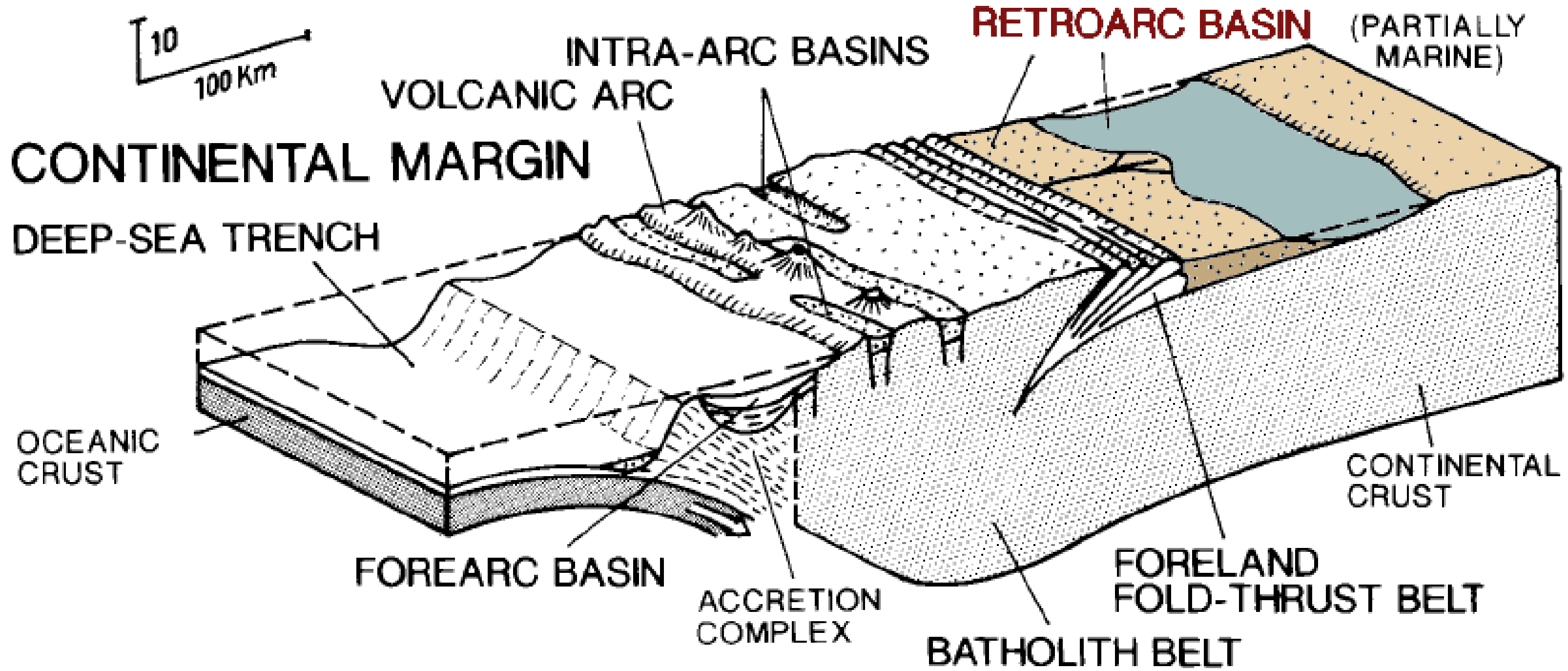
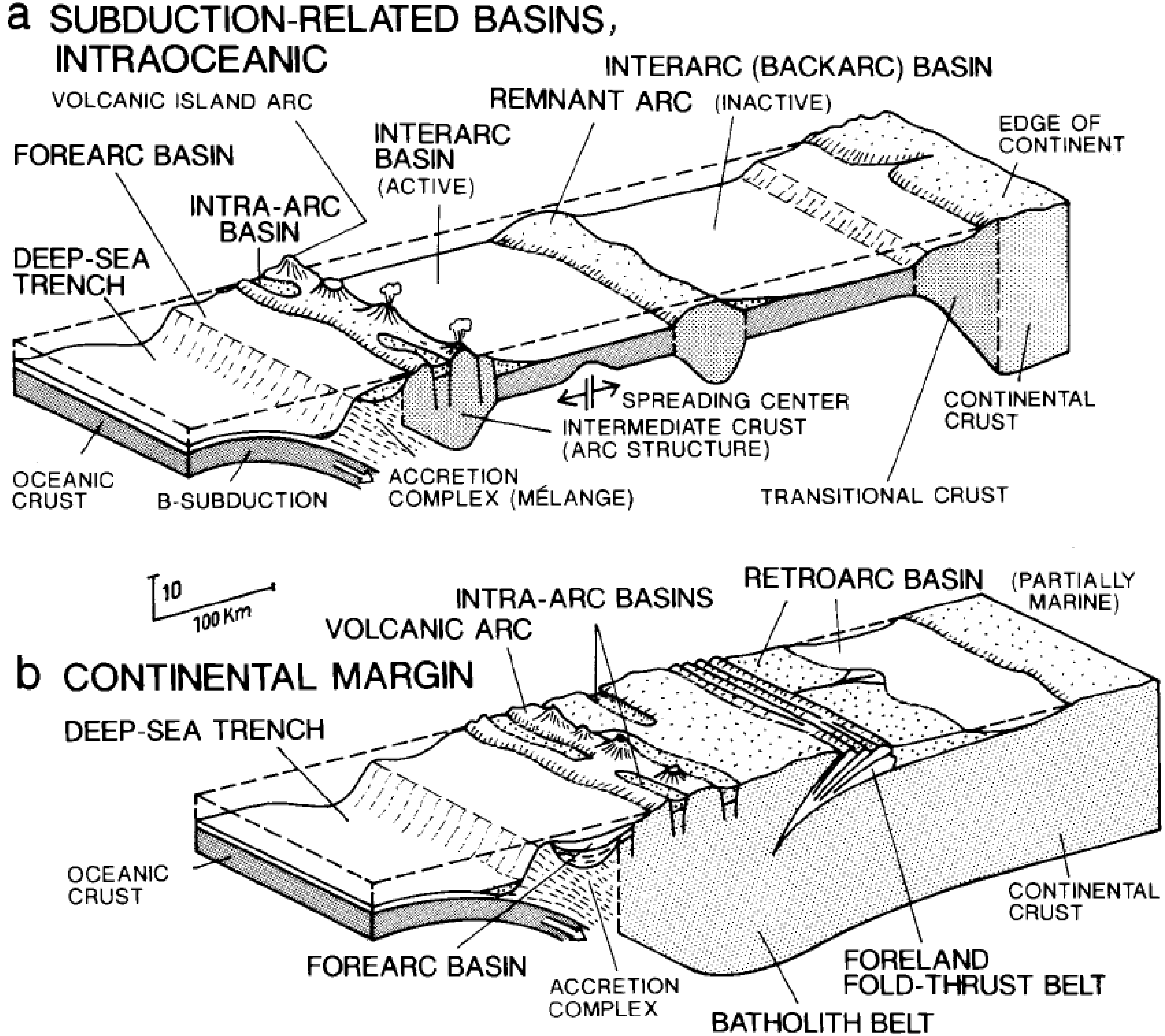
Bacias de Margens convergentes 2: orógenos de subducção

- Bacias de Ante-arco

- Bacias de Backarc

-Bacias de Retroarco de Antepaís


10
100 Km
CONTINENTAL MARGIN
VOLCANIC ARC
INTRA-ARC BASINS
RETROARC BASIN
(PARTIALLY
MARINE)
DEEP-SEA TRENCH
OCEANIC
CRUST
FOREARC BASIN
ACCRETION
COMPLEX
BATHOLITH BELT
FORELAND
FOLD-THRUST BELT
CONTINENTAL
CRUST


a SUBDUCTION-RELATED BASINS, INTRAOCEANIC
INTERARC (BACKARC) BASIN
REMNANT ARC
(INACTIVE)
VOLCANIC ISLAND ARC
EDGE OF CONTINENT
INTERARC BASIN (ACTIVE)
FOREARC BASIN
INTRA-ARC BASIN
DEEP-SEA TRENCH
SPREADING CENTER
CONTINENTAL CRUST
INTERMEDIATE CRUST (ARC STRUCTURE)
OCEANIC CRUST
B-SUBDUCTION
ACCRETION COMPLEX (MÉLANGE)
TRANSITIONAL CRUST
10
100 Km
RETROARC BASIN
(PARTIALLY MARINE)
INTRA-ARC BASINS
VOLCANIC ARC
b CONTINENTAL MARGIN
DEEP-SEA TRENCH
OCEANIC CRUST
CONTINENTAL CRUST
FOREARC BASIN
FORELAND FOLD-THRUST BELT
ACCRETION COMPLEX
BATHOLITH BELT

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

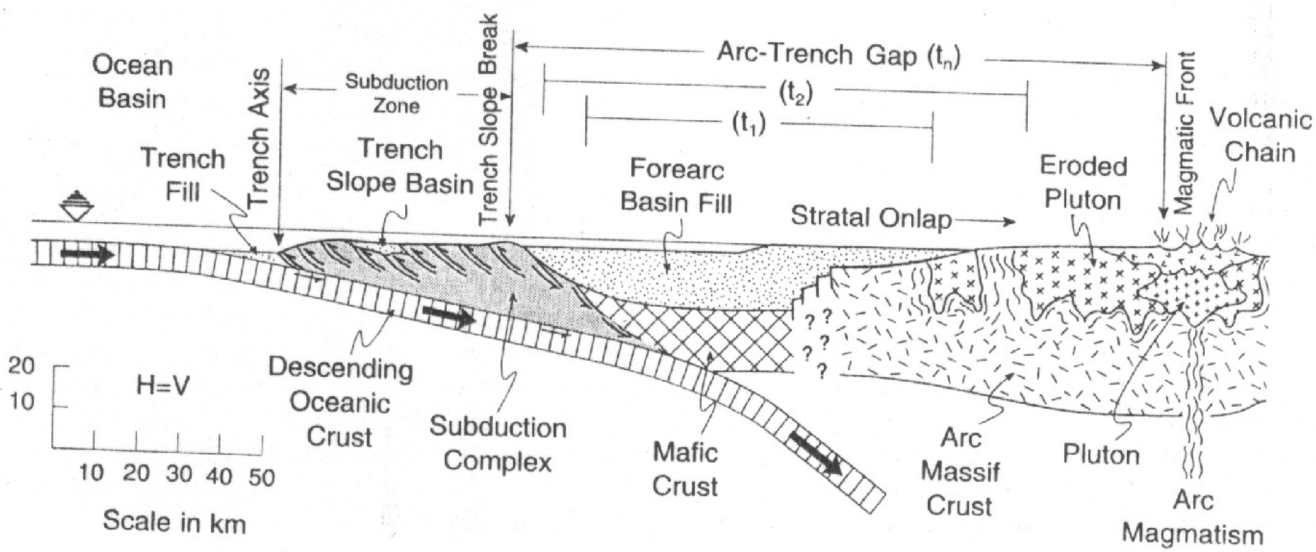


Fig. 6.1 Geotectonic features of forearc basins in transverse profile. See Fig. 6.5 for internal structures of subduction complex and Fig. 6.6 for origins of forearc ophiolites (mafic crustal substratum). Stipples indicate undeformed sediment accumulations. Diagram shows ideal case for which sedimentary 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 pela infra-carga da placa subductada.

- Flexura pela sobrecarga do complexo de subducção

- Flexura pela sobrecarga sedimentar.

- Subsidência termal da lateral do maciço do arco.

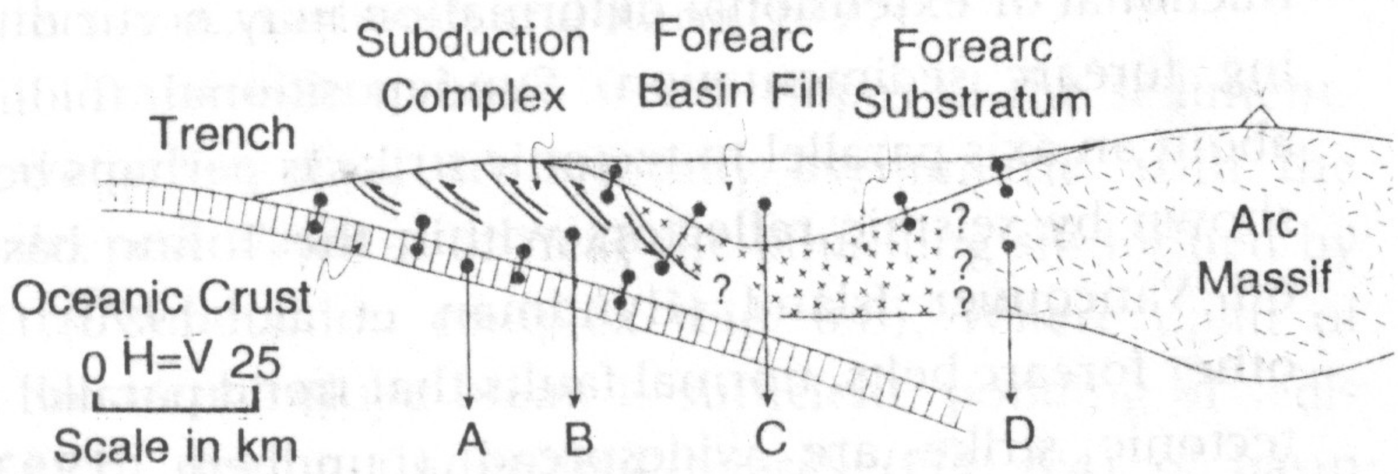


Fig. 6.7 Key factors (diagrammatic) at crustal levels influencing subsidence of forearc basins (arrows): A, negative buoyancy of slab of descending oceanic lithosphere (only capping oceanic crust shown); B, isostatic tectonic load of subduction complex; C, isostatic sedimentary load of forearc-basin 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 progradacional, 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. Gerealmente 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 patróleo.

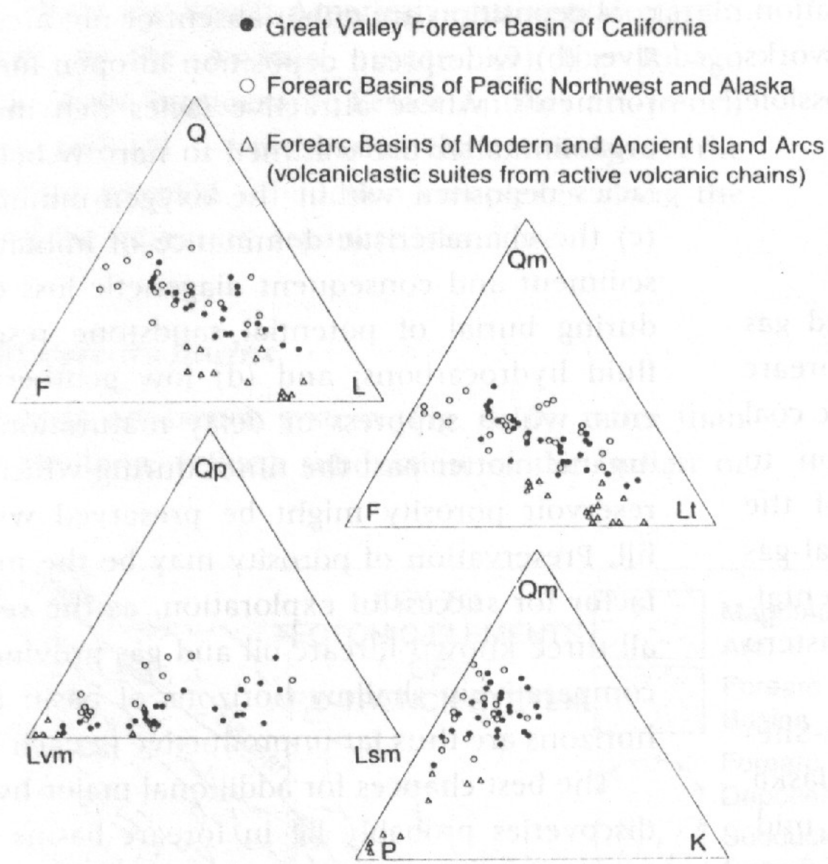
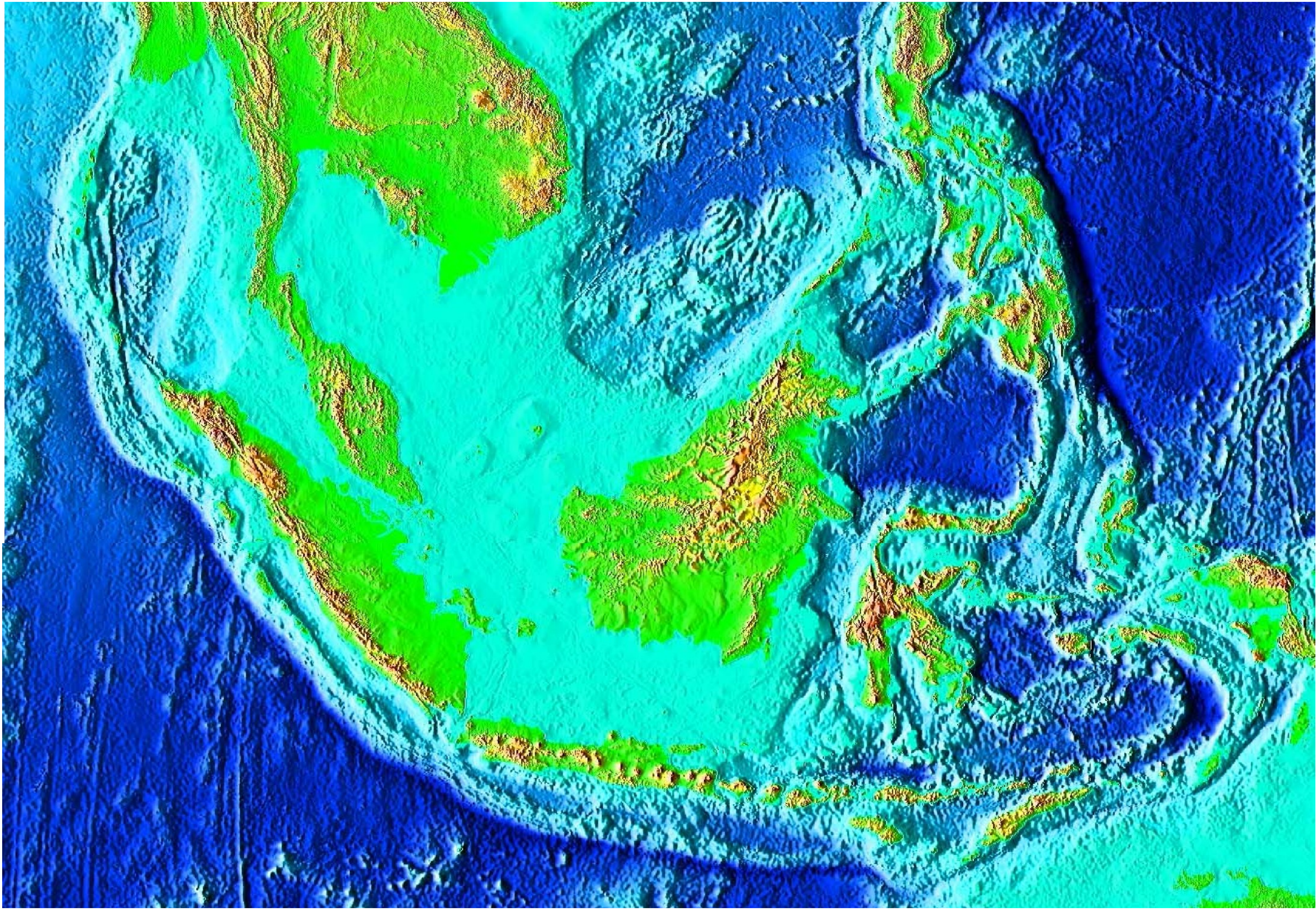


Fig. 6.9 Modal compositions of volcanoplutonic sandstone suites from forearc basins, where Q (total quartzose grains) = Qm (monocrystalline quartz grains) + Qp (polycrystalline quartzose lithic fragments), L (total unstable lithic fragments) = Lvm (volcanic and metavolcanic lithic fragments) + Lsm (sedimentary 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 Valey california
  - Hokonui – Nova Zelândia



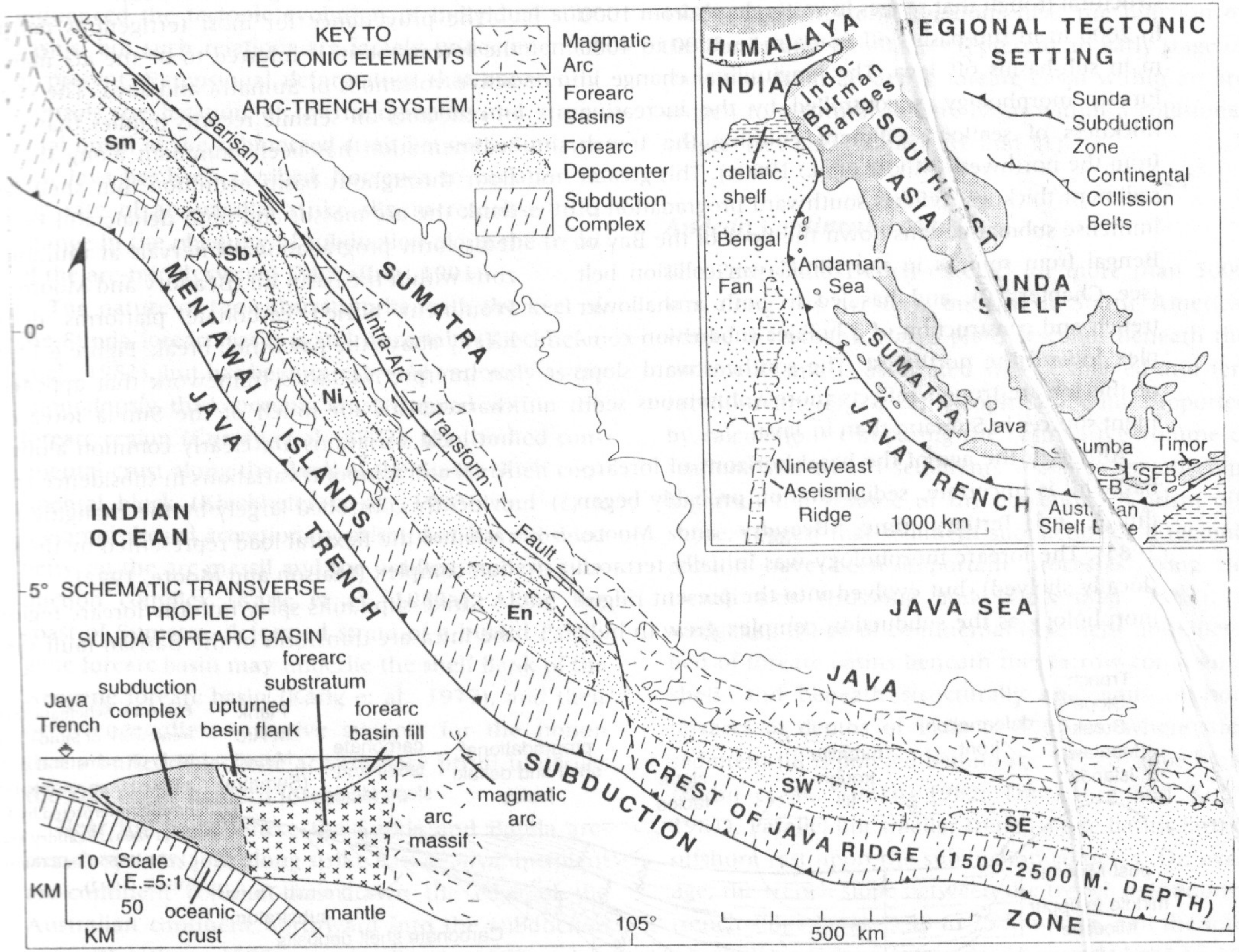


Fig. 6.10 Configuration of elongate forearc basin, with multiple depocenters, in Sunda arc-trench system of Sumatra and Java (Hamilton, 1979; Karig et al., 1979, 1980a; Kieckhefer et al., 1981). Inset shows relation of Sunda subduction zone (note position of Sumatra and Java) to Himalayan suture belt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

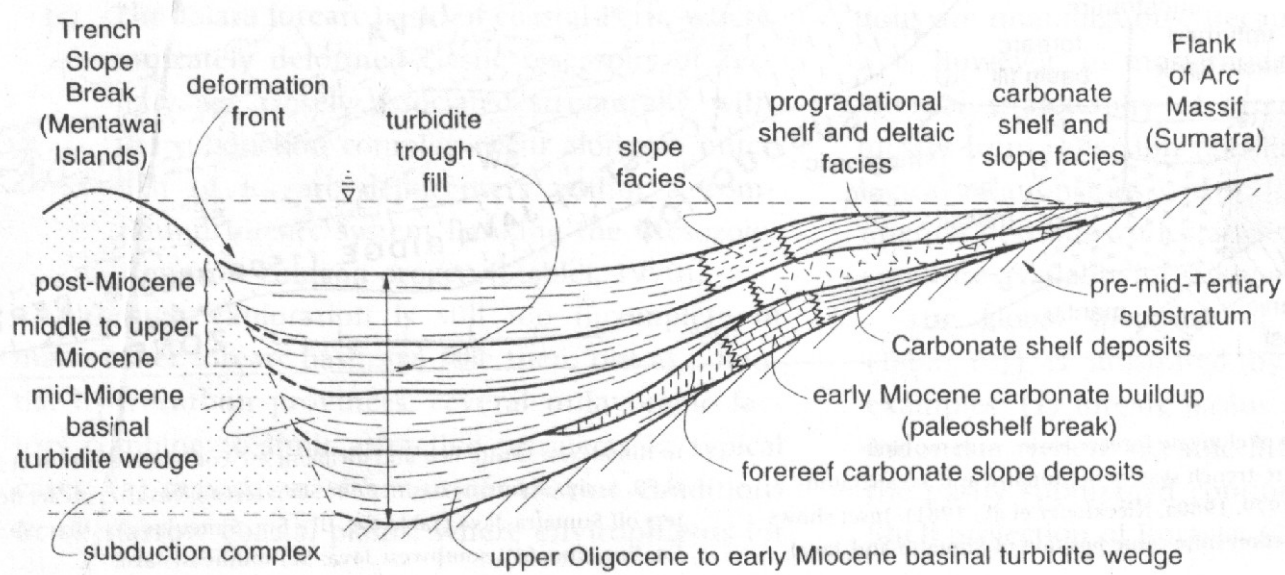
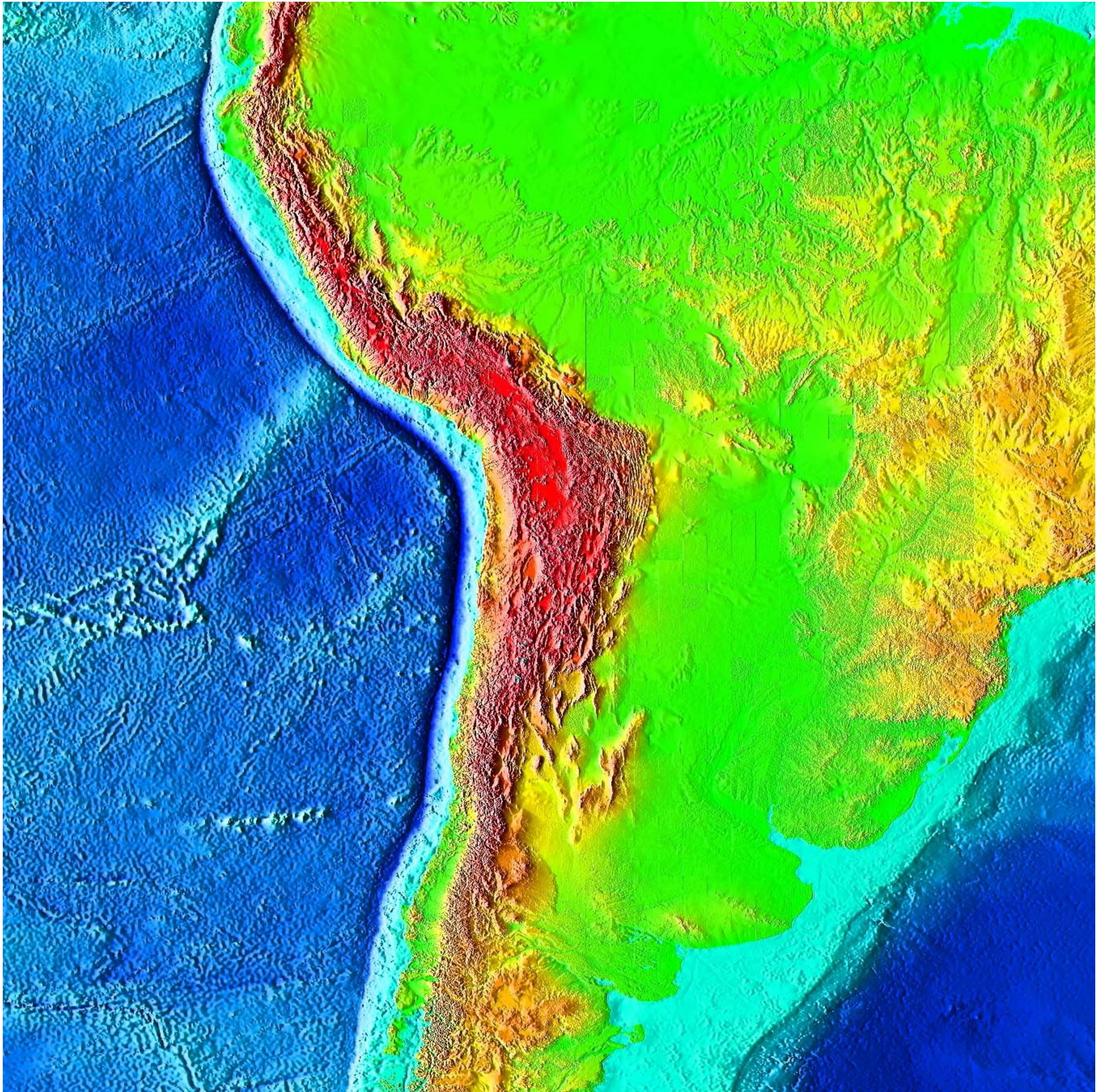


Fig. 6.11 Schematic facies framework of Sunda forearc basin off Sumatra (Fig. 6.10); adapted from seismic-reflection profiles interpreted by Karig et al. (1980a), Beaudry and Moore (1981, 1985), and Matson and Moore (1992).



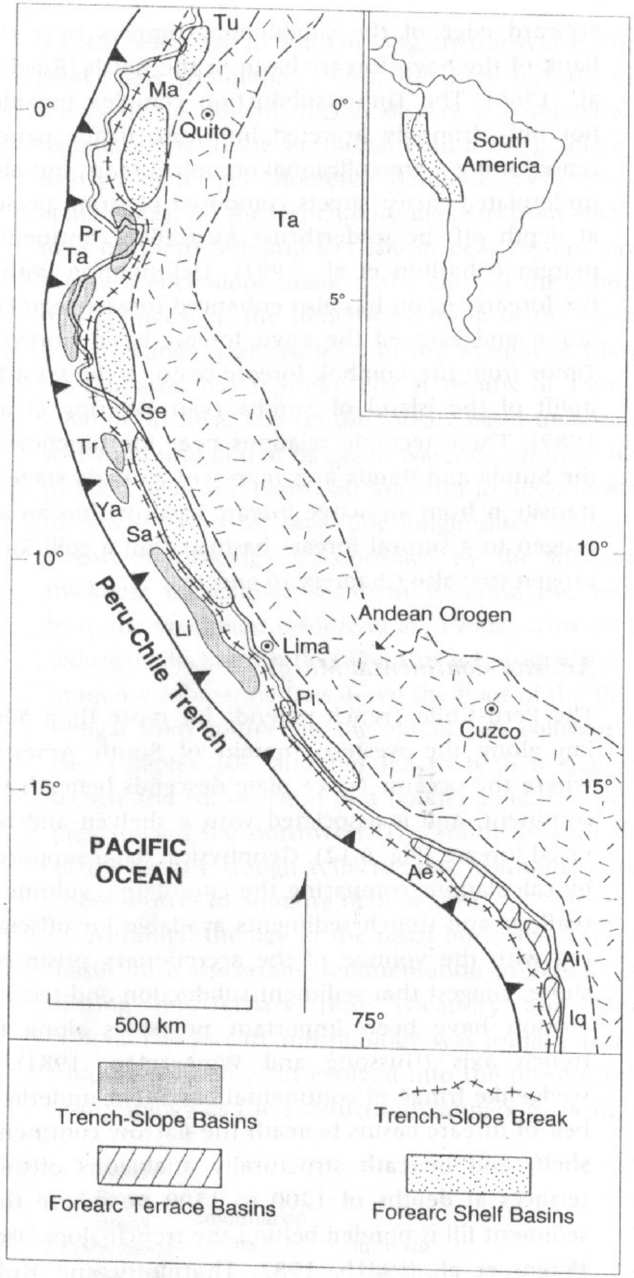
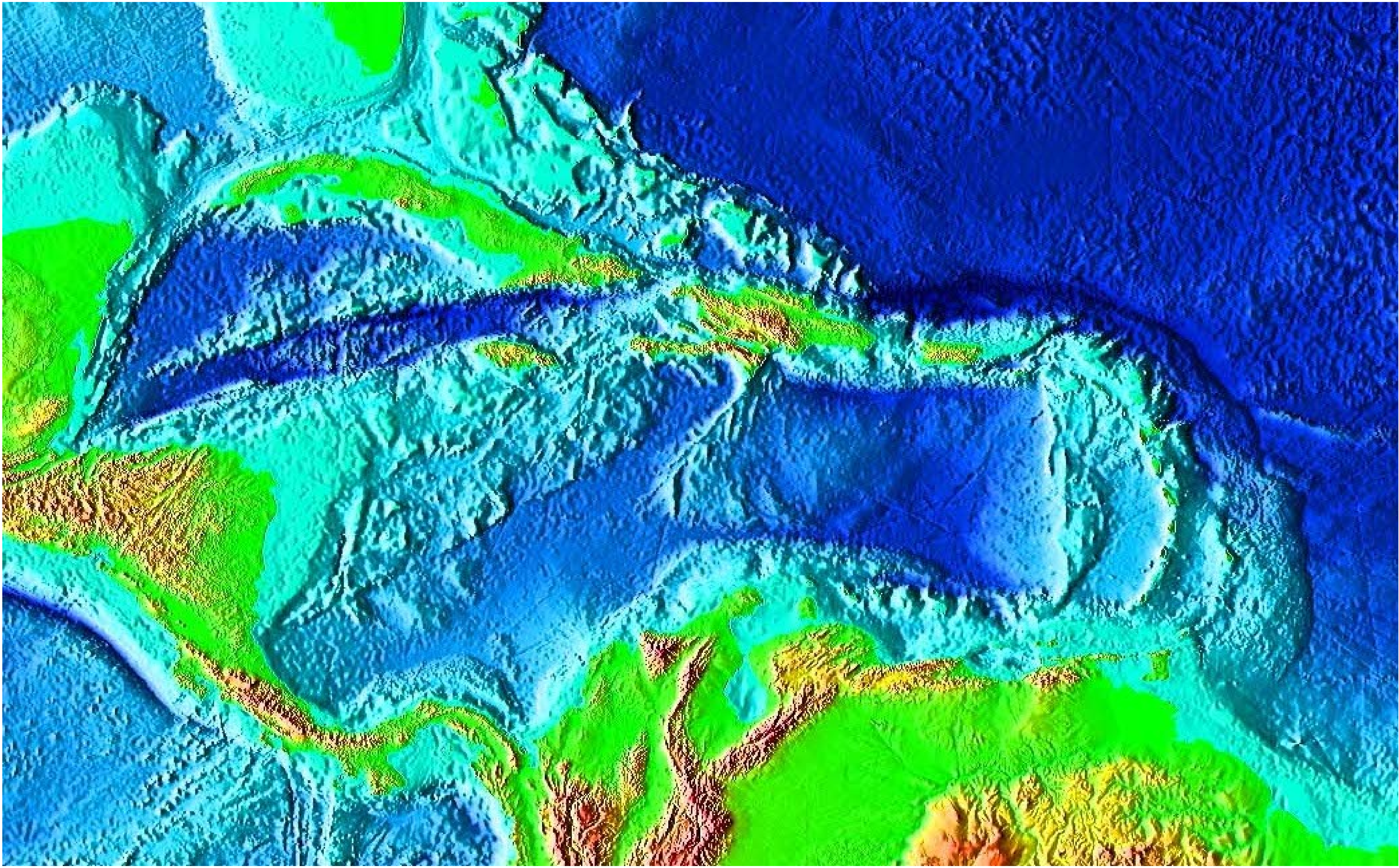


Fig. 6.12 Distribution of forearc basins of central Andean continental margin (Lonsdale, 1978; Coulbourn, 1981; Thornburg and Kulm, 1981). Double line indicates coastline. Inset shows location off South America. Basin names (Table 6.1, I): Ae, Arequipa; Ai, Arica; Iq, Iquique; Li, Lima; Ma, Manabi; Pi, Pisco; Pr, Progresso; Sa, Salaverry; Se, Sechura; 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.



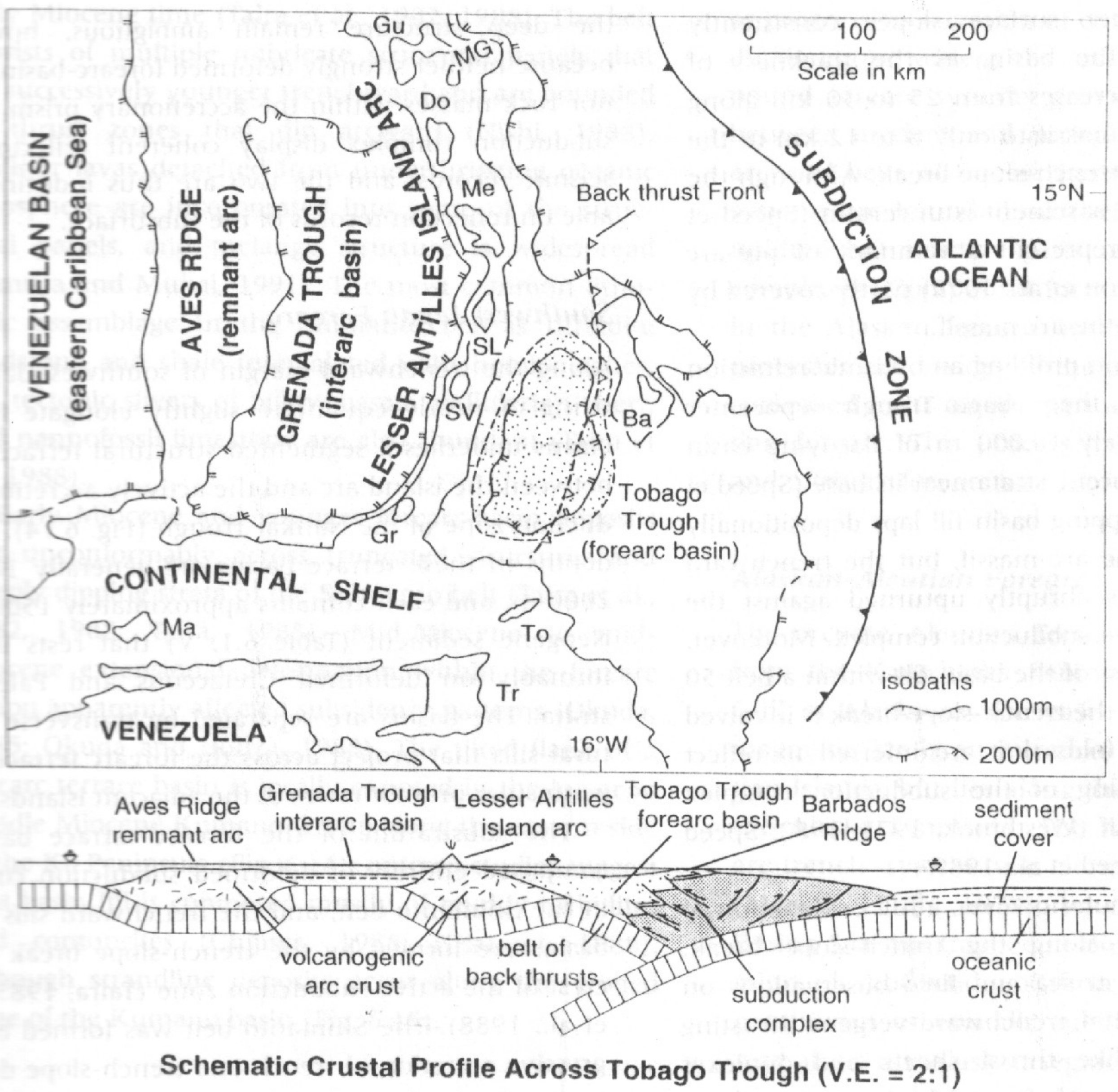
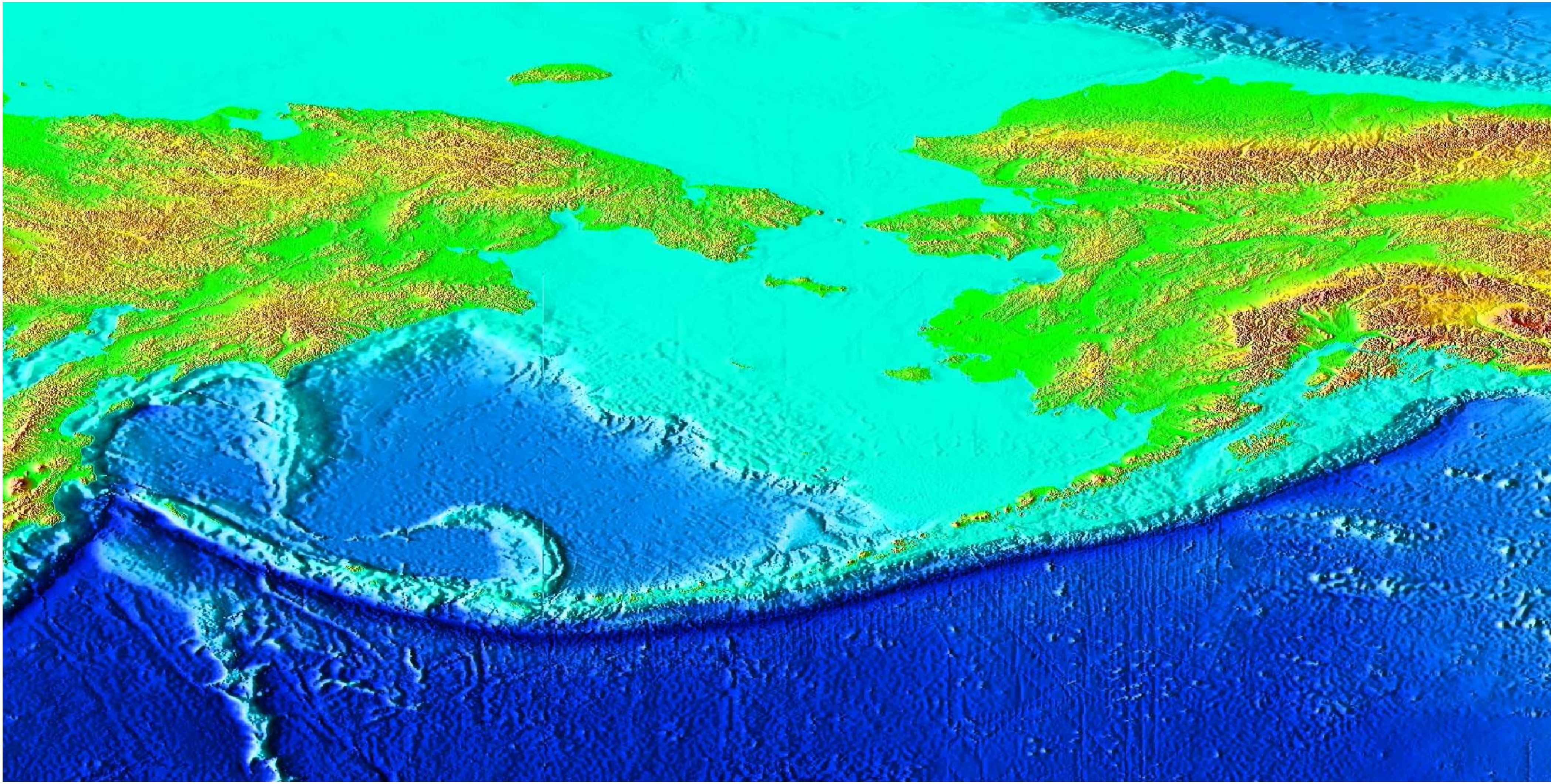


Fig. 6.13 Tectonic setting (map) and inferred structural relations (section) of Tobago Trough forearc basin (Table 6.1, VI) within Lesser Antilles arc-trench system (Westbrook, 1975, 1982; Speed et al., 1989; Torrini and Speed, 1989); arcward vergent folds deform forearc-basin fill at shallow levels 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.



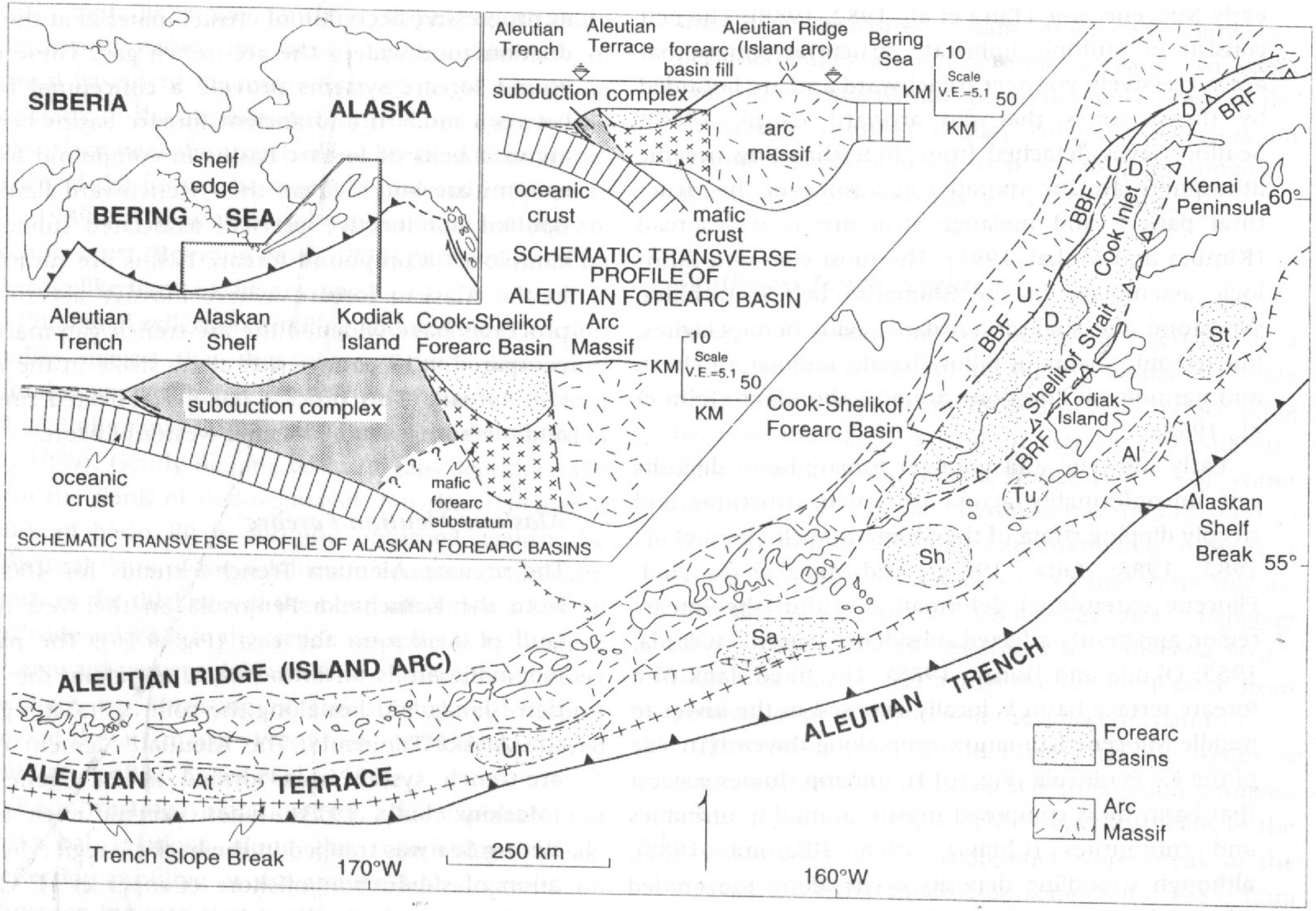
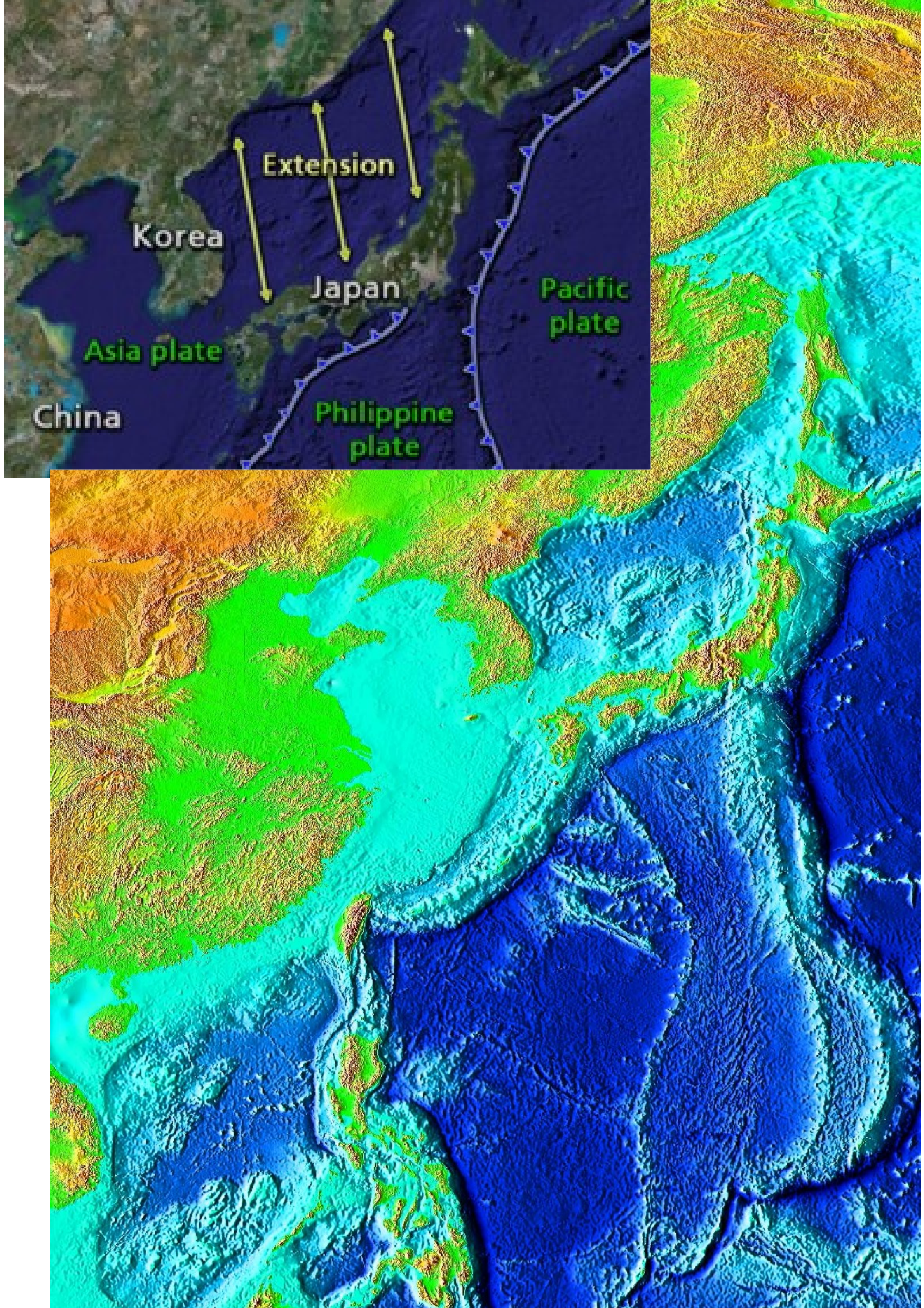


Fig. 6.16 Relations of multiple Alaskan and Aleutian forearc basins (Bruns et al., 1987; Fisher et al., 1987; Scholl et al., 1987b; von Huene et al., 1987): Aleutian terrace basins (At, Atka; Un, Unalaska), Alaskan shelf basins (Sa, Sanak; Sh, Shumagin; Tu, Tugidak; Al, Albatross; St, Stevenson), and 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).

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


Extension
Korea
Japan
Pacific
plate
Asia plate
China
Philippine
plate

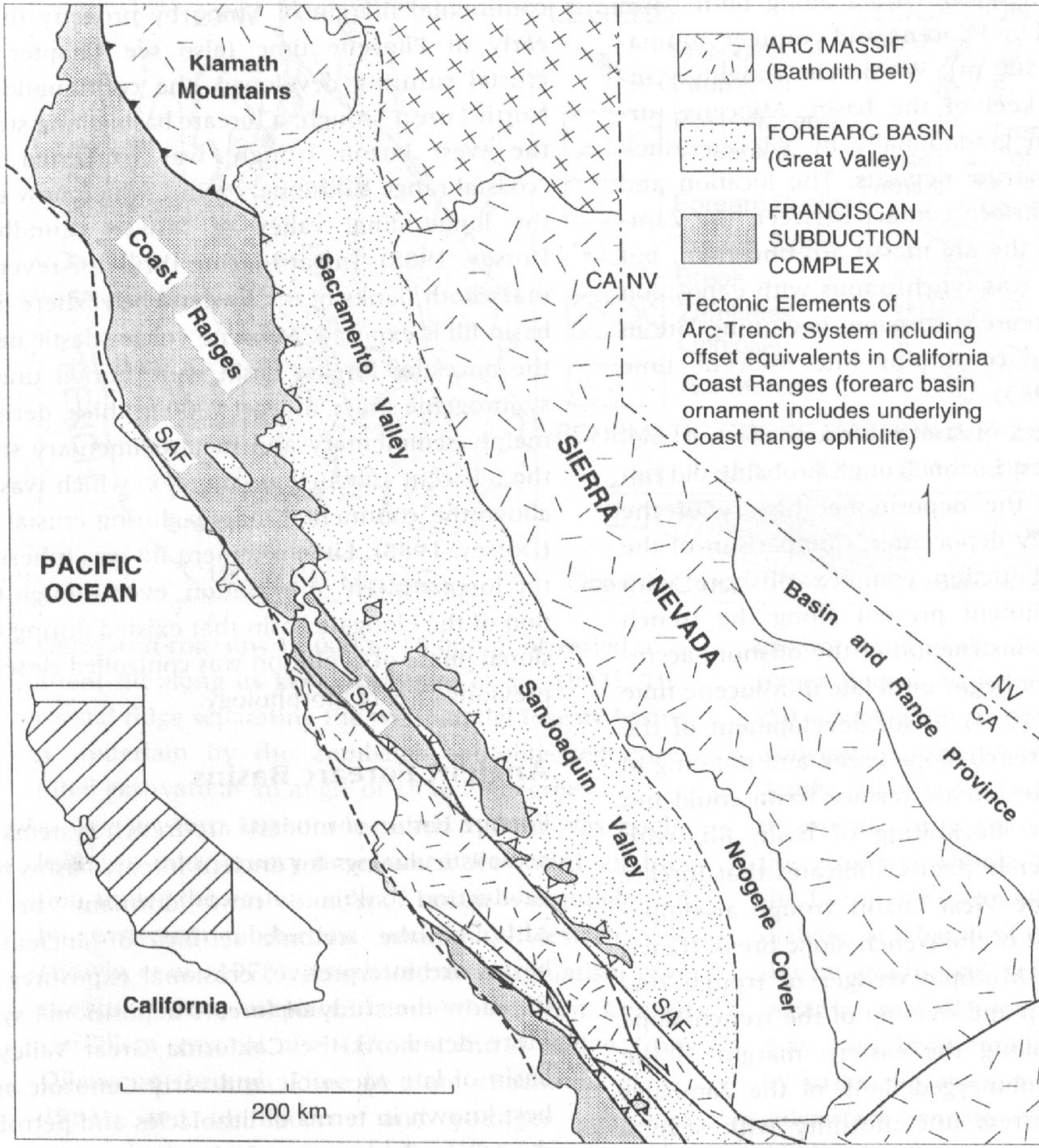


Fig. 6.18 Geologic setting of Late Jurassic to Paleogene Great Valley forearc basin (Table 6.2D) in California (Dickinson and Seely, 1979; Dickinson et al., 1979; Ingersoll, 1982b, 1988a). San Andreas (SAF), San Gregorio-Hosgri (SGF), and related Neogene strike-slip faults in California Coast Ranges 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.

Cretáceo a Terciário

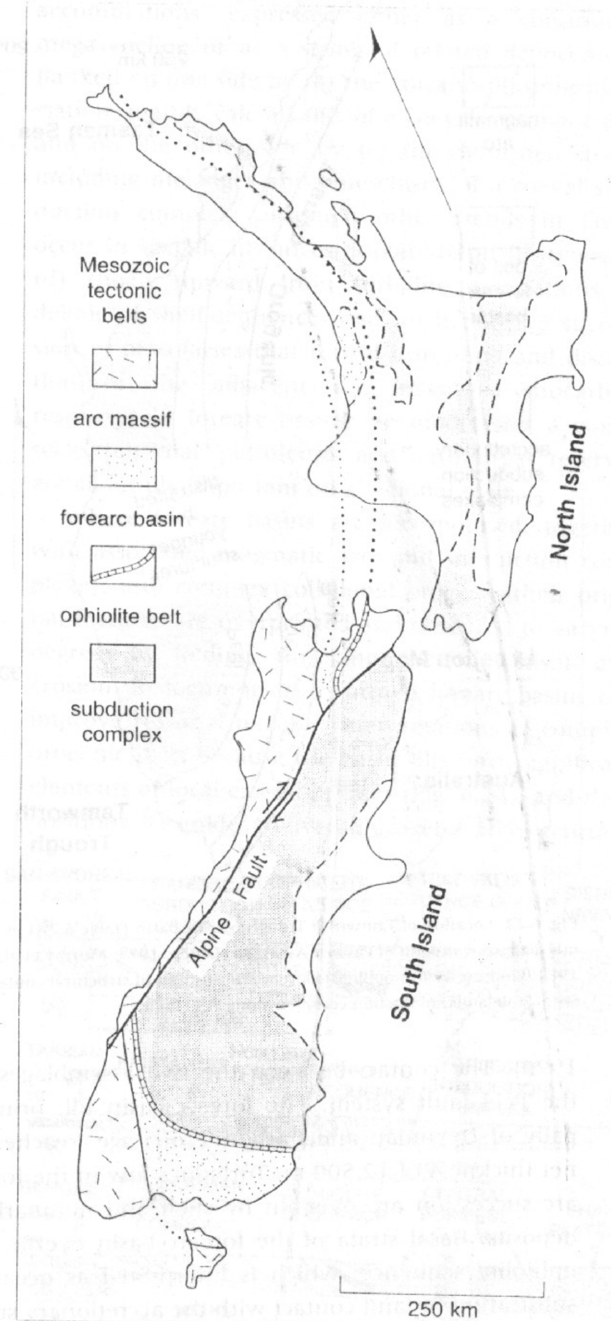


Fig. 6.21 Tectonic elements of Permian to Cretaceous arc-trench system, offset by Cenozoic Alpine fault, in New Zealand (Dickinson, 1971a,b; Landis and Bishop, 1972; Blake et al., 1974; Sporli, 1978): (a) flank of arc massif is western basement province, (b) forearc-basin belt (Table 6.2D) is Hokonui 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

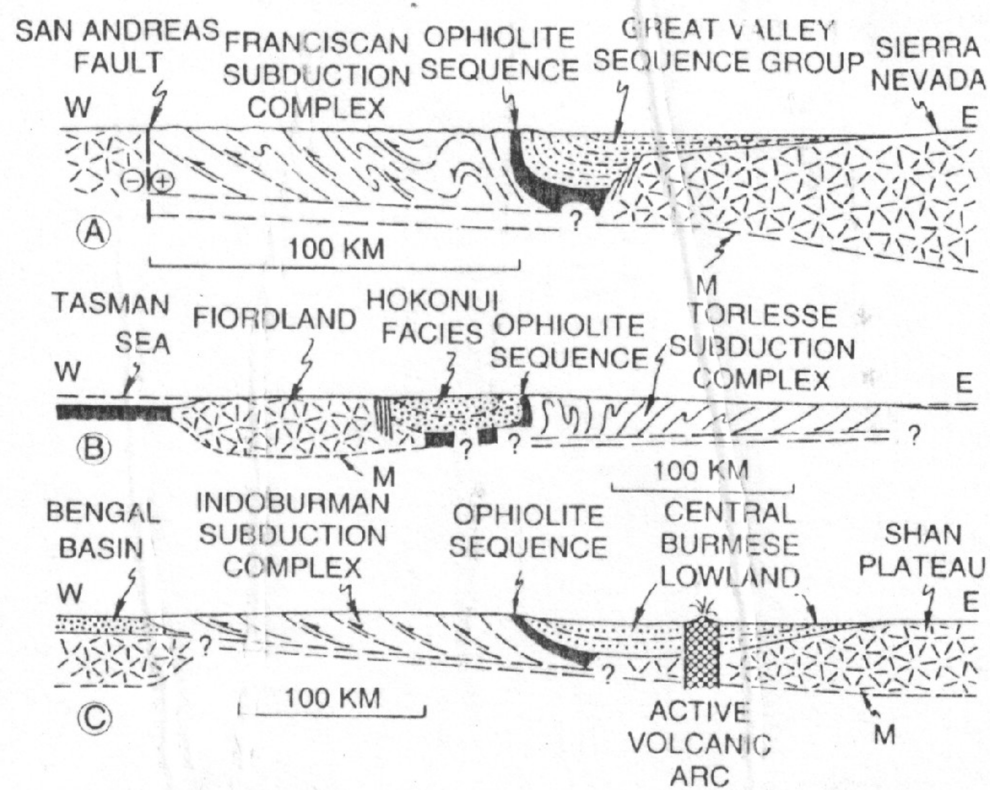


Fig. 6.24 Schematic crustal diagrams (M is base of crust) indicating scale of forearc basin fill (stippled with dashes to show bedding) in relation to arc massifs (star-dash pattern) and subduction complexes (thrusts shown schematically): A, coastal California; B, New Zealand (South Island); C, Bangla Desh 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 Caleidonides.

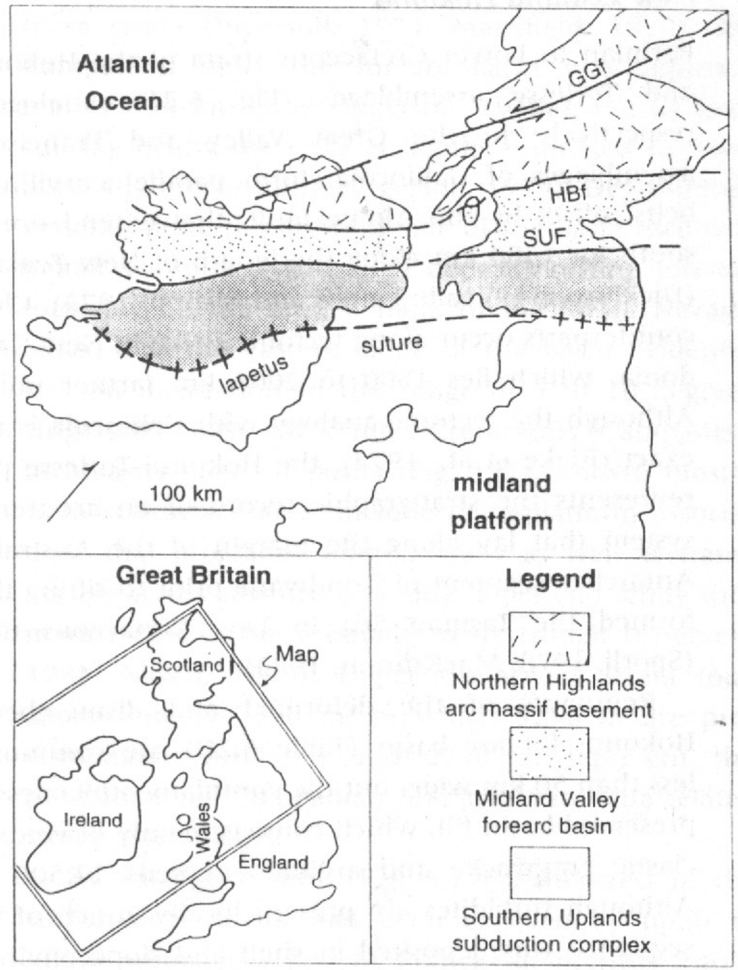


Fig. 6.23 Tectonic relations of remnant lower Paleozoic Midland Valley forearc basin (Table 6.2E) parallel to collisional suture marking closure of Iapetus Ocean within Caledonian orogen of British Isles (Dewey, 1971; Leggett et al., 1982; McKerrow and Soper, 1989); GGF, sinistral Great Glen fault; HBF,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

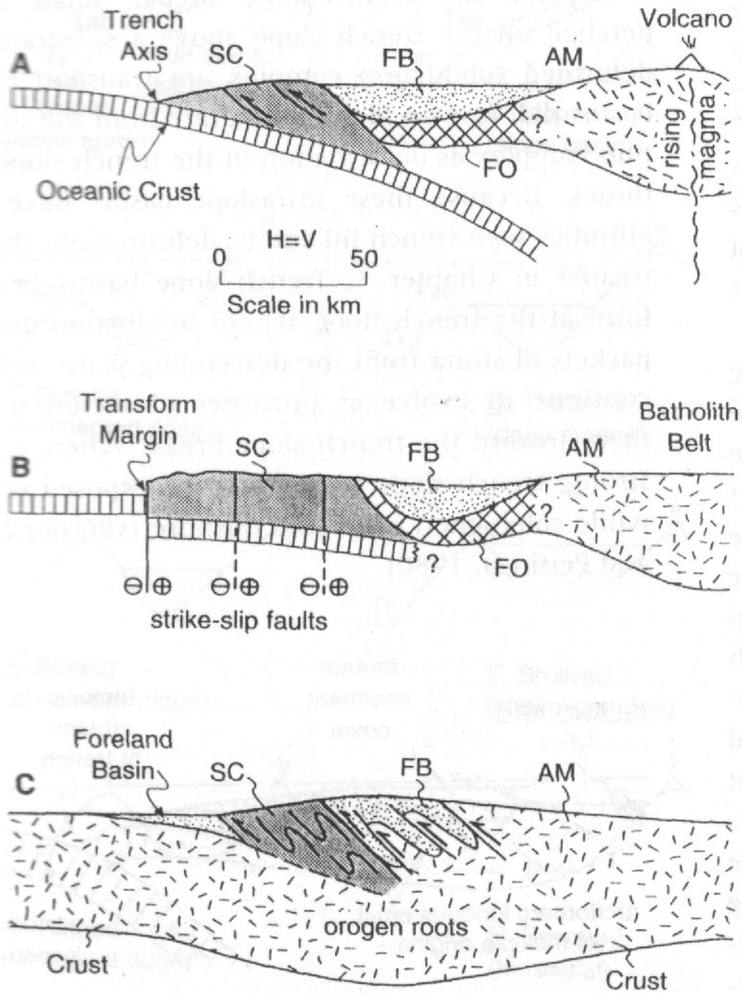


Fig. 6.2 Tectonic settings of forearc basins (schematic): A, origin within active arc-trench system (after Fig. 6.1); B, preservation of basin remnant after conversion of subduction to transform slip (e.g., Great Valley of California); C, deformation of basin fill by incorporation into suture belt of 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).

Bacias de backarc

- Formadas por distensão atrás de um arco, geralmente de ilhas.

- Podem iniciar-se em crosta continental, mas a distensão continuada leva à formação de litosfera oceânica.

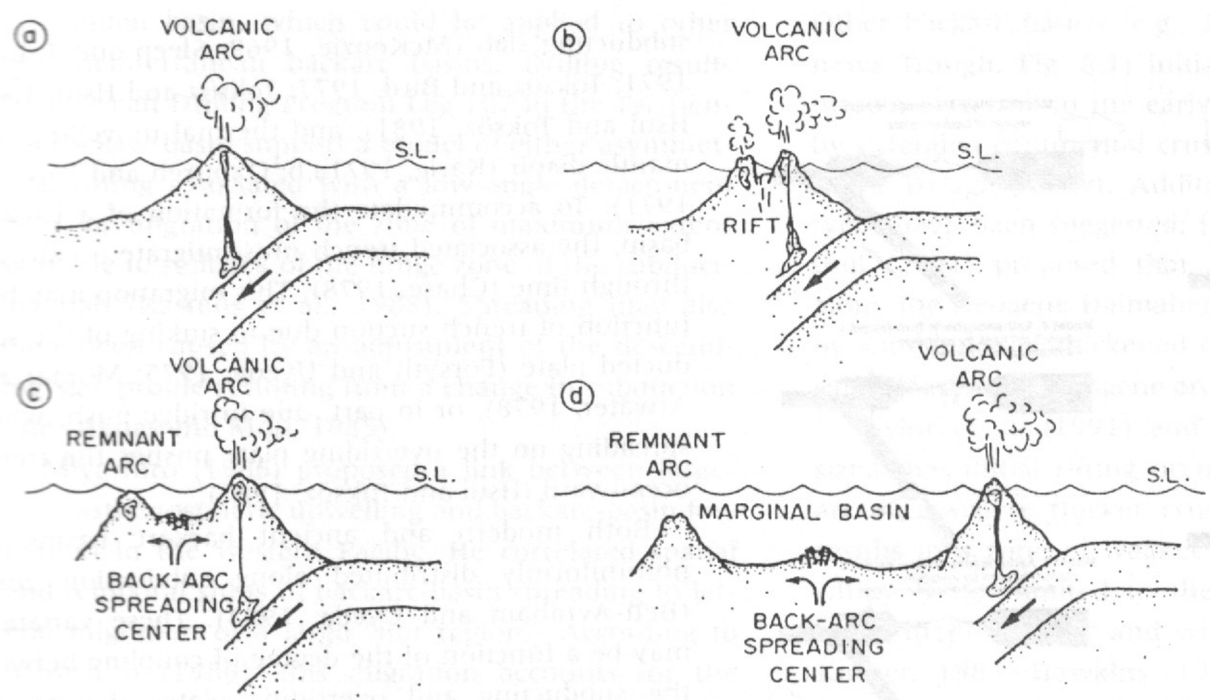


Fig. 8.2 Generalized tectonic evolution of an intraoceanic backarc basin. From Carey and Sigurdsson (1984). After Karig (1971a,b).

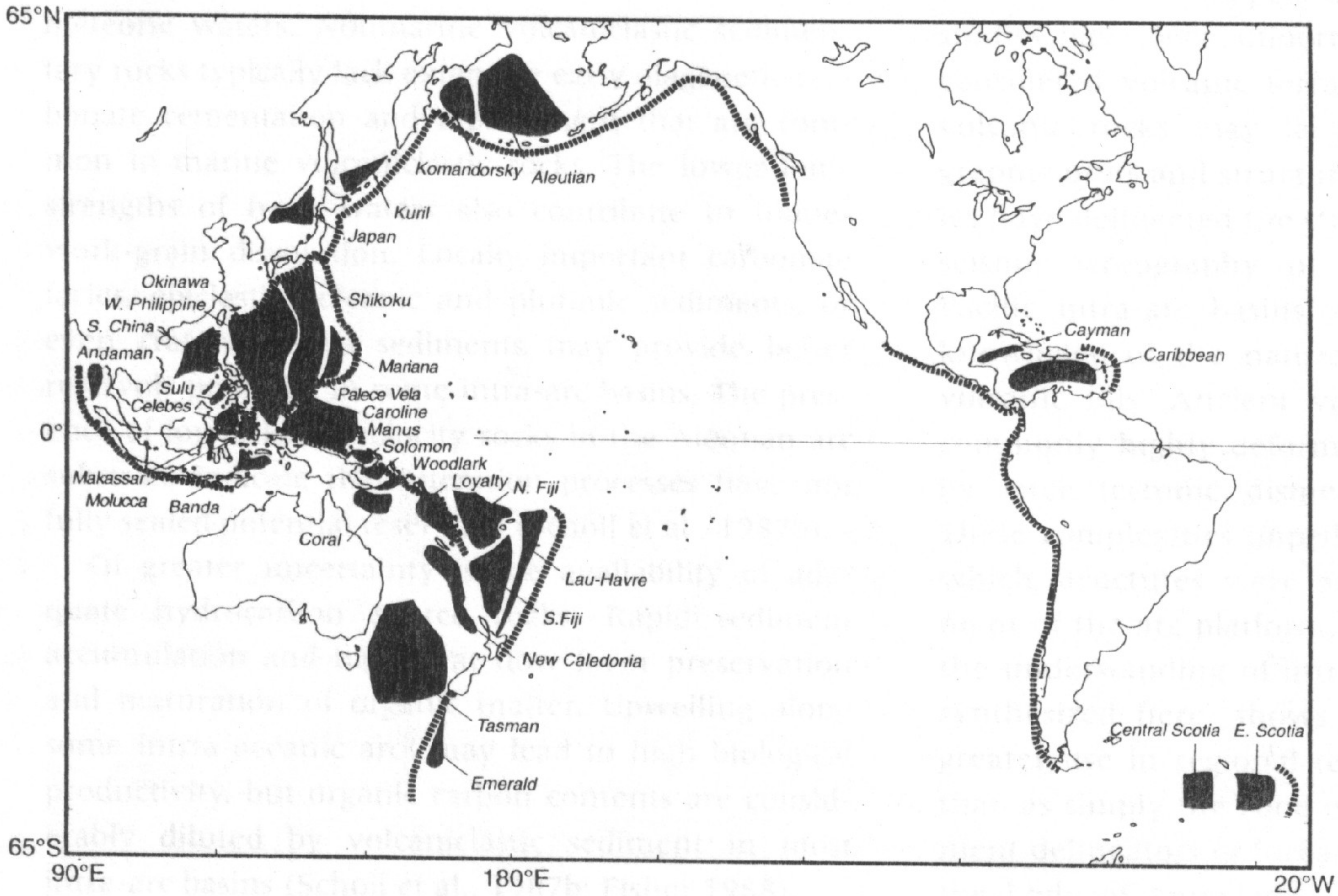


Fig. 8.1 Distribution of trenches (blocked lines) and backarc basins (solid areas) in the circum-Pacific region. After Tamaki and Honza (1991).

Origem da distensão

- Parece estar relacionada a altos ângulos de subducção.

- Vários modelos:

    - Recuo da trincheira

    - Movimento independente da placa que sofre subducção

    - Plumas

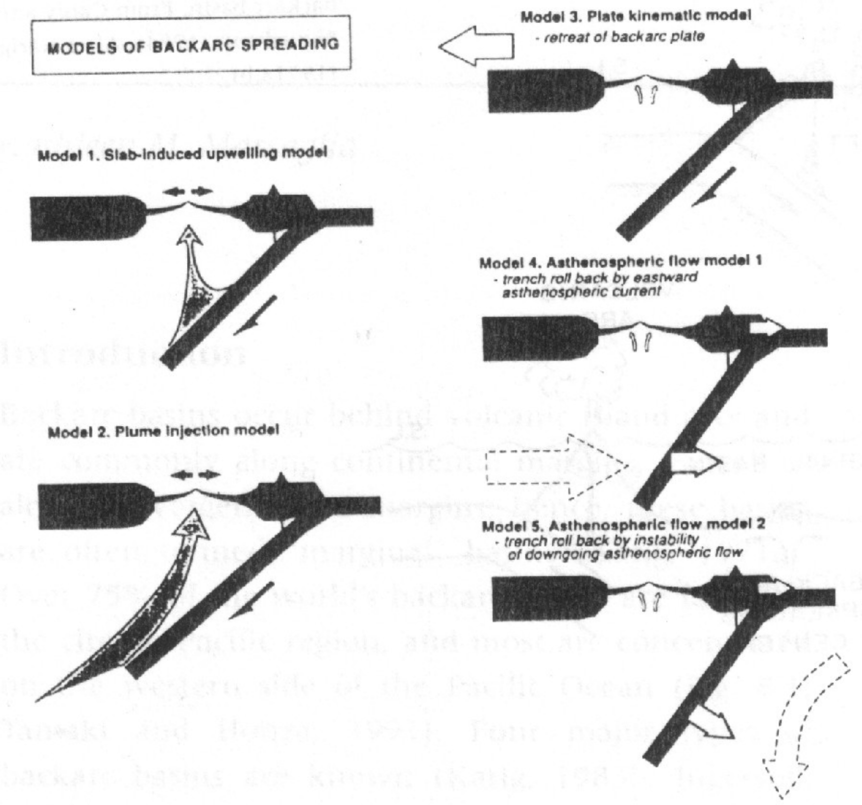
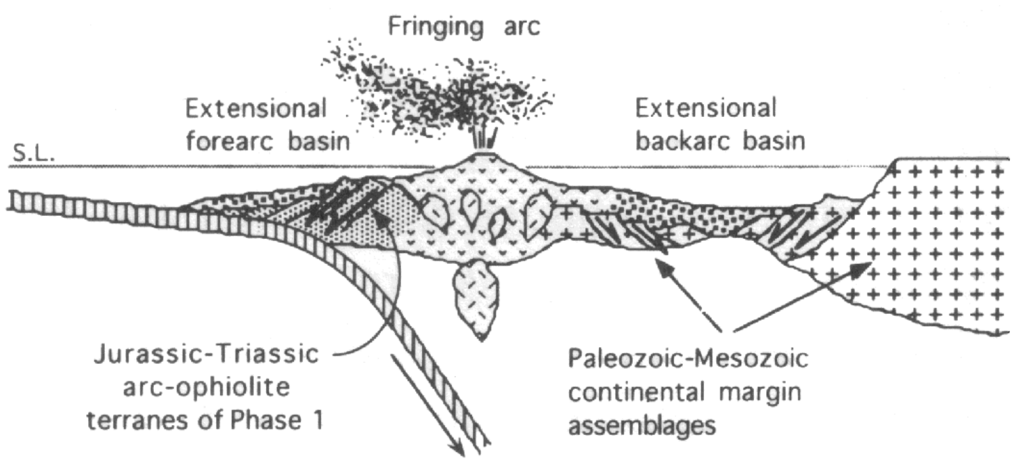
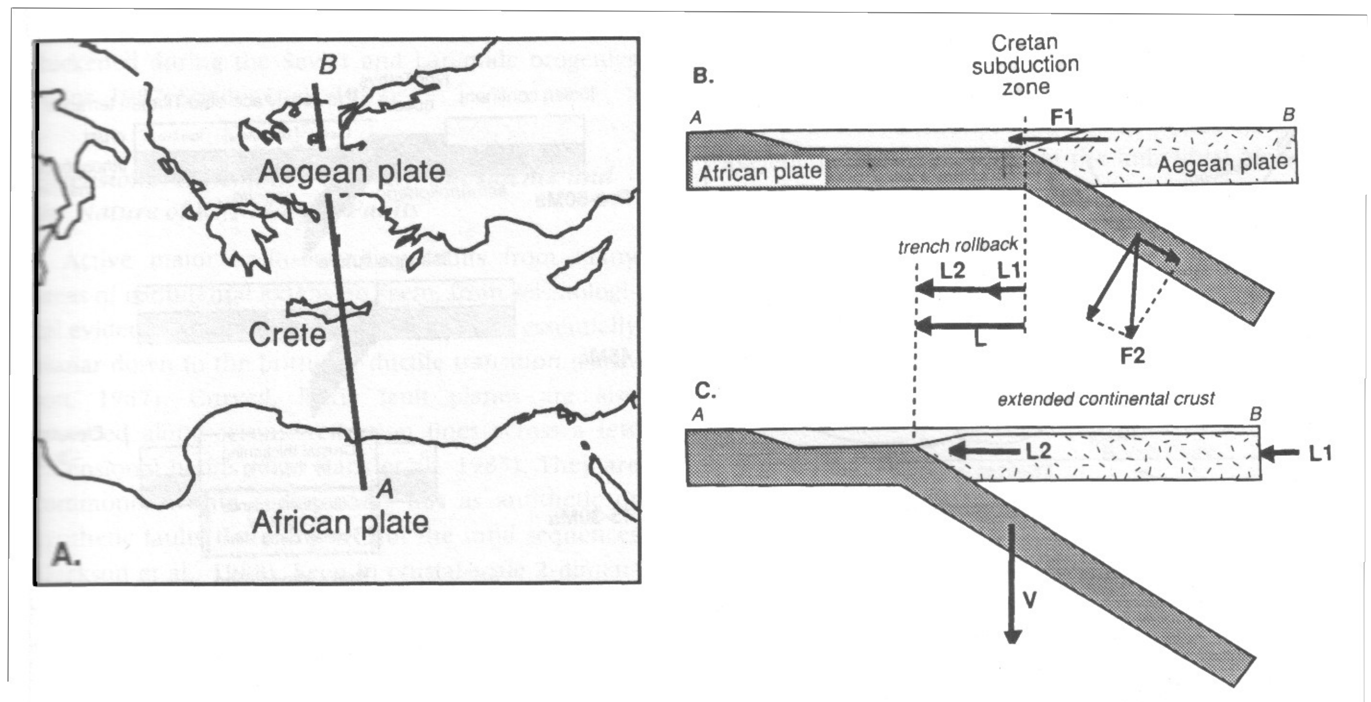


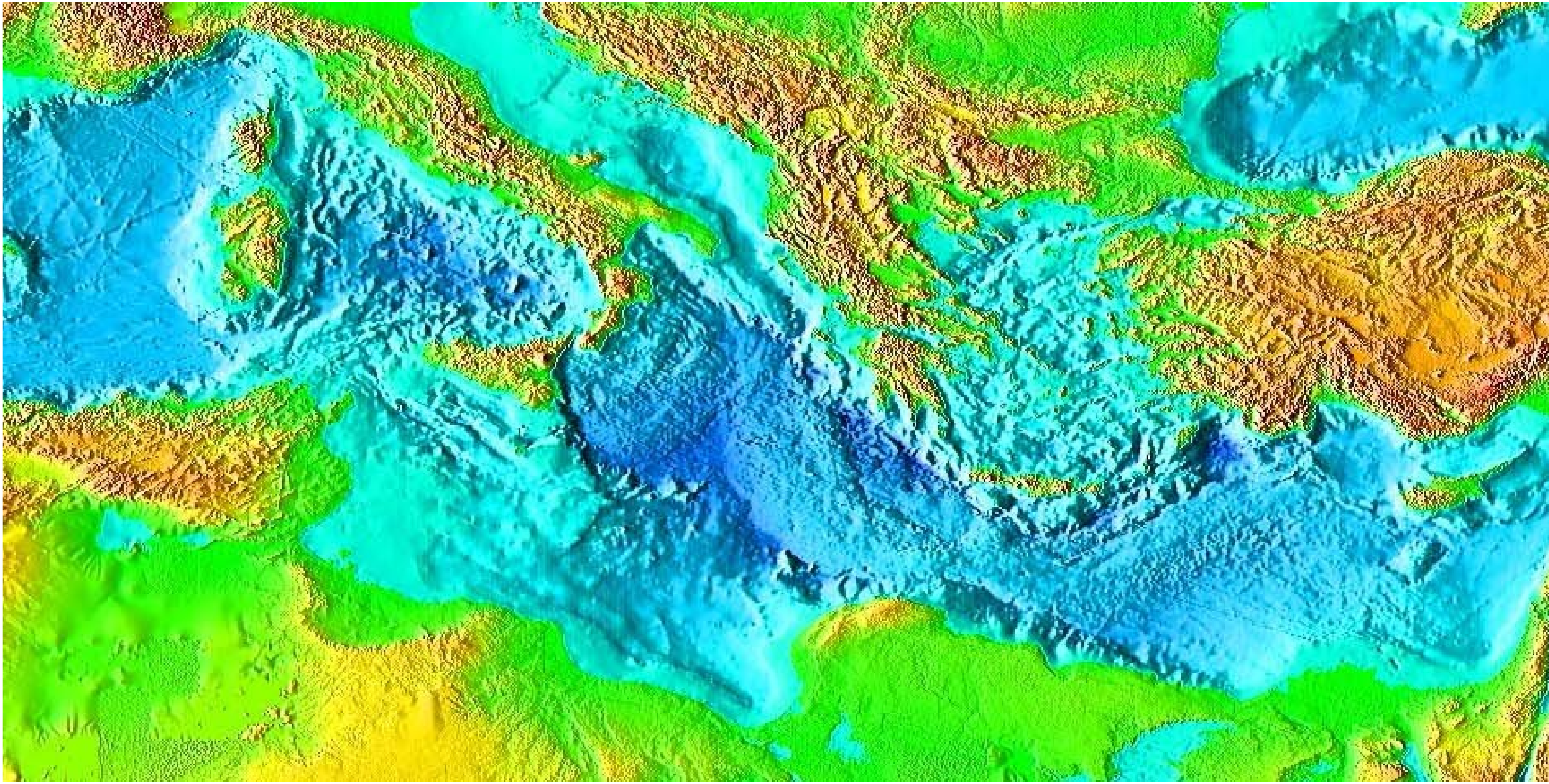
Fig. 8.3 Various models of backarc spreading. According to Tamaki and Honza (1991), Models 1 and 2 are active-opening models, Model 3 is a passive-opening model, and Models 4 and 5 may be classified as either passive, in terms of plate kinematics, or active, in that they depend on dynamic asthenospheric flow. Model 1 proposes mantle upwelling induced by slab subduction (Karig, 1971a; Sleep and Toksöz, 1971). In Model 2, backarc spreading is induced by injection of a mantle plume (Miyashiro, 1986). Model 3 is a kinematic model, where backarc spreading results from the retreat of the overriding plate from the subduction zone (Dewey, 1980). Backarc spreading in Model 4 is induced by eastward asthenospheric flow, possibly associated with the earth's rotation (Uyeda and Kanamori, 1979), and in Model 5, it is induced by global downward asthenospheric flow (slab pull)(Glatzmaier et al., 1990). From Tamaki and Honza (1991).



Fringing arc
Extensional forearc basin
Extensional backarc basin
S.L.
Jurassic-Triassic arc-ophiolite terranes of Phase 1
Paleozoic-Mesozoic continental margin assemblages



B
Aegean plate
Crete
A
African plate
A.
B.
Cretan subduction zone
A
B
F1
African plate
Aegean plate
trench rollback
L2
L1
L
F2
C.
extended continental crust
A
B
L2
L1
V



Tectônica sin-deposicional

Distensão ativa na fase *rift*

Espalhamento de fundo oceânico na fase madura

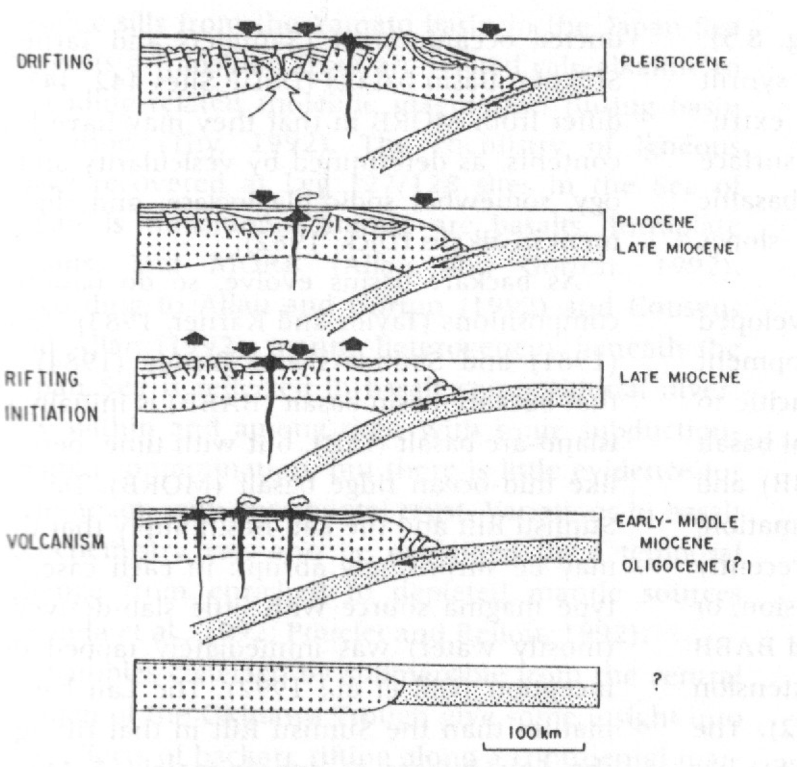


Fig. 8.11 Tectonic evolution of the Okinawa Trough. From Letouzey and Kimura (1985).

Preenchimento

- Turbiditos com proveniência do arco.

- Vulcanismo – evolução de composição de arco para de fundo oceânico

- Contribuição vulcanoclástica

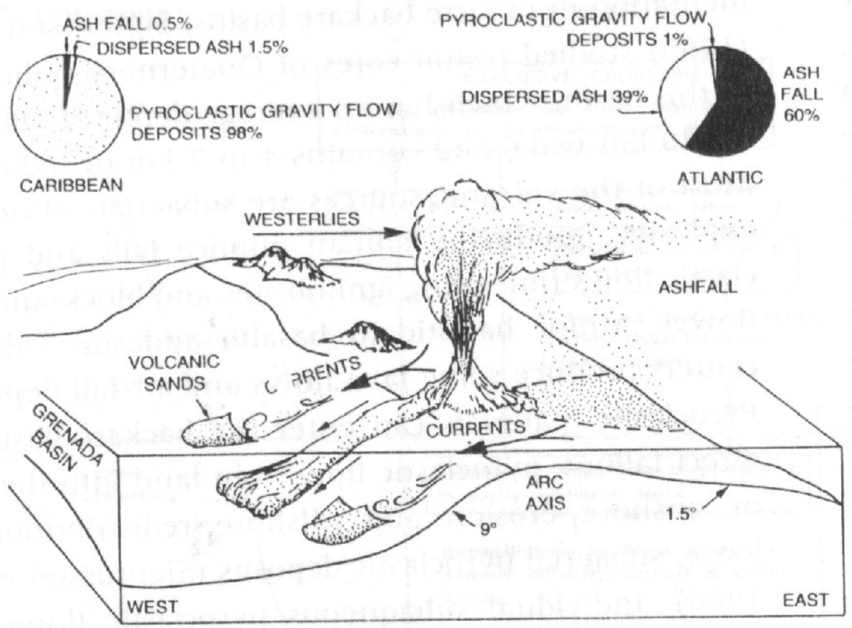


Fig. 8.13 Asymmetric distribution of volcaniclastic material across the Lesser Antilles arc, controlled by bathymetry and marine and atmospheric currents. Fine-grained ash is carried by the tropospheric westerlies to the east, whereas coarse-grained proximal sediments are preferentially distributed to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

Evolução

Evolução para oceano

Inversão em orógenos colisionais:

- Colisão do arco com o orógeno

- Fechamento do oceano