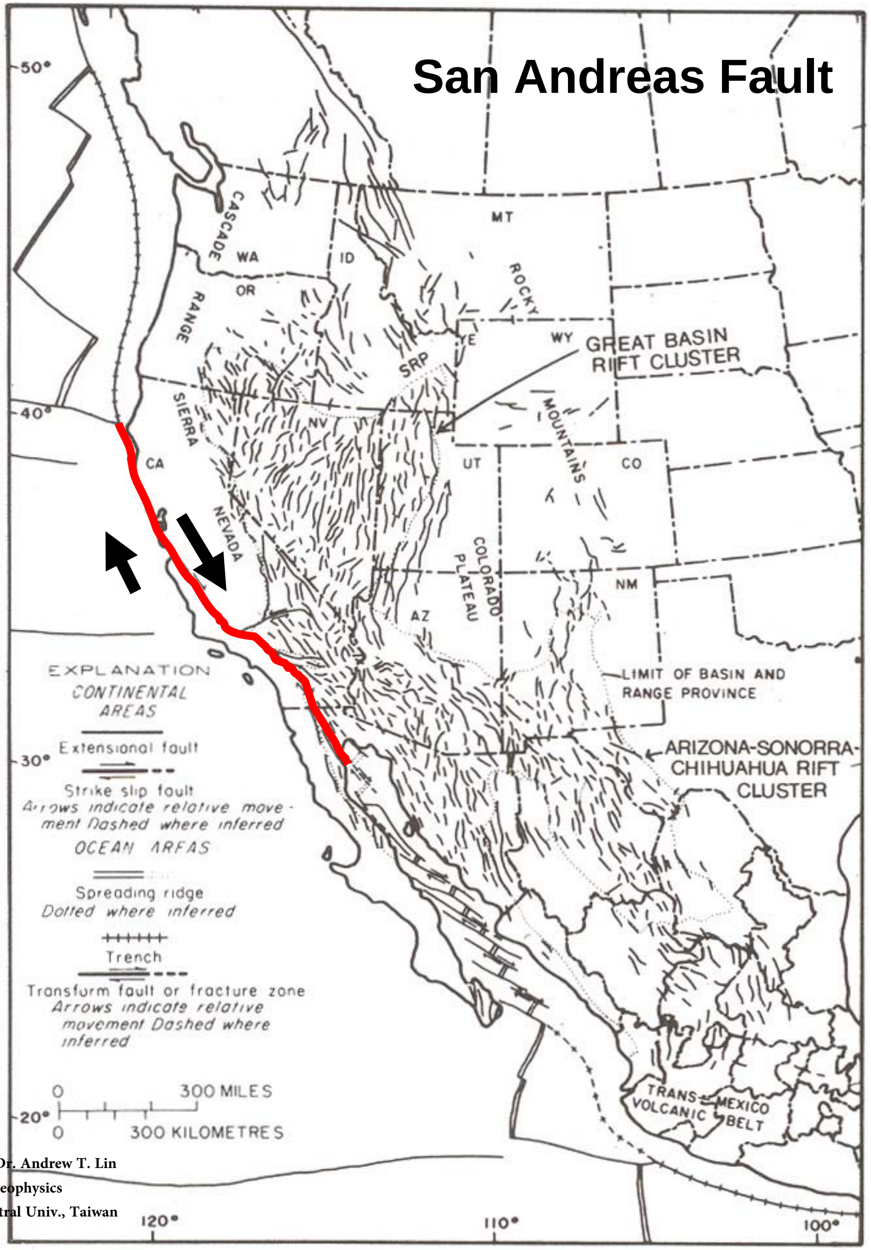
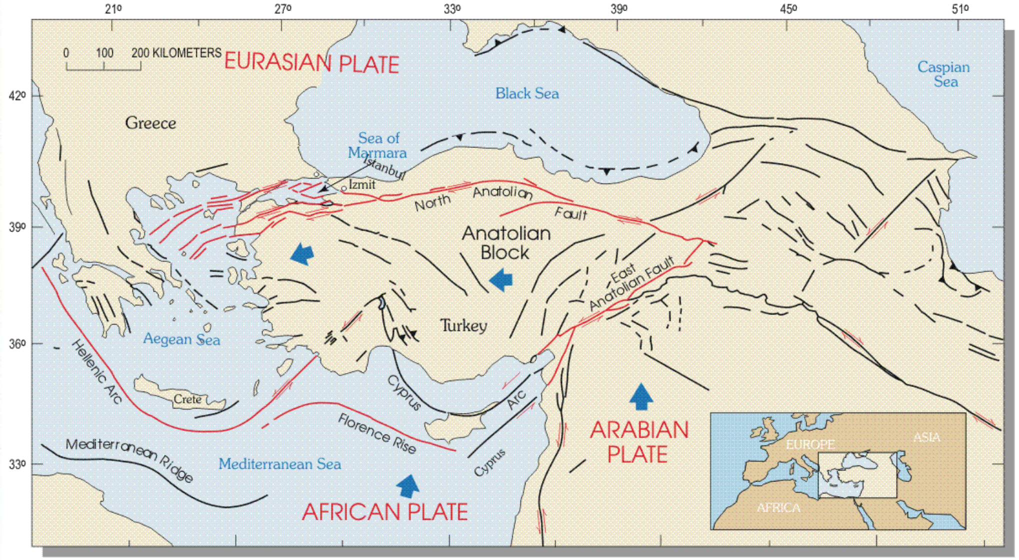
6. Basins associated with strike-slip deformation





Dead Sea transform, East Anatolian and North Anatolian Faults

San Andreas fault system joins a ridge at its southern end to a trench and a transform fault at its northern end.

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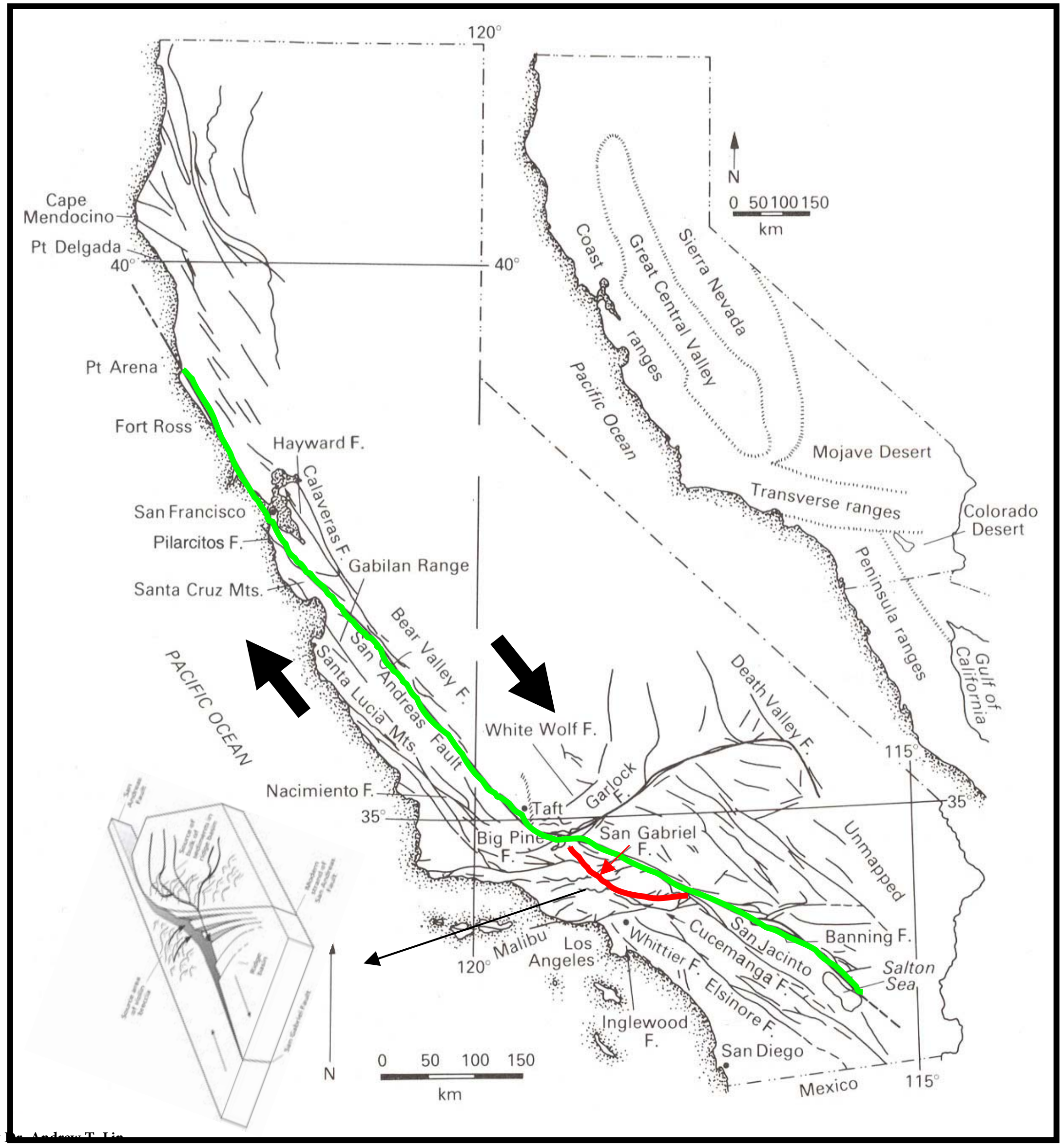
Main features of the SAF



- main strike-slip zone (main through going fault)
- width: 200~300 km
- transpressive vs. transtensional zones
- secondary strike-slip and thrust faults branch off the main strike slip zone
- rotation of small-scale fault blocks
- ~1500 km dextral total offset (300 km taken up by main strike-slip zone, the rest by secondary faults and folds).
- seismicity < 15 km depth
- a weak fault

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Miall's (1984) classification of strike-slip faults

1 *Plate boundary transform faults*	
Intracontinental	San Andreas (California), Alpine (New Zealand), Dead Sea (Middle East)
Intraoceanic	El Pilar–Oca, Caribbean, Greater Antillean–Cayman, Magellan–North Scotia
Oceanic with continental margin or fragment	Bismarck (New Guinea), Fairweather–Queen Charlotte (western Canada)
2 *Divergent margin transform faults*	
(Spreading ridge offsets and fracture zones)	Spitzbergen (Hornsund Fault) (Svalbard), Romanche (Atlantic Ocean), Falkland–Agulhas (Atlantic Ocean), Mendocino (Pacific)
3 *Convergent margin transcurrent faults*	
(Arc parallel)	Sumatra (Sunda Arc), Atacama (Chile), Median Tectonic Line (Japan)
4 *Suture zone transcurrent faults*	
(Oblique collision)	Hornelen Basin faults (Norway), Altyn Tagh and Kunlun (Tibet), North Anatolian (Turkey), Vienna Basin faults (Austria–Czechoslovakia)

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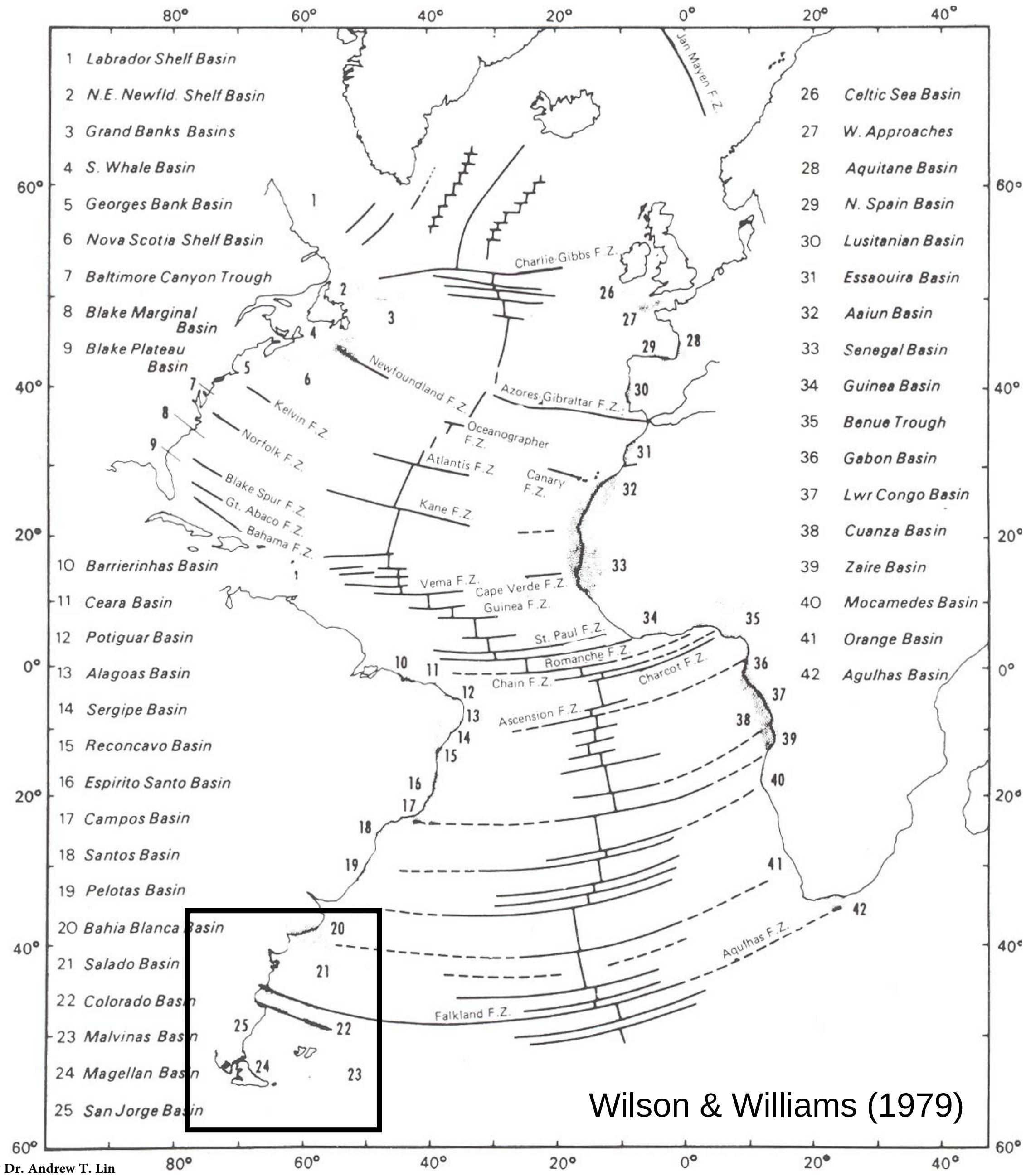
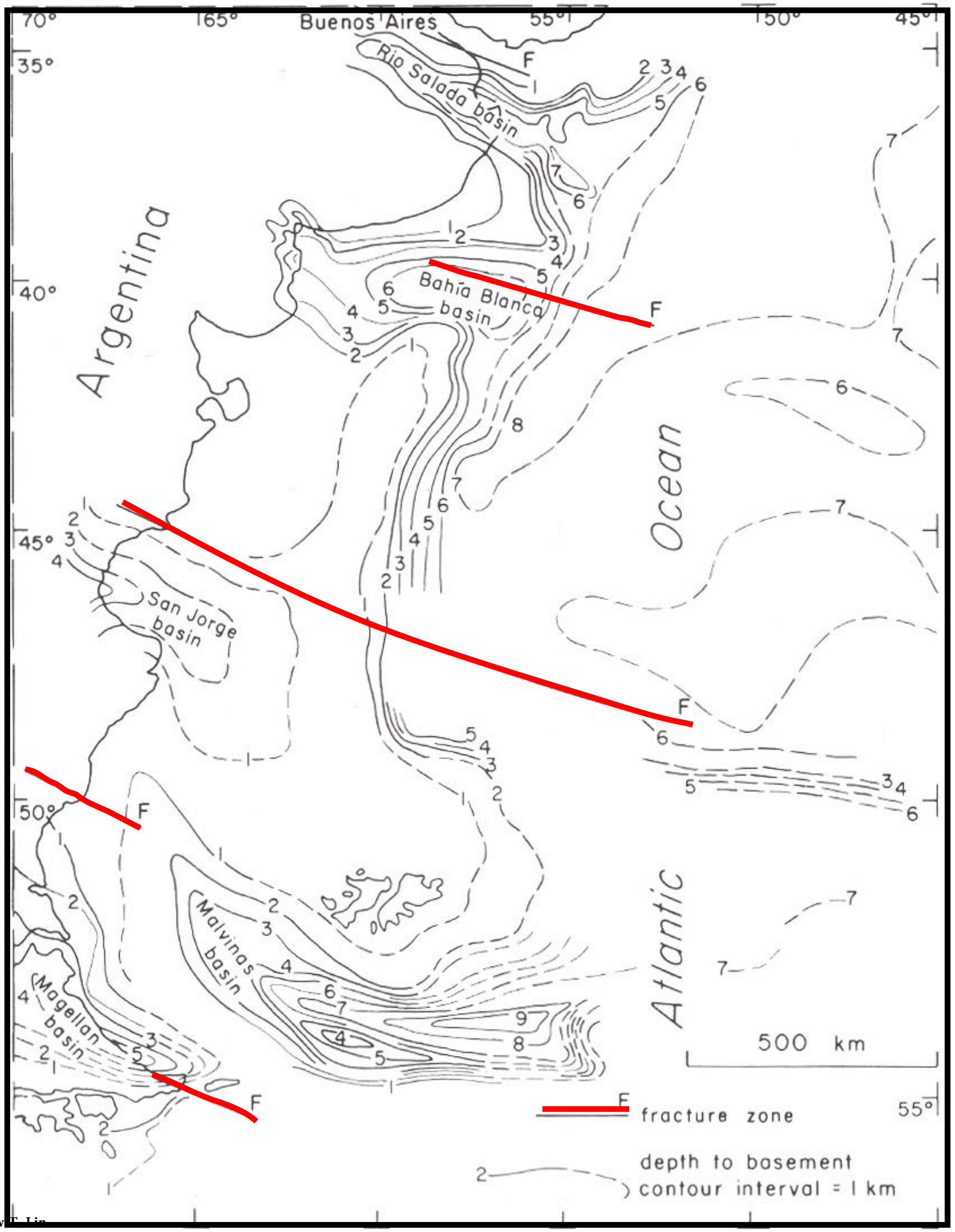


Wilson & Williams (1979)

Fracture zones and continental-margin basins bordering the Atlantic Ocean

Divergent margin transform fault of Miall's (1984) classification



Francheteau & Le Pichon (1972)

Sediment isopachs of the Argentina's passive margin segmented by fracture zones

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Sylvester's (1988) classification of strike-slip faults

1 **Interplate 'transforms'**
(deep-seated, delimiting plate)

1.1 *Ridge transform faults*
Displace segments of oceanic crust with similar spreading vectors
E.g. Romanche fracture zone (Atlantic Ocean)

1.2 *Boundary transform faults*
Separate different plates parallel to the plate boundary
E.g. San Andreas (California), Alpine fault (New Zealand)

1.3 *Trench-linked strike-slip faults*
Accommodate horizontal component of oblique subduction
E.g. Atacama fault (Chile), Median Tectonic Line (Japan)

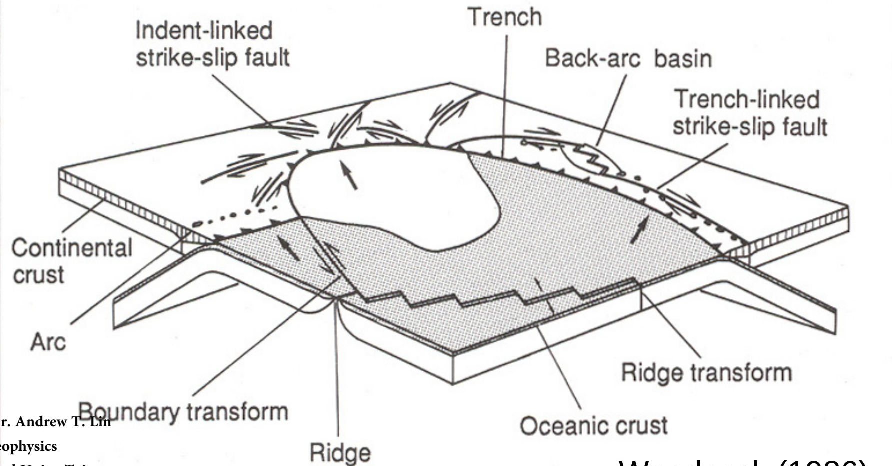
2 **Intraplate 'transcurrent' faults**
(confined to crust)

2.1 *Indent-linked strike-slip faults*
Bound continental blocks in collision zones
E.g. North Anatolian (Turkey), Altyn Tagh and Kunlun (Tibet)

2.2 *Intracontinental strike-slip faults*
Separate allochthons of different tectonic styles
E.g. Garlock fault (California)

2.3 *Tear faults*
Accommodate different displacement within a given allochthon or between the allochthon and adjacent structural units
E.g. Asiak fold thrust belt (Canada)

2.4 *Transfer faults*
Linking overstepping or en echelon strike-slip faults
E.g. Southern and Northern Diagonal faults (eastern Sinai, Israel)



Woodcock (1986)

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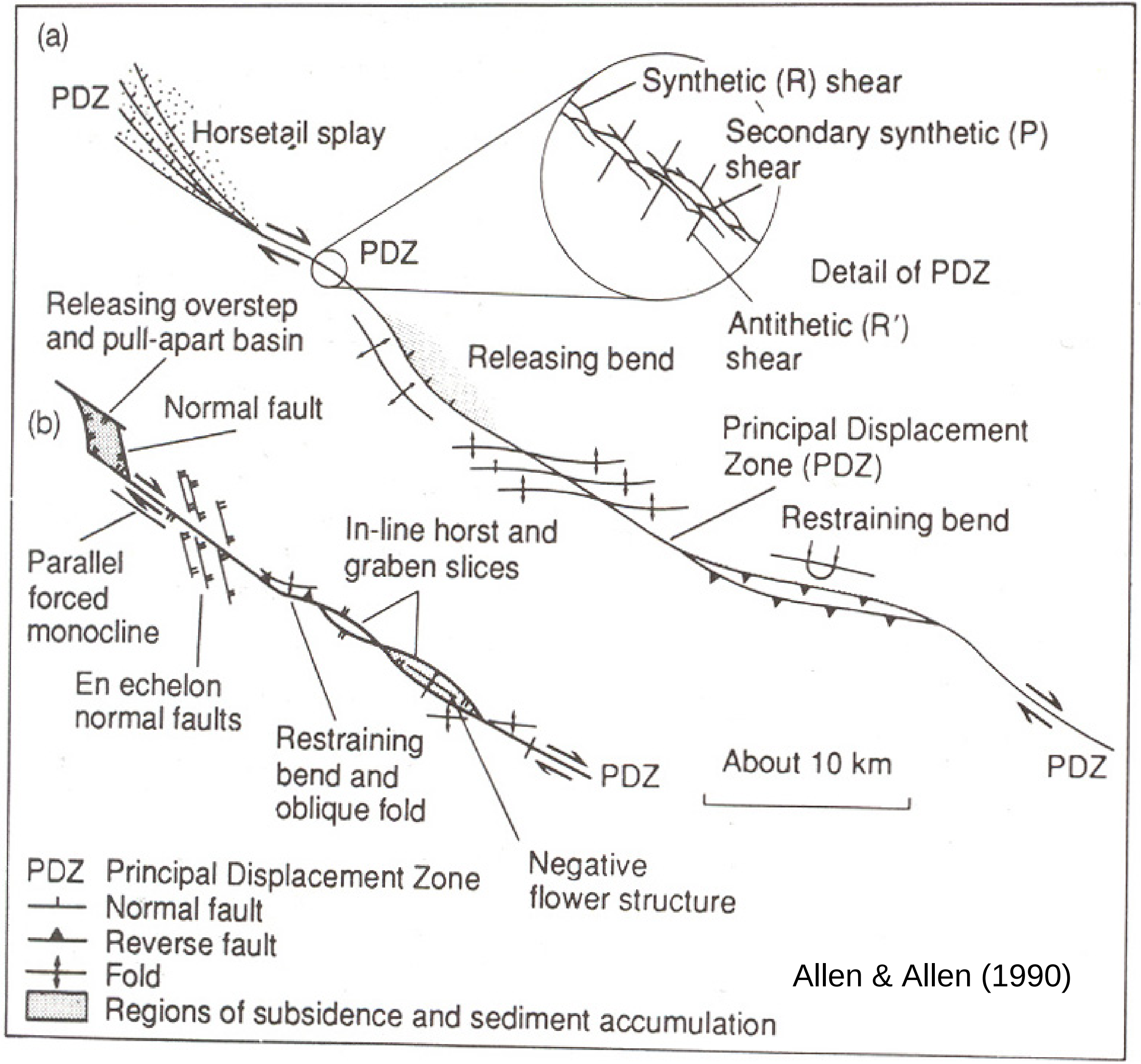
Structures associated with strike-slip systems



Allen & Allen (1990)

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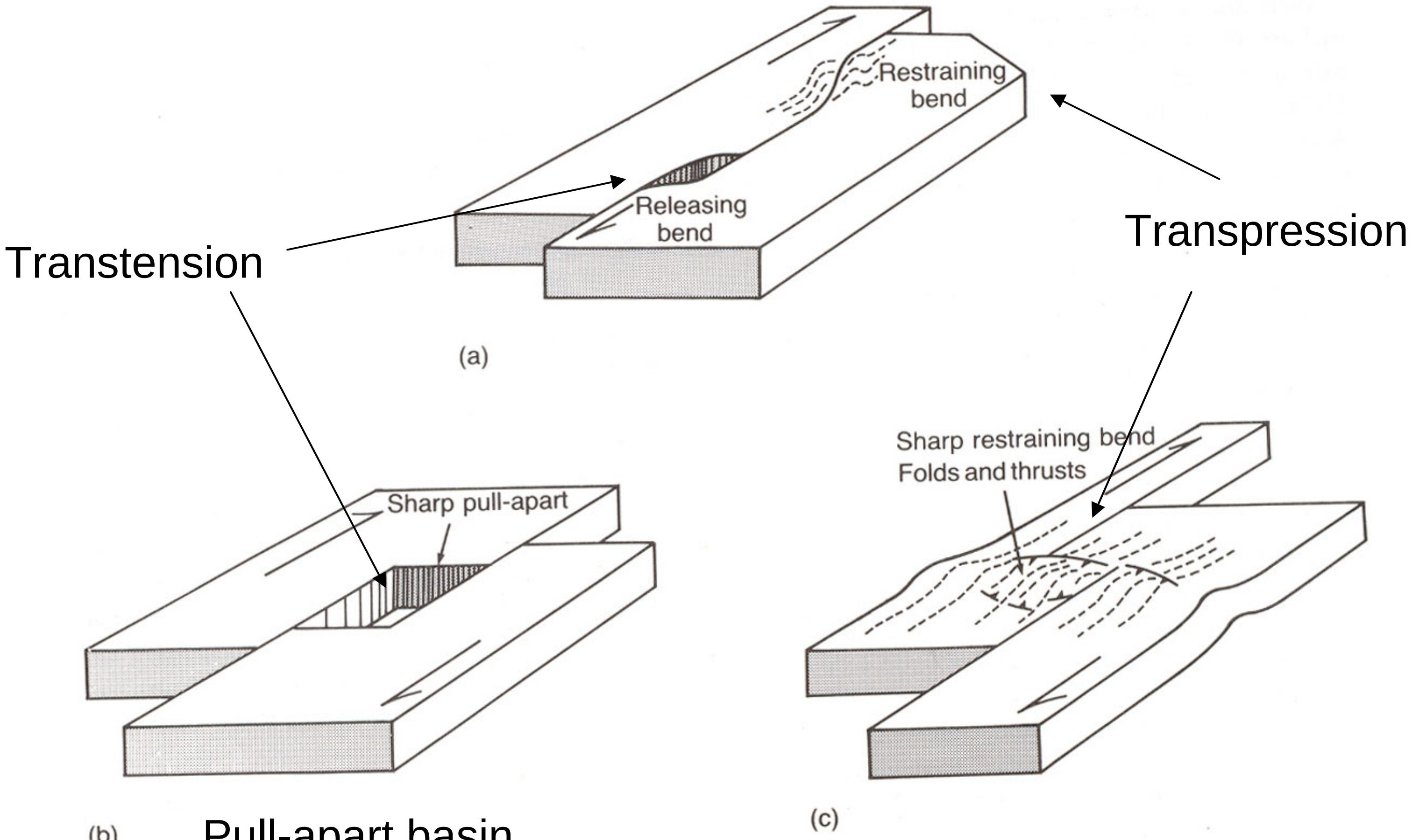
Terminology

Restraining bend: a bend that facilitates movement along the strike of the fault.
Releasing bend: a bend that obstructs movement along the strike of the fault.
Transtension: A tectonic regime combining strike-slip movement with oblique extension.
Transpression: A tectonic regime combining both strike-slip movement with oblique compression.



Pull-apart basin

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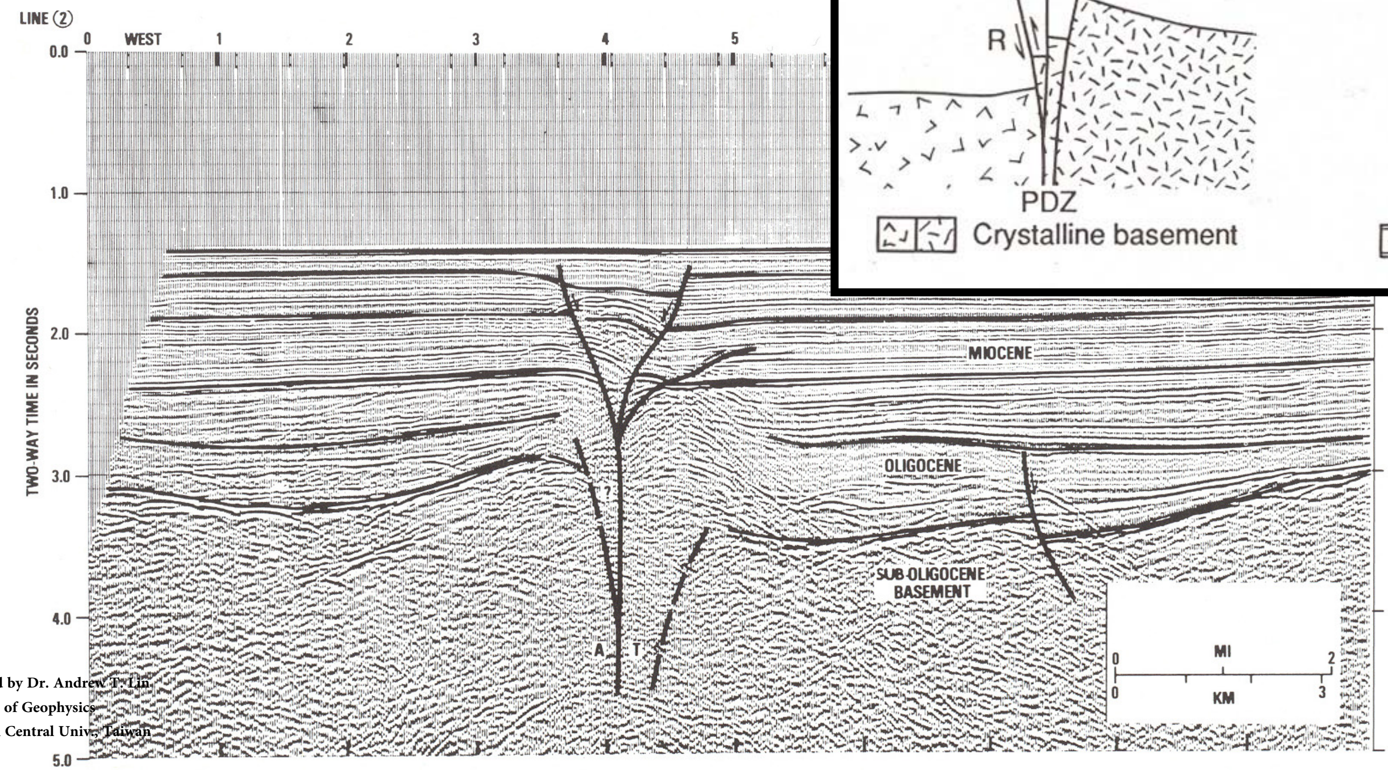
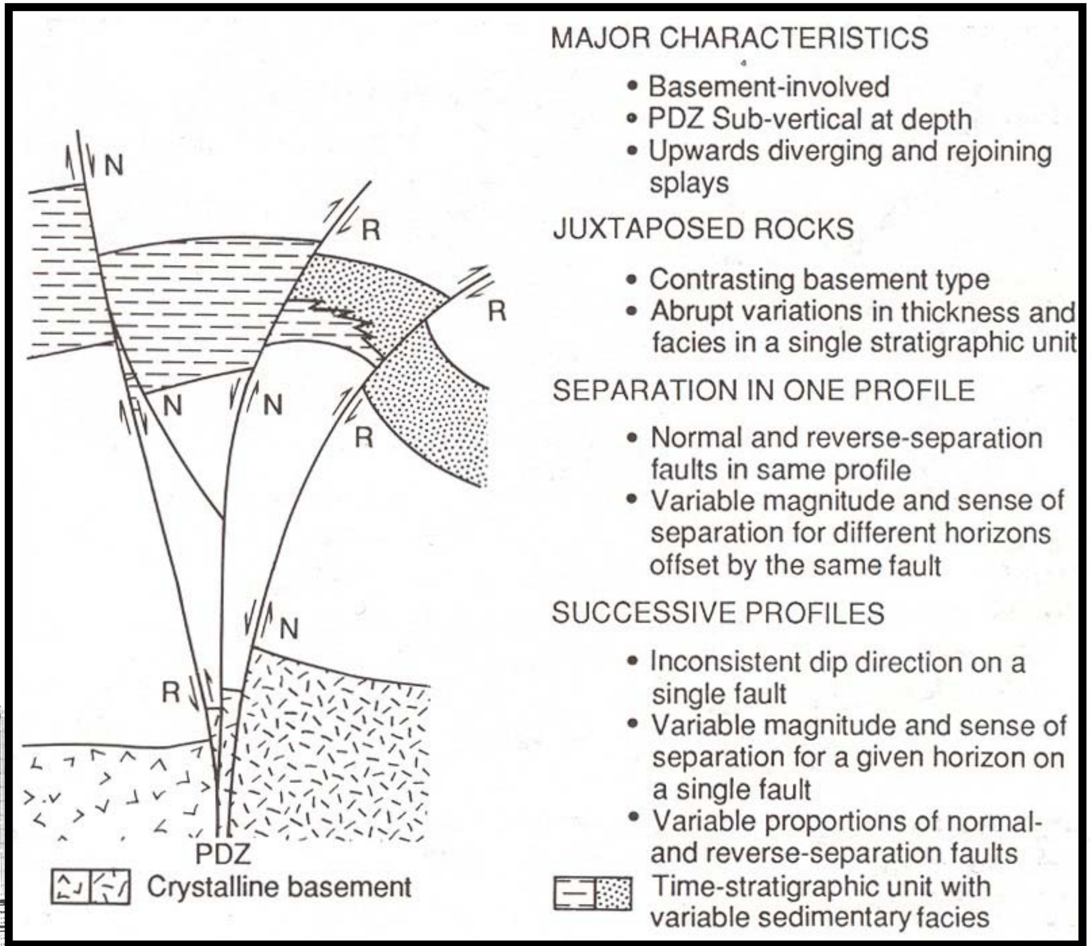
Cross section of strike-slip fault

Positive flower structures

Seismic profile across a wrench fault, showing typical development of a flower structure, Andaman Sea.
T, A: displacement toward (T) and away (A) from the viewer, respectively.

Harding (1985)





Christie-Blick & Biddle (1985)

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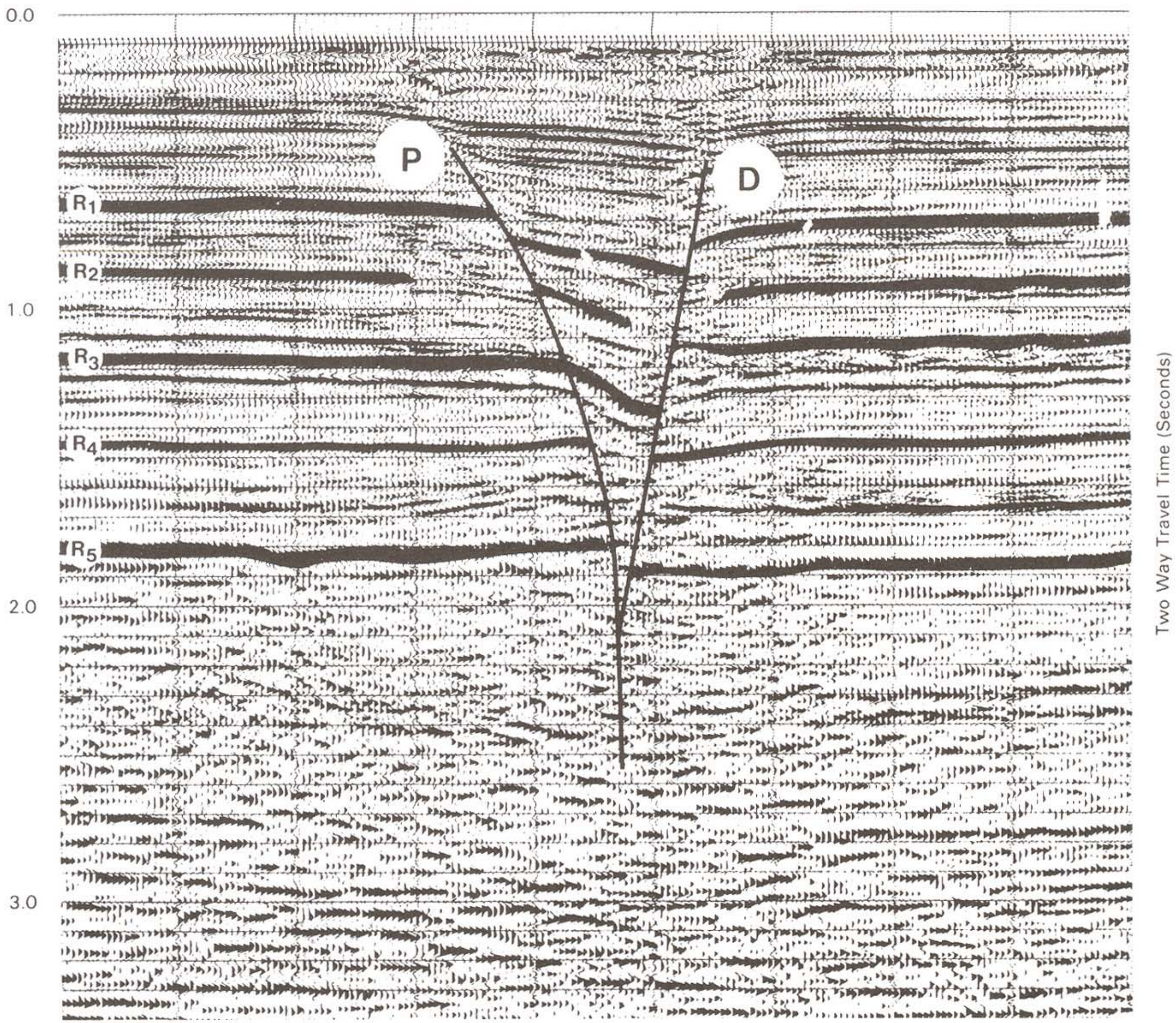
Negative flower structure



Note: P and D indicate fault names.

D'Onfro & Glagola (1983)

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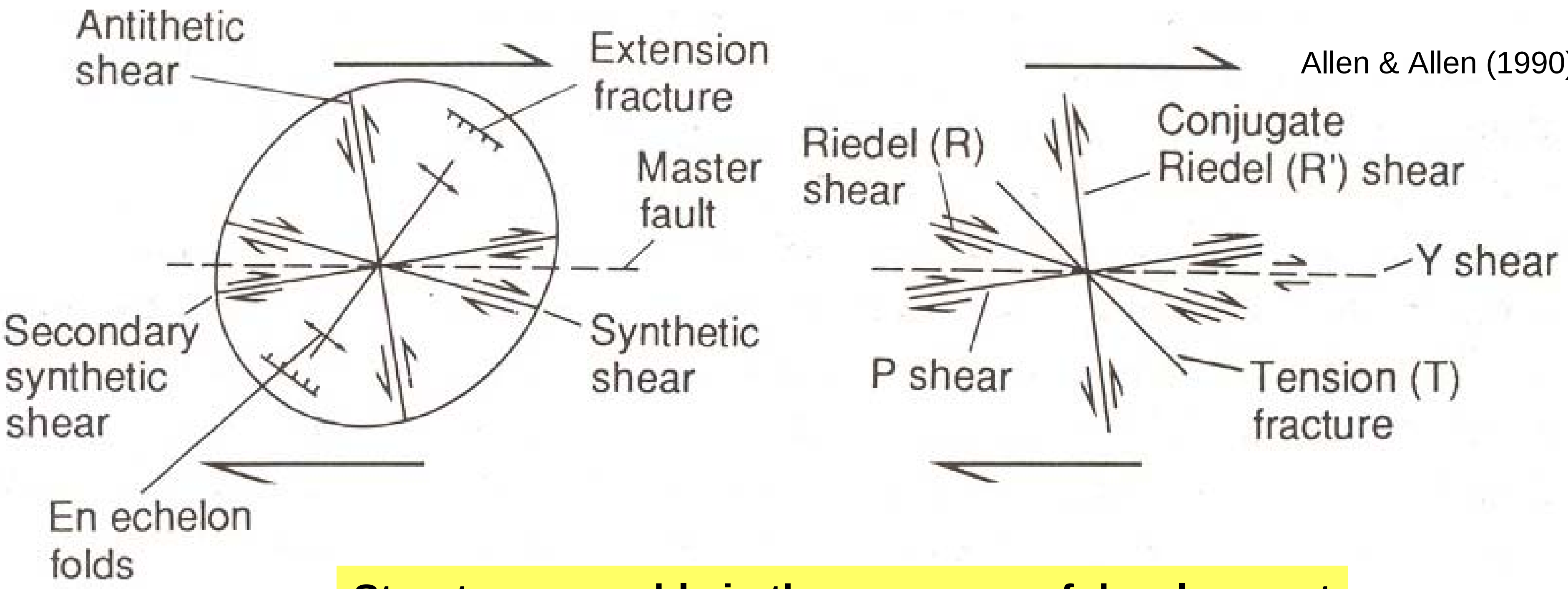
Strain ellipse and structures associated with shear zones



Allen & Allen (1990)

Structures roughly in the sequence of development

Early → **Late**

1. Fold and thrust
2. Extension fracture: Tension fracture (T) or tension gashes
3. Synthetic shear: Riedel shear (R_1 or R)
4. Antithetic shear: Conjugate Riedel shear (R_2 or R’)
5. Secondary synthetic shear: P-shear
6. Master fault: Y-shear

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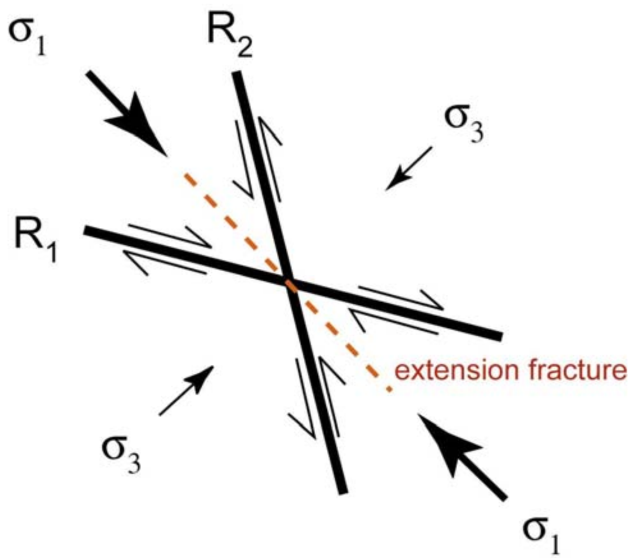
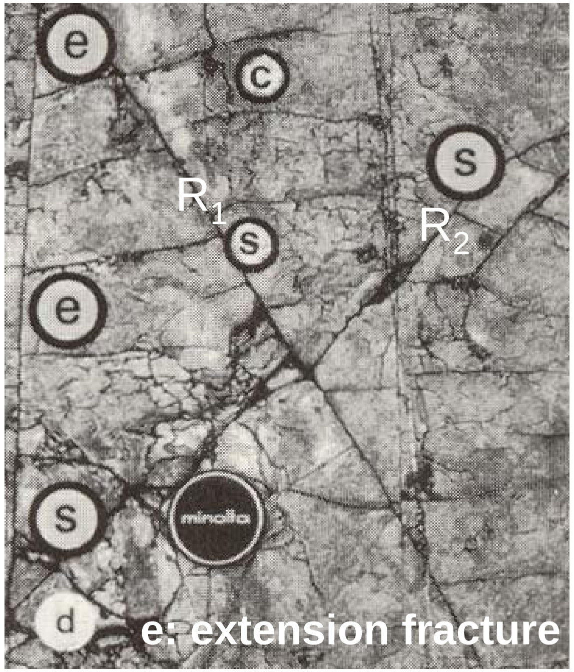
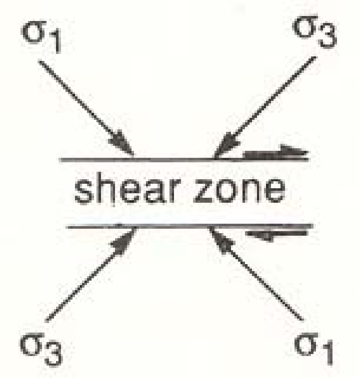
Stress and fracture in homogeneous material

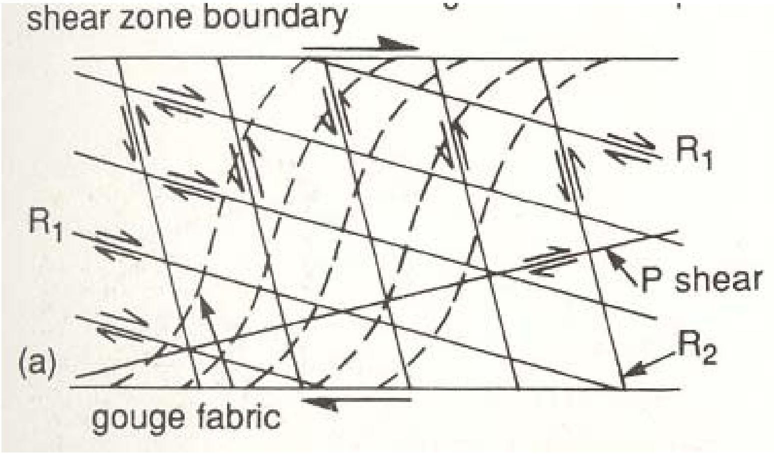


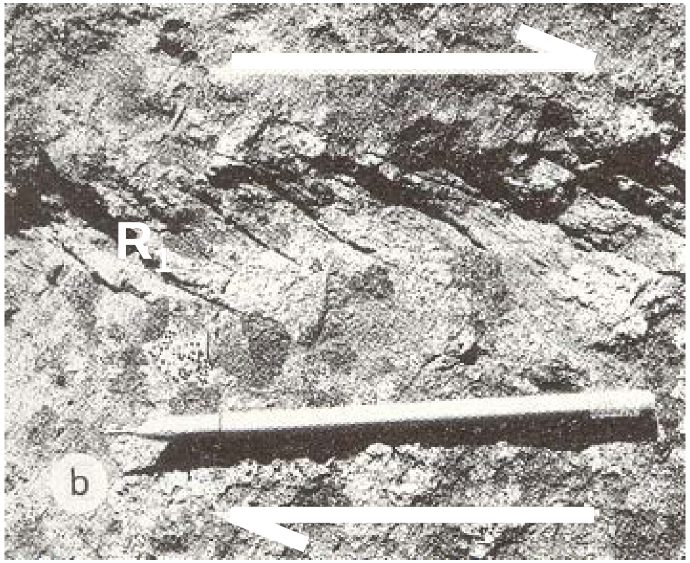


In a brittle shear zone

R_1: Riedel shear
R_2: conjugate Riedel shear







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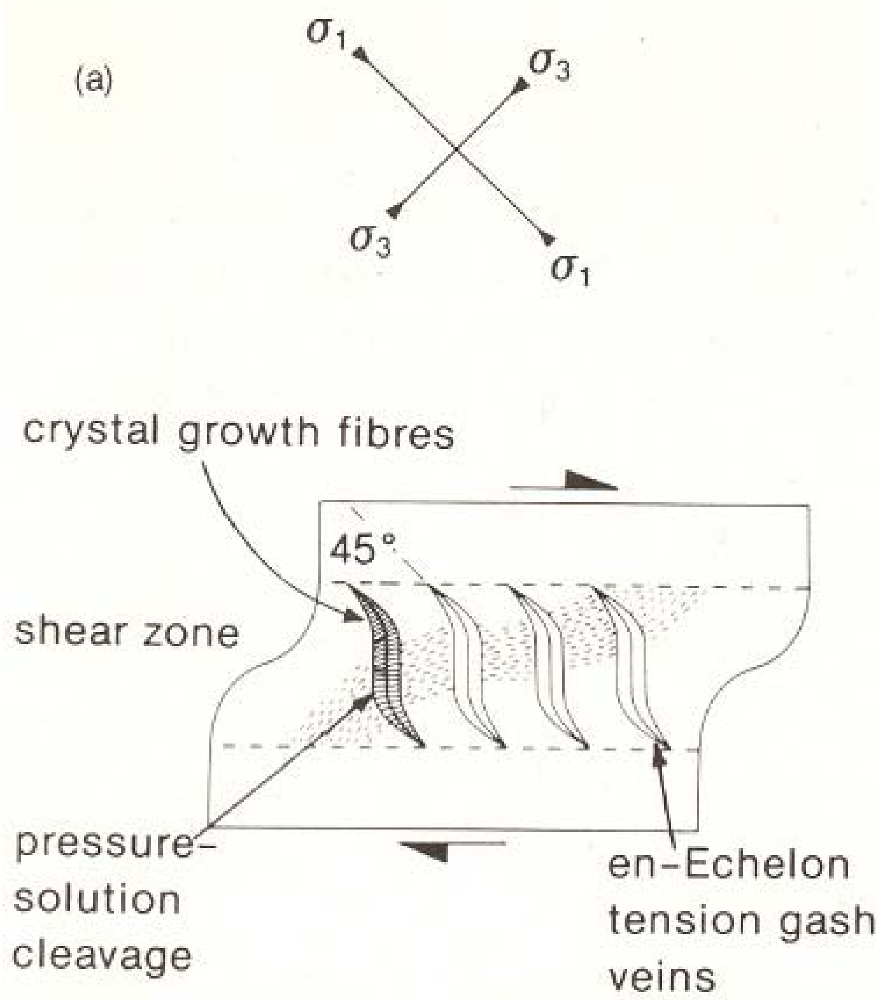
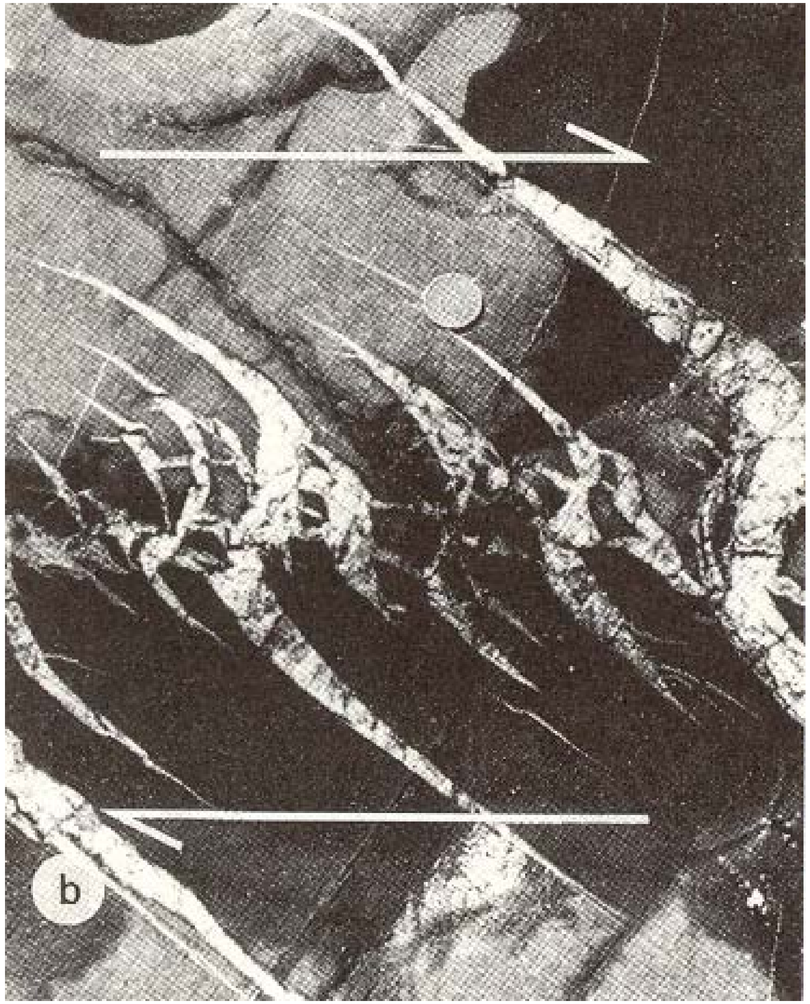
Semi-brittle shear zone (*en-echelon* tension gashes)





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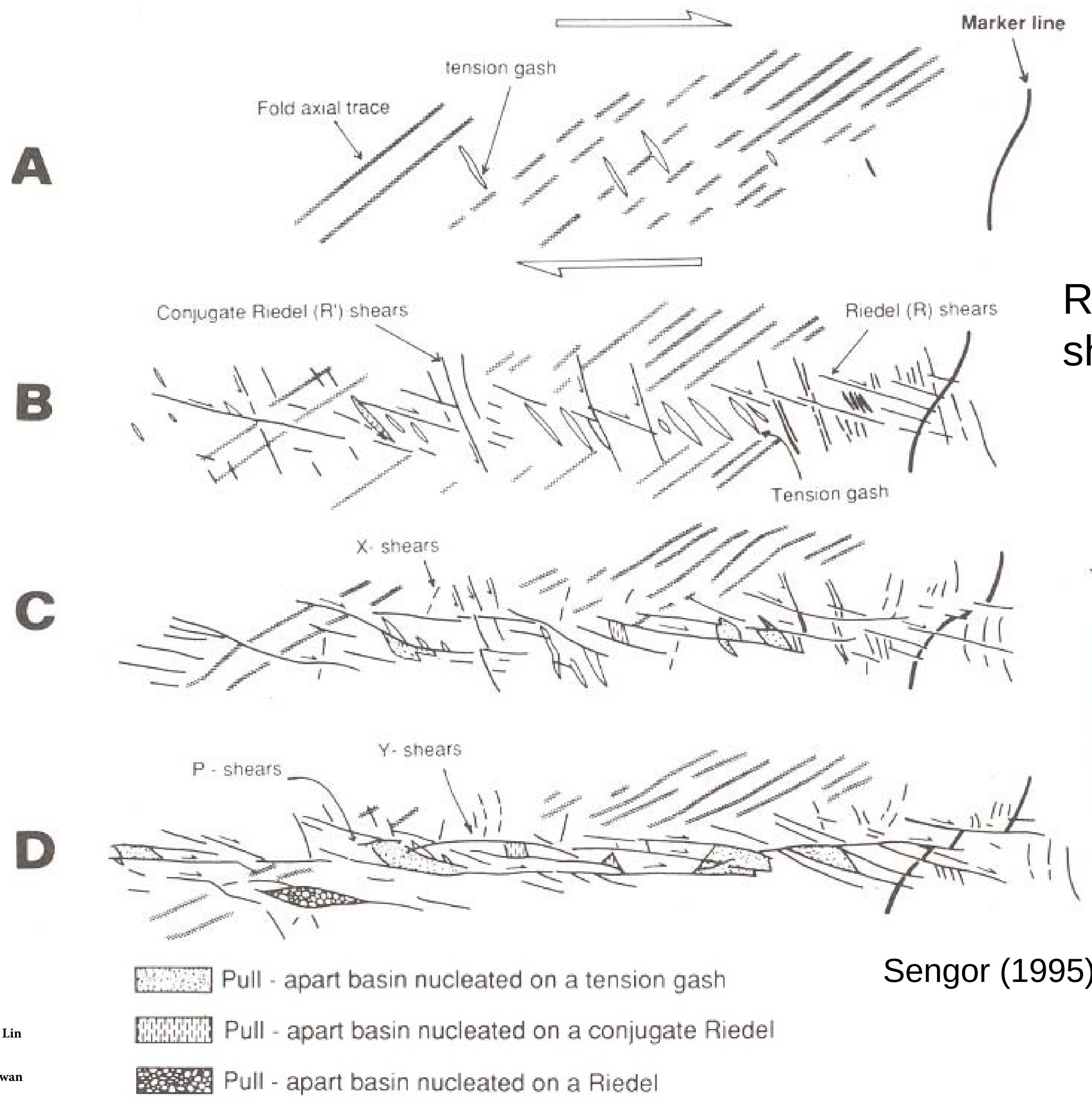
Ideal sequential development of structures and basins in a strike-slip zone



En-echelon folds and tension gashes

PRE-PEAK STRUCTURE

Riedel and conjugate Riedel shears

PEAK STRUCTURE

P-shear and Y-shear

POST - PEAK STRUCTURE

Sengor (1995)

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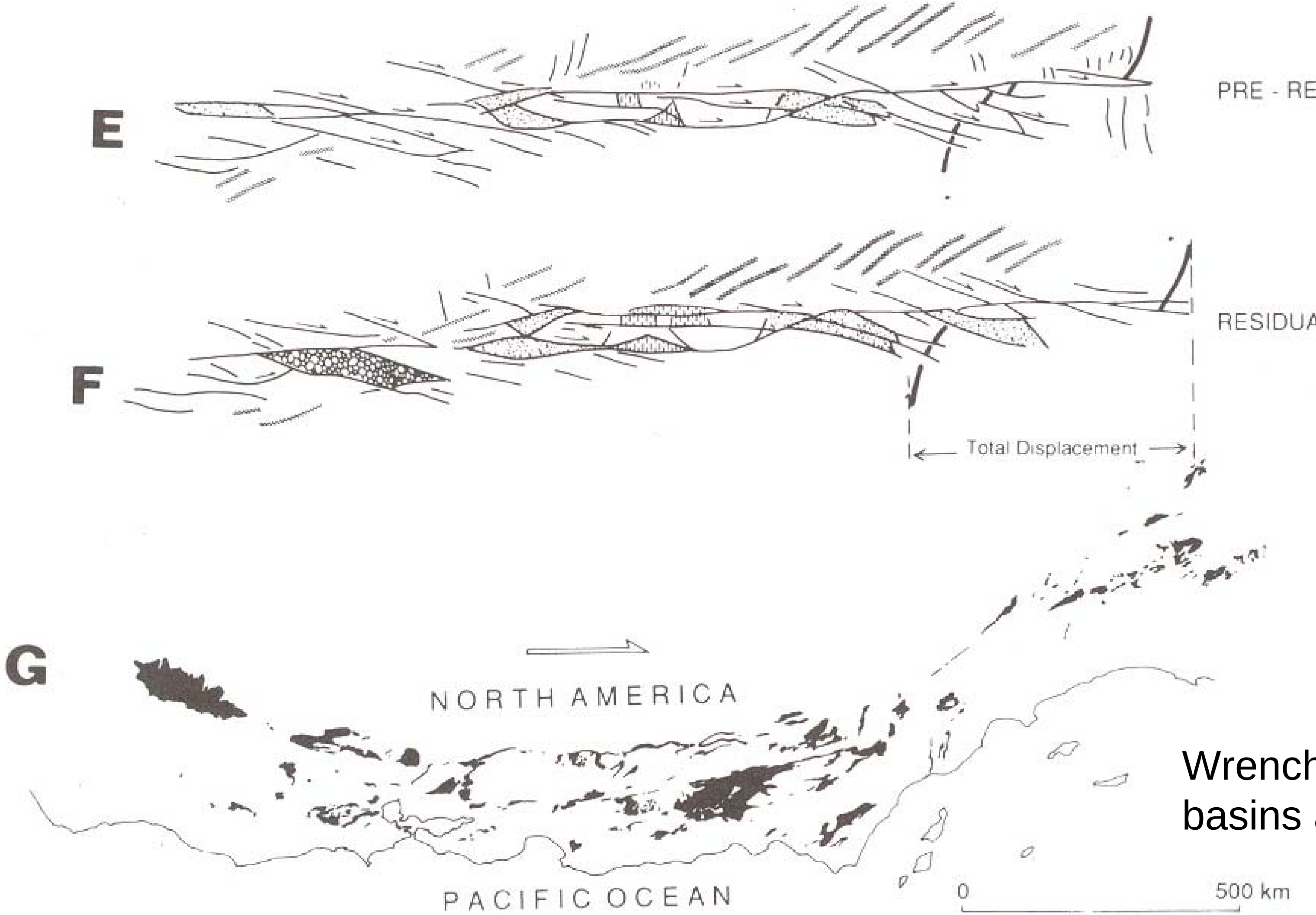
The master fault (Y-shear) results from the interconnection of Riedels and P-shears.



Wrench-related basins along the SAF

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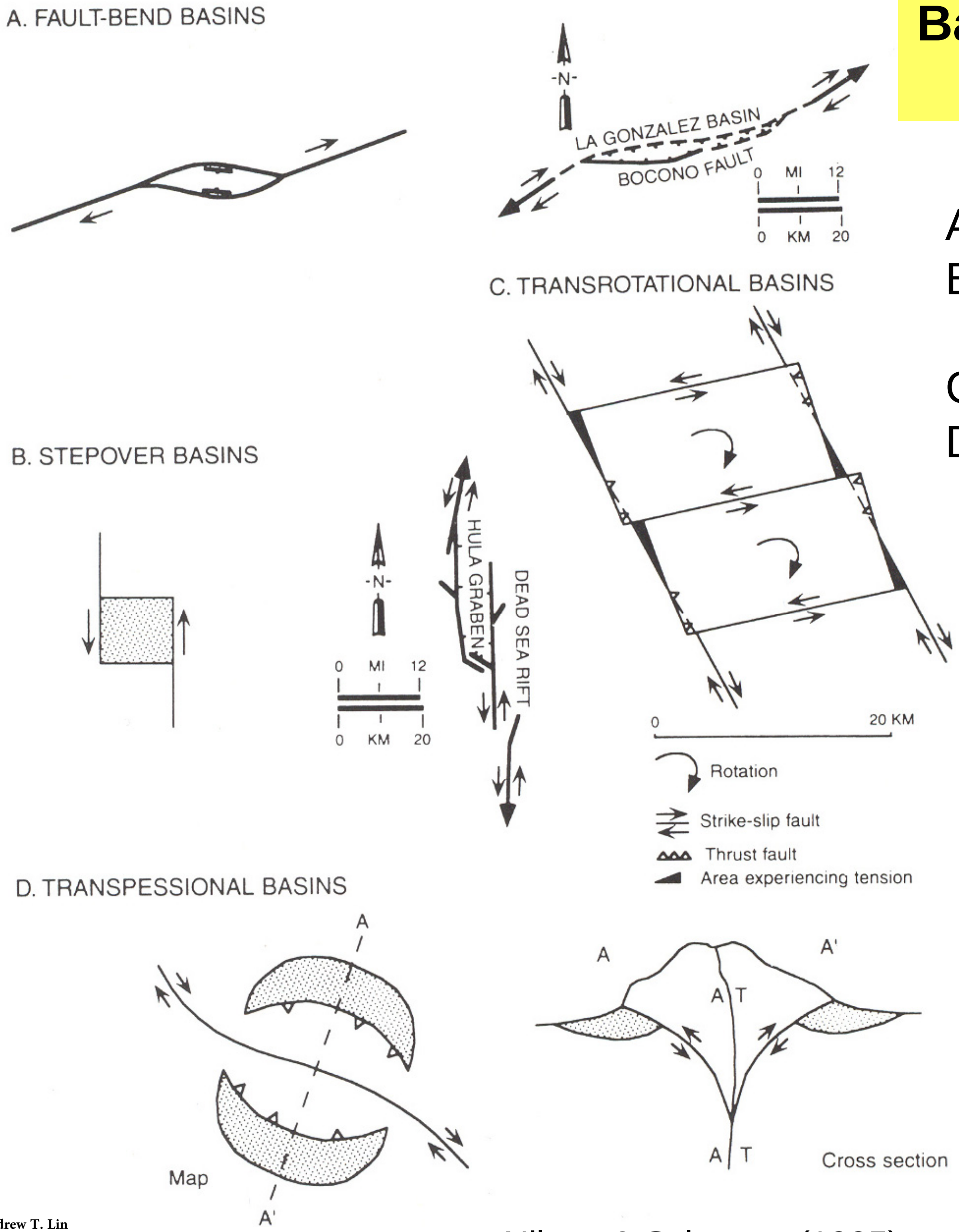

Basins associated with strike-slip faults

A. Fault-bend basins
B. Stepover basins
(transtensional or pull-apart basins)
C. Transrotational basins
D. Transpressional basins

Stepover basin forms between left-stepping faults in left slip and between right-stepping faults in right slip.

Nilsen & Sylvester (1995)

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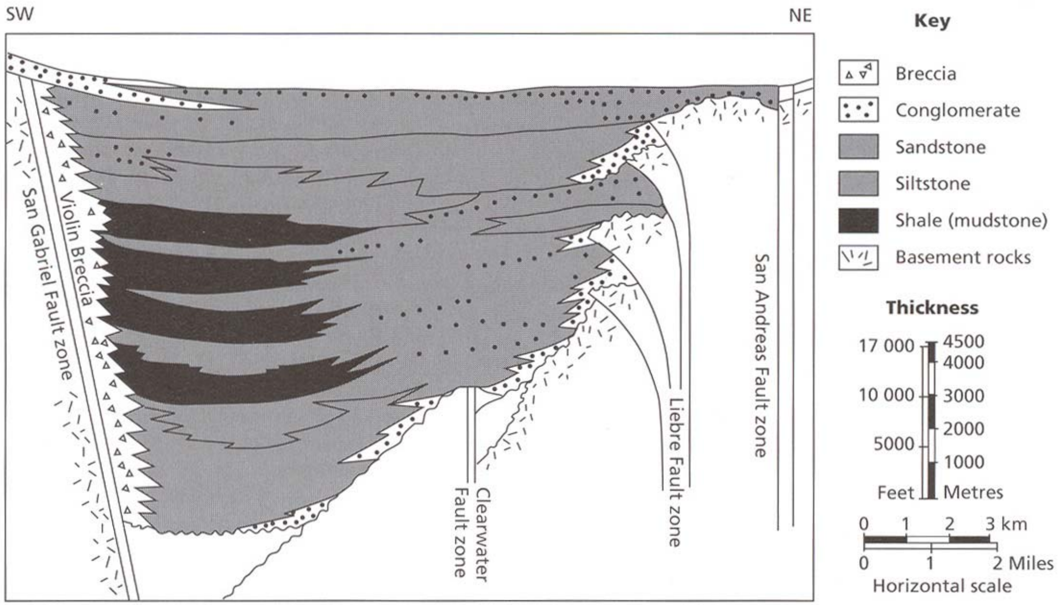
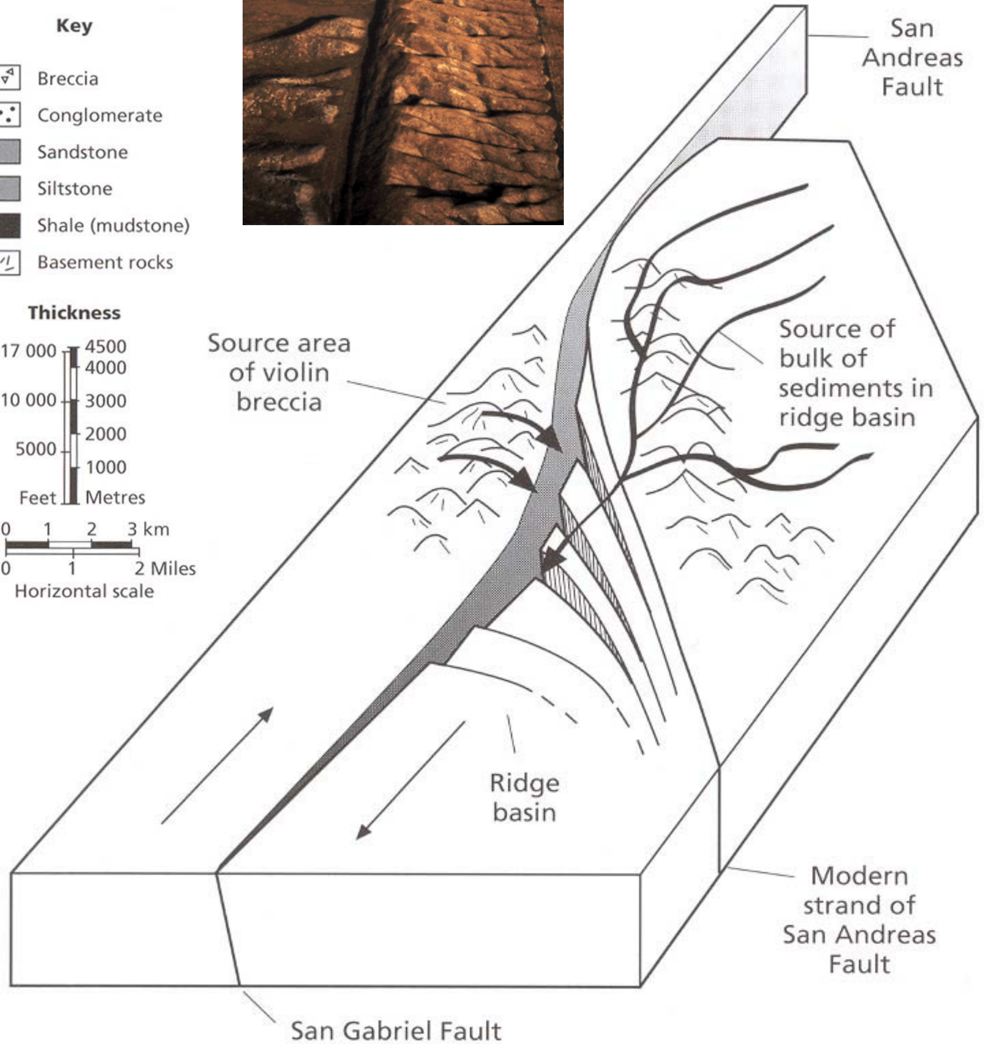
Transpressional basin (Ridge Basin)



Crowell & Link (1982)

12-5 Ma



(inactive now)

Crowell (1974)

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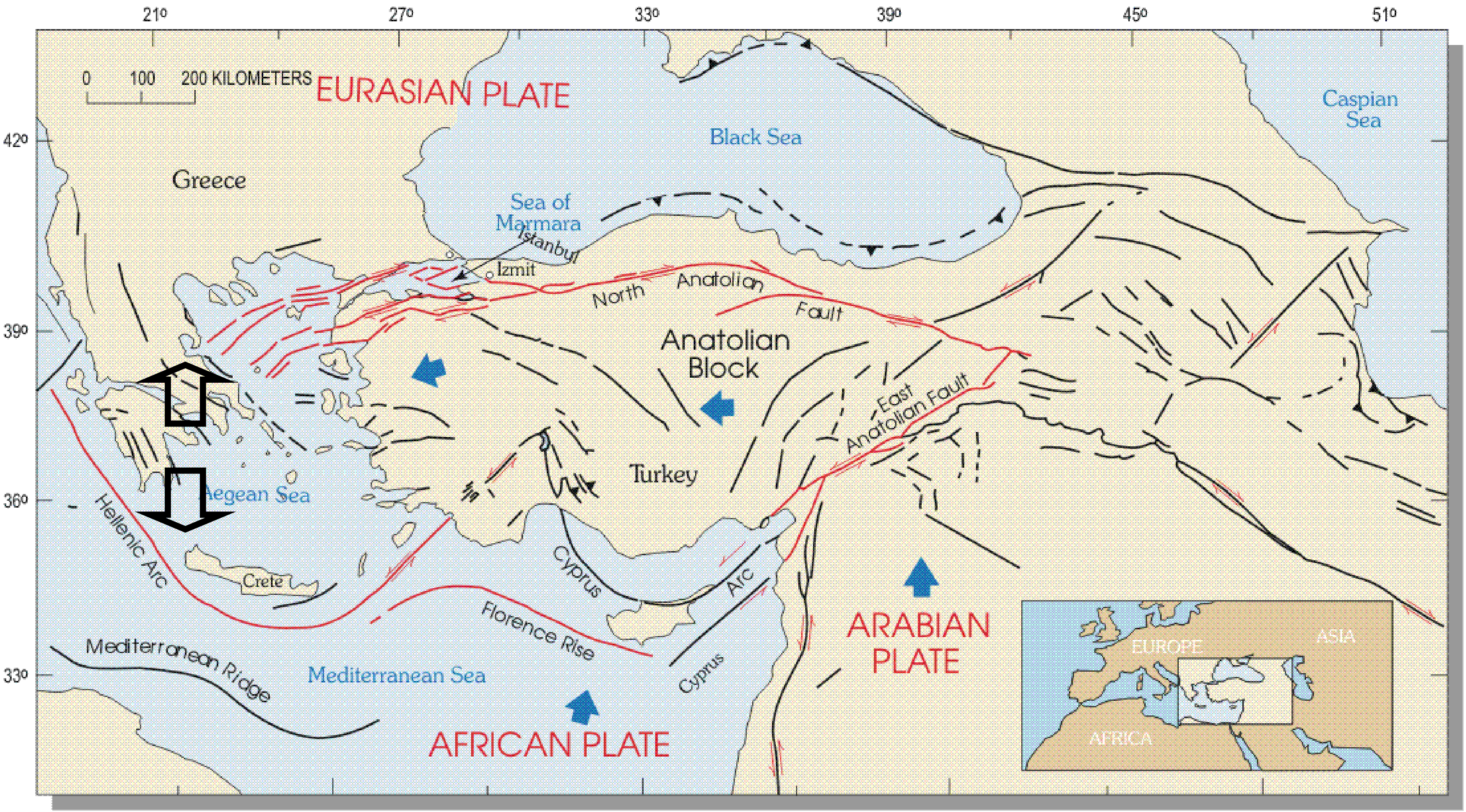
Plates and major faults in the eastern Mediterranean



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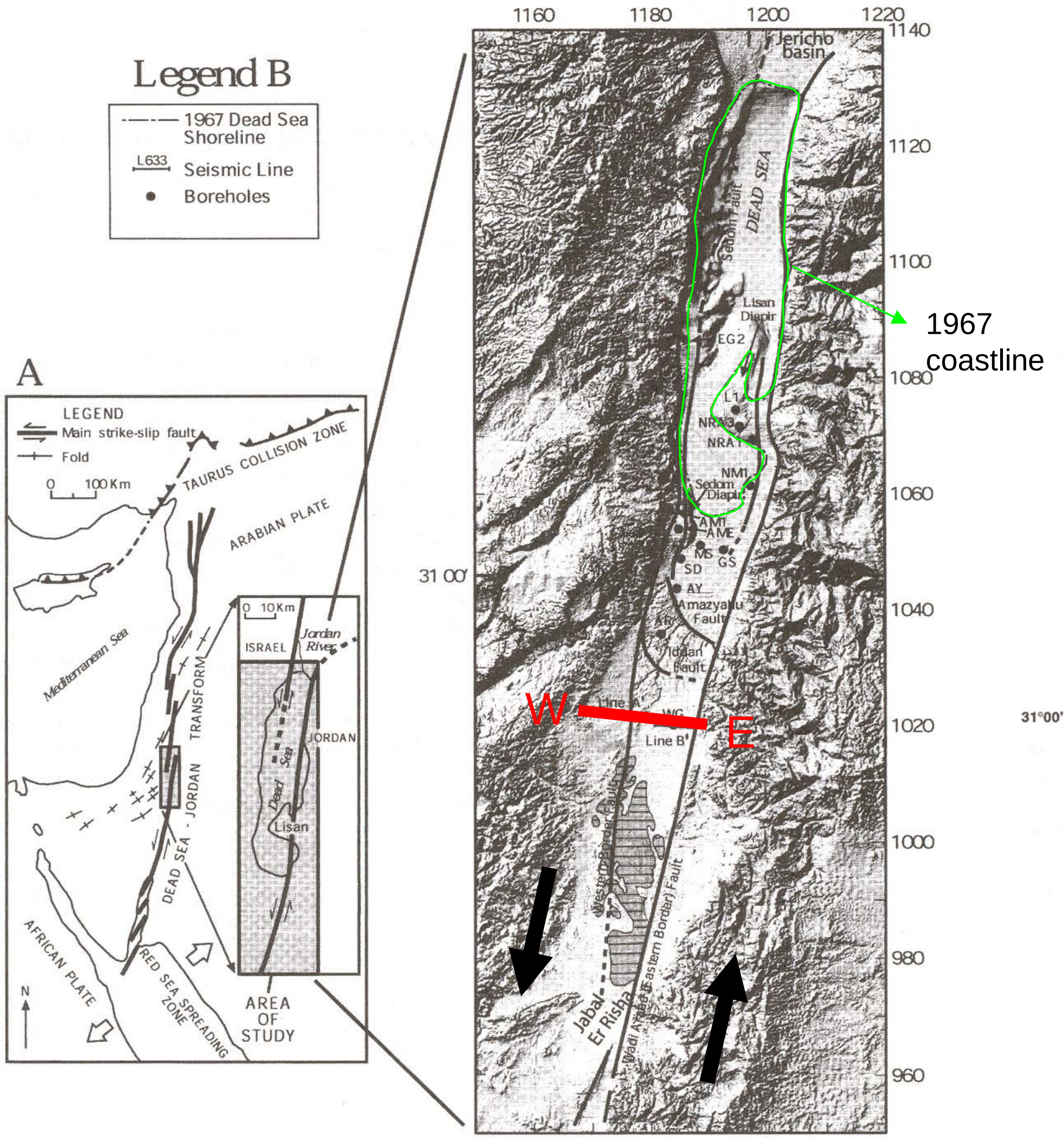
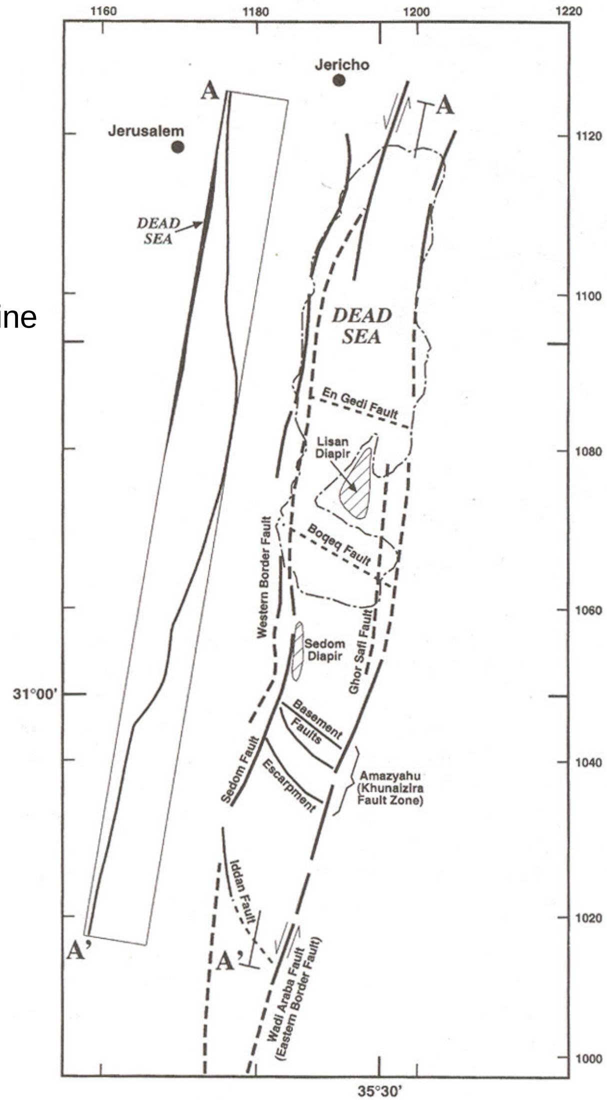
Transtensional basin (Dead Sea Basin)



Al-Zoubi (2002)

Tectonic feature

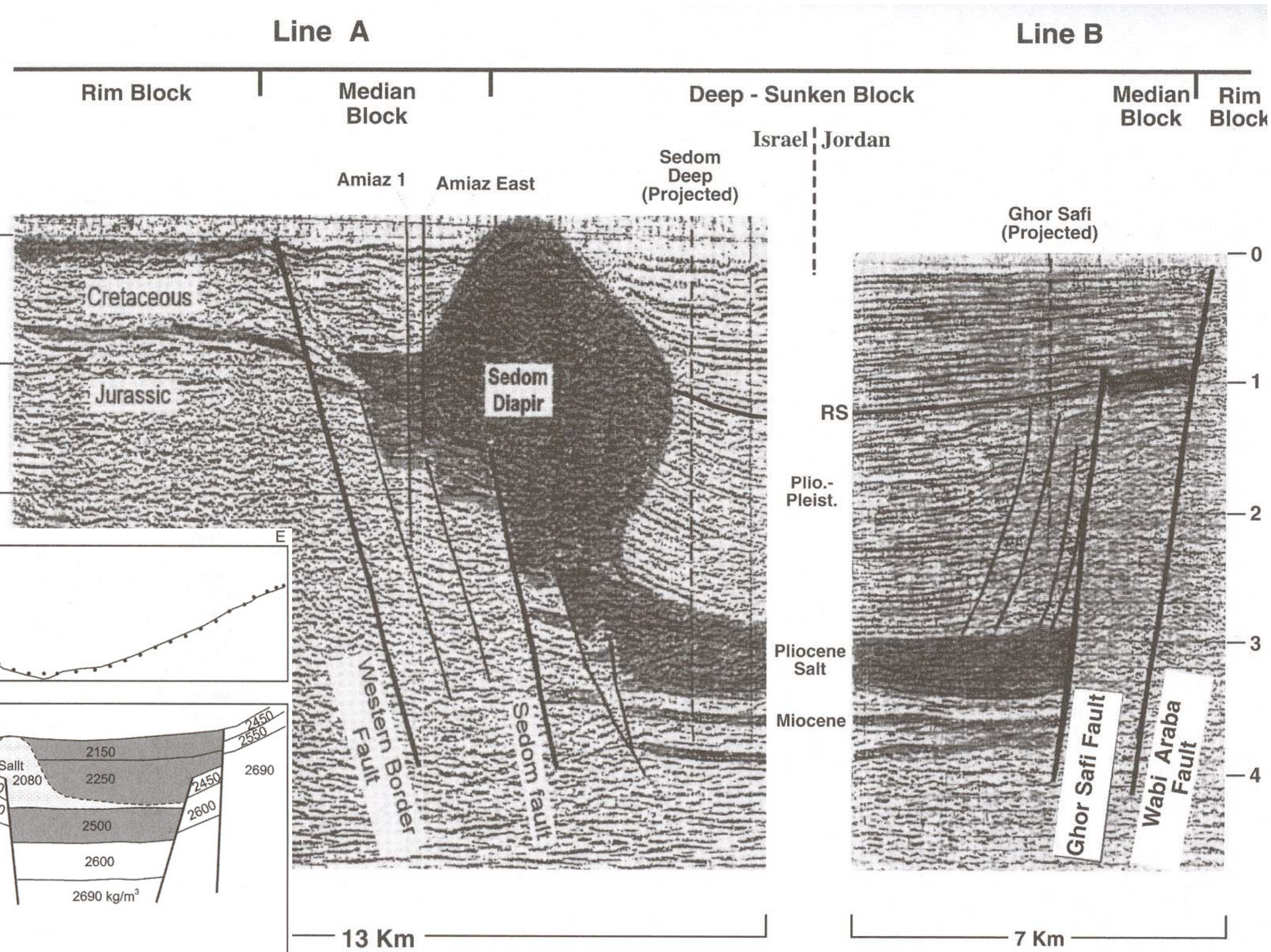


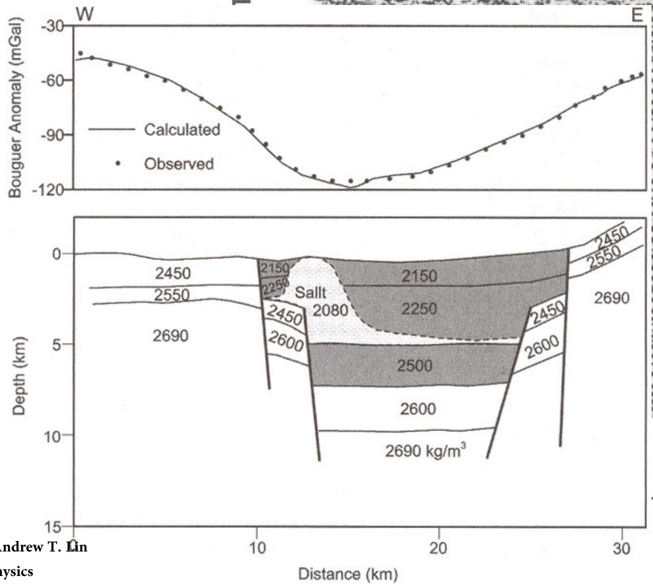
Basin architecture

W

E

Gravity modelling





Al-Zoubi (2002)

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Characteristics of strike-slip basins

Christie-Blick & Biddle (1985)

- mismatches across basin margins;
- longitudinal and lateral basin asymmetry;
- episodic rapid subsidence;
- abrupt lateral facies changes and local unconformities;
- marked contrasts in stratigraphy, facies geometry and unconformities among different basins in the same region.

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