

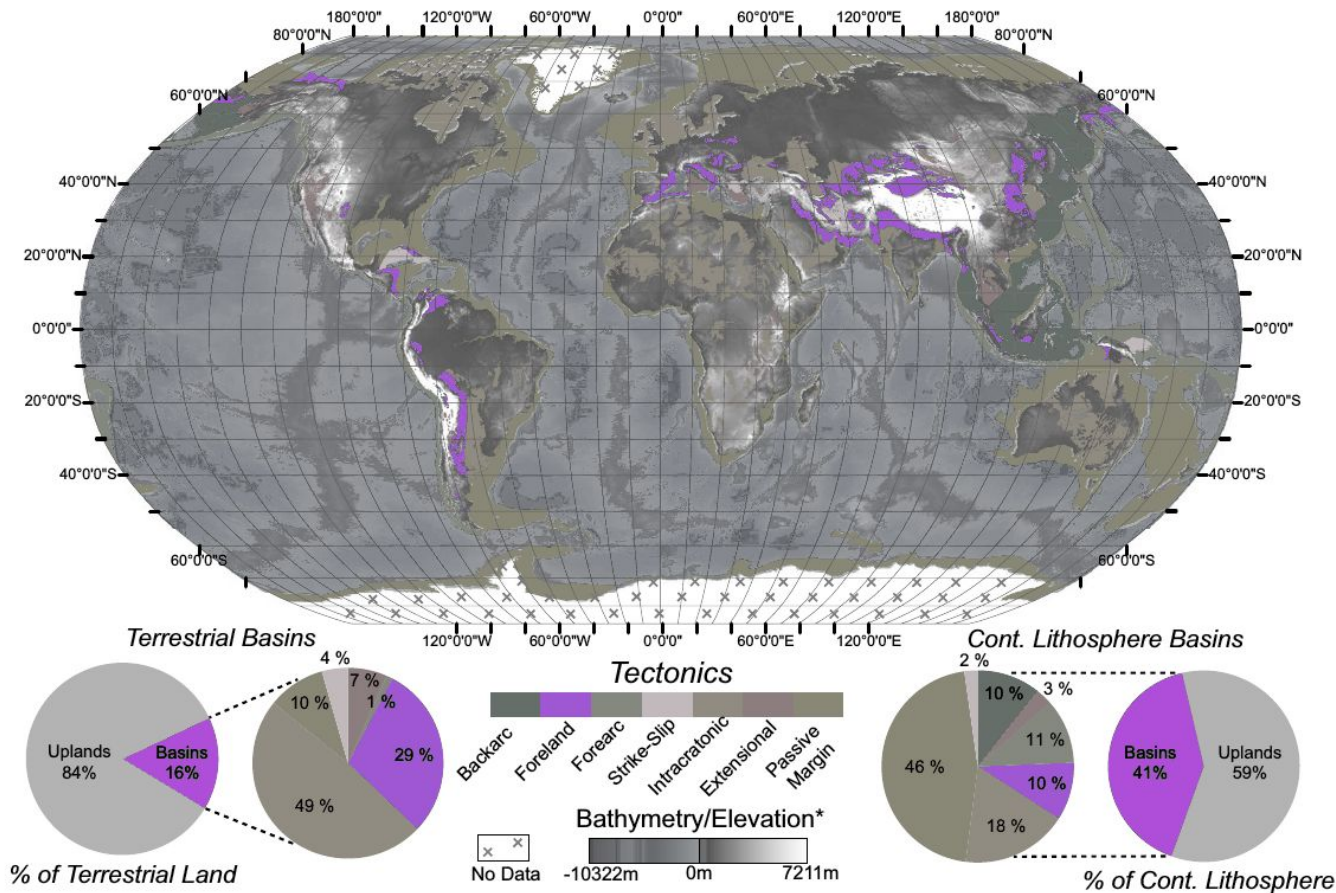


Bacias formadas por subsidiência flexural e topografia dinâmica

Bacias de antepaís, antearco e outras

Bacias de antepaís

Modificado de:
Nyberg, B., Holwell, J.A. (2015)
Geology 43, 643-646.



Bacias de Antepaís

Antepaís- área estável, adjacente a um cinturão orogênico, em direção à qual ocorre transporte tectônico por cavalgamentos e dobras assimétricas. Geralmente é uma parte da crosta continental, na borda de um cráton ou plataforma.

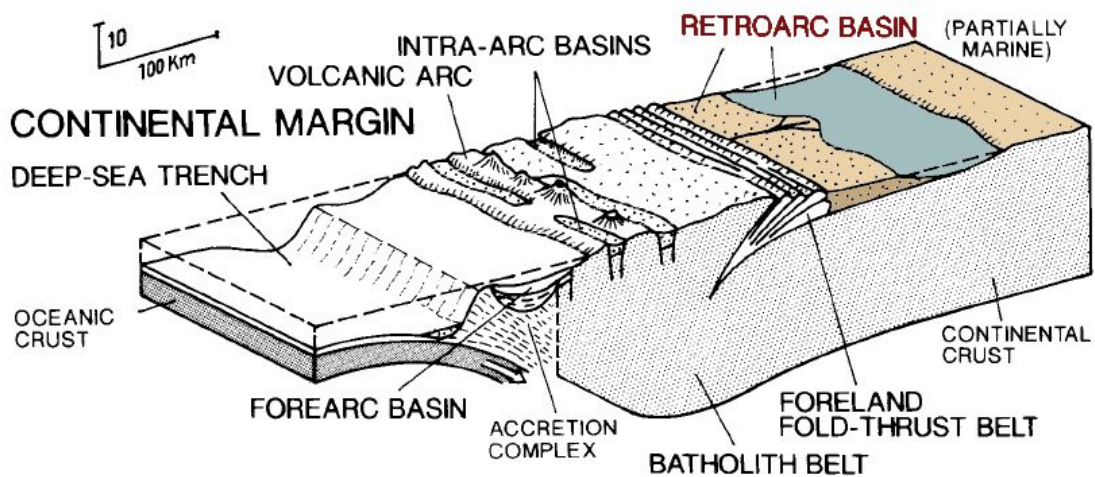
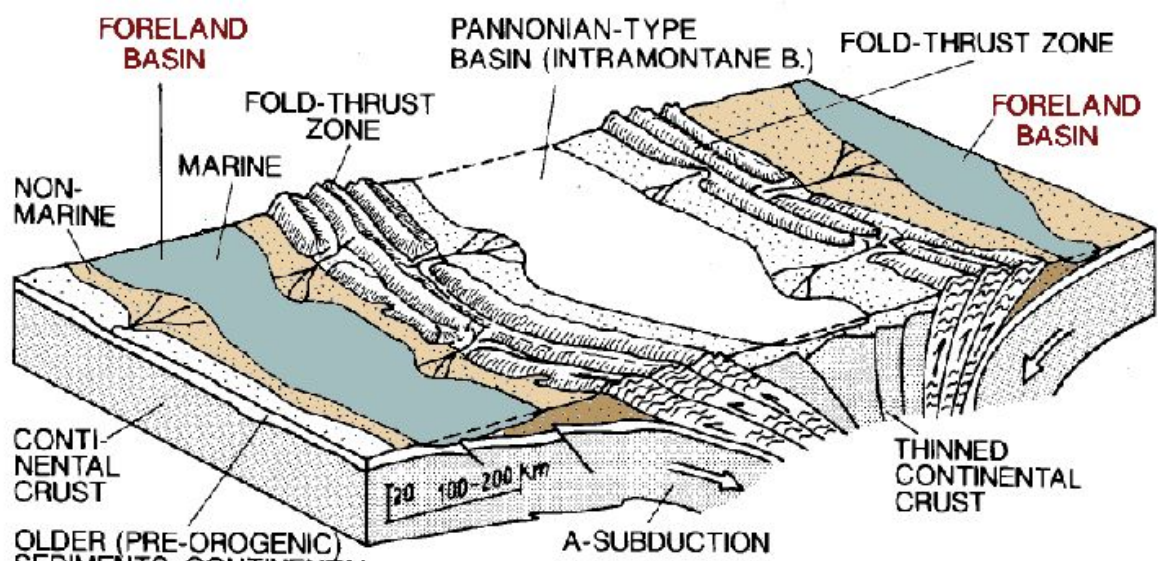
Contexto tectônico – Bacias de antepaís ocorrem em áreas adjacentes a zonas de espessamento crustal, principalmente por flexura causada pela sobrecarga de grandes cavalgamentos.

- **Bacias de retroarco de antepaís** (*retroarc foreland basins*)

- **Bacias colisionais de antepaís** (*collisional foreland basins*)

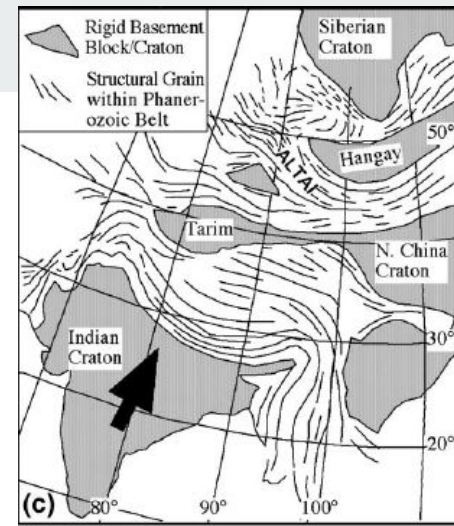
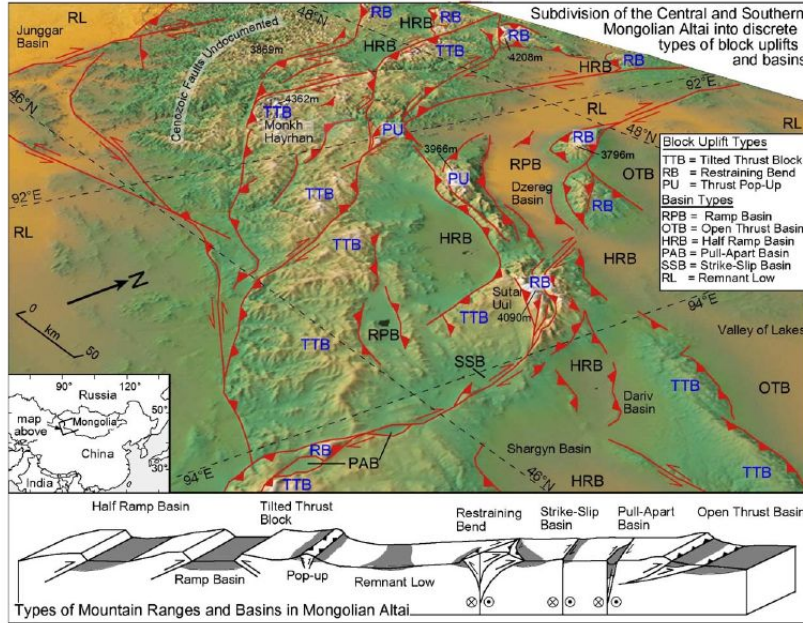
- Bacias periféricas de antepaís (*peripheral foreland basins*)

- Bacias colisionais de retroarco (*collisional retroarc basins*)

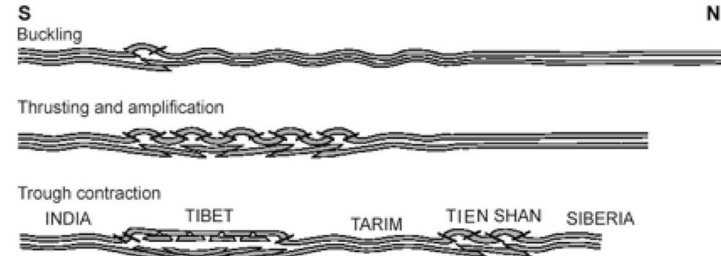


Einsele, G; 1992. *Sedimentary Basins, Evolution, Facies and Sediment Budget*.
 792 p.

Bacias flexurais intra-placa



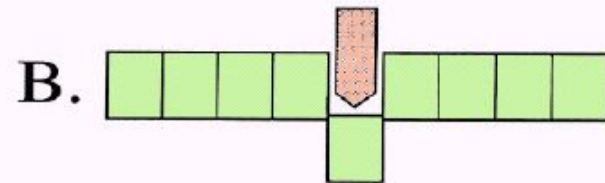
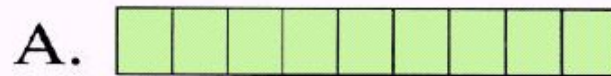
Cunningham, D. (2005)
Earth Planet. Sci. Lett. **240**, 436-444.



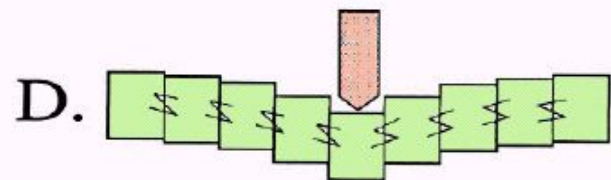
Dickerson, P.W. (2003)
Tectonophysics **365**,
 129-142.



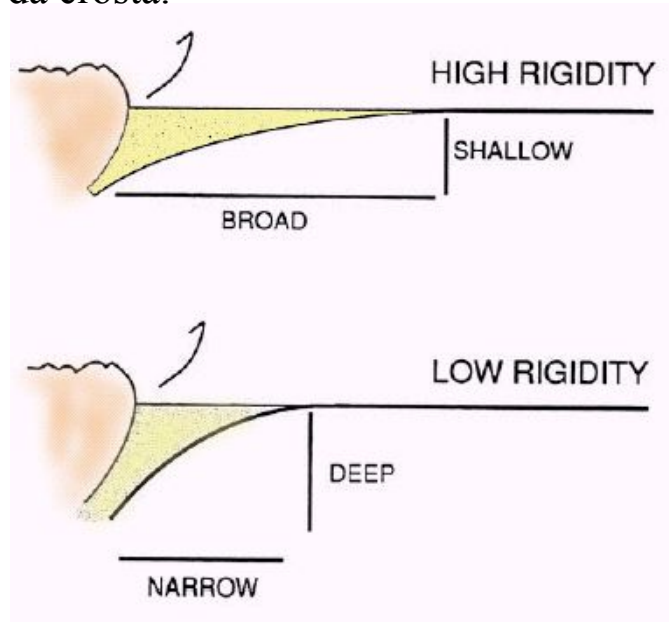
LOCAL ISOSTASY



FLEXURE (REGIONAL ISOSTASY)



A distância a partir da área de sobrecarga afetada pela subsidência e a profundidade dessa subsidência dependem da rigidez flexural da crosta.



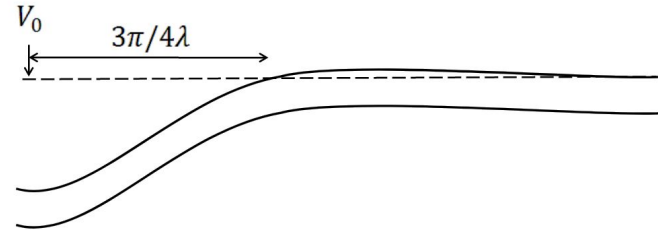
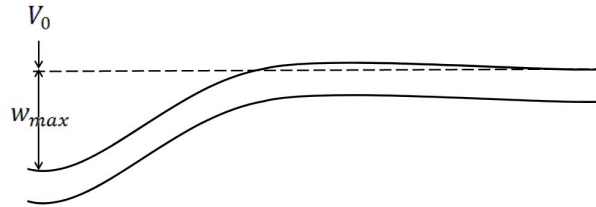
Processos geodinâmicos

$$D = \frac{E T_e^3}{12(1-\nu^2)}$$

$$\lambda = \left[\frac{(\rho_m - \rho_r)g}{4D} \right]^{1/4}$$

$$w = \frac{V_0 \lambda}{2(\rho_m - \rho_r)g} e^{-\lambda x} (\cos \lambda x + \sin \lambda x)$$

$$x = 0, \quad w = w_{max} = \frac{V_0 \lambda}{2(\rho_m - \rho_r)g}$$



D = rigidez flexural

ρ_m = densidade do manto

ρ_r = densidade do preenchimento

E = módulo de Young

T_e = espessura elástica

ν = coeficiente de Poissons

Cálculos baseados em:

Turcotte, D. & Schubert, G. (1982)
Geodynamics.

Nadai, A (1963) *The theory of
flow and fracture of solids, vol. 2.*



A rigidez flexural (ou espessura elástica equivalente) varia com a temperatura:

Te coincide com isoterma de 450° ou varia de 900 a 300?

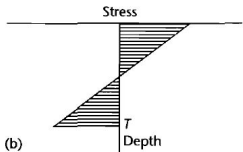
Aumento da temperatura reduz muito Te.

Descolamento da crosta em relação ao manto é outro processo possível de redução de Te:

Para grandes curvaturas de inflexão, o esforço pode superar o envelope de deformação, causando descolamento e flexura independente das porções rúpteis de crosta e manto.

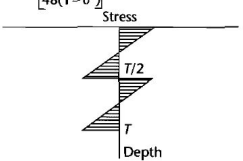
Rigidez flexural e resistência

$$M = \frac{ETe^3K}{12(1-\nu^2)} \quad Te = \left[\frac{MKE}{12(1-\nu^2)} \right]^{1/3}$$

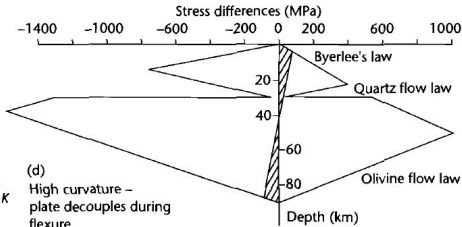


$$M = \frac{E}{12(1-\nu^2)} \left[\frac{Te^3}{2} + \left(\frac{Te}{2} \right)^3 \right] K = \frac{E}{12(1-\nu^2)} \frac{Te^3}{4} K$$

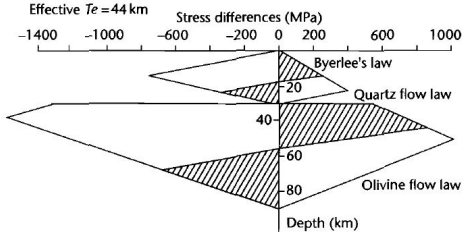
$$Te = \left[\frac{MKE}{48(1-\nu^2)} \right]^{1/3} = 63\% \text{ of (a)}$$



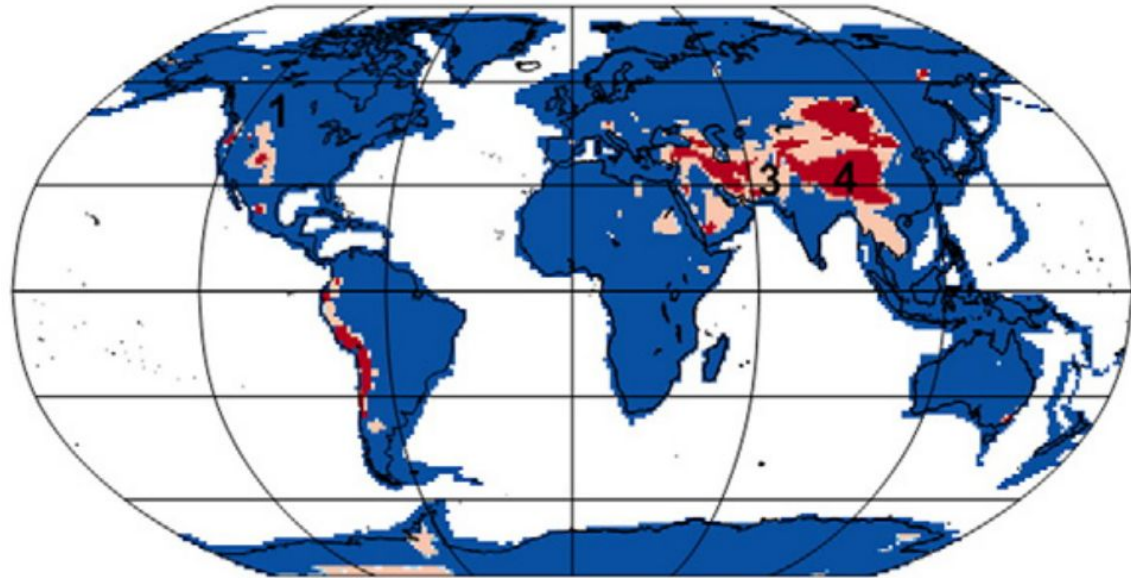
(c) Low curvature – flexes as a whole
Effective $Te = 89 \text{ km}$



(d) High curvature – plate decouples during flexure
Effective $Te = 44 \text{ km}$



Crosta acoplada (azul) e desacoplada (vermelho)



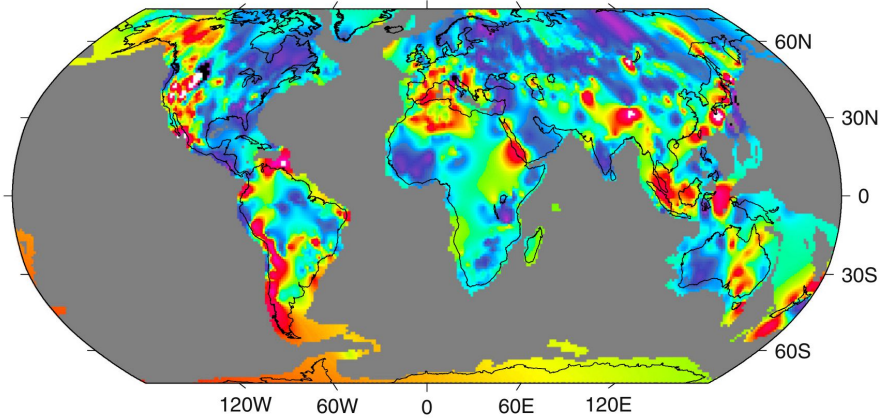
McNutt, M.K. et al. (1988)
J. Geophys. Res. **93**, 8825-8838.

Allen, P.A. & Allen, J.R. (2013) *Basin Analysis* 3rd ed. 632 p.

Tesauro, M. et al. (2013)
Tectonophysics **602**, 78-86.

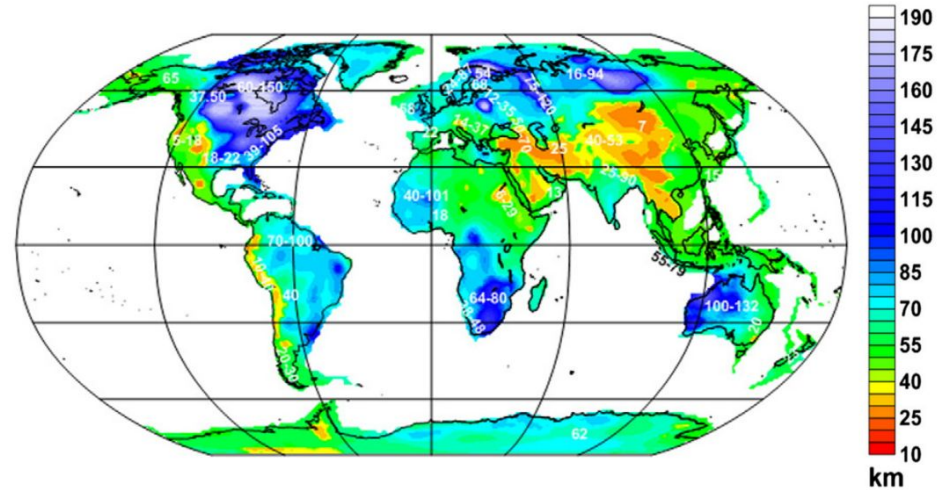
Rigidez flexural e temperatura

Fluxo térmico



Jaupart, C. et al. (2016)
Lithos **262**, 398-427.

Rigidez flexural



Tesauro, M. et al. (2013)
Tectonophysics **602**, 78-86.

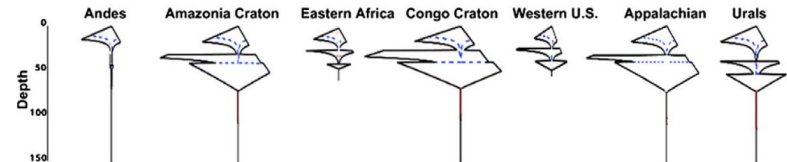


Table 4.1 Equivalent elastic thickness (T_e) compiled by Watts (2001) for the continental lithosphere at sites of foreland basins. Particular foreland basins may appear more than once if estimates have been made by different authors. Sources given in Watts (2001, Table 6.2, pp.251–3).

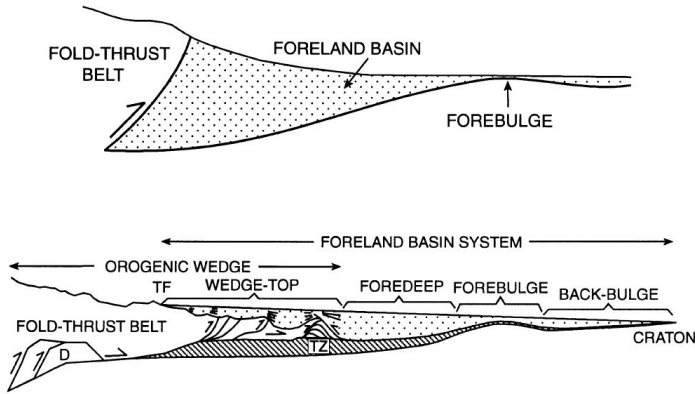
Site	Age of plate (Ma)	Plate age error (Myr)	Age of load (ka)	Load age error (kyr)	T_e (km)	T_e error (km)
Idaho–Wyoming	2650	50	125	25	22.0	0.0
Alps East	350	50	110	0	50.0	10.0
Alps West	275	25	110	0	25.0	10.0
Appalachians	1050	50	375	75	105.0	25.0
Himalaya East	1200	500	52	2	90.0	10.0
Ganges	1500	500	52	2	86.5	25.0
Kunlun–Tarim	800	200	52	2	40.0	5.0
Apennines	300	50	5	0	11.5	6.5
Carpathians Southeast	1600	200	110	0	30.0	10.0
Bolivian Andes	950	350	60	0	45.0	20.0
Transverse Ranges S	100	0	50	0	10.0	10.0
Transverse Ranges N	100	0	50	0	50.0	0.0
Zagros	700	200	35	10	50.0	25.0
Ebro	275	25	40	5	18.6	6.9
Aquitaine	275	25	40	5	25.5	5.0
Colville	1900	100	140	20	65.0	5.0
Carpathians	1600	200	110	0	22.0	0.0
Calabria	300	50	2	2	18.7	4.7
Urals	1500	100	325	50	75.0	25.0
Apennines	300	50	5	0	20.0	5.0
Oman	700	200	85	10	13.0	3.0
Urals	1500	100	325	50	75.0	25.0
Verkhoyansk	1950	150	230	40	50.0	10.0
Pamir	300	100	52	2	15.0	5.0
Tien Shan Tarim	800	200	52	2	40.0	20.0
Sicily	275	25	25	0	6.0	4.0
Himalaya West	1200	500	52	2	34.0	6.0
Greater Caucasus	1600	200	100	0	45.0	5.0
Kilohigok	2575	75	1965	45	12.0	4.0
Thelon front	2575	75	2000	0	58.0	0.0
Grenville front	2700	100	1050	50	126.0	0.0
Labrador Trough	2575	75	1585	50	120.0	0.0
Cape Smith	2575	75	1800	50	74.0	0.0
New Guinea East	700	100	25	0	10.0	0.0
New Guinea West	700	100	25	0	75.0	25.0
Tarim	1800	50	900	50	55.0	5.0
Ebro	275	25	40	0	20.0	0.0
Dzhungarian	1800	50	900	50	12.5	12.5
Alps West	275	25	17	0	10.0	5.0
Po Basin	275	25	30	0	5.0	0.0
Apennines	300	50	5	0	6.3	2.2
Guadalquivir Betics	275	25	25	0	10.0	5.0
Apennines	300	50	5	0	20.0	0.0
Carpathians	1600	200	110	0	40.0	0.0
Hellenides	300	50	2	2	70.0	0.0
Himalayas	1200	500	52	2	80.0	0.0
East Alps	350	50	110	0	40.0	0.0
South Alps	300	50	110	0	20.0	0.0

Table 4.1 *Continued*

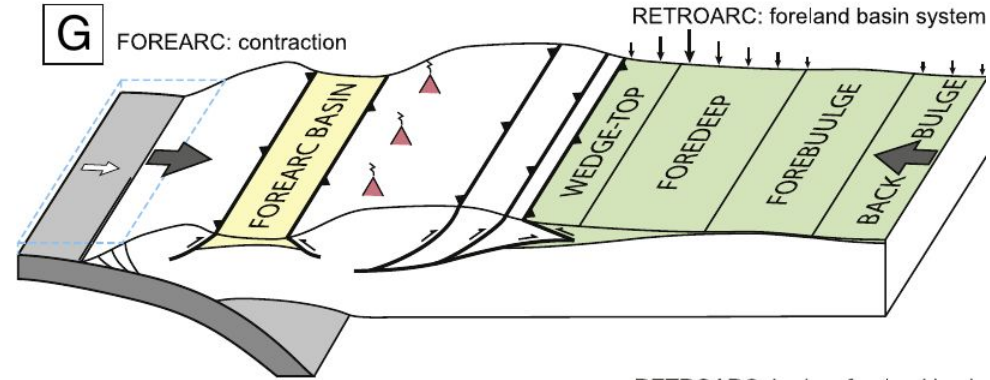
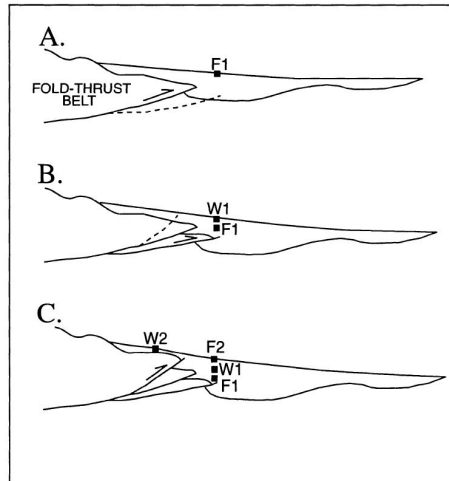
Site	Age of plate (Ma)	Plate age error (Myr)	Age of load (ka)	Load age error (kyr)	<i>T_e</i> (km)	<i>T_e</i> error (km)
West Alps	275	25	110	0	50.0	0.0
South Alps	300	50	110	0	15.0	0.0
Apennines	300	50	5	0	15.0	0.0
Oman	700	200	85	10	35.0	13.0
Apennines–Dinarides	300	50	2	2	12.5	2.5
Plio–Quaternary						
Apennines–Dinarides	300	50	40	5	7.5	2.5
Eocene–Oligocene						
Kopet Dag	1600	200	52	2	25.0	5.0
Karakorum India	1200	500	52	2	90.0	10.0
Karakorum Asia	1200	500	52	2	110.0	10.0
Andes Peru	950	350	60	0	39.0	16.0
Himalaya East	1200	500	52	2	90.0	0.0
Tarim	1800	50	900	50	40.0	0.0
Atlas East	300	50	25	0	20.0	1.0
Atlas West	300	50	25	0	9.0	1.0
Appalachians	1050	50	375	75	70.0	20.0
Alps East	350	50	110	0	25.0	10.0
Alps West	275	25	110	0	10.0	5.0
Carpathians Southeast	1600	200	110	0	12.0	8.0
Andes Colombia	950	350	80	0	45.0	40.0
Andes Ecuador	950	350	80	0	25.0	20.0
Andes North Peru	950	350	60	0	35.0	35.0
Andes Peru	950	350	60	0	25.0	20.0
Andes Peru–N. Chile	950	350	60	0	45.0	40.0
Andes Argentina	950	350	60	0	30.0	20.0
Ouachita	1050	50	375	75	50.0	10.0
E. Papua New Guinea	97	32	30	5	20.0	10.0
W. Papua New Guinea	387	132	30	5	75.0	5.0

Exercício rigidez flexural e subsidiência

Flexura e falhas



DeCelles, G., Giles, K.A. (1996) *Basin Res.* **8**,105-123.



Horton, B.K. (2018) *Earth-Sci. Rev.* **178**,279-309.

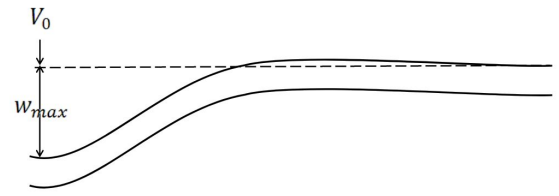
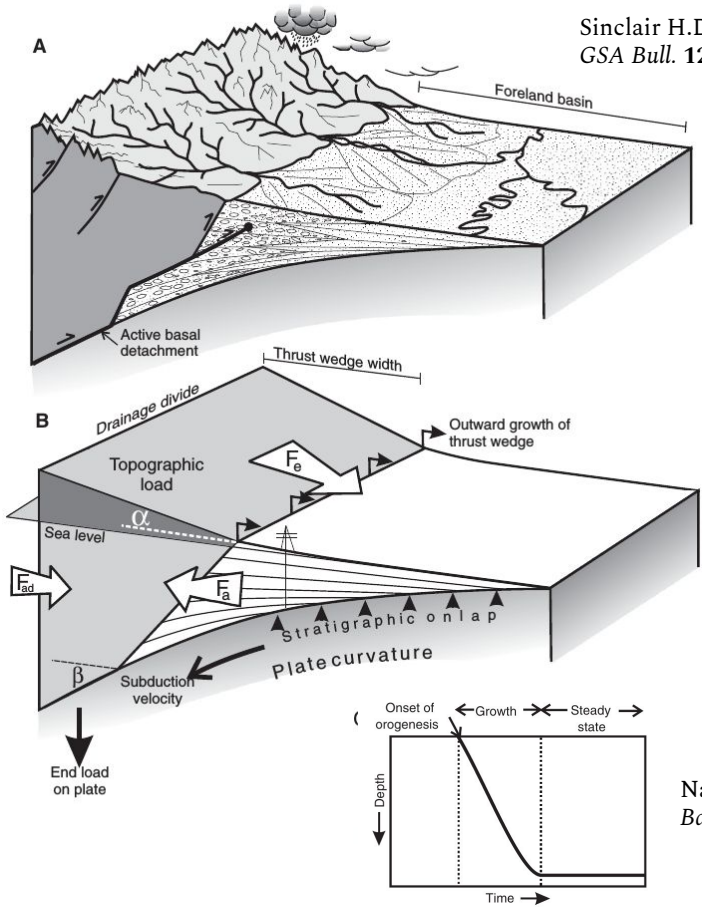
"Compressão do ante-arco gera bacias relacionadas a cavalgamentos ou **falhas inversas que induzem subsidência flexural**"

Carga e topografia

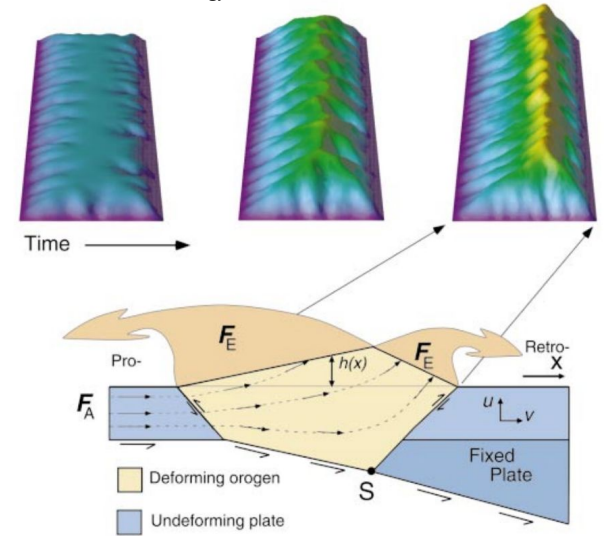
$$w = \frac{V_0 \lambda}{2(\rho_m - \rho_r)g} e^{-\lambda x} (\cos \lambda x + \sin \lambda x)$$

$$x = 0, \quad w = w_{max} = \frac{V_0 \lambda}{2(\rho_m - \rho_r)g}$$

Sinclair H.D. & Naylor, M. (2012)
GSA Bull. **124**, 368-379.

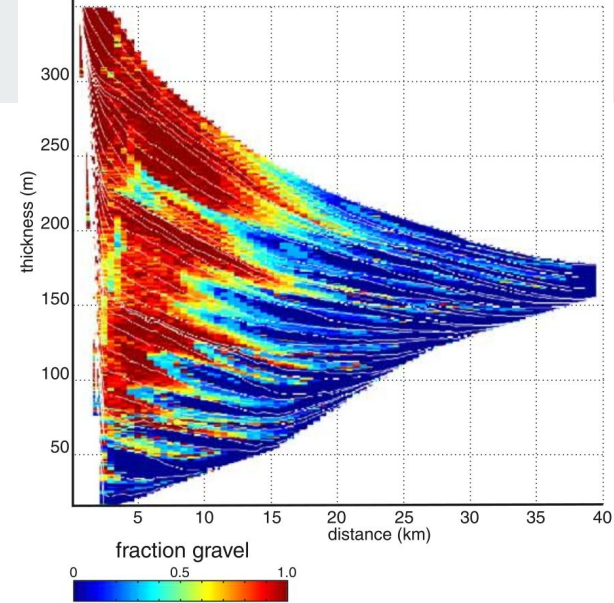
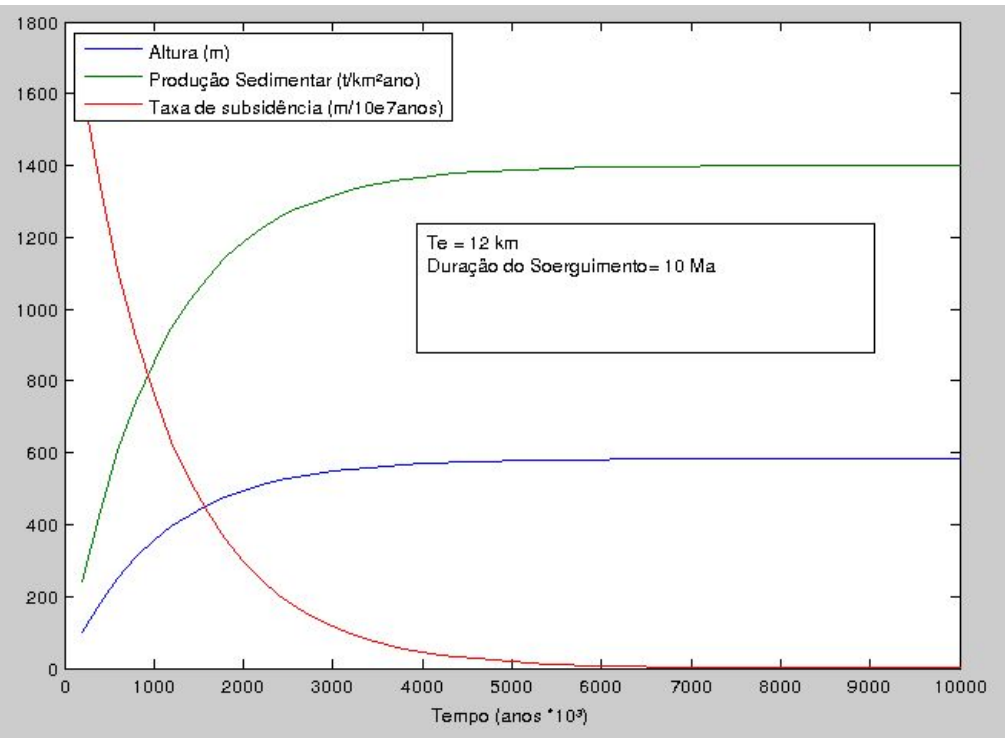


Willet, S.D. & Brandon M.T. (2002)
Geology **30**, 175-178.

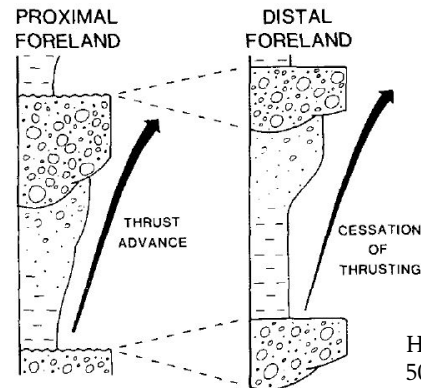


Naylor, M. & Sinclair H.D. (2008)
Basin Res. **20**, 285-303.

Subsidência e aporte



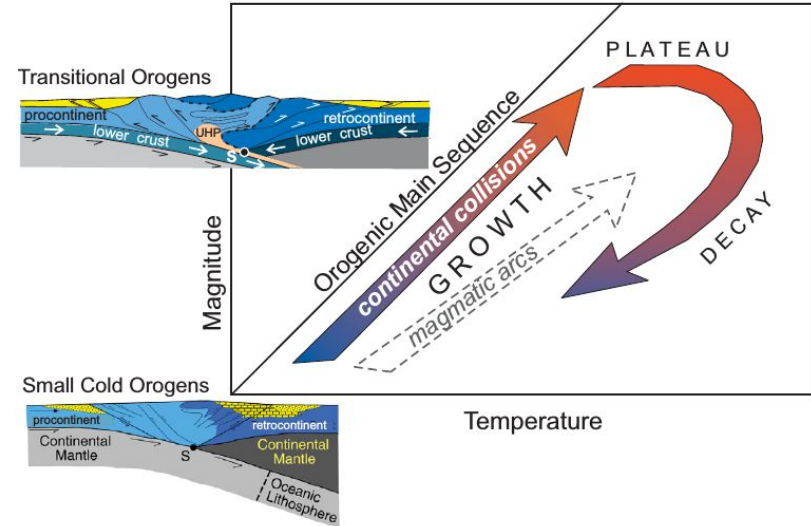
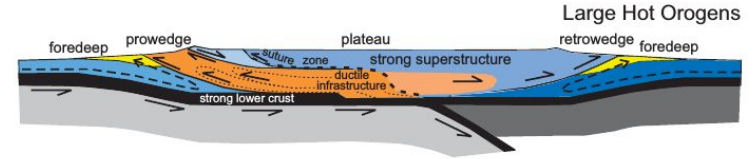
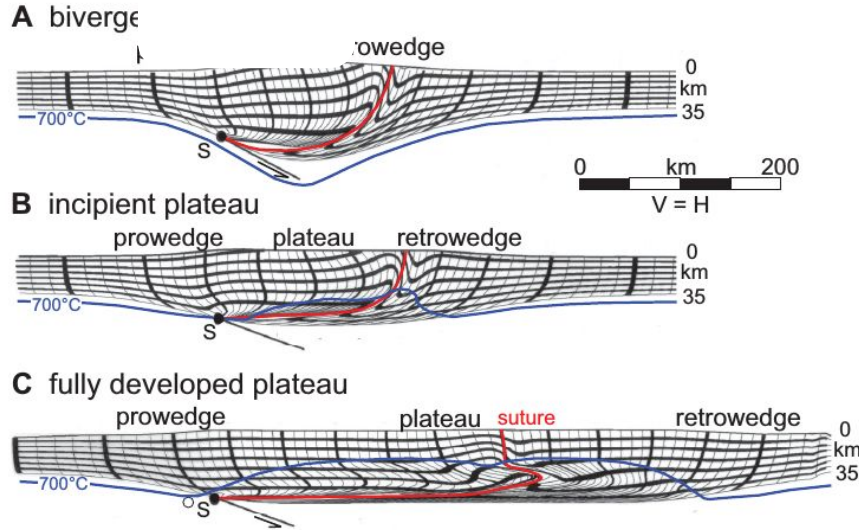
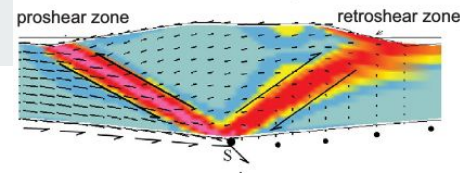
Clevis, Q. et al. (2003) *Sed. Geol.* **163**, 85-110.



Heller, P.L. et al. (1988) *Geology* **16**, 501-504.

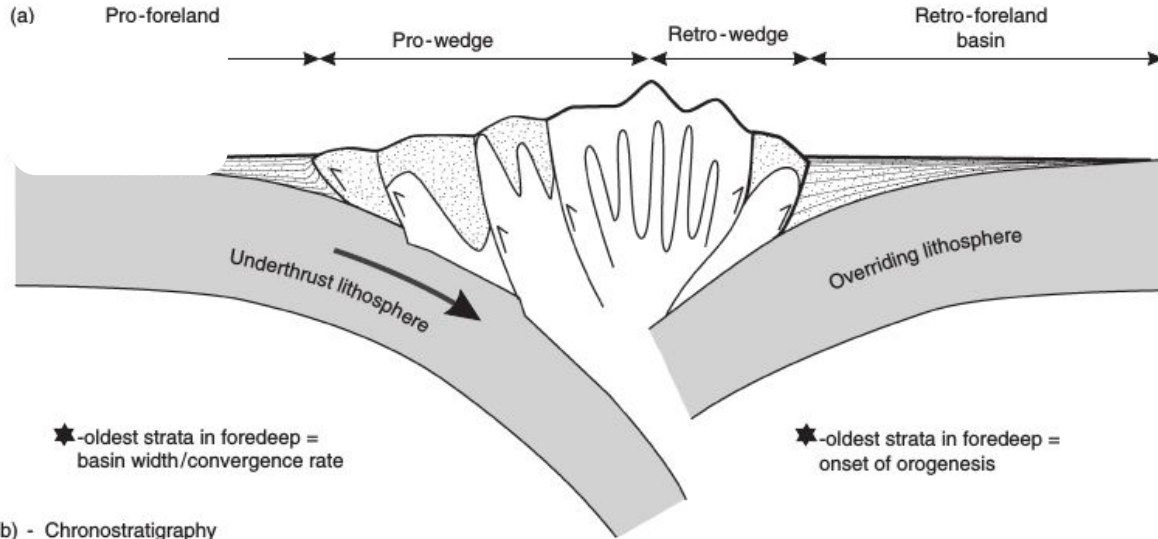
Exercício subsidência e aporte sedimentar

Evolução da cunha orogênica

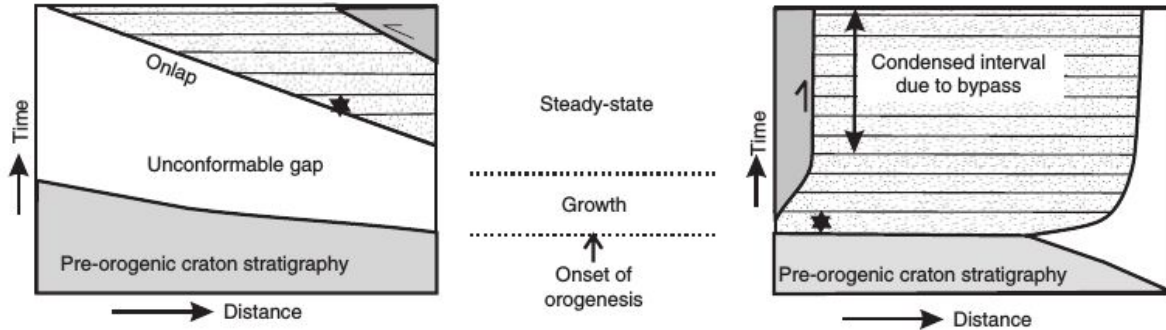


Jamieson, R.A. & Beaumont C. (2013)
GSA Bull. 125, 1671-1702.

Implicações estratigráficas

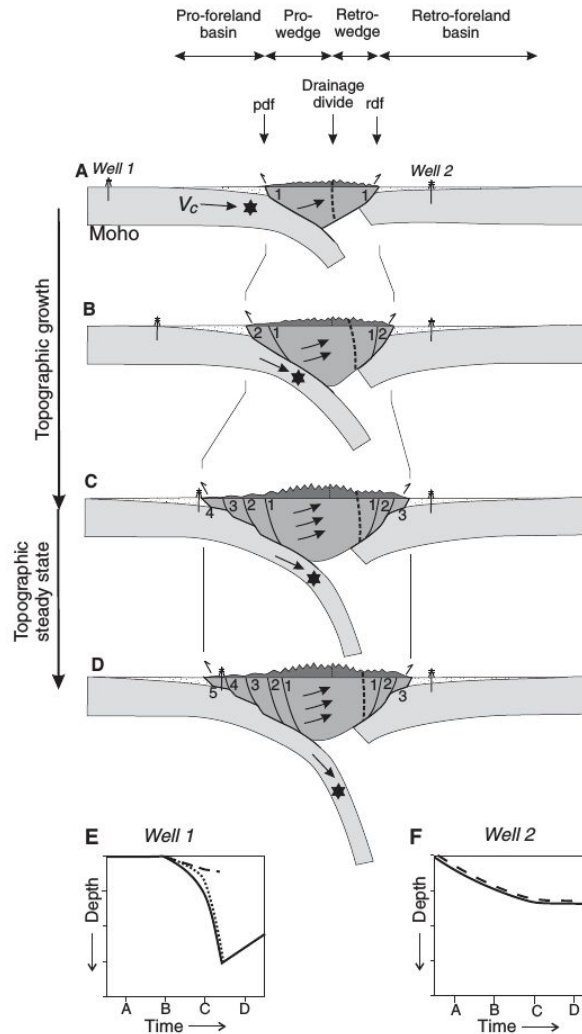


(b) - Chronostratigraphy



Naylor, M. & Sinclair H.D. (2008)
Basin Res. **20**, 285-303.

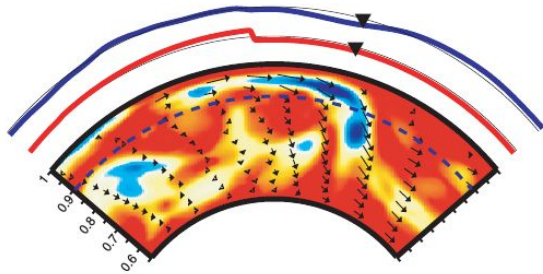
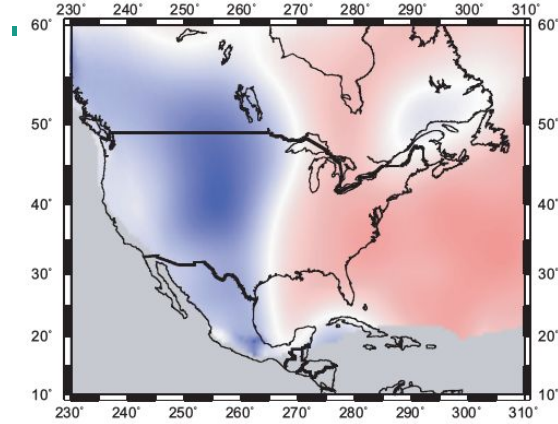
Infra-carga de subducção



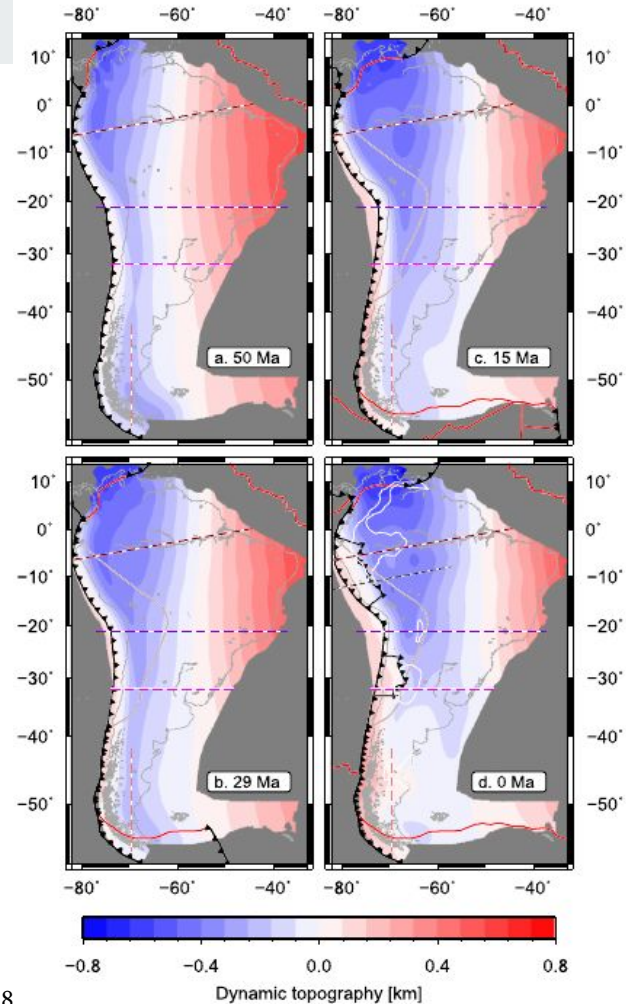
Sinclair H.D. & Naylor, M. (2012)
GSA Bull. **124**, 368-379.

Topografia dinâmica

70 Ma



Flament, N. et al. (2013)
Lithosphere 5, 189-210.

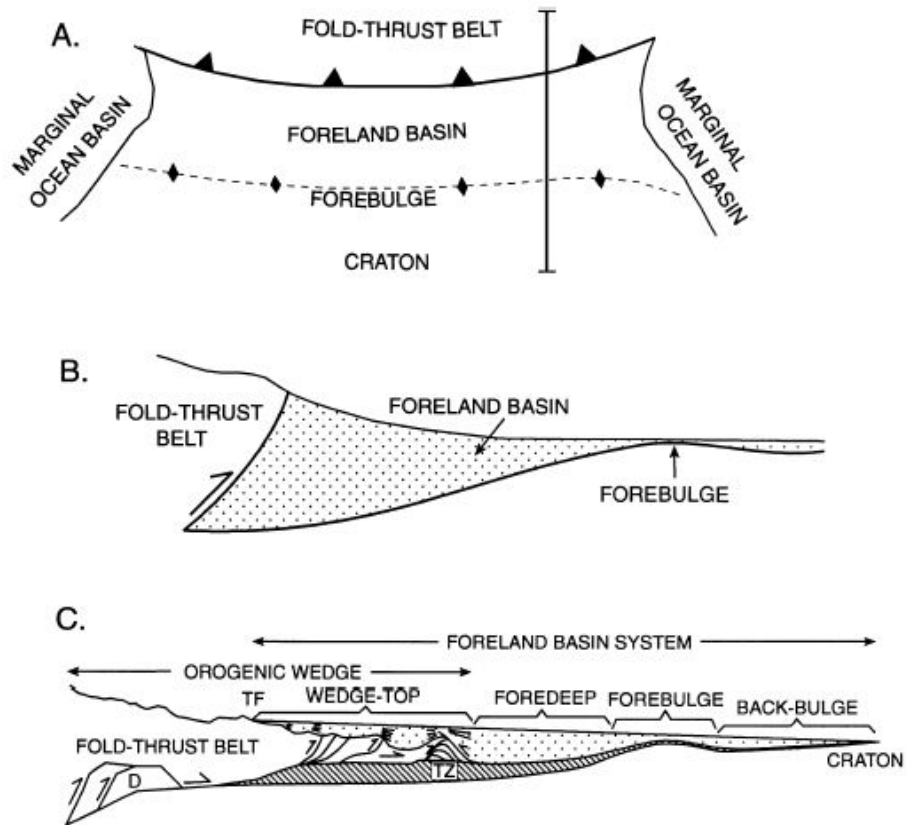


Flament, N. et al. (2015)
Earth Planet. Sci. Lett. 430, 9-18.




Características

O sistema de antepaís



DeCelles, G., Giles, K.A. (1996)
Basin Res. **8**,105-123.

O sistema de antepaís



Bacias de antepaís são fortemente assimétricas, com fundo inclinado em direção ao orógeno e subsidência diferencial (em gangorra), com as maiores taxas nas proximidades da sobrecarga.

A subsidência e deposição não ocorrem apenas na depressão periférica (antefossa – *foredeep*), mas também:

- Sobre a cunha orogênica cavalgante (*wedge-top*)
- Sobre a área soerguida da porção distal da bacia (*forebulge*)
- Atrás do *forebulge* (*back-bulge*)

Foredeep (antefossa)



Área principal de subsidência, com maior potencial de preservação.

O aporte sedimentar principal vem do orógeno, formando cunhas clásticas com grande espessamento em direção à borda ativa e rápida diminuição da granulação para a porção distal.

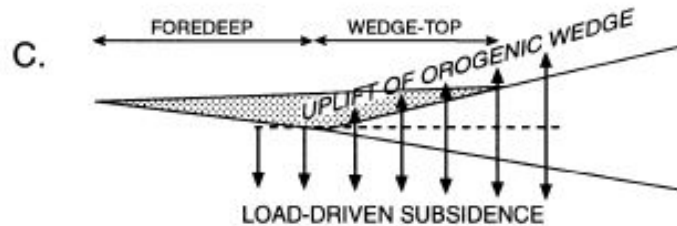
A deformação compressiva sin-sedimentar também diminui para a porção distal, com cavalgamento do orógeno na borda, importante deformação por falhas inversas e dobras assimétricas na porção proximal e dobramentos progressivamente mais suaves na porção distal.

Sucessivos eventos de reativação podem causar discordâncias angulares na bacia.

Wedge-top

Wedge-top: Em muitas zonas de colisão a elevação topográfica não coincide com a falha frontal de cavalgamento, havendo deposição significativa sobre a frente da cunha cavalgante.

Essa zona deposicional é uma área proximal, com granulação mais grossa, deformação progressiva, abundantes discordâncias e preservação como bacias isoladas sobre blocos cavalgantes (bacias tipo *piggy-back* ou *thrust-top*)



Forebulge

Forebulge: Normalmente, a subsidência flexural adjacente ao orógeno tem como conseqüência a elevação de uma área na outra borda da bacia (*forebulge*).

Essa área pode ter apenas subsidência diminuída, com menores taxas de geração de espaço de acomodação e maior recorrência de discordâncias por tectonismo ou queda eustática, ou pode ser área de soerguimento, com erosão de depósitos anteriores e potencial como área-fonte.

No caso de soerguimento, pode ocorrer distensão decorrente do arqueamento, com potencial para desenvolvimento de pequenas bacias distensionais de subsidência mecânica.

Back-bulge: A área além do *forebulge* pode estar sujeita a uma subsidência flexural secundária, com a formação de bacias rasas sobre a área cratônica.

Termos antigos



Flysch e molassa.

Discuta seu significado em termos de espaço e aporte sedimentar.

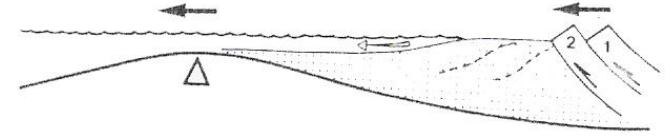
Relaxamento da rigidez

O aquecimento da litosfera pelo espessamento crustal pode causar um relaxamento térmico, resultando em deformação visco-elástica após a deformação elástica inicial.

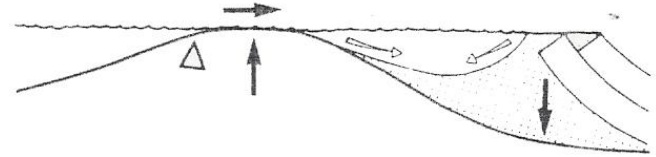
A diminuição da rigidez flexural causa aumento da taxa de subsidência, diminuição da área e aproximação do *forebulge*.

Sucessivas reativações podem causar repetição do processo.

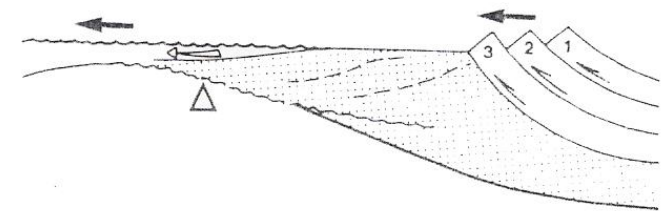
1. OVERTHRUST LOADING - Flexural deformation



2. RELAXATION PHASE - Viscoelastic response



3. RENEWED OVERTHRUST LOADING - Flexural deformation





Preenchimento

Bacias de antepaís têm proveniência do alto soerguido (orógeno colisional), com abundantes litoclastos metamórficos e assembléias de pesados ricas em minerais metamórficos.

Outros fatores, como o clima e o padrão de drenagens podem influenciar muito o tipo de preenchimento – grande diferença entre os depósitos das bacias Alpinas, Himalaianas e do Golfo Pérsico.

A proveniência metamórfica não é exclusiva de bacias de antepaís. A idade do metamorfismo tem que ser próxima da idade da bacia.

Exemplos de diagramas discriminantes de proveniência

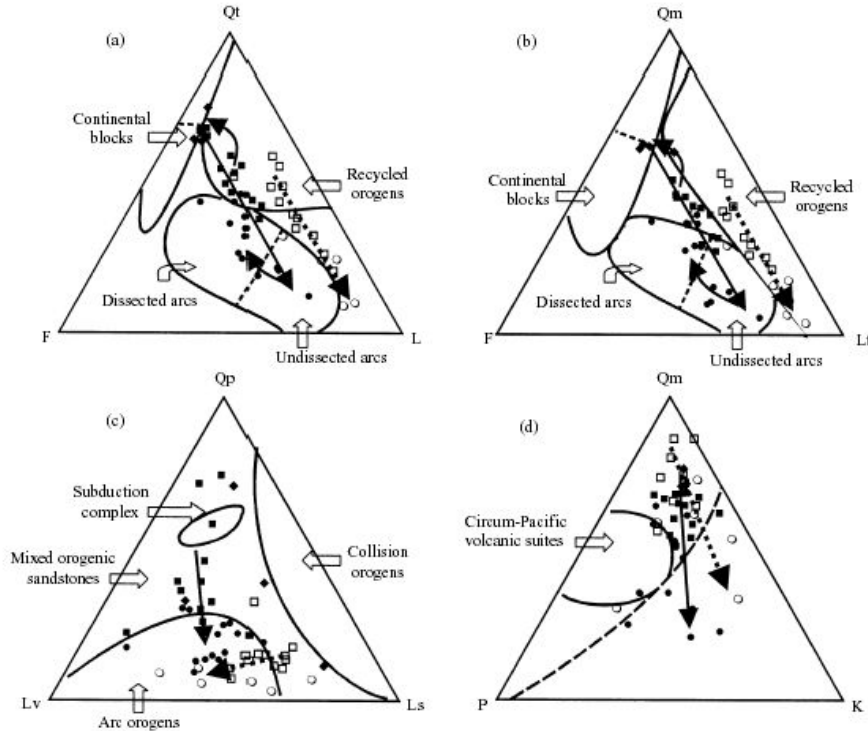


Fig. 3 Sandstone framework detrital compositions and their provenance types. Framework mode diagrams according to Dickinson and Suczek (1979), and data from Table 1. (a) Qt-F-L; (b) Qm-F-Lt; (c) Qp-Lv-Ls; and (d) Qm-P-K. Jurassic provenance evolution of the Feixi and the Hucshan sections are indicated by solid arrows and dotted arrows, respectively. The component codes of the triangular plots are the same as those in Table 1. ○, Fenghuangtai Formation; □, Sanjianpu Formation; ●, Zhongengshan Formation; ◆, Yuanlongshan Formation; ■, Fanghushan Formation.



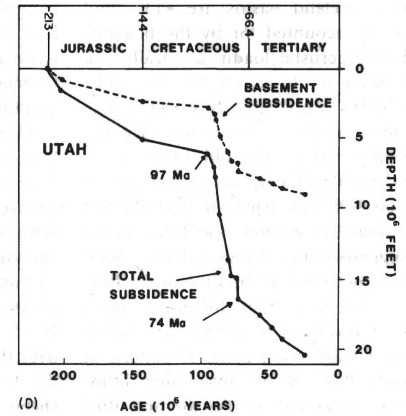
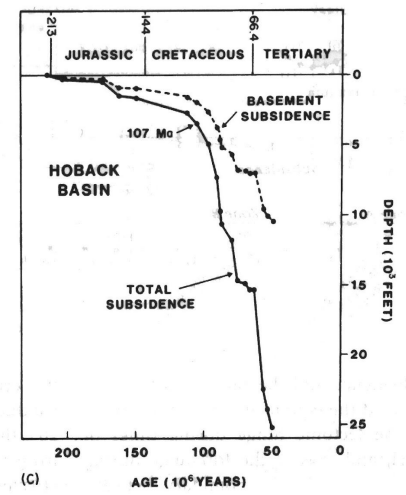
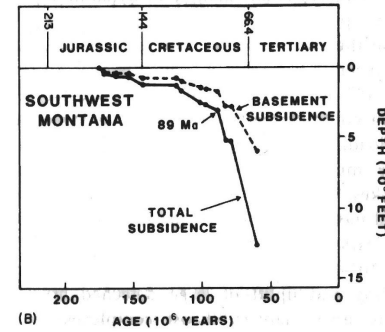
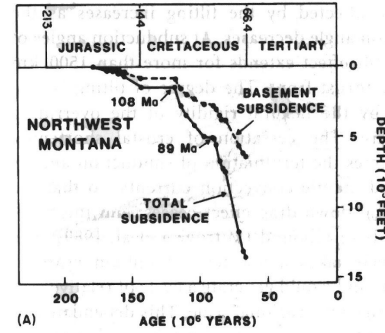
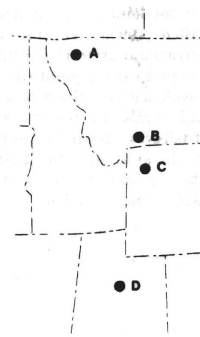
Preenchimento

Bacias de antepaís são assimétricas, com maior subsidência próximo à sobrecarga.

A assimetria é contrária àquela de bacias de margem passiva, pois o aporte sedimentar principal vem diretamente para a área de maior subsidência.

A ciclicidade é controlada principalmente pela variação das taxas de subsidência e de aporte sedimentar, que obedecem a ciclos de reativação tectônica. A eustasia é mascarada pelas altas taxas de subsidência durante os cavalgamentos e por eventos de soerguimento que simulam queda eustática.

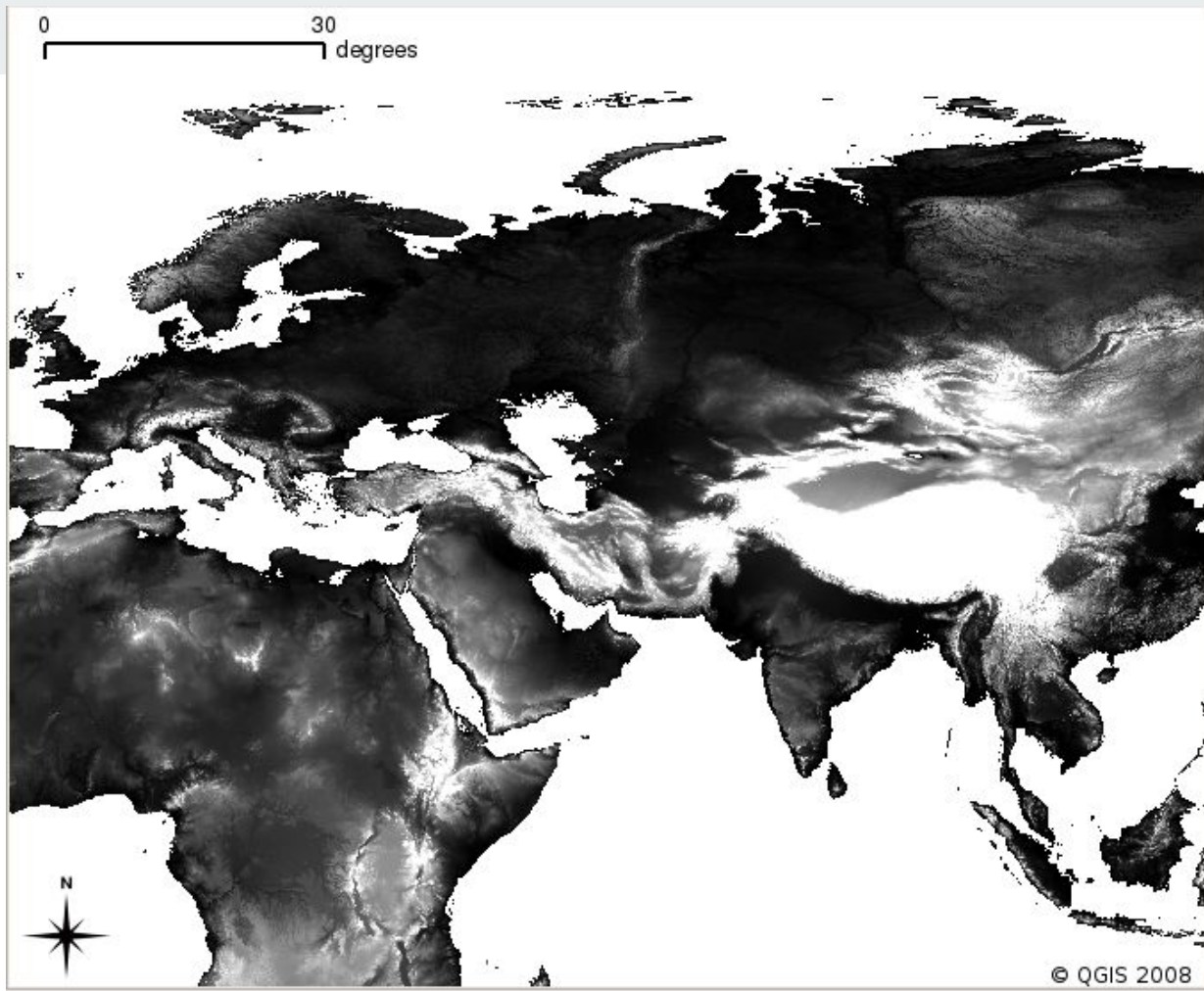
Subsidência






Exemplos

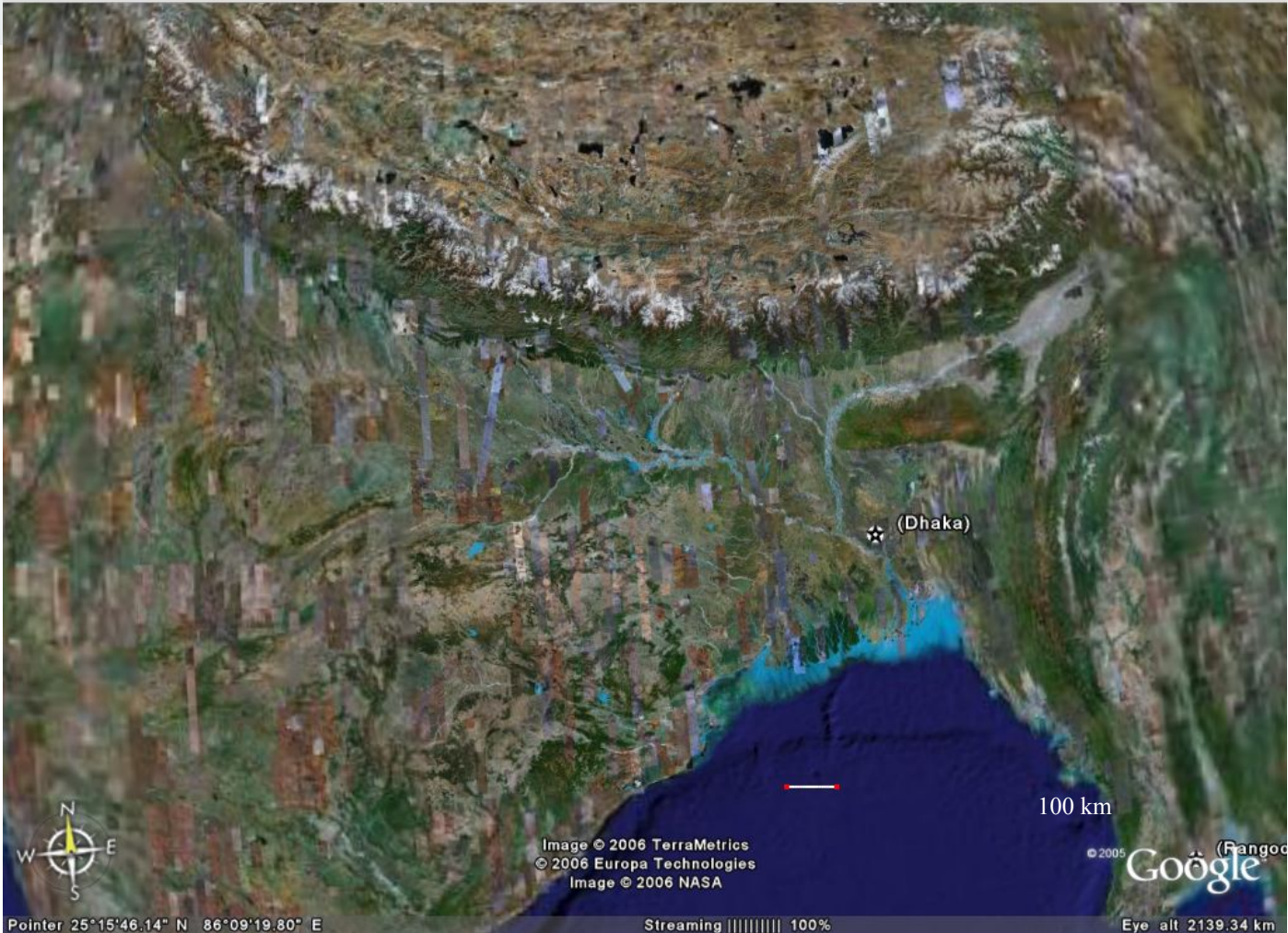
Bacia do Ganges, Golfo Pérsico,
Bacias Alpinas





A Bacia do Ganges

- Resposta a cavalgamento da Ásia sobre a Índia
- Grande Te (~90 km)
- Flexura menor que a prevista pelo modelo (força contrária à flexura?)
- Preenchimento aluvial tropical

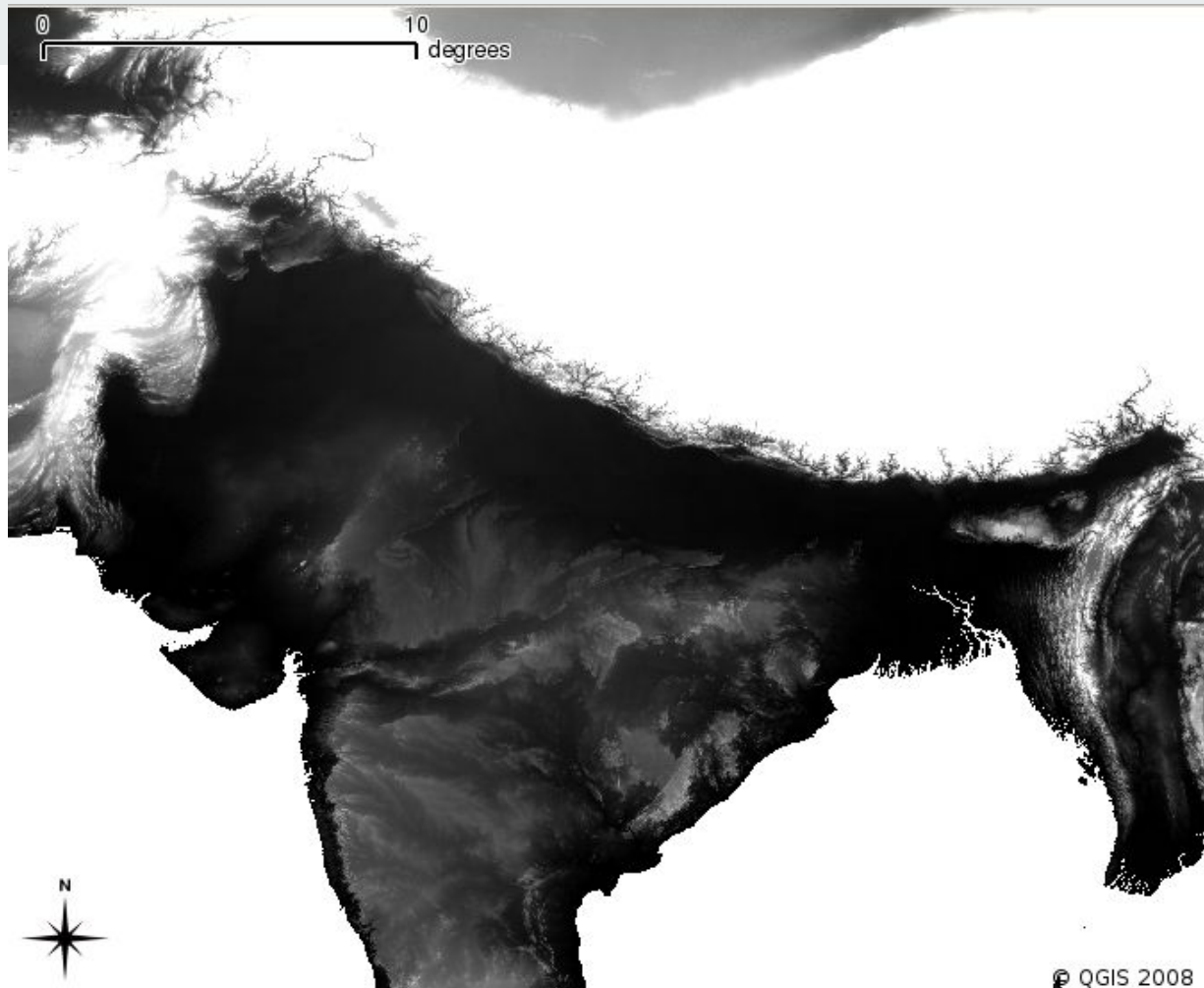


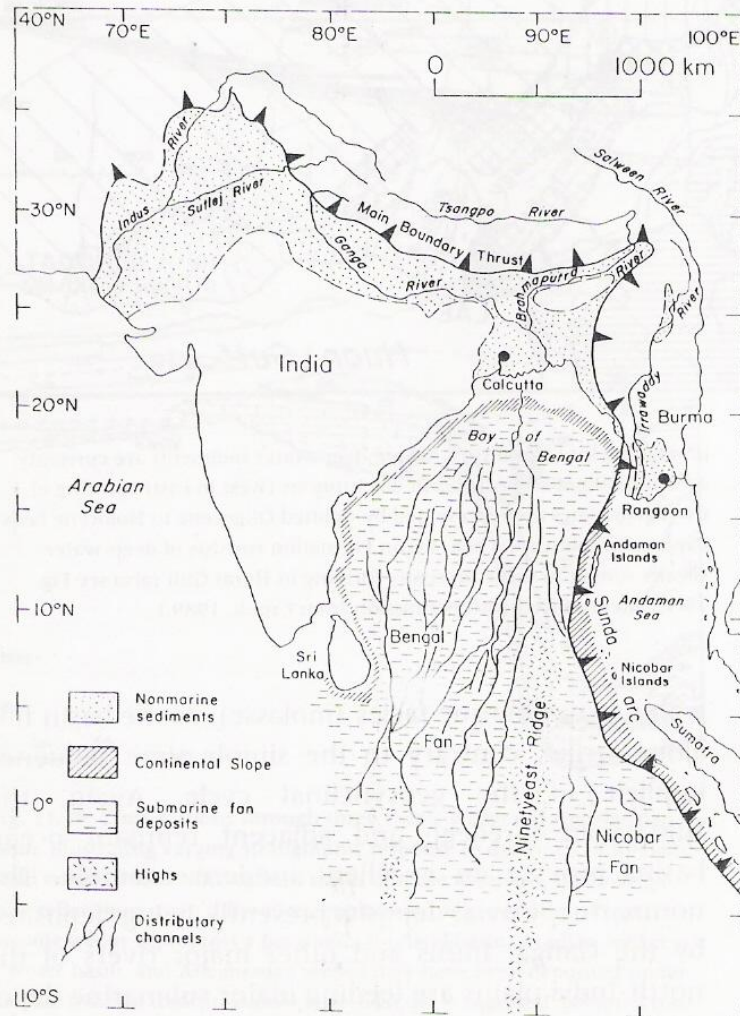
(Dhaka)

100 km

Image © 2006 TerraMetrics
© 2006 Europa Technologies
Image © 2006 NASA

© 2005 Google (Fangoc)





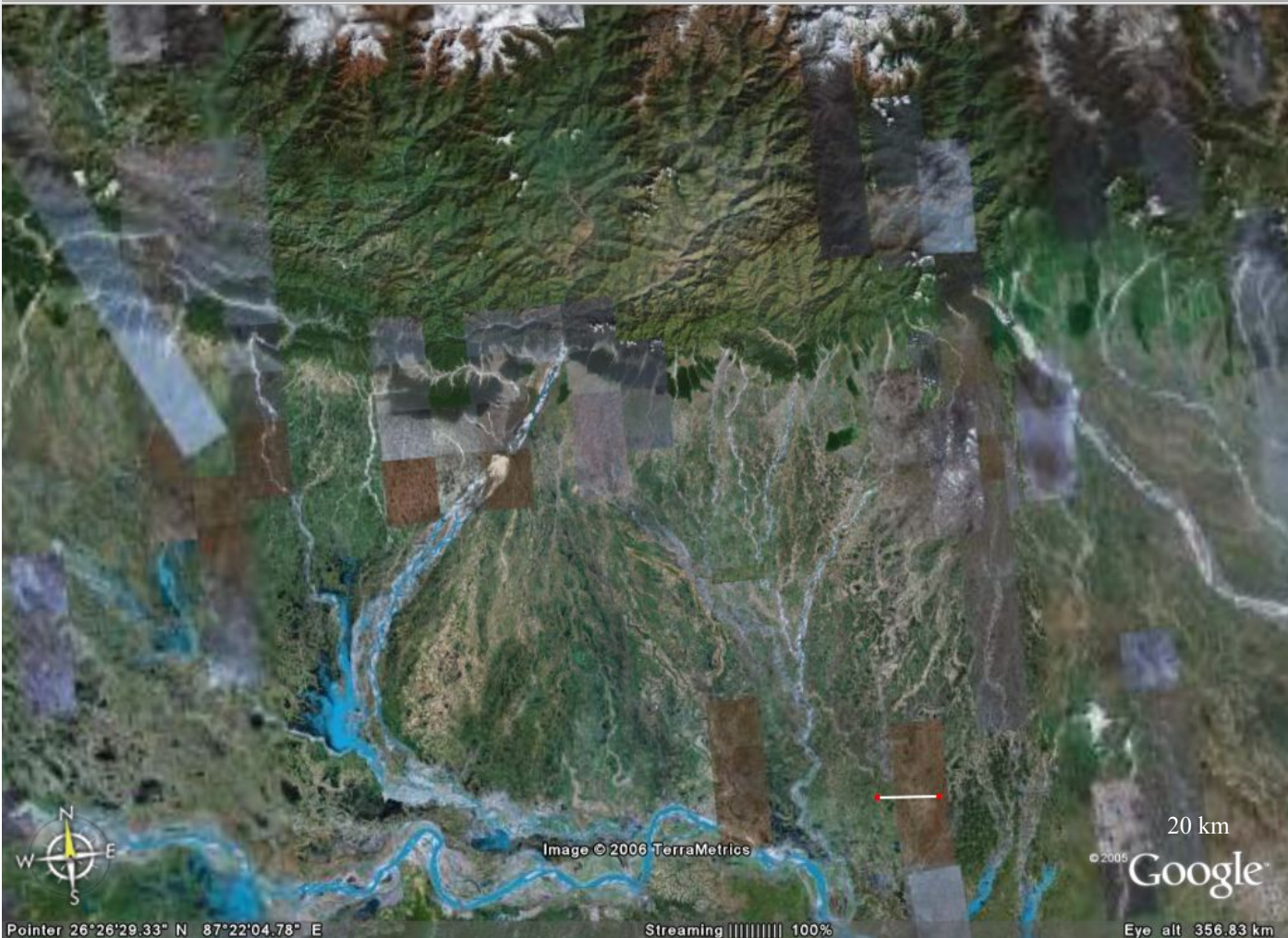


Image © 2006 TerraMetrics

20 km
© 2005 Google

Pointer 26°26'29.33" N 87°22'04.78" E

Streaming ||||| 100%

Eye alt 356.83 km



Image © 2006 TerraMetrics



Pointer 25°59'37.24" N 87°16'54.80" E

Streaming ||||| 100%

Eye alt 177.57 km



3 km

Image © 2006 TerraMetrics

© 2005 Google

Pointer 25°49'23.36" N 87°16'10.23" E

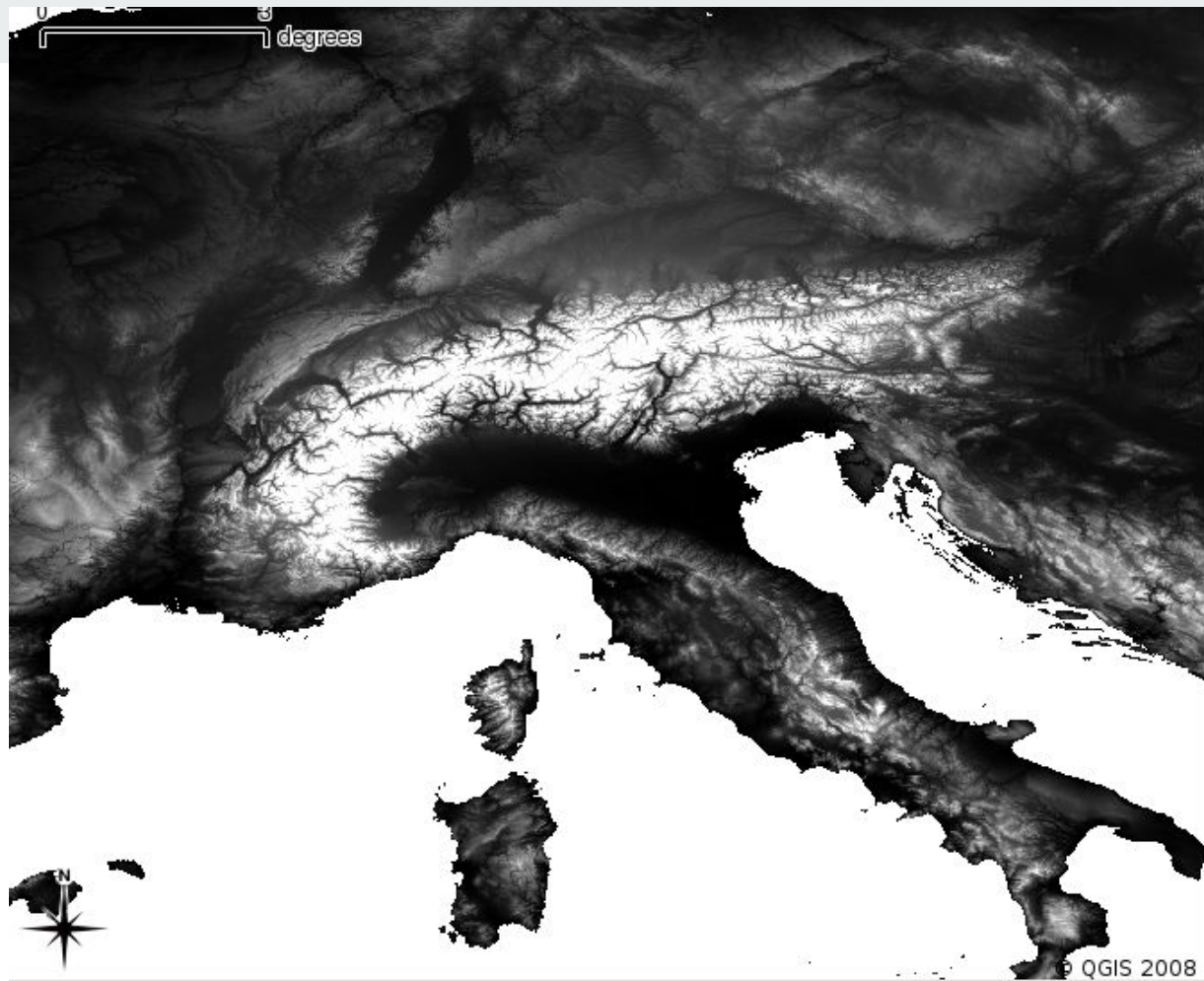
Streaming ||||| 100%

Eye alt 51.87 km



A Bacia do Pó

- Resposta a cavalgamento dos Alpes e interação com subducção do Mediterrâneo.
- Te muito pequeno (<10 ou ~5 km!)
- Preenchimento aluvial e marinho.





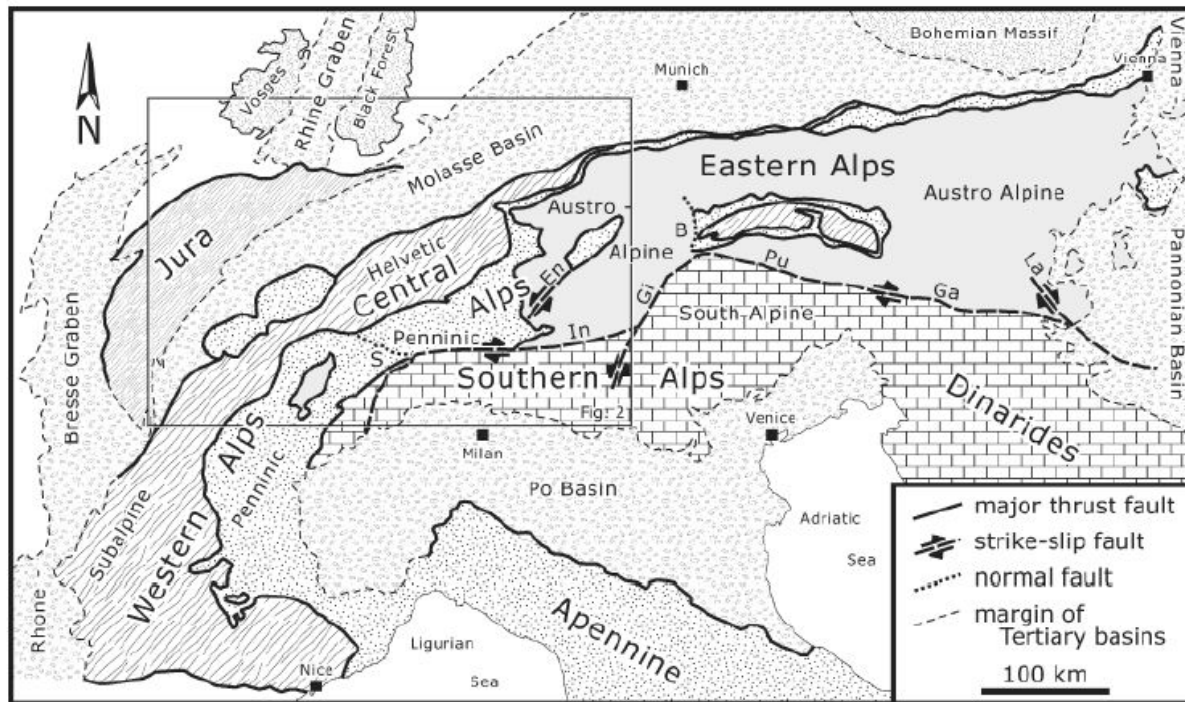
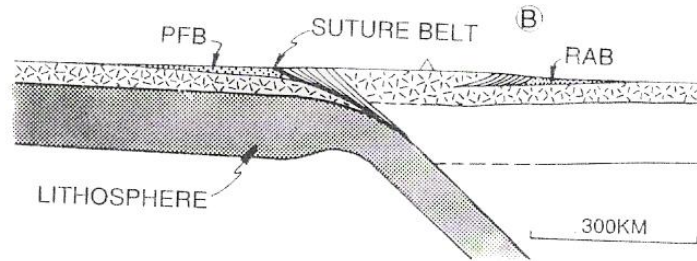
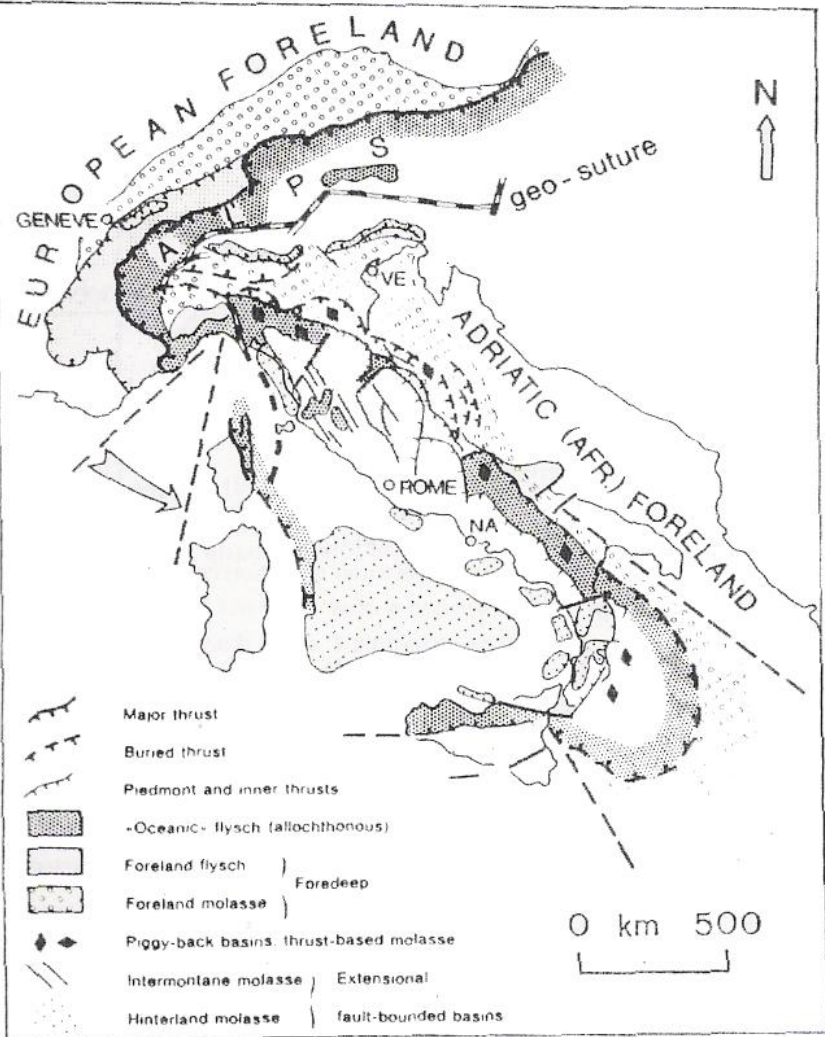
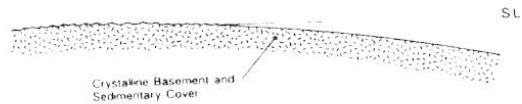


Fig. 1. Structural map of the Alps showing major tectonic units and fault systems, as well as the associated foreland basins. The study area (Fig. 2) is outlined.



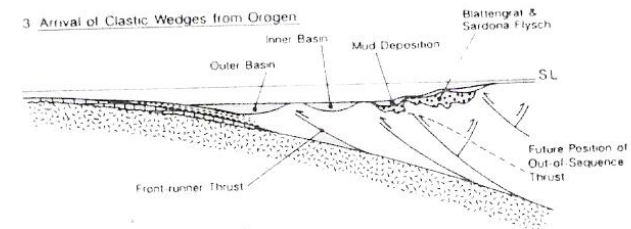
1 Pre-Lutetian



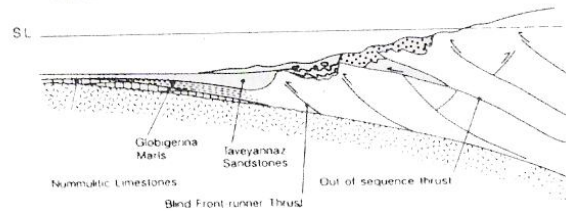
2 Carbonate Ramp Development



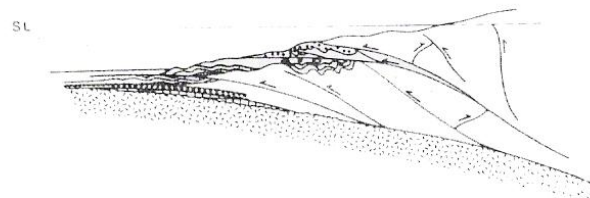
3 Arrival of Clastic Wedges from Orogen



4 Emplacement of Surface Mud Sheets



5 South Helvetic/North Penninic Sheets Thrust over Basin-Fill





A Bacia do Golfo Pérsico

- Resulta a cavalgamento dos Zagros sobre a Placa da Arábia
- Te 50 km
- Preenchimento marinho, costeiro e aluvial árido
- Flexura maior que a esperada (força adicional de subsidência?)

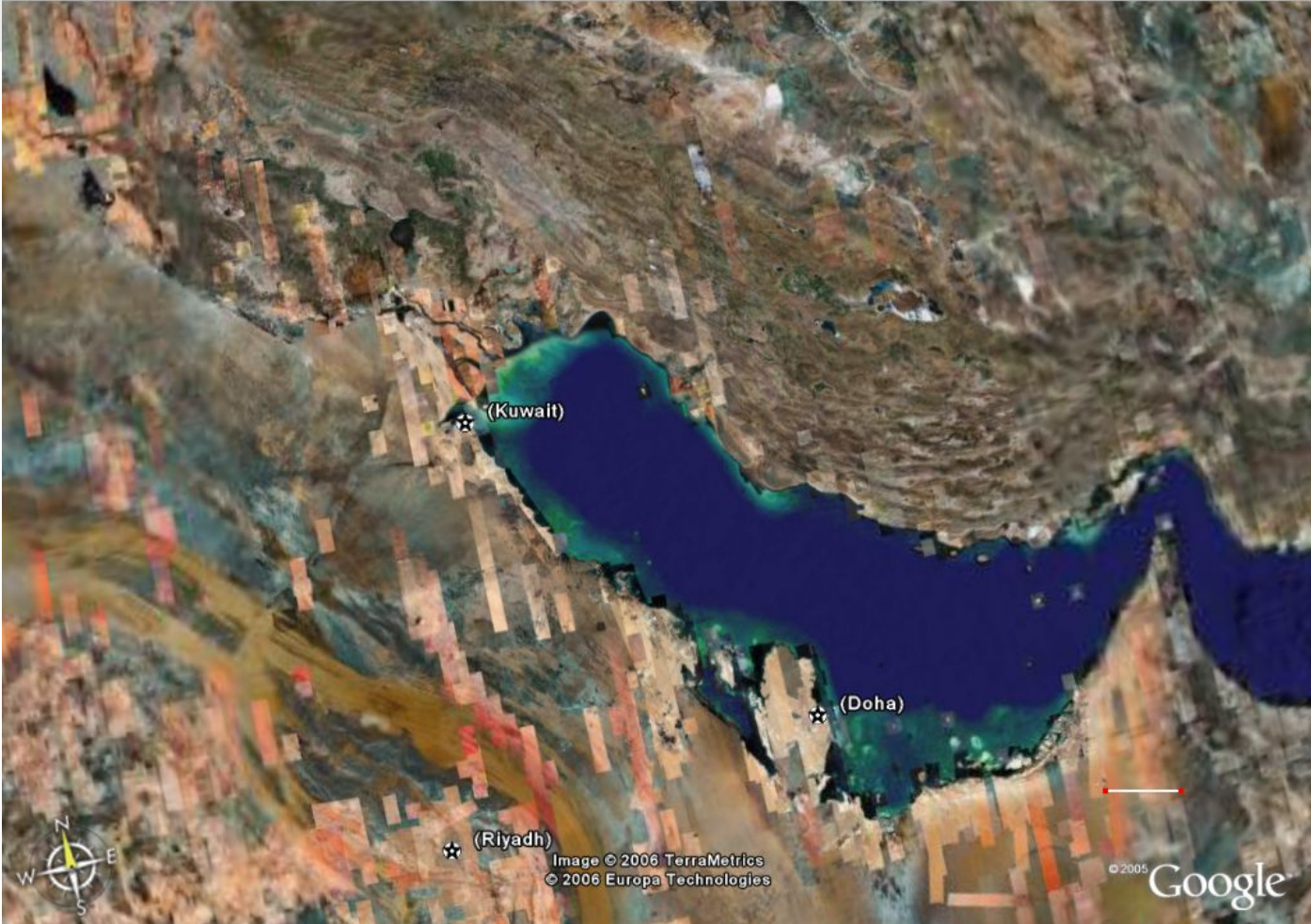
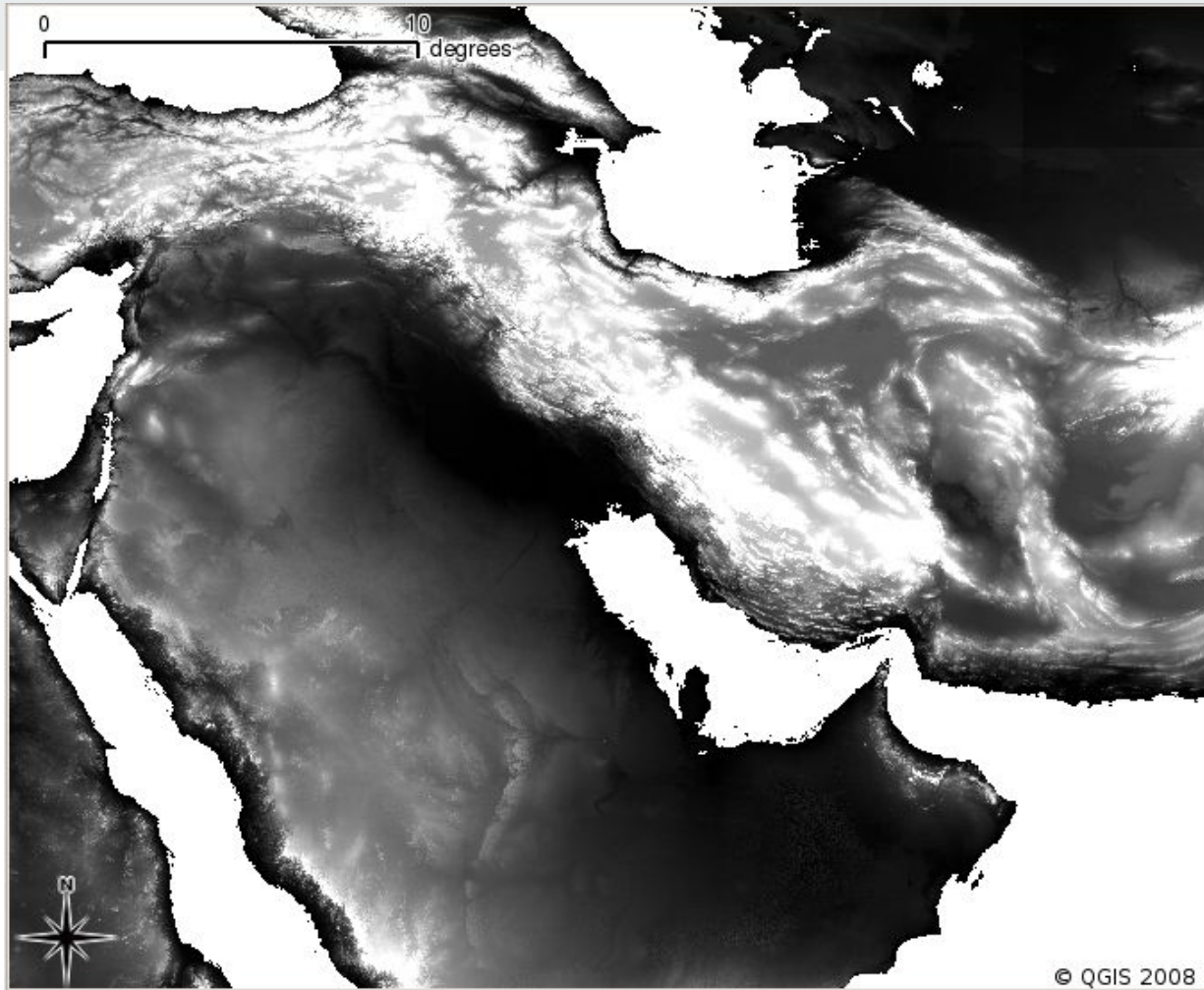
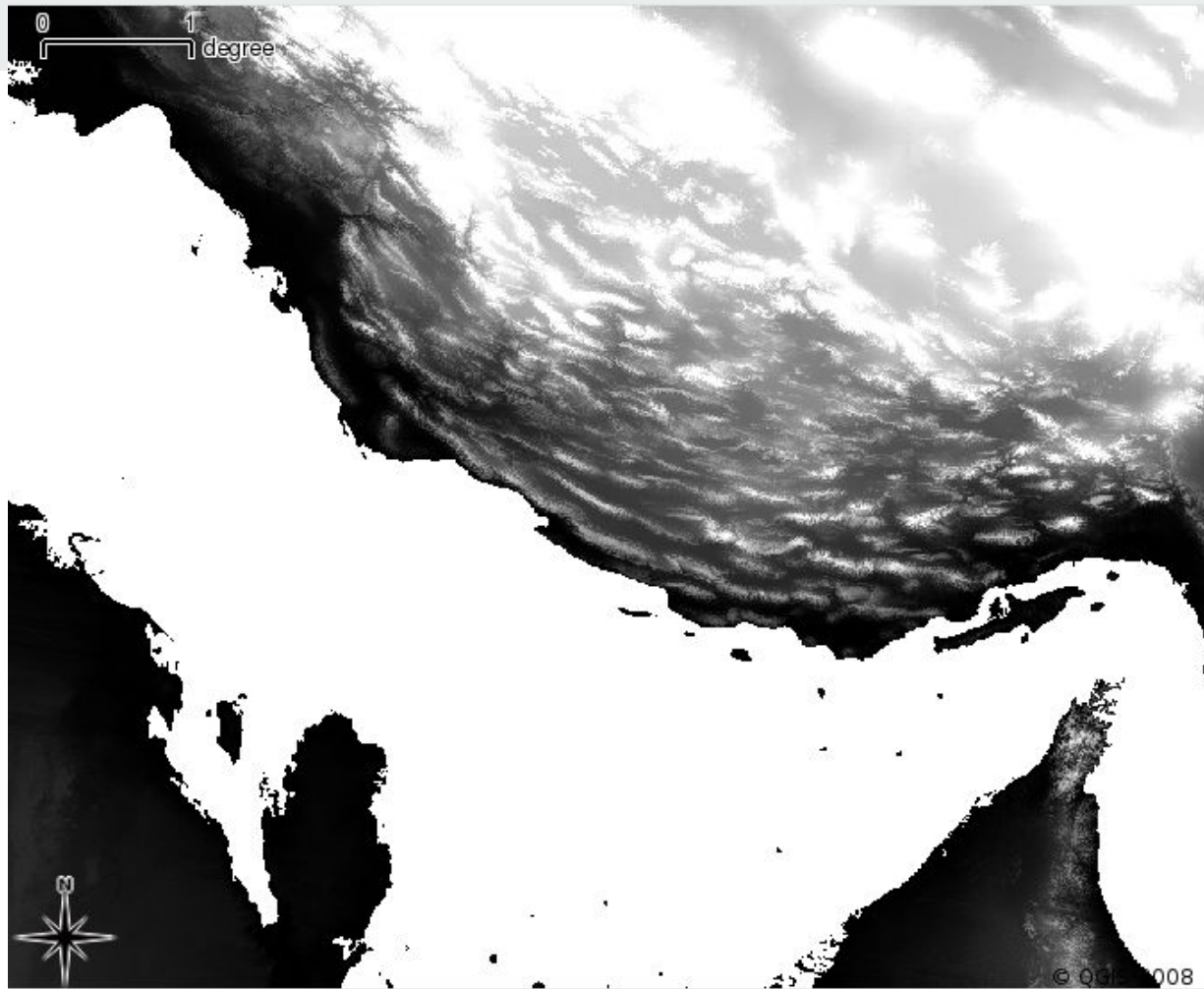
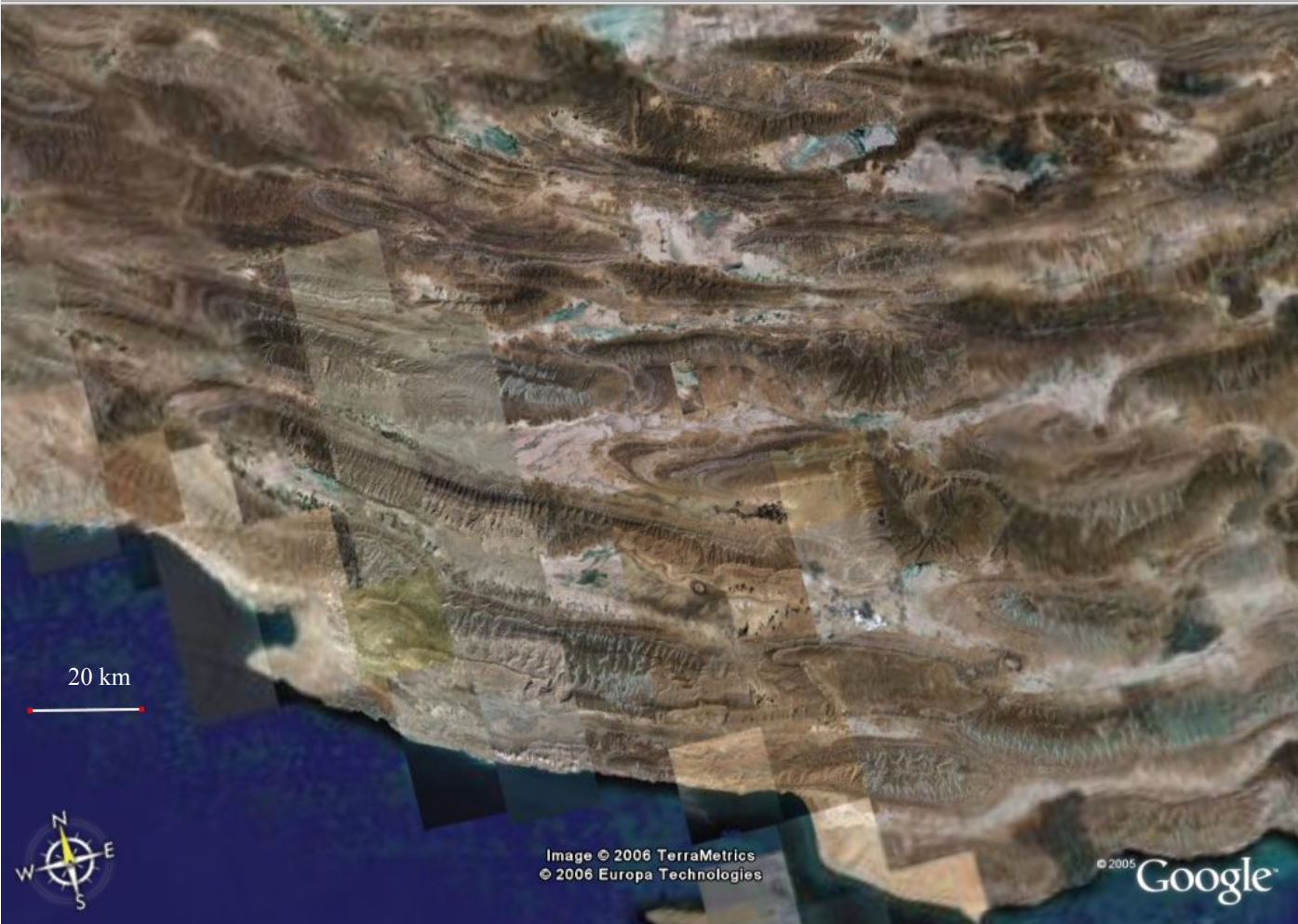


Image © 2006 TerraMetrics
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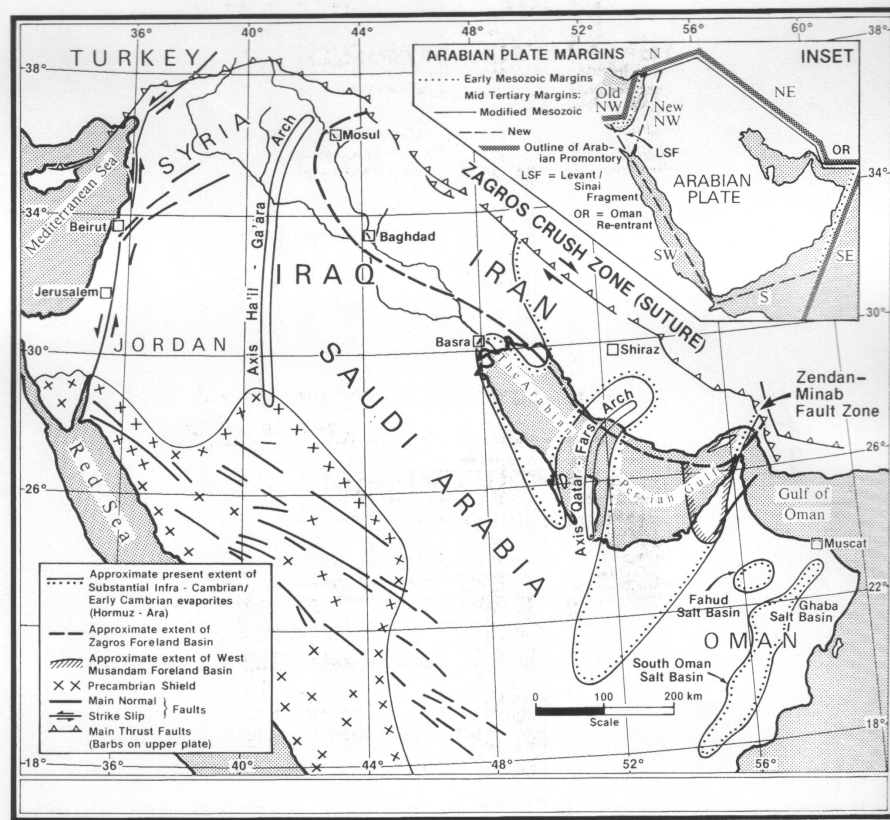


FIGURE 1. Orogenic setting of the Zagros foreland basin.

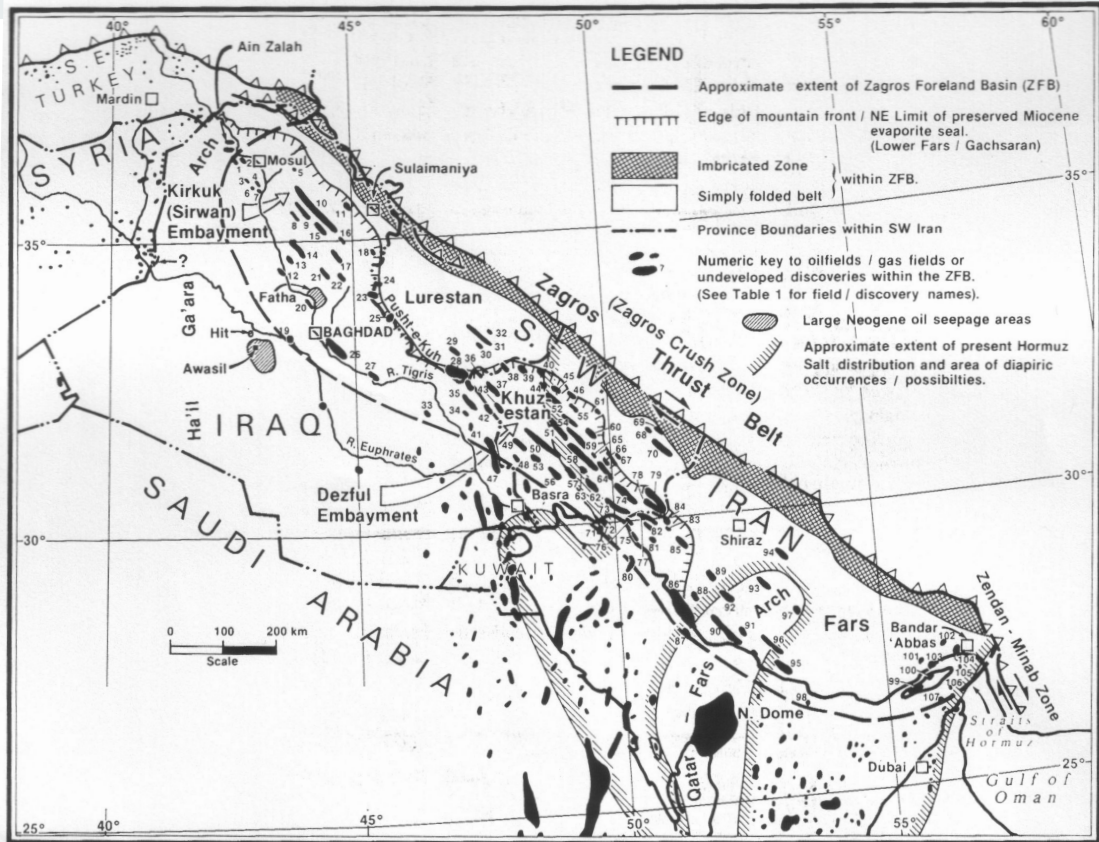


FIGURE 2. Regional oil and gas map showing locations, provinces, and key structural elements in the Zagros foreland basin.

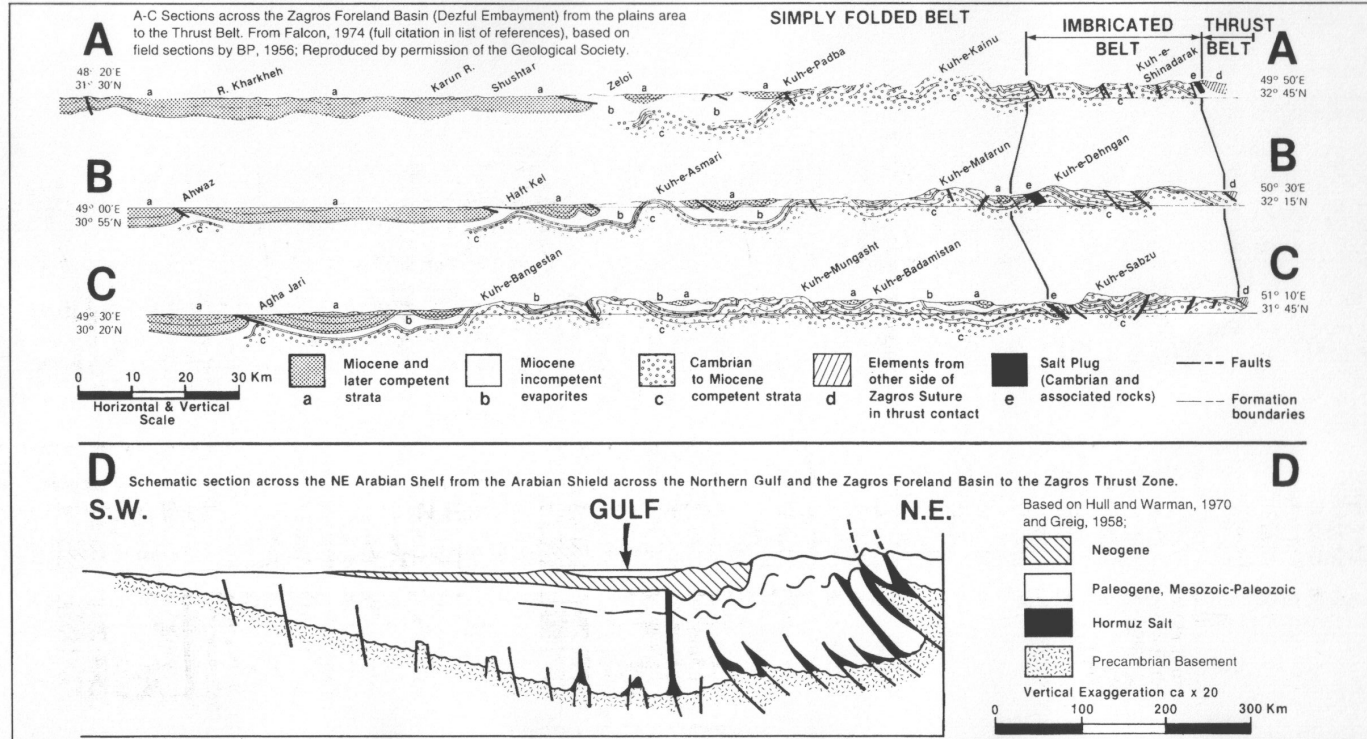


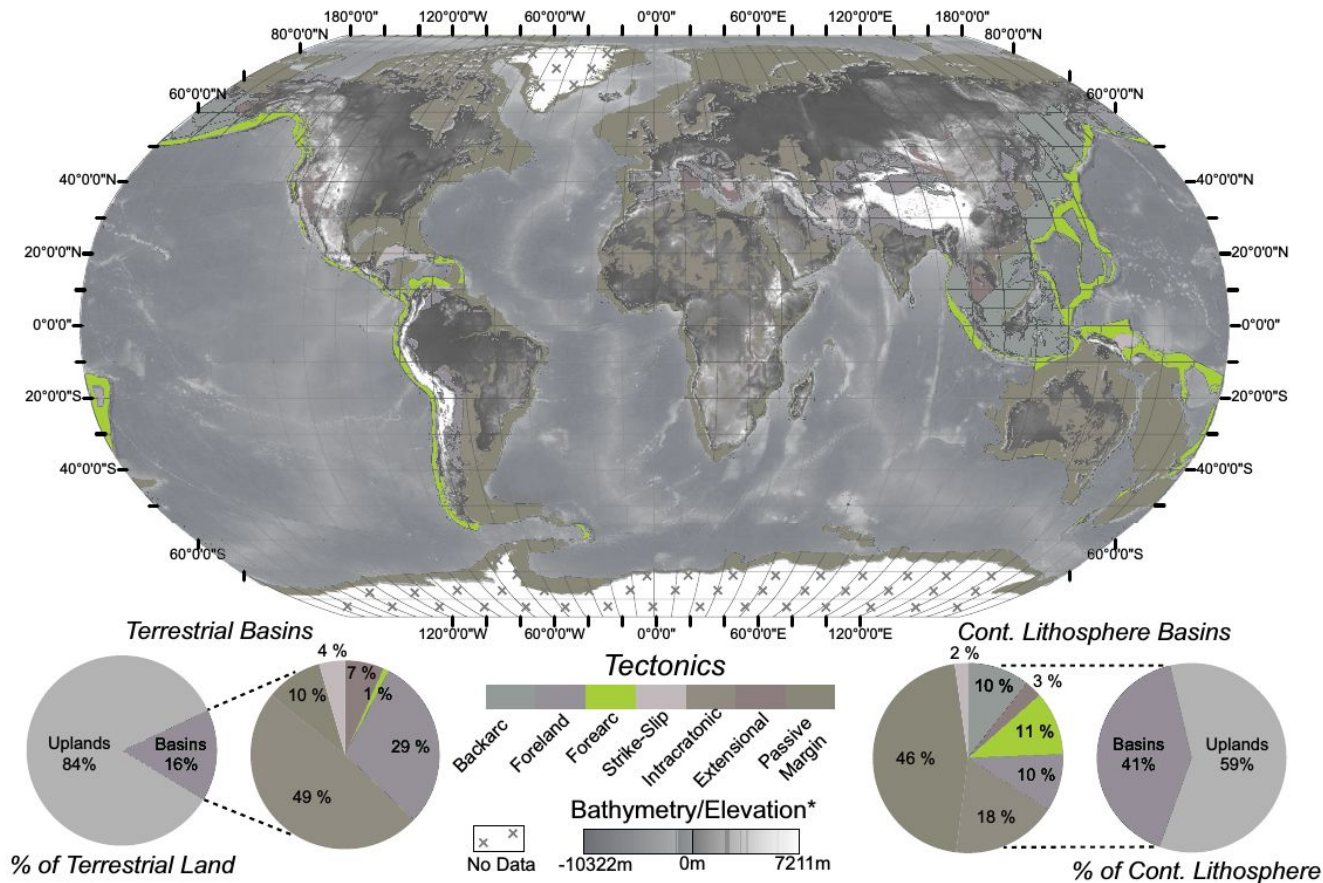
FIGURE 8. Zagros structural cross sections. Sections A to C are sections across the Zagros foreland basin (Dezful embayment) from the plains area to the thrust belt. Section D is a schematic section across the northeastern Arabian shelf from the Arabian shield across the northern Gulf and the Zagros foreland basin to the Zagros thrust zone. Sections A to C from Falcon (1974), based on field sections by BP (1956). Reproduced by permission of The Geological Society (London). Section D is based on Hull and Warman (1970) and Greig (1958).



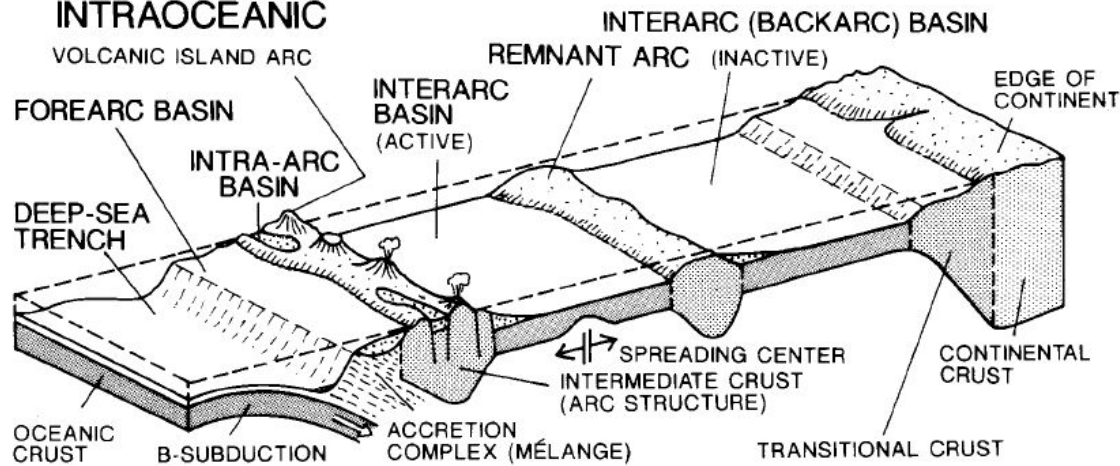
Bacias de Antearco

Bacias de ante-arco

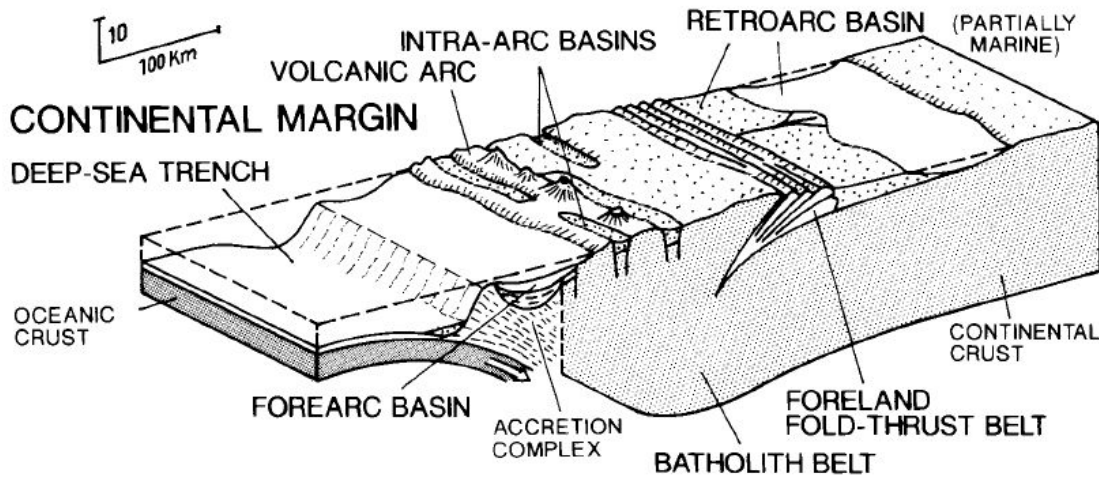
Modificado de:
Nyberg, B., Holwell, J.A. (2015)
Geology **43**, 643-646.



**a SUBDUCTION-RELATED BASINS,
INTRA-OCEANIC**



b CONTINENTAL MARGIN



Einsele, G; 1992. *Sedimentary Basins, Evolution, Facies and Sediment Budget*. 792 p.

Bacias de Ante-Arco

- Posicionadas entre o arco e a trincheira de subducção
- Sedimentação simultânea ao vulcanismo e plutonismo do arco
- Também simultânea à deformação e metarmofismo do complexo de subducção

Dickinson, W.R. (1998). *Forearc Basins*, in:
 Busby & Ingersoll: *Tectonics of
 Sedimentary Basins*. 221-261

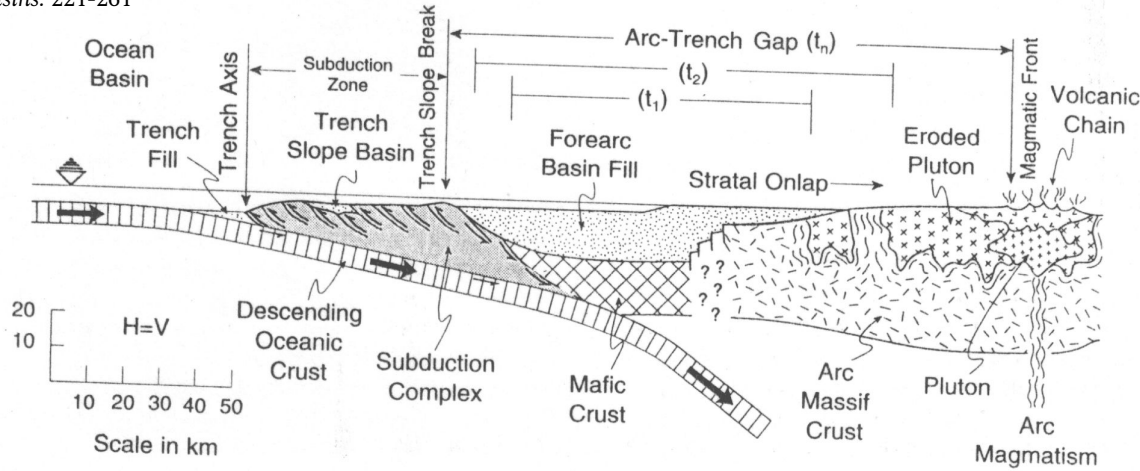


Fig. 6.1 Geotectonic features of forearc basins in transverse profile. See Fig. 6.5 for internal structures of subduction complex and Fig. 6.6 for origins of forearc ophiolites (mafic crustal substratum). Stipples indicate undeformed sediment accumulations. Diagram shows ideal case for which sedimentary infilling of forearc basin keeps pace with accretionary growth of subduction complex, and omits potential faults (thrust, normal, strike-slip) that may cut forearc sediment prism. Cases lacking subduction complex not depicted (see text for discussion).

Relação com o complexo de subducção:

- Pode ser embasamento de parte da bacia (a parte principal fica sobre fundo oceânico)
- É caracterizado por uma *mélange*, presença de lascas ofiolíticas e xistos azuis.

Pela relação com o complexo de subducção, as bacias de ante-arco têm baixo gradiente térmico, diferindo das bacias de *backarc*.

Em situações em que todo sedimento da trincheira é subductado, não ocorre desenvolvimento de complexos de subducção, e a bacia de ante-arco é apenas um prisma curto.

Mecanismos de subsidência:

É controverso, os principais mecanismos propostos são:

- Flexura pela carga infra-carga da placa subductada.
- Flexura pela sobrecarga do complexo de subducção
- Flexura pela sobrecarga sedimentar.
- Subsidência termal da lateral do maciço do arco.

Dickinson, W.R. (1998). *Forearc Basins*, in:
Busby & Ingersoll: *Tectonics of
Sedimentary Basins*. 221-261

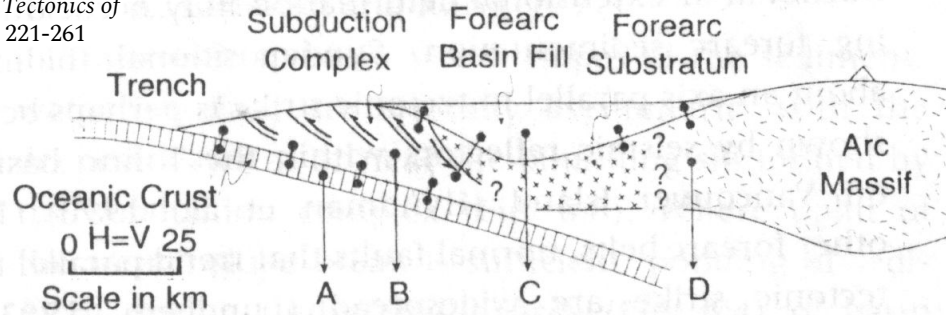


Fig. 6.7 Key factors (diagrammatic) at crustal levels influencing subsidence of forearc basins (arrows): A, negative buoyancy of slab of descending oceanic lithosphere (only capping oceanic crust shown); B, isostatic tectonic load of subduction complex; C, isostatic sedimentary load of forearc-basin fill; D, thermotectonic subsidence of flank of magmatic arc massif (arrows A,B,D potentially reversible to induce uplift of basin flanks and rebound of basin floor). Barbells denote flexural couplings of oceanic lithosphere and subduction complex, subduction complex and forearc-basin fill, and forearc-basin fill and arc massif.

Tectônica sin-deposicional

Pode ser:

- Compressiva, com cavalgamentos e dobras,
- Distensiva, com formação de hemigrabens
- Dominada por transcorrências.

Preenchimento

- O padrão típico é um megaciclo progracional, causado pela diminuição progressiva da subsidência. Turbiditos passando a fácies de plataforma e subaéreas.

- A proveniência é dominada por fontes do arco magmático (ou de ilhas), com alguns casos especiais de rios que cortam o arco permitindo fontes do interior do continente. Geralmente evolui de vulcânica para plutônica com a exumação do arco.

No caso de complexos de subducção soerguidos, também a associação mélange-ofiolito pode servir de fonte.

A grande profundidade dessas bacias (mais de 10 km) e a composição instável (vulcânica) dos sedimentos geralmente resulta em importante metamorfismo de soterramento.

A grande e rápida perda de porosidade resulta em maus prospectos para petróleo.

Dickinson, W.R. (1998). *Forearc Basins*, in:
 Busby & Ingersoll: *Tectonics of
 Sedimentary Basins*. 221-261

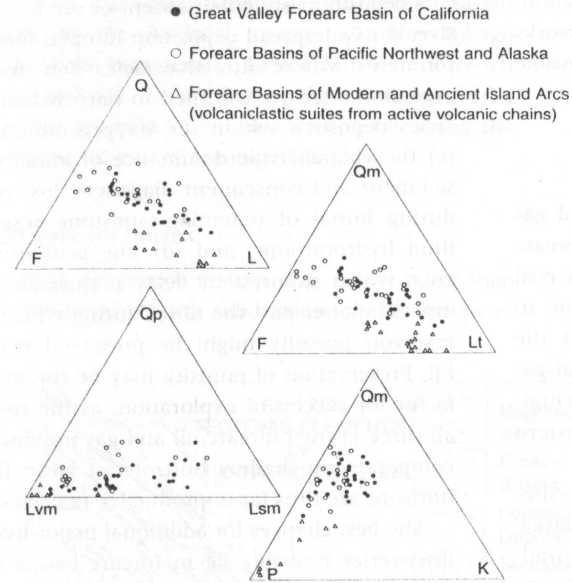


Fig. 6.9 Modal compositions of volcanoplutonic sandstone suites from forearc basins, where Q (total quartzose grains) = Qm (monocrystalline quartz grains) + Qp (polycrystalline quartzose lithic fragments), L (total unstable lithic fragments) = Lvm (volcanic and metavolcanic lithic fragments) + Lsm (sedimentary and metasedimentary lithic fragments), and F (total feldspar grains) = P (plagioclase grains) + K (K-feldspar grains). Points plotted are reported or calculated means for selected forearc sandstone suites from Dickinson (1982), Dickinson et al. (1982), Ward and Stanley (1982), Cawood (1983), Heller and Ryberg (1983), Ingersoll (1983), Johnson (1984), Korsch (1984), Short and Ingersoll (1990), and Lundberg (1991).

Exemplos

- Bacias atuais:

- Arco de Sunda

- Bacias do Orógeno Andino

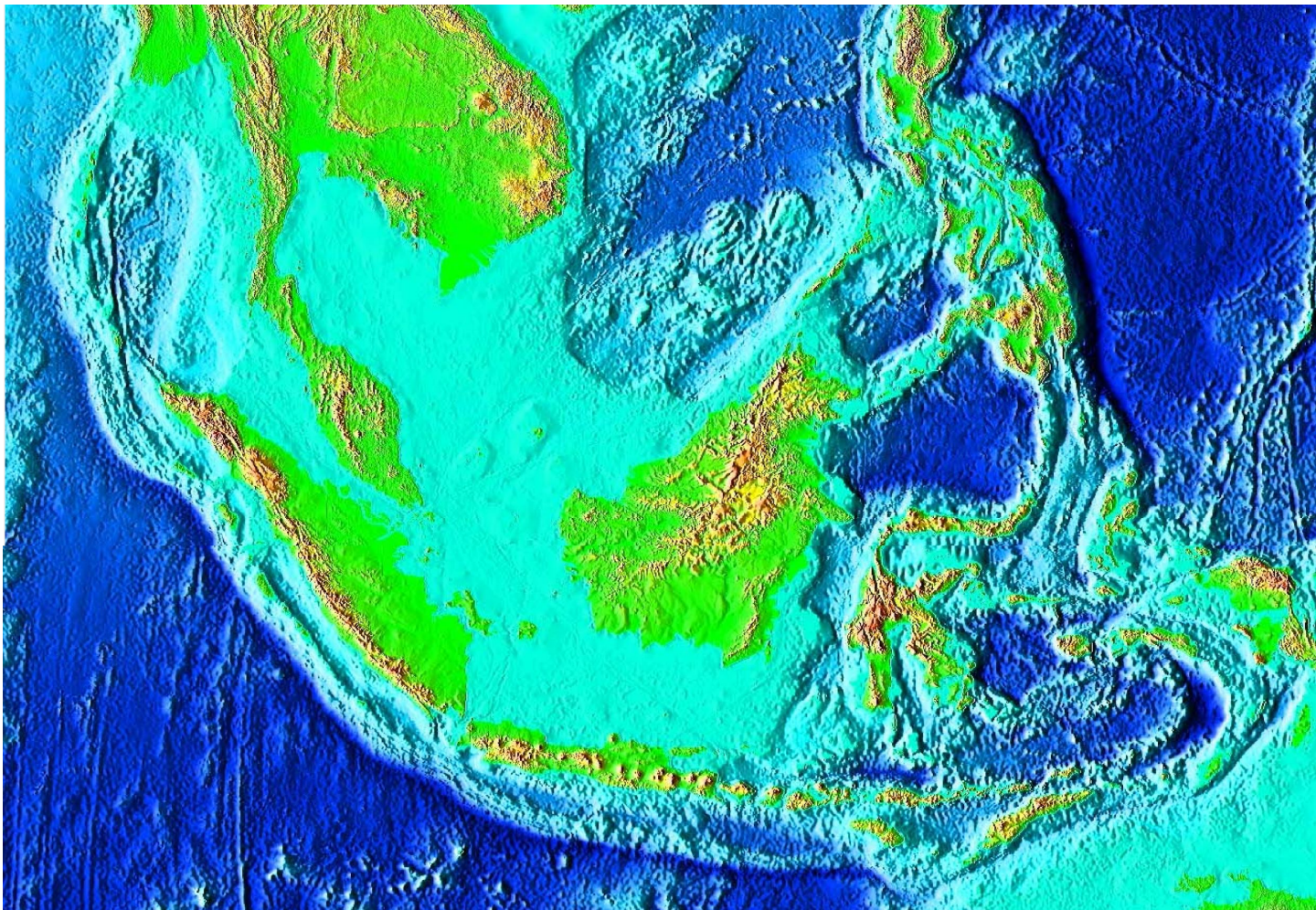
- Antilhas

- Alaska-Aleutas

- Bacias antigas:

- Great Valley califórnia

- Hokonui – Nova Zelândia



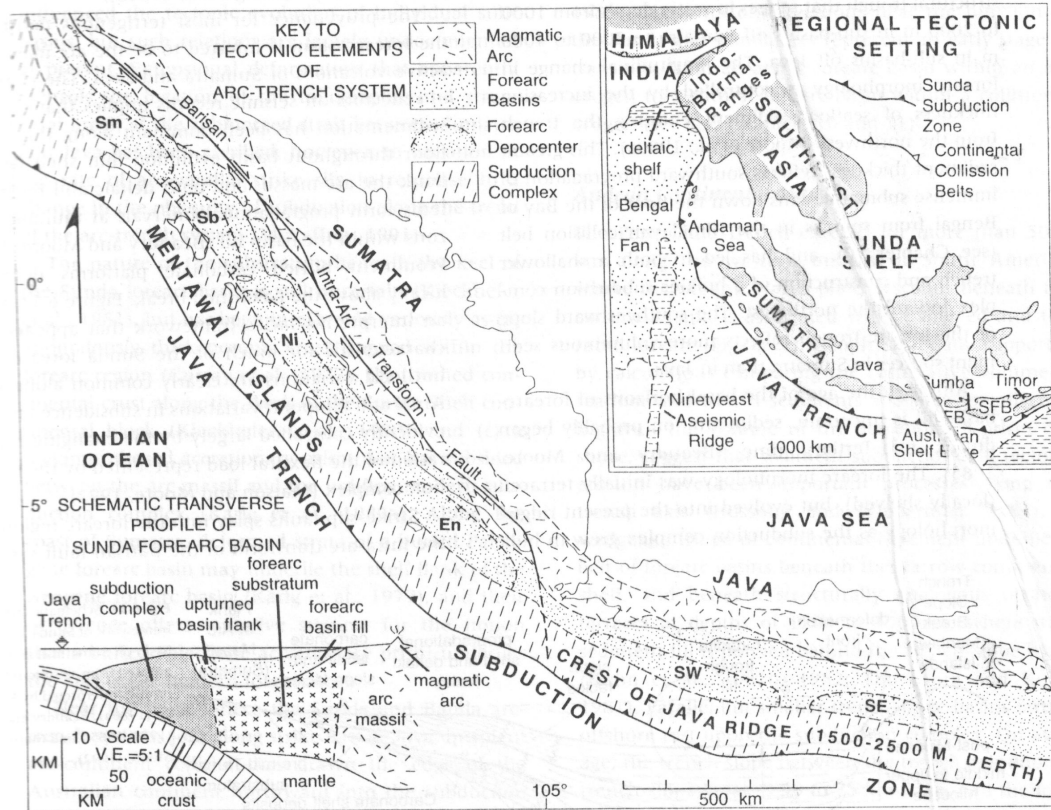


Fig. 6.10 Configuration of elongate forearc basin, with multiple depocenters, in Sunda arc-trench system of Sumatra and Java (Hamilton, 1979; Karig et al., 1979, 1980a; Kieckhefer et al., 1981). Inset shows relation of Sunda subduction zone (note position of Sumatra and Java)

to Himalayan suture belt and incipient arc-continent collision at Timor (LFB, Lombok forearc basin; SFB, Savu forearc basin). Forearc depocenters off Sumatra-Java (Table 6.1, III): Sm, Simeulue; Ni, Nias; Sb, Siberut; En, Enggano; SW, southwest Java; SE, southeast Java.

Dickinson, W.R. (1998). *Forearc Basins*, in: Busby & Ingersoll: *Tectonics of Sedimentary Basins*. 221-261

Dickinson, W.R. (1998). *Forearc Basins*, in:
 Busby & Ingersoll: *Tectonics of
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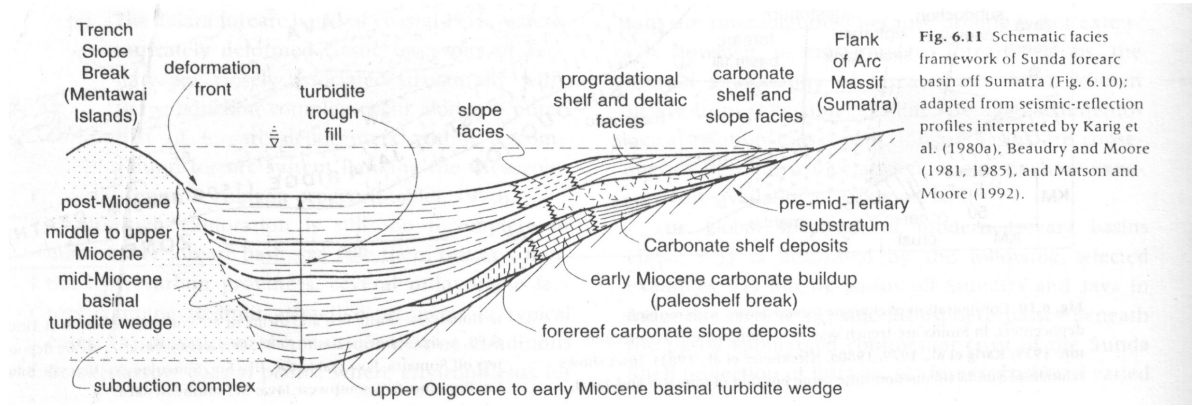
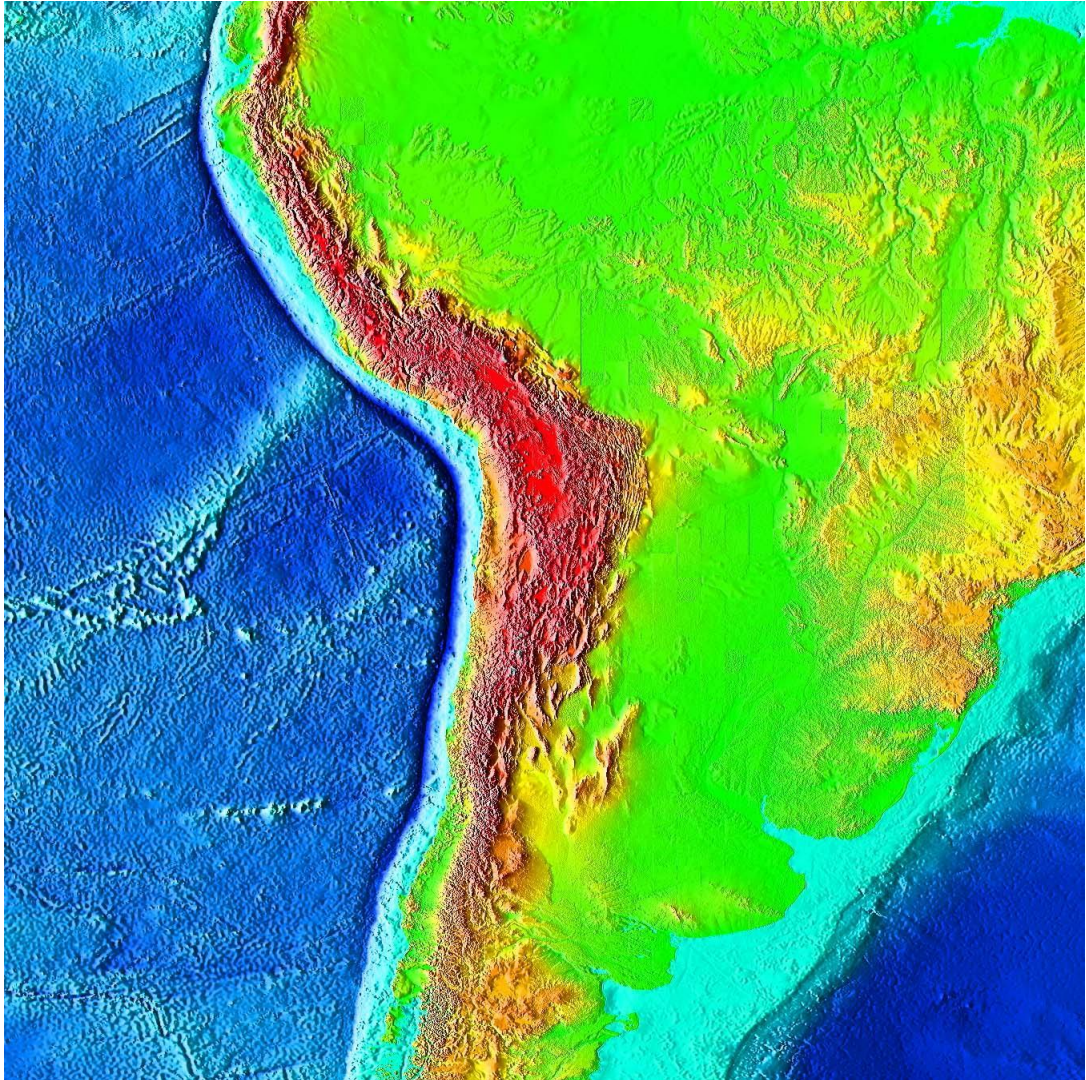


Fig. 6.11 Schematic facies framework of Sunda forearc basin off Sumatra (Fig. 6.10); adapted from seismic-reflection profiles interpreted by Karig et al. (1980a), Beaudry and Moore (1981, 1985), and Matson and Moore (1992).



Dickinson, W.R. (1998). *Forearc Basins*, in: Busby & Ingersoll: *Tectonics of Sedimentary Basins*. 221-261

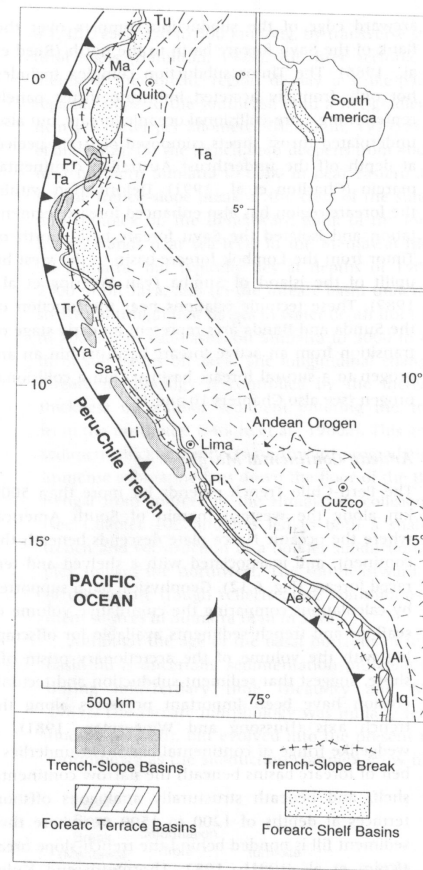
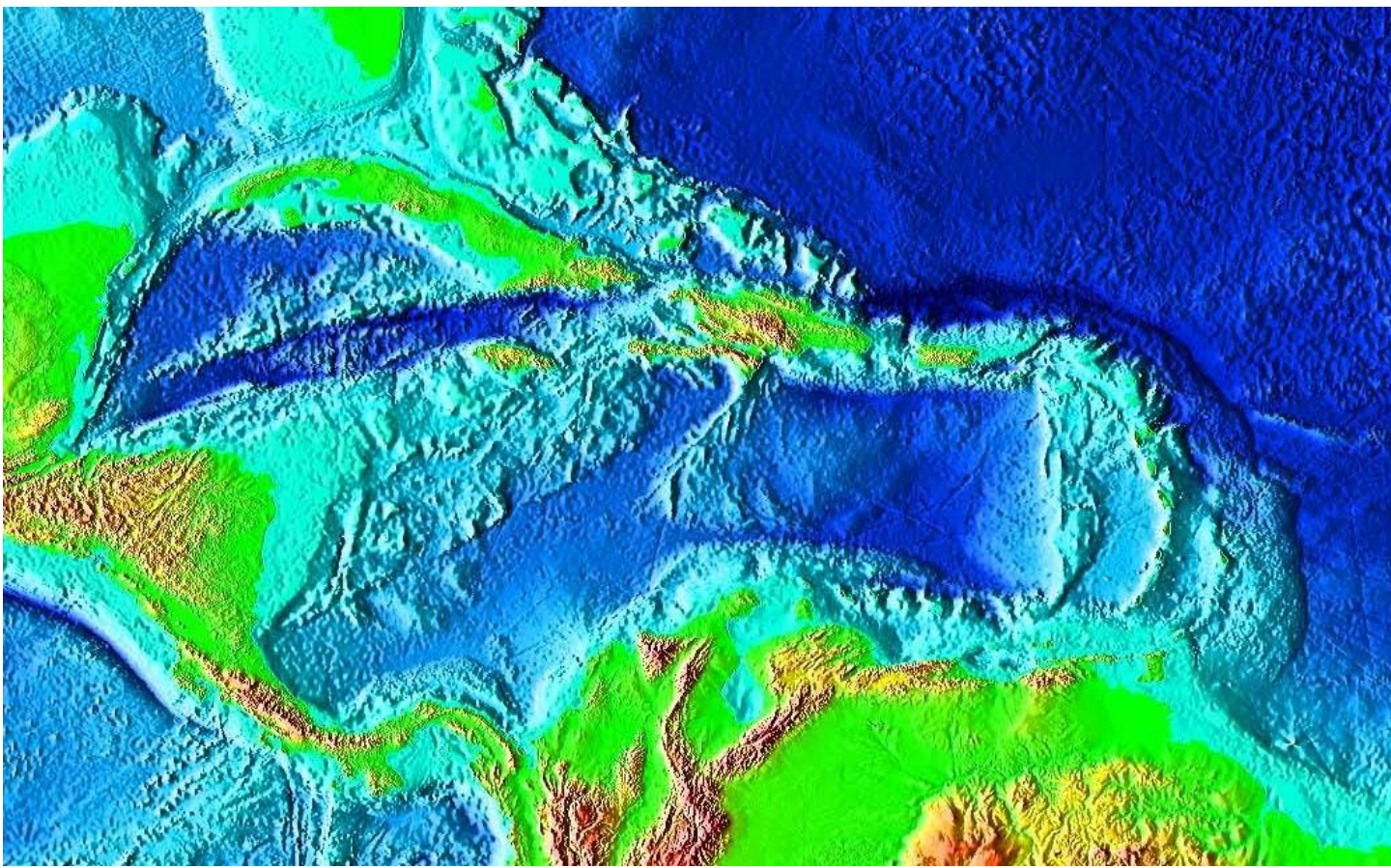


Fig. 6.12 Distribution of forearc basins of central Andean continental margin (Lonsdale, 1978; Coulbourn, 1981; Thornburg and Kulm, 1981). Double line indicates coastline. Inset shows location off South America. Basin names (Table 6.1, I): Ae, Arequipa; Ai, Arica; Iq, Iquique; Lj, Lima; Ma, Manabí; Pi, Pisco; Pr, Progresso; Sa, Salaverry; Se, Secura; Ta, Talara; Tr, Trujillo; Tu, Tumaco; Ya, Yaquina (onshore shelf basins include terrestrial deposystems). See Figure 6.4 for comparative morphology of shelf and terrace basins.



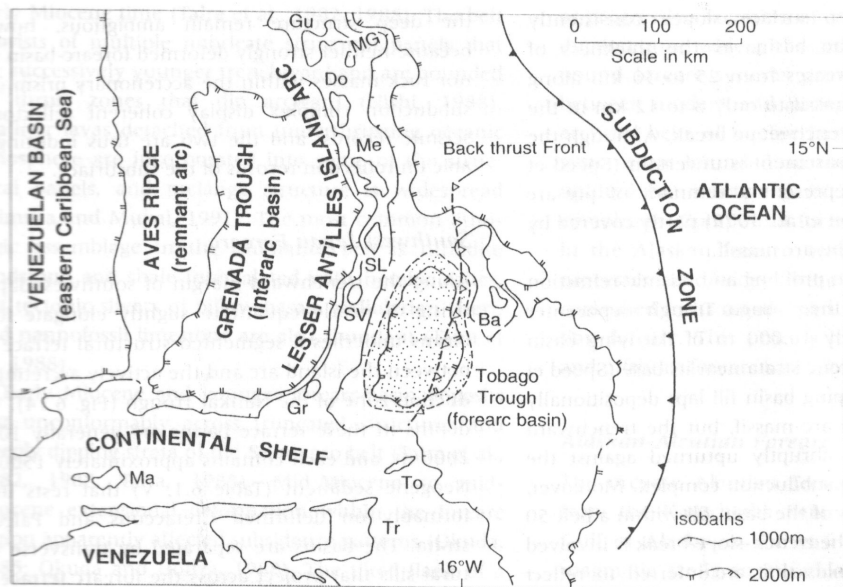
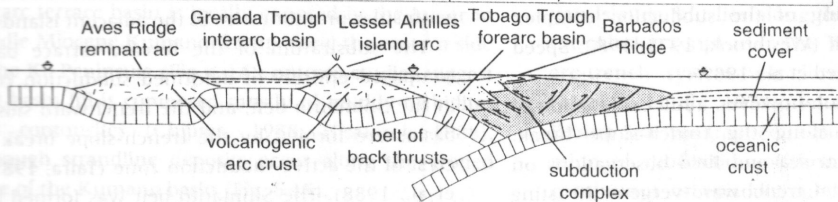
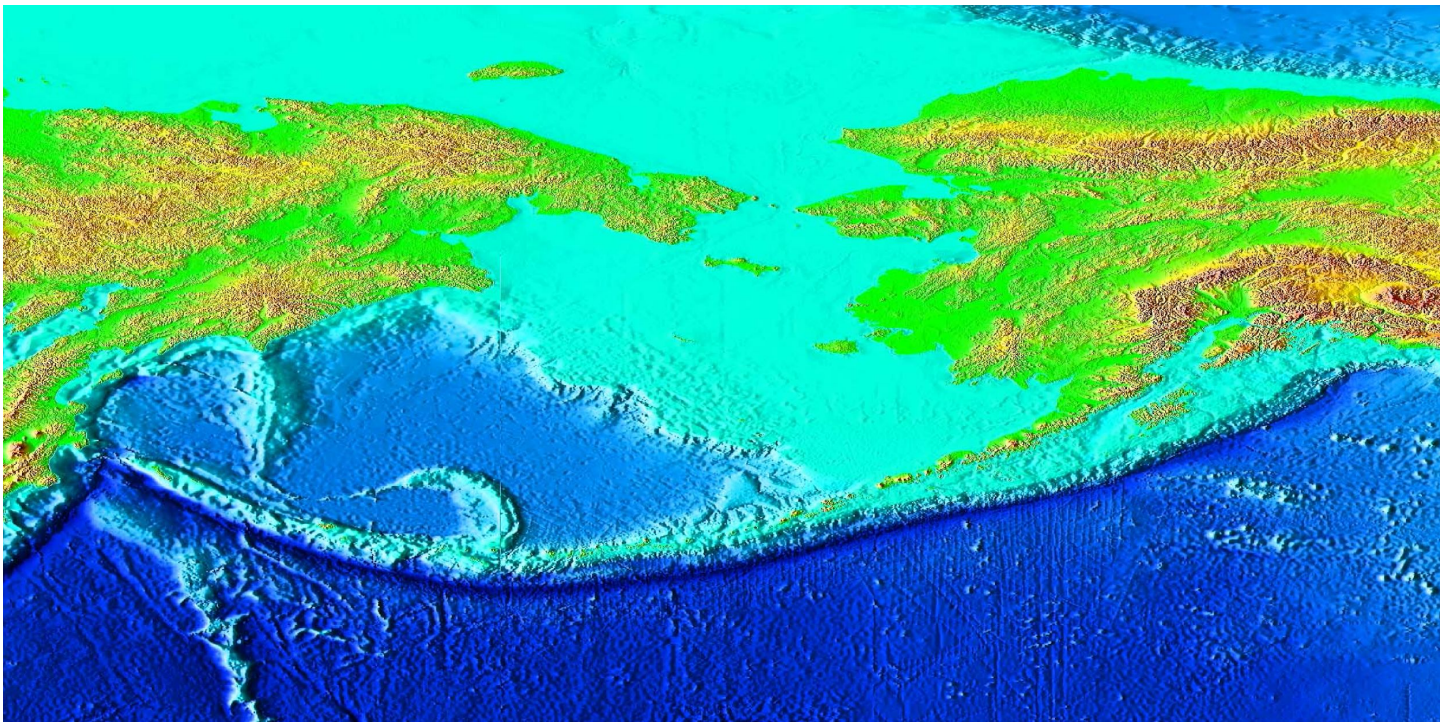


Fig. 6.13 Tectonic setting (map) and inferred structural relations (section) of Tobago Trough fore-arc basin (Table 6.1, VI) within Lesser Antilles arc-trench system (Westbrook, 1975, 1982; Speed et al., 1989; Torrini and Speed, 1989); arcward vergent folds deform forearc-basin fill at shallow levels above zone of backthrusting at depth. Islands shown: Ba, Barbados; Do, Dominica; Gr, Grenada; Gu, Guadeloupe; Ma, Margarita; Me, Martinique; MG, Marie Galante; SL, St. Lucia; SV, St. Vincent; To, Tobago; Tr, Trinidad.



Schematic Crustal Profile Across Tobago Trough (V.E. = 2:1)

Dickinson, W.R. (1998). *Forearc Basins*, in: Busby & Ingersoll: *Tectonics of Sedimentary Basins*. 221-261



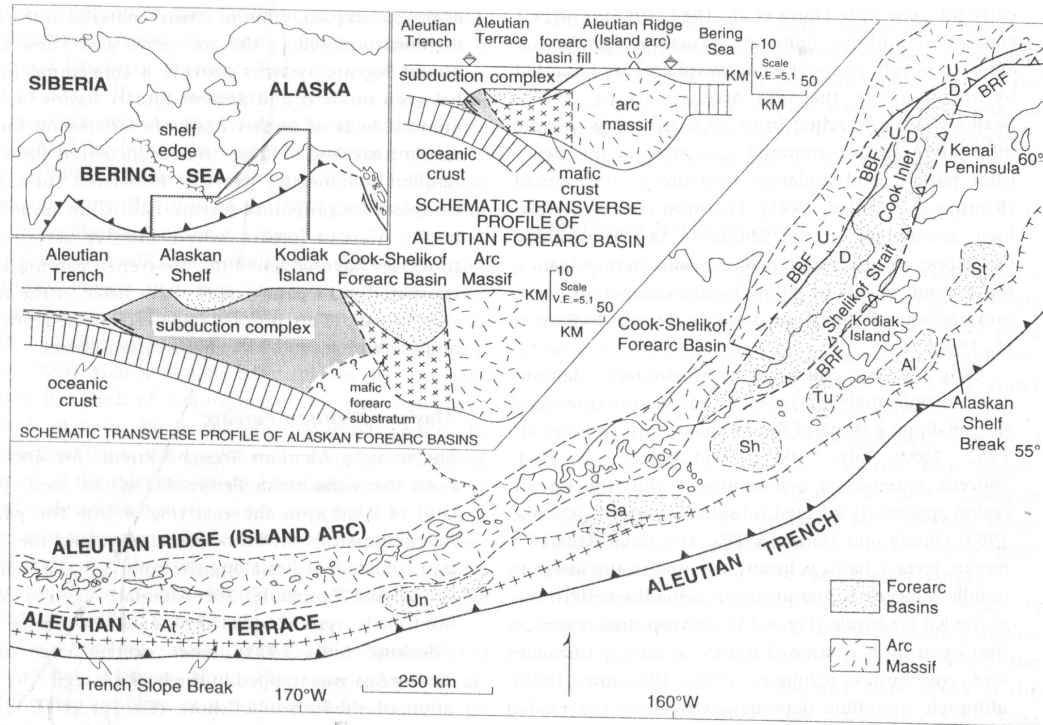
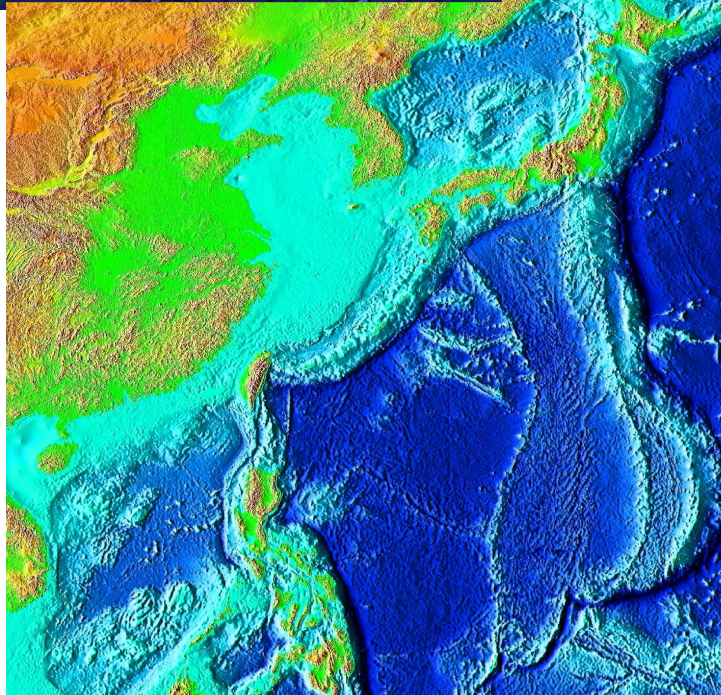
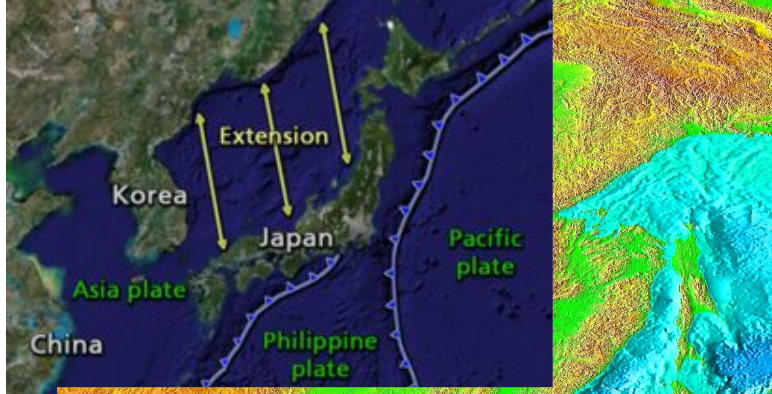


Fig. 6.16 Relations of multiple Alaskan and Aleutian forearc basins (Bruns et al., 1987; Fisher et al., 1987; Scholl et al., 1987b; von Huene et al., 1987): Aleutian terrace basins (At, Atka; Un, Unalaska), Alaskan shelf basins (Sa, Sanak; Sh, Shumagin; Tu, Tugidak; Al, Albatross; St, Stevenson), and Cook-Shelikof basin (Table 6.1, I, II, IV; Kanaga basin is

west of edge of map); inset map shows relations to continental blocks and linked transform system along continental margin. Mafic crust beneath Aleutian forearc basins can be regarded as buried flank of arc massif (Geist et al., 1988).

Dickinson, W.R. (1998). *Forearc Basins*, in: Busby & Ingersoll: *Tectonics of Sedimentary Basins*. 221-261

Ante arco composto por várias bacias devido à migração da trincheira.



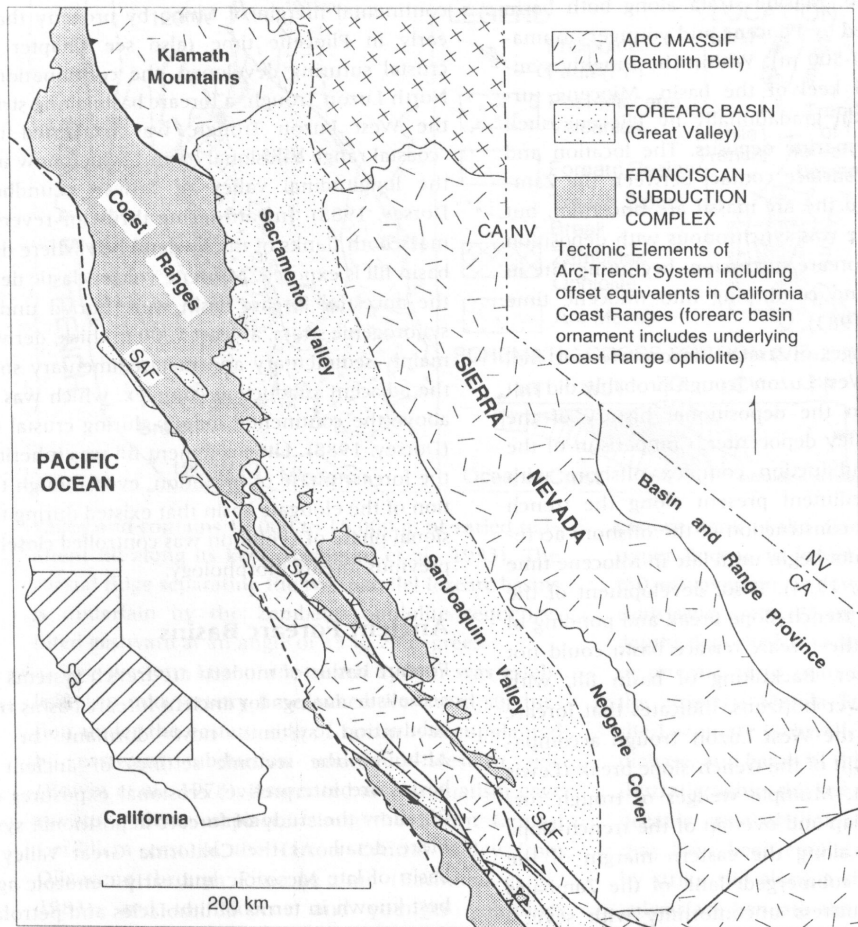


Fig. 6.18 Geologic setting of Late Jurassic to Paleogene Great Valley forearc basin (Table 6.2D) in California (Dickinson and Seely, 1979; Dickinson et al., 1979; Ingersoll, 1982b, 1988a). San Andreas (SAF), San Gregorio-Hosgri (SGF), and related Neogene strike-slip faults in California Coast Ranges obliquely disrupt older forearc trends. South Fork Mountain thrust between arc massif of Klamath Mountains and Franciscan subduction complex indicated by solid triangles, and Coast Range fault between Great Valley forearc-basin fill (including ophiolitic substratum) and Franciscan subduction complex indicated by open triangles.

Dickinson, W.R. (1998). *Forearc Basins*, in: Busby & Ingersoll: *Tectonics of Sedimentary Basins*. 221-261

Cretáceo a Terciário

Dickinson, W.R. (1998). *Forearc Basins*, in:
 Busby & Ingersoll: *Tectonics of
 Sedimentary Basins*. 221-261

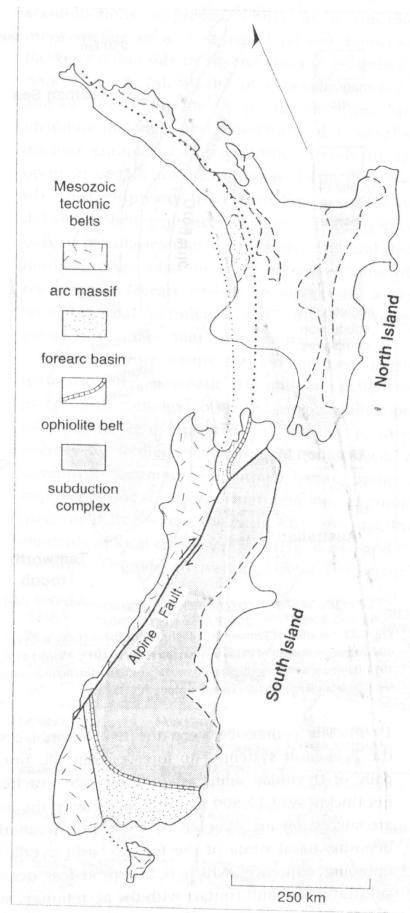


Fig. 6.21 Tectonic elements of Permian to Cretaceous arc-trench system, offset by Cenozoic Alpine fault, in New Zealand (Dickinson, 1971a,b; Landis and Bishop, 1972; Blake et al., 1974; Sporli, 1978): (a) flank of arc massif is western basement province, (b) forearc-basin belt (Table 6.2D) is Hokonui assemblage and other strata of Murihiku Supergroup, (c) ophiolitic assemblage is Dun Mountain ophiolite and associated strata, (d) subduction complex is Torlesse assemblage and related metamorphic rocks.

Sedimentação
 Devoniana a
 Carbonífera

Preservação de Bacias antigas de ante-arco

Dickinson, W.R. (1998). *Forearc Basins*, in: Busby & Ingersoll: *Tectonics of Sedimentary Basins*. 221-261

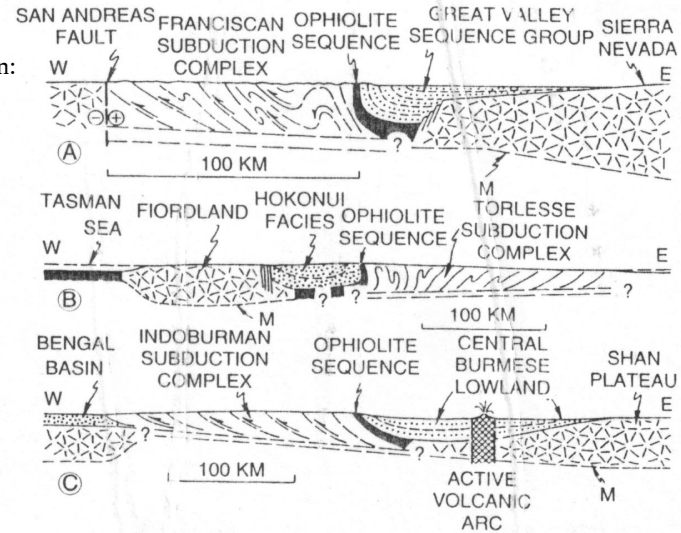


Fig. 6.24 Schematic crustal diagrams (M is base of crust) indicating scale of forearc basin fill (stippled with dashes to show bedding) in relation to arc massifs (sta.-dash pattern) and subduction complexes (thrusts shown schematically): A, coastal California; B, New Zealand (South Island); C, Bengal Basin and Burma (Bengal Basin is peripheral foreland basin formed by collision of arc-trench system with underthrust Indian subcontinent); no vertical exaggeration.

Evolução

Possibilidades de curto prazo:

1- Inversão durante colisão (destino final de todas as formas)

2 – Fim da subducção

3 – Migração da zona de subducção com expansão do complexo de subducção – soerguimento da bacia. Orógeno tipo turco.

Preservação: evidência de sutura

Sedimentação siluriana, devoniana e carbonífera (já durante a sutura).

Evidência de sutura dos
Caledonides.

Dickinson, W.R. (1998). *Forearc Basins*, in:
Busby & Ingersoll: *Tectonics of
Sedimentary Basins*. 221-261

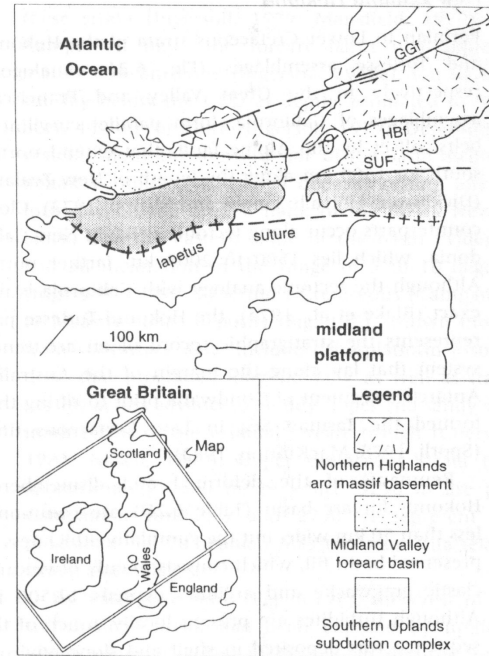
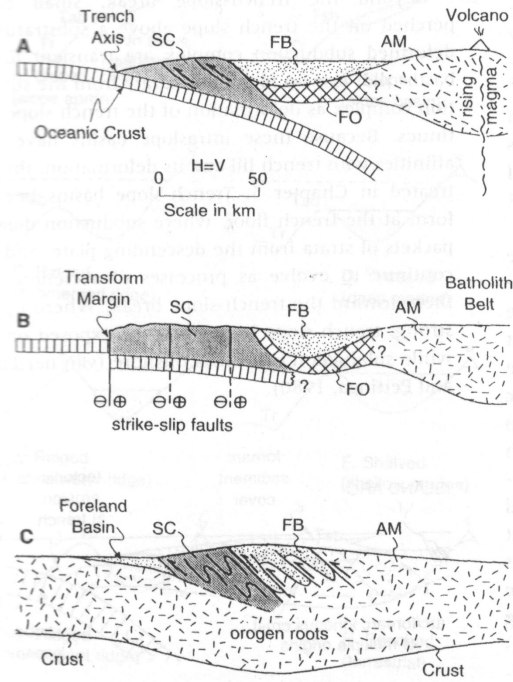


Fig. 6.23 Tectonic relations of remnant lower Paleozoic Midland Valley forearc basin (Table 6.2E) parallel to collisional suture marking closure of Iapetus Ocean within Caledonian orogen of British Isles (Dewey, 1971; Leggett et al., 1982; McKerrow and Soper, 1989); GGF, sinistral Great Glen fault; HBF, highland boundary fault; SUF, southern uplands fault zone.



Dickinson, W.R. (1998). *Forearc Basins*, in: Busby & Ingersoll: *Tectonics of Sedimentary Basins*. 221-261

Fig. 6.2 Tectonic settings of forearc basins (schematic): A, origin within active arc-trench system (after Fig. 6.1); B, preservation of basin remnant after conversion of subduction to transform slip (e.g., Great Valley of California); C, deformation of basin fill by incorporation into suture belt of collisional orogenic system (e.g., Midland Valley of Scotland). Symbols: AM, arc massif; FB, forearc basin; FO, forearc ophiolite; SC, subduction complex (but forearc substratum not everywhere ophiolitic; see text for discussion).

Prenchimento

- Turbiditos com proveniência do arco.
- Vulcanismo – evolução de composição de arco para de fundo oceânico
- Contribuição vulcanoclástica

Marsaglia, M.M. (1998). *Interarc and Backarc Basins*, in: Busby & Ingersoll: *Tectonics of Sedimentary Basins*. 299-329

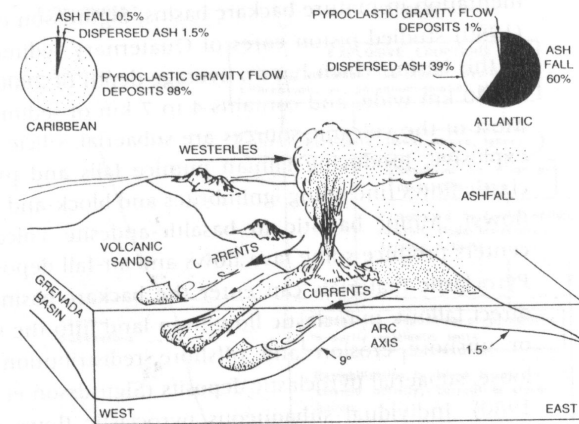


Fig. 8.13 Asymmetric distribution of volcaniclastic material across the Lesser Antilles arc, controlled by bathymetry and marine and atmospheric currents. Fine-grained ash is carried by the tropospheric westerlies to the east, whereas coarse-grained proximal sediments are preferentially distributed to the west. See text for discussion. From Sigurdsson et al. (1980).