
Persculptus
Anceps
Complanatus
Linearis
CARADOC
Clingani
Wilsoni
Peltifer
Gracilis
LLANDEILO
TRACT
I 1
II 2
IIIa 3a
3b
IV 4
V 5
VI 6
VII 7
VIII 8
9
10a
10b
Rudite
Greywacke
Chert
Black Shale


0 10 20 30 kms
FIRTH OF CLYDE
MIDLAND VALLEY
LUCE BAY
SOLWAY FIRTH
55°N
54°30'N
4°30'W
4°W
3°30'W
3°W
LRF
CP
Ba
G
SF
GAF
SUF
LO
LOG
CCG
Af
ND
BH
SG
Cj
A
B
C
Lw
HH
PH
CPF
N
L
GF
Ed
Moorfoot Hills
Dr
S
Pe
LL
T
I
PS
St
MB
P
DB
CB
GI
GBF
DF
TTZ
KF
Mo
Th
CFG
HtL
Ha
DL
MVF
EVF
M
Cr
E
Me
HL
Cm
Gk
W
BHd
K
CG
Q
La
RL
H
Lm
R
1
2
3
4
5
6
7
8
9
10
Pipeline
Granites and Granodiorites
Upper Palaeozoic and Triassic
Upper Slope Basin (and Girvan slope)
Accretionary Prism
Ballantrae Ophiolite Sequence
Lower Palaeozoic


UPPER SLOPE BASIN
EMERGENT TRENCH SLOPE BREAK
LOWER TRENCH SLOPE
TRENCH
Site of Midland Valley inliers
Site of Southern Upland Fault
Site of Solway Firth
NW
COCKBURNLAND
SE
Sea level
present level of erosion
1
2
3
4
5
6
7
8
9
10
5 km
V.E. x2
10 km
Northern Belt
Central Belt


SUBMARINE CANYON
TERRIGENOUS SOURCE
Paleocurrents:
HIGH ANGLE TO MARGIN
MATURE SLOPE BASIN
SLOPE
Associations:
INNER TO OUTER FAN
Paleocurrents:
RADIAL TO LONGITUDINAL
IMMATURE SLOPE BASIN
LOCAL SOURCE
TRENCH FLOOR
Associations:
SLOPE OR BASIN PLAIN