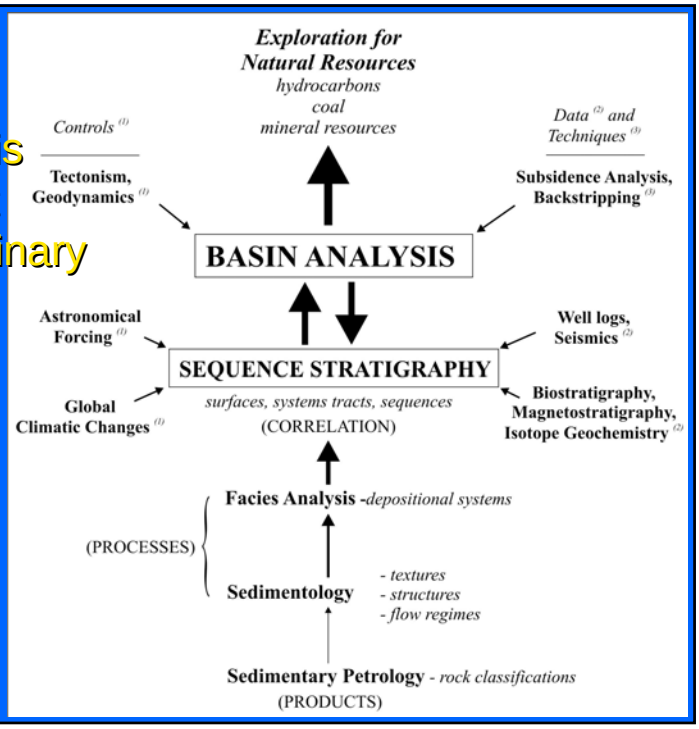
Elements of Basin Analysis

Basin Analysis

Basin analysis is a process that requires the integration of various methods and data sets with the purpose of understanding the origin and evolution of sedimentary basins

Basin Analysis in the context of interdisciplinary research



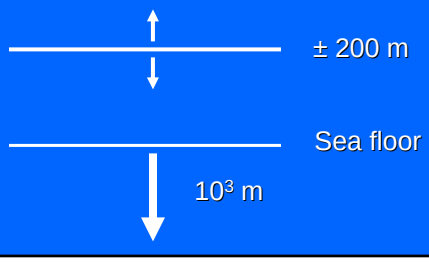
Data sets

- Outcrop data
- Core data
- Well-log data
- Seismic data

Sedimentary basins

Large areas of positive accommodation in which sediments can accumulate to considerable thickness over geological time scales

- Eustasy
- Tectonics



Basin classification – *plate tectonics*

1. Type of crust on which the basin rests
2. The position of the basin relative to plate margins
3. Where the basin lies close to a plate margin, the type of plate interaction occurring during sedimentation

Types of plate margins:

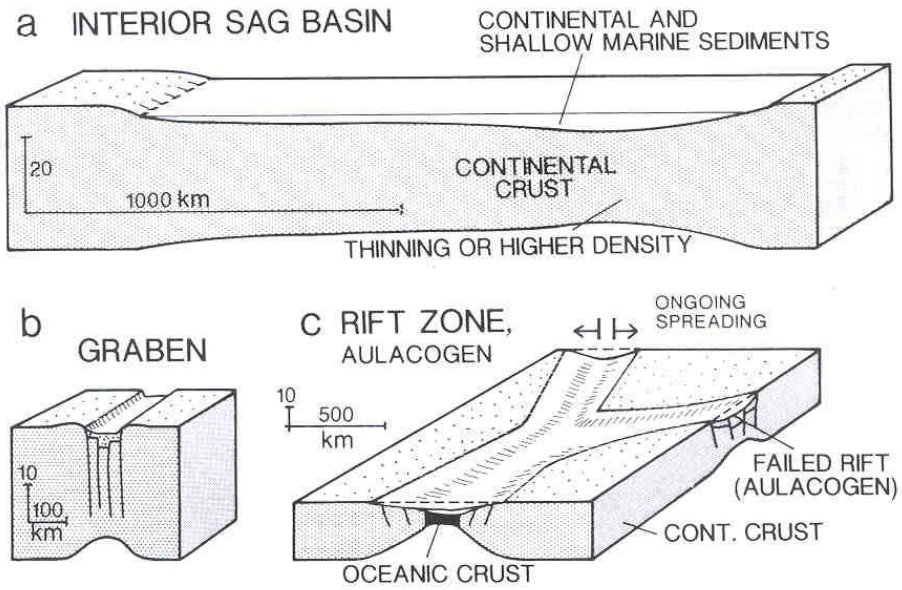
1. Convergent *(subduction)*
2. Divergent *(rifts, mid-oceanic ridges)*
3. Transform *(offset mid-oceanic ridges)*

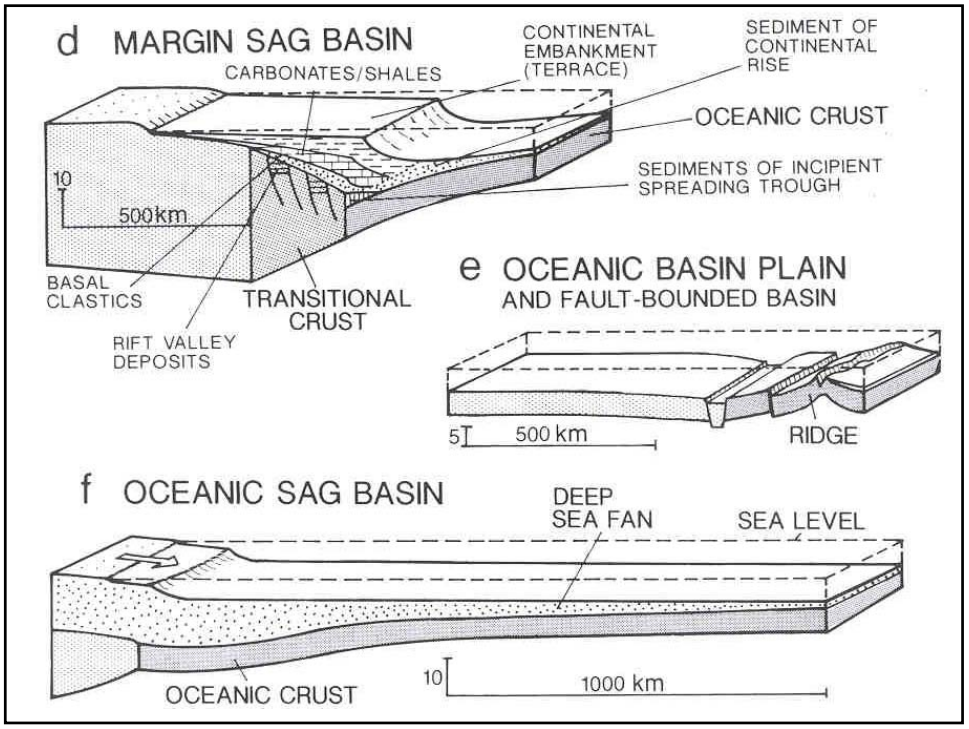
Basin classification

I. Intraplate basins (pre-rift)
II. Divergent-margin basins (syn-rift)
III. Intraplate basins (post-rift)
IV. Convergent-margin basins
V. Collision and post-collision basins
VI. Strike-slip basins

Basin classification (modified from Einsele, 1992 and Miall, 2000)

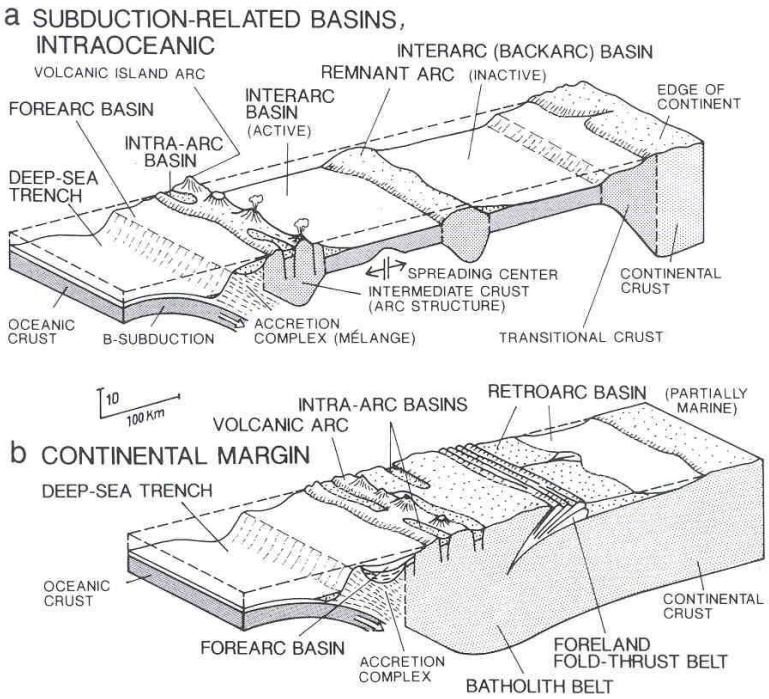
Basin type	Underlying crust	Tectonics	Features
I. Intraplate basins (pre-rift)			
1. Intracratonic basins (interior sag basins)	continental	divergence	large areas, slow subsidence
2. Graben structures (interior fracture basins)	continental	divergence	relatively narrow, fault-bounded, rapid subsidence
II. Divergent-margin basins (syn-rift)			
3. Rift basins	transitional/oceanic	divergence	relatively narrow, fault-bounded early rapid subsidence
III. Intraplate basins (post-rift)			
4. Divergent continental margins	transitional	divergence	asymmetric, moderate to low subsidence
5. Oceanic sag basins	oceanic	divergence	large, asymmetric, slow subsidence





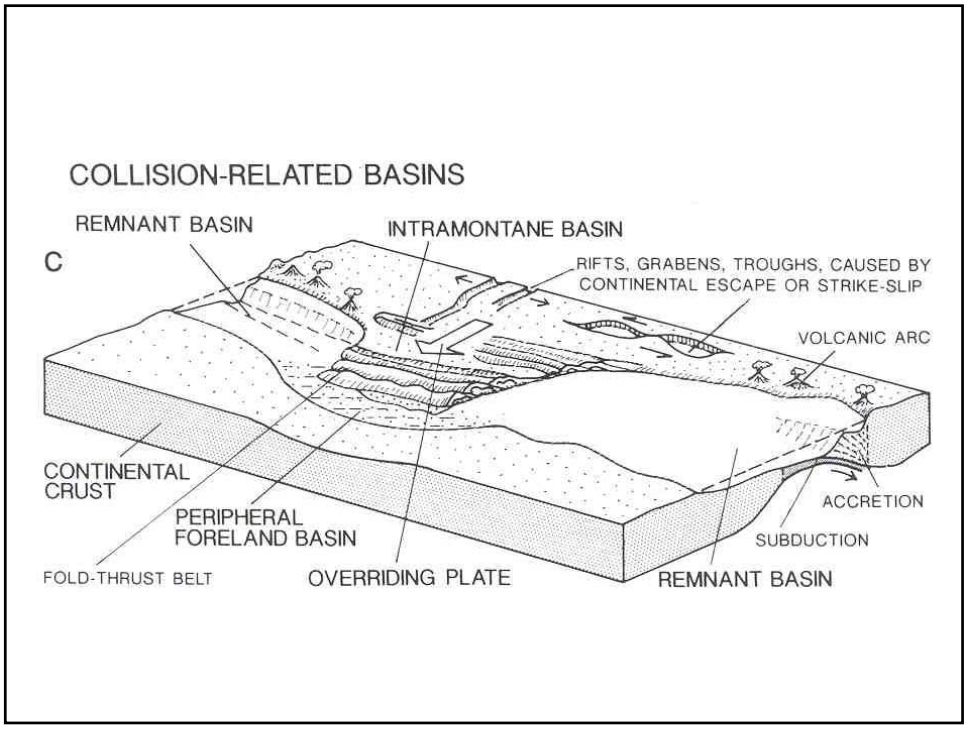
IV. Convergent-margin basins			
6. Subduction zones (trenches)	oceanic	convergence	asymmetric, varying depth and subsidence
7. Forearc, interarc, intra-arc backarc basins	transitional/oceanic	divergence	± symmetric, varying depth and subsidence
8. Retroarc foreland systems (overriding plate)	continental	flexural	asymmetric, varying depth and subsidence
9. Proarc foreland systems (underriding plate	oceanic	flexural	asymmetric, varying depth and subsidence
10. Piggyback basins (thrust-fold belts)	continental	convergence	asymmetric, varying depth and subsidence

Subduction:
1. No terrain accretion: forearc-backarc systems
2. Terrain accretion: orogenesis, and foreland systems



V. Collision and post-collision basins

11. Remnant basins (paleo-trenches)	oceanic	convergence	moderate to low subsidence driven by sediment loading
12. Intramontane basins (thrust-fold belts)	continental	divergence	the equivalent of grabens in thrust-fold belts
13. Foreland systems (pro/retro)	continental	flexural	asymmetric, varying depth and subsidence


COLLISION-RELATED BASINS
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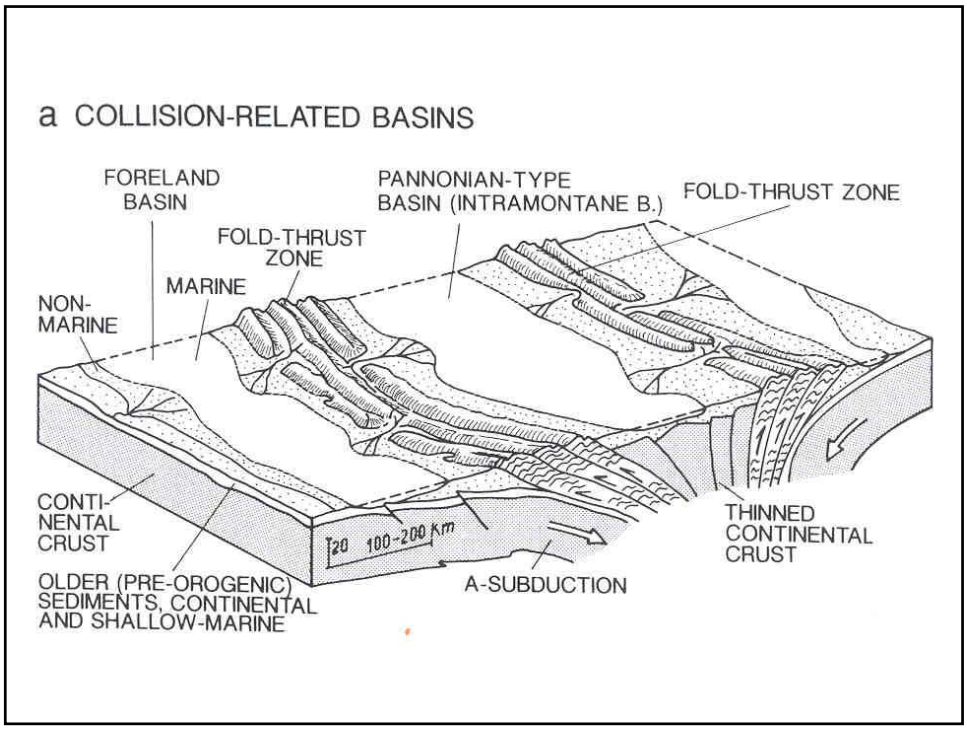
REMNANT BASIN
INTRAMONTANE BASIN
RIFTS, GRABENS, TROUGHS, CAUSED BY CONTINENTAL ESCAPE OR STRIKE-SLIP
VOLCANIC ARC
CONTINENTAL CRUST
PERIPHERAL FORELAND BASIN
ACCRETION
SUBDUCTION
FOLD-THRUST BELT
OVERRIDING PLATE
REMNANT BASIN


a COLLISION-RELATED BASINS
FORELAND BASIN
PANNONIAN-TYPE BASIN (INTRAMONTANE B.)
FOLD-THRUST ZONE
FOLD-THRUST ZONE
MARINE
NON-MARINE
CONTI-NENTAL CRUST
20
100-200 km
THINNED CONTINENTAL CRUST
OLDER (PRE-OROGENIC) SEDIMENTS, CONTINENTAL AND SHALLOW-MARINE
A-SUBDUCTION

VI. Transform- and transcurrent-fault (strike-slip) basins

14. Pull-apart basins	continental/oceanic	transtension	relatively small, elongate, rapid subsidence