

BASES DA BIOGEOGRAFIA HISTÓRICA

Tempo geológico

Deriva continental

Especiação e extinção

Dispersão

EONOTHEM EON	ERATHEM ERA	SYSTEM PERIOD	SUBSYSTEM SUBPERIOD	SERIES EPOCH	STAGE AGE	AGES G.S. ODIN		AGES S/C	STAGE NOTATION	SERIES NOTATION	SYSTEM NOTATION											
						Ma	+/-															
						250	3															
PHANEROZOIC PH	PALEOZOIC PZ	PERMIAN	LOPINGIAN	Changhsingian	p9	P3	P	GSSP														
				Wuchiapigian	p8																	
			GUADALUPIAN	Capitanian	p7																	
				Wordian	p6																	
			CISURALIAN	Roadian	p5																	
				Kungurian	p4																	
				Artinskian	p3																	
				Sakmarian	p2																	
				Asselian	p1																	
			CARBONIFEROUS	PENNSYLVANIAN	Gzhelian	c7						C2	C	GSSP								
					Kazimovian	c6																
					Moscovian	c5																
		Bashkirian			c4																	
		Serpukhovian			c3																	
		Tournaisian			c2																	
		MISSISSIPPIAN		Visean	c2																	
				Tournaisian	c1																	
				DEVONIAN	UPPER/LATE	Famennian	d7	D3	D	GSSP												
					MIDDLE	Frasnian	d6															
						Givetian	d5															
					LOWER/EARLY	Eifelian	d4															
		Emsian	d3																			
		Pragian	d2																			
		Lochkovian	d1																			
		SILURIAN	PRIDOLI		s8	S4	S	GSSP														
			LUDLOW	Ludfordian	s7																	
				Gorstian	s6																	
			WENLOCK	Homerian	s5																	
				Sheinwoodian	s4																	
			LLANDOVERY	Telychian	s3																	
				Aeronian	s2																	
				Rhuddanian	s1																	
			ORDOVICIAN	UPPER/LATE					o3	O3	O	GSSP										
				MIDDLE	Darriwilian				o2													
				LOWER/EARLY	Tremadocian				o1													
			CAMBRIAN	UPPER/LATE					e3	E3												
		MIDDLE			e2																	
		LOWER/EARLY			e1																	

EONOTHEM EON	ERATHEM ERA	SYSTEM PERIOD	SERIES EPOCH	STAGE AGE	AGES G.S. ODIN		AGES S/C	STAGE NOTATION	SERIES NOTATION	SYSTEM NOTATION	
					Ma	+/-					
					250	3					
PHANEROZOIC PH	CENOZOIC CZ	QUATERNARY	HOLOCENE						Q2	Q	
			PLEISTOCENE								Q1
		NEOGENE	PLIOCENE	Gelasian	1.75	0.05	1.81	GSSP	n9	N	
				Piacenzian	3.4	0.15	3.60	GSSP	n8		
			Zanclean	5.30	0.15	5.33	GSSP	n7			
			MIOCENE	Messinian	7.30	0.15	7.1	GSSP	n6		
				Tortonian	11.0	0.3	11		n5		
				Serravallian	14.3	0.5	13.6		n4		
				Langhian	15.8	0.2	16.4		n3		
				Burdigalian	20.3	0.4	19.1		n2		
				Aquitanian	23.5	1.0	23.8	GSSP	n1		
				Chattian	28	1			e9		
		OLIGOCENE	Rupelian	33.7	0.5		GSSP	e8	E3		
			Priabonian	37.0	1/0.5			e7			
		EOCENE	Bartonian	40	1			e6	E2		
			Lutetian	46.0	1/0.5			e5			
			Ypresian	53	1			e4			
			Thanetian	53	1			e3			
		PALEOCENE	Selandian	65.0	0.5	65.0	0.1	GSSP	e2	E1	
			Danian	72.0	0.5	71.3	0.5		e1		
		CRETACEOUS	UPPER/LATE	Maastrichtian	83	1	83.5	0.5		k6	K2
				Campanian	87	1	85.8	0.5		k5	
				Santonian	88	1	89.0	0.5		k4	
				Coniacian	92	2	93.5	0.2		k3	
				Turonian	96	2	98.9	0.6		k2	
				Cenomanian	108	3/1	112.2	1.1		k1	
			LOWER/EARLY	Albian	113	3	121.0	1.4		b6	K1
				Aptian	117	5/2	127.0	1.6		b5	
				Barremian	123	6/2	132.0	1.9		b4	
				Flauviian	131	4	136.5	2.2		b3	
				Valanginian	135	5/5	144.2	2.6		b2	
				Berriasian	141	7/5				b1	
		JURASSIC	UPPER/LATE	Tithonian	146	5			j7	J	
				Kimmeridgian	154	5			j6		
				Oxfordian	160	2			j5		
			MIDDLE	Callovian	164	2			j4		
				Bathonian	170	4/3			j3		
				Bajocian	175	3			j2		
		LOWER/EARLY	Aalenian	184	3			j1			
			Toarcian	191	4/7			i4			
			Pliensbachian	200	3			i3			
		TRIASSIC	UPPER/LATE	Sinemurian	203	3			i2	J1	
				Hettangian	220	6			i1		
				Rhettian	230	5			t7		
			MIDDLE	Norian	233	5			t6	T3	
Carnian	240			5			t5				
Ladinian	250			3	251.1	3.6		t4			
LOWER/EARLY	Anisian	250	3			t3	T2				
	Olenekian	250	3			t2					
Induan	250	3				t1	T1				

Escala do Tempo geológico

Era	Period	Epoch	Approximate Duration (millions of years)	Approximate Date of Commencement (millions of years)
Cenozoic	Quaternary	Holocene	0.01	0.01
		Pleistocene	1.59	1.6
	Tertiary	Pliocene	3.7	5.3
		Miocene	21.9	23.5
		Oligocene	10.5	34.0
		Eocene	19.0	53.0
		Paleocene	12.0	65.0
Mesozoic	Cretaceous	70	135	
	Jurassic	70	205	
	Triassic	40	245	
Paleozoic	Permian	50	295	
	Carboniferous	65	360	
	Devonian	50	410	
	Silurian	25	435	
	Ordovician	71	500	
	Cambrian	70	570	
Proterozoic			4,000	4,600

Tab. 2.5 - O CALENDÁRIO CÓSMICO - traduzido e resumido de C. Sagan (1978).

B.a. = bilhões de anos; M.a. = milhões de anos		
15 B.a.	"Big Bang"; início do Universo que conhecemos	1 Janeiro
	- Origem da Via Láctea	1 Maio
	- Origem do sistema solar	9 Setembro
4 B.a.	- Formação da Terra	14 Setembro
3,9 B.a.	- Formação das rochas mais antigas que se conhece na Terra	2 Outubro
	- Fósseis mais antigos (bactérias e cianobactérias)	9 Outubro
	- Invenção do sexo pelos microorganismos	1 Novembro
	- Fósseis de plantas fotossintéticas mais antigas	12 Novembro
	- Oxigênio começa a ser parte significativa da atmosfera terrestre ..	1 Dezembro
	- Primeiros vermes	16 Dezembro
	- Termina o Pré-cambriano. Era Paleozóica e	
	Período Cambriano se iniciam. Invertebrados prosperam	17 Dezembro
	- Primeiro plâncton oceânico. Trilobitas prosperam	18 Dezembro
	- Período Ordoviciano. Primeiros peixes, primeiros vertebrados	19 Dezembro
	- Período Siluriano. Primeiras plantas vasculares.	
	Plantas iniciam a colonização dos continentes	20 Dezembro
400 M.a.	- Início do Período Devoniano. Primeiros insetos.	
	Animais começam a colonização dos continentes	21 Dezembro
	- Primeiros anfíbios. Primeiros insetos com asa	22 Dezembro
300 M.a.	- Período Carbonífero. Primeiras árvores. Primeiros répteis	23 Dezembro
	- Período Permiano se inicia. Primeiros dinossauros	24 Dezembro
225 M.a.	- Termina a Era Paleozóica. Começa a Era Mesozóica	25 Dezembro
220 M.a.	- Período Triássico. Primeiros mamíferos	26 Dezembro
180 M.a.	- Período Jurássico. Primeiros pássaros	27 Dezembro
135 M.a.	- Período Cretáceo. Primeiras flores. Os dinossauros se extinguem ..	28 Dezembro
60 M.a.	- Termina a Era Mesozóica. Começa a Era Cenozóica e o Terciário.	
	Primeiros Cetáceos; primeiros primatas	29 Dezembro
	- Início da evolução dos lóbulos frontais do crânio dos primatas.	
	Primeiros hominídeos. Mamíferos gigantes prosperam	30 Dezembro
2 M.a.	Final do Período Plioceno. Início do Período Quaternário	
	(Pleistoceno e Holoceno)	31 Dezembro

Tab. 2.5 - (continuação).

O DIA 31 DE DEZEMBRO	
- Origem do Proconsul e do Ramapithecus, prováveis ancestrais dos macacos e do homem	1:30 pm
- Primeiros humanos	10:30 pm
- Uso bem difundido de instrumentos de pedra	11:00 pm
- Domesticação do fogo pelo homem de Pequim	11:46 pm
- Início da última glaciação	11:56 pm
ÚLTIMO MINUTO	
- Invenção da agricultura	11:59:20" pm
- Invenção do alfabeto; Império Acadiano	51"
- Metalurgia do bronze; invenção da bússula	53"
- Metalurgia do ferro; 1º Império Assírio	54"
- Atenas de Péricles; nascimento de Buda	55"
- Geometria Euclidiana, Física de Arquimedes; Astronomia de Ptolomeu. Império Romano. Nascimento de Cristo	56"
- Invenção do zero e do decimal na Índia. Queda do Império Romano	57"
- Renascimento na Europa. Emergência do método experimental em ciência ...	59"
- Desenvolvimento e difusão da ciência e tecnologia; emergência da cultura global. Aquisição do poder de auto destruição pelo homem. Primeiros passos para a exploração espacial dos planetas e a busca de formas extra-terrestres de inteligência.....	O PRESENTE Primeiro segundo do Ano Novo

Deriva continental

Teoria especulativa no início do século XX até fato em 1960:

Ortelius 1596, cartógrafo – Europa e África separadas das Américas por terremotos e enchentes.

Antonio Snider-Pelligrini 1858 – “encaixe geométrico das linhas costeiras de lados opostos do Atlântico.

Início do séc. XX – **Teoria da Permanência** de James Dana:

1. oceanos formados pela contração da terra resfriando;
2. continentes eram maiores e várias partes foram submersas com a formação dos oceanos.

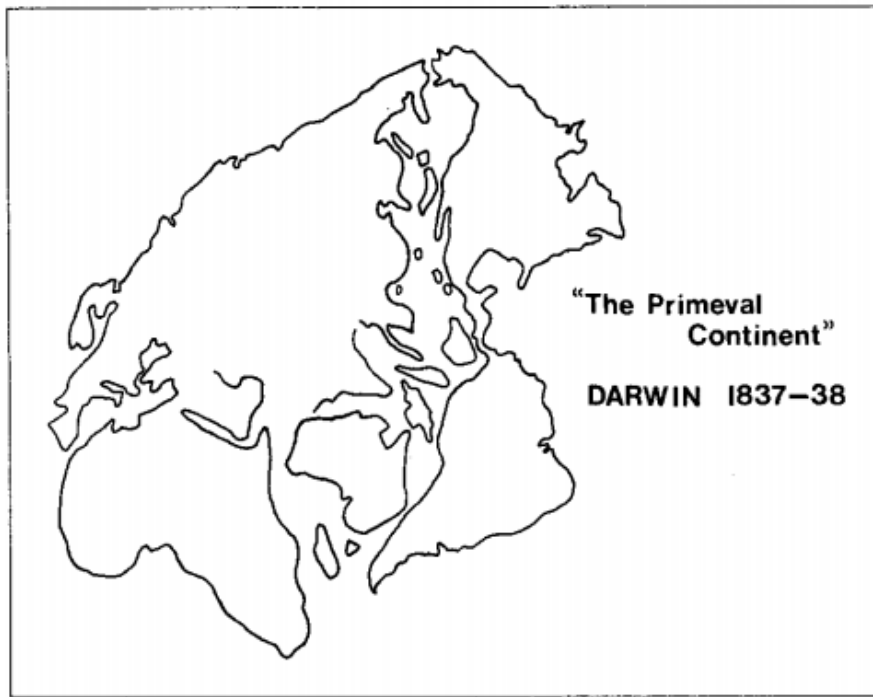
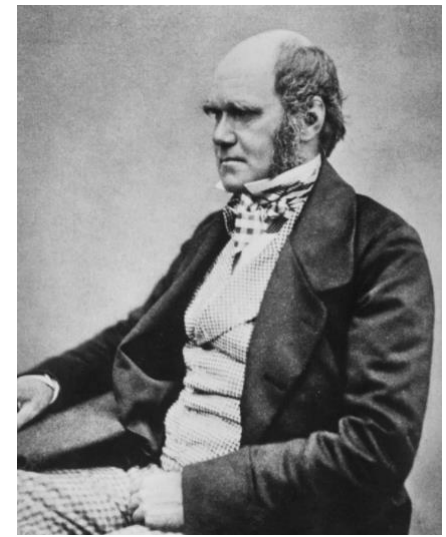


Fig. 1. A reconstruction of Darwin's (1837-38) "continent of Pacific". Darwin (in de Beer, 1960: 50) wrote of this "primeval continent": "Speculate on land being grouped towards centre near Equator for former periods and then splitting off". Note that this reconstruction of the past position of the continents closes the Pacific Ocean and widens the Atlantic Ocean.



DE BEER, G. (Ed.) 1960: **Darwin's notebooks on transmutation of species. Part 1. First notebook** (July 1837-February 1838). Bulletin of the British Museum (Natural History) Historical Series. 2(2): 27-73.

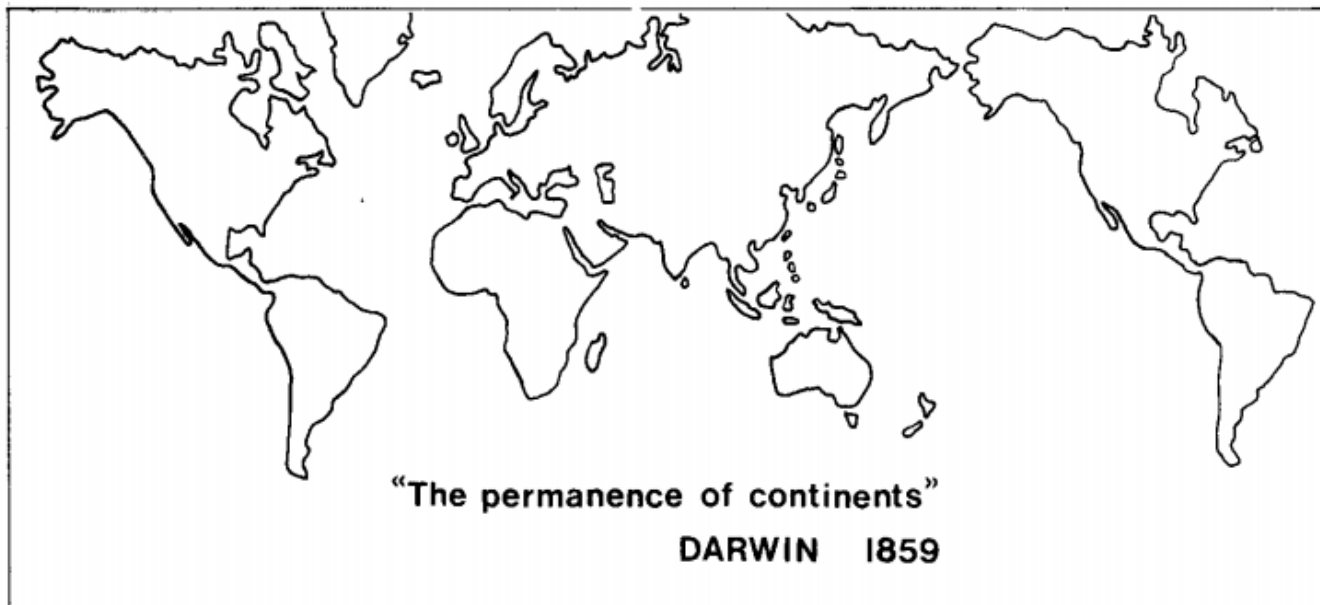
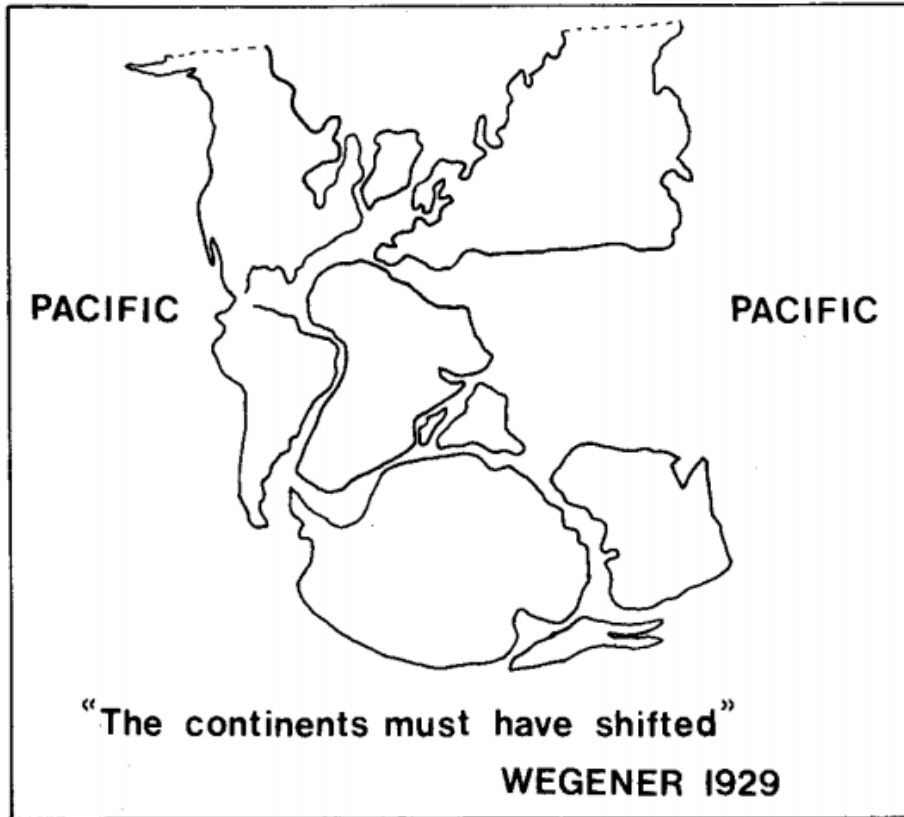
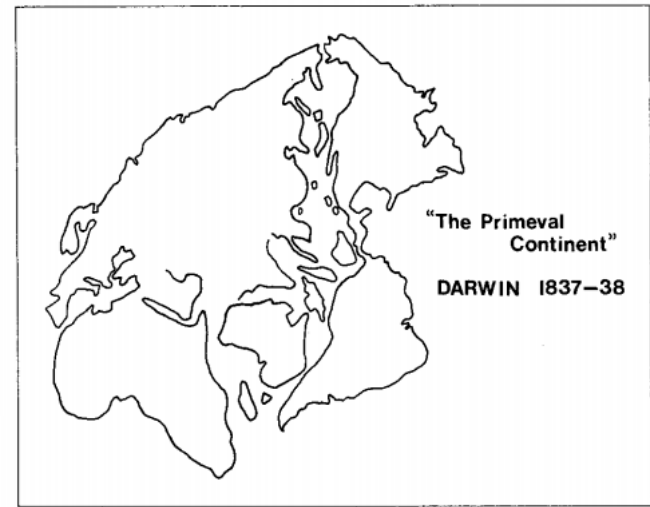


Fig. 2. Darwin's later and much better known view of earth history. He wrote ("On the Origin of Species", 6th Ed., 1872; John Murray Reprint, 1911) that there was no evidence of "vast changes in the position and extension of our continents, as to have united them within the recent period to each other" (p. 505). Darwin believed "that our continents have long remained in nearly the same relative position" (p. 520).

Fig. 1. A reconstruction of Darwin's (1837-38) "continent of Pacific". Darwin (in de Beer, 1960: 50) wrote of this "primeval continent": "Speculate on land being grouped towards centre near Equator at former periods and then splitting off". Note that this reconstruction of the past position of the continents closes the Pacific Ocean and widens the Atlantic Ocean.

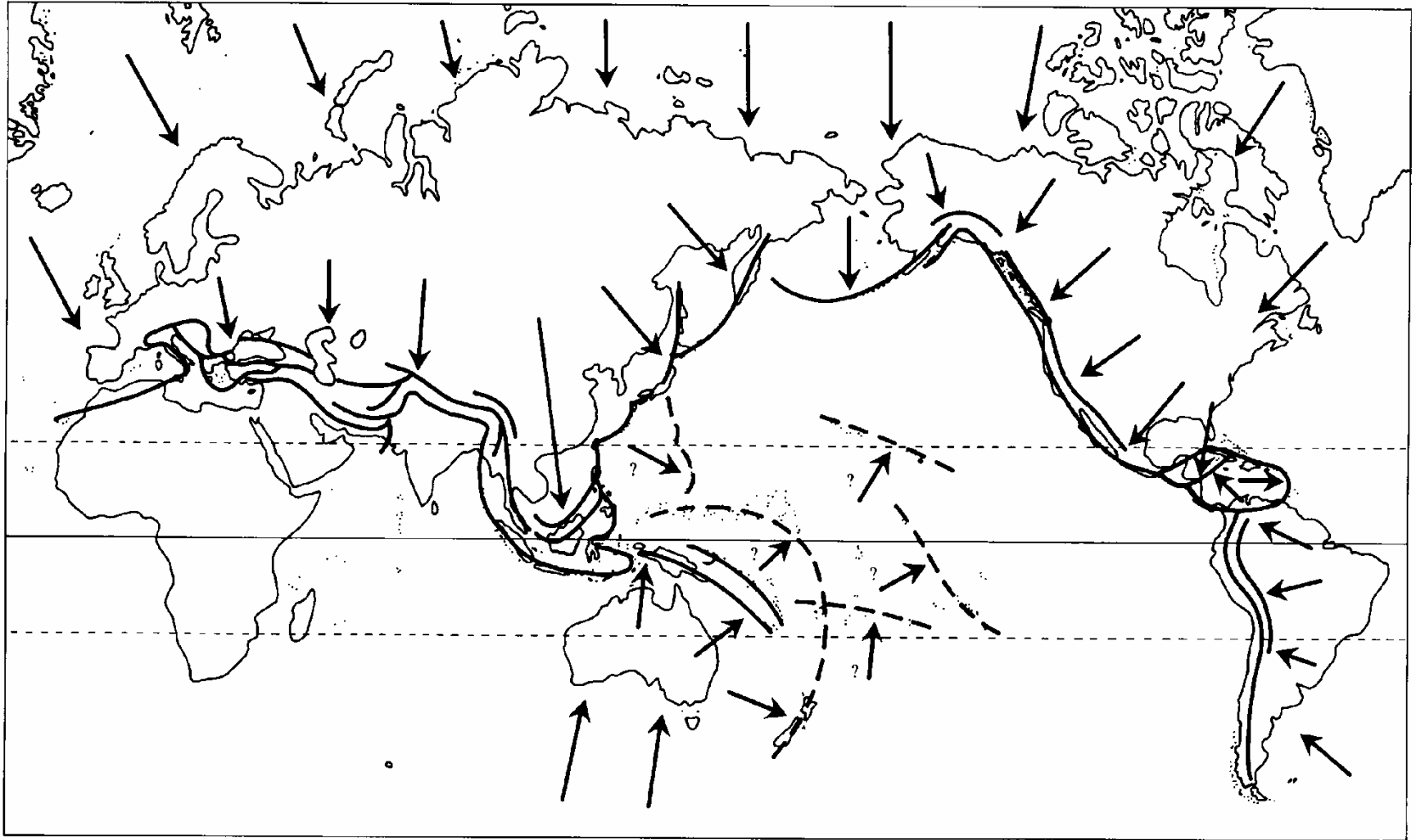


Alfred Wegener
1910, 1929

Fig. 3. Alfred Wegener's well known concept of Pangaea. In Wegener's reconstruction the Pacific Ocean Basin is open, and much wider than at present, while the Atlantic Ocean is closed.

Craw 1984

**1910 – F.B. Taylor, geólogo norte-americano:
modelo de crosta em distorsão.**



An early model by Taylor (1910) showing crustal movement. This scenario suggests a general drift of the major landmasses toward the equator

Deriva continental

Alfred Wegener 1910, meteorologista alemão, independentemente de Taylor:

-deriva de blocos continentais – fracas evidências.

-1915: movimentos horizontais, integração de dados geológicos, geofísicos, paleoclimáticos, paleontológicos e biogeográficos:

1. Rochas continentais = SiAl = menos densas e menos magnetizadas que as do fundo oceânico (SiMA) = blocos siálicos mais leves sobre uma camada de manto viscoso.
2. Supercontinente **PANGEA (termo criado em 1920)**: unia as maiores massas continentais; quebra iniciou no Mesozoico (200 m.a.)
3. Processo gradual e não catastrófico (atualismo!)

Deriva continental

Wegener faleceu em 1930.

Grande oposição às suas idéias até 1960:

conflito com T. Permanência;

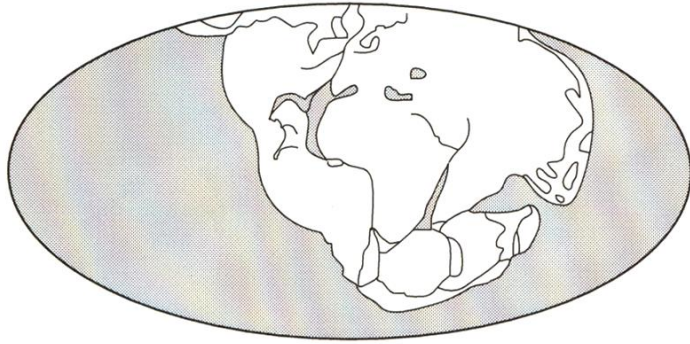
erros factuais;

falta de mecanismos plausíveis;

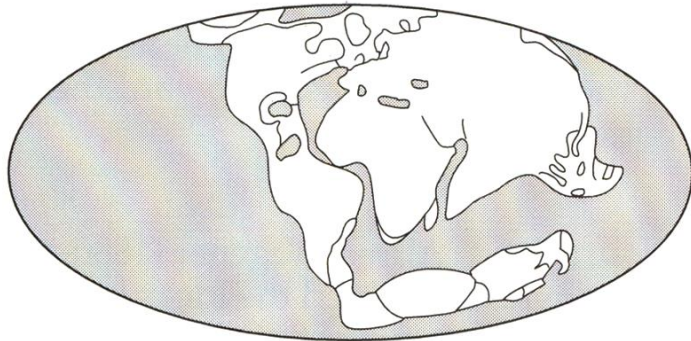
homem fora da área da Geologia!

**Paleontólogos desestimulados pelo trabalho de Simpson (1943)
sobre mamíferos.**

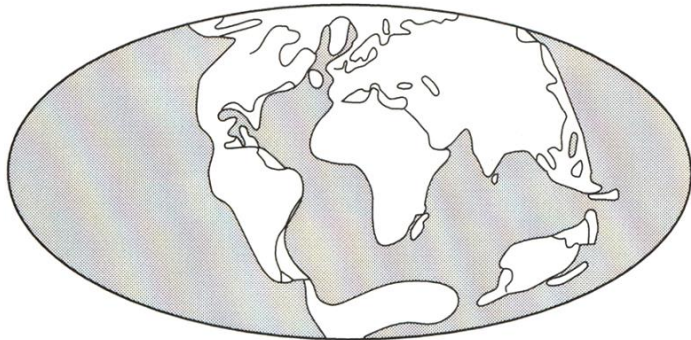
Upper Carboniferous



Eocene



Lower Quaternary



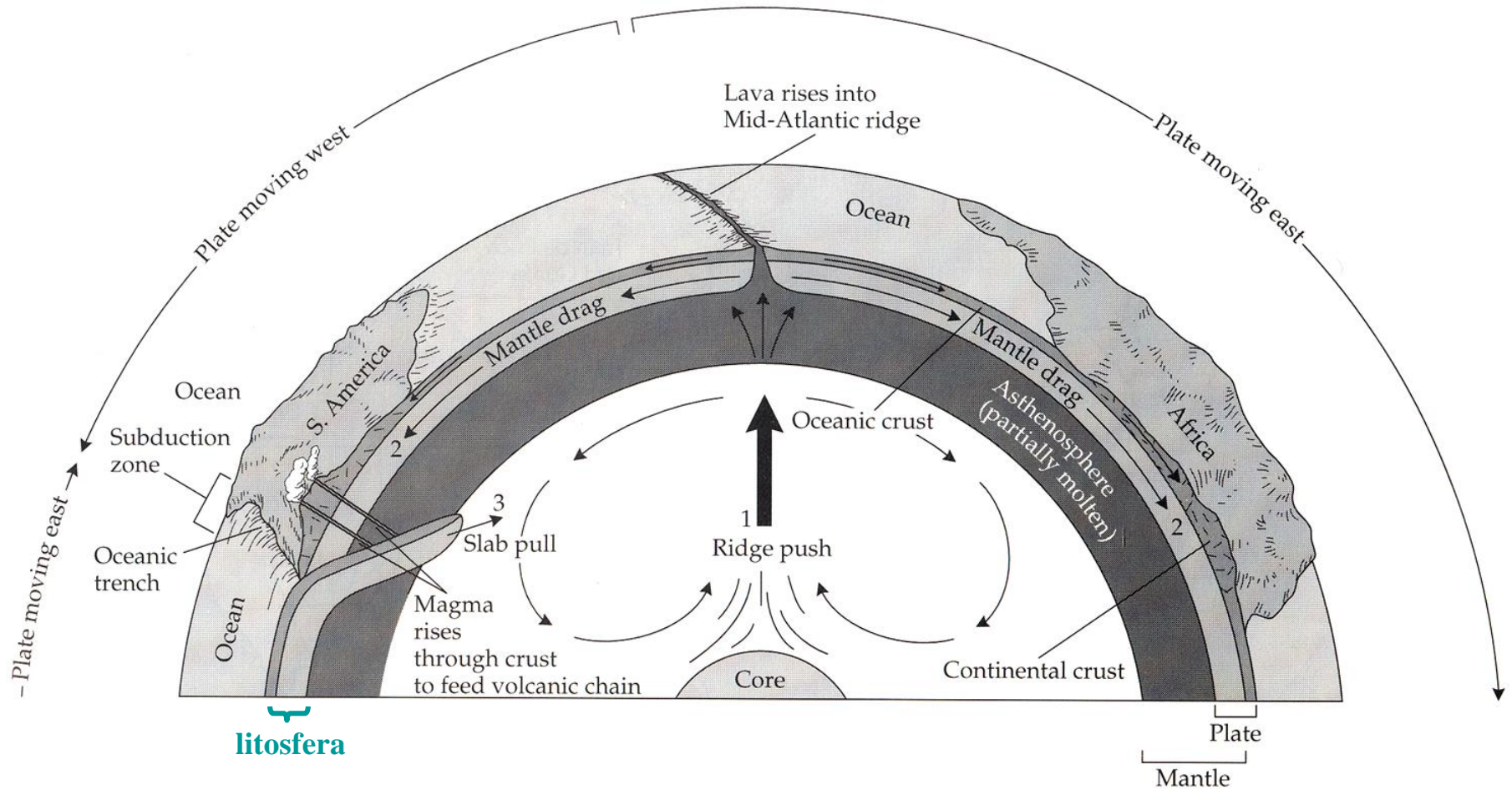
Wegener's (1929) model of continental drift, showing how he envisioned the continents, initially united in one giant landmass, to have moved apart during the Mesozoic and early Tertiary. In Wegener's time, the geological epochs and periods were thought to have been more recent than has been indicated by modern dating methods. Nevertheless, comparison with Figure 6.15E and Figure A in Box 6.2 shows that Wegener's view was extremely similar to current reconstructions of continental movement. (After Wegener 1966.)



Avanços no paleomagnetismo:
1956 - em colunas estratigráficas,
orientação dos cristais nas
rochas
indicava que América do Norte
e Europa antes unidas!

Avanços na geologia marinha:
Herman Hess 1950 –
embasamento oceânico é jovem,
do Jurássico (150 m.a.),
enquanto os crátons continentais
são do Pré-cambriano (+1 bilhão
de anos)!

Sistemas montanhosos
submarinos de 65.000 km + falhas
= altas temperaturas ali,
sugerindo liberação de material
magmático nas falhas!
Regiões de vulcanismo e
terremotos alinhadas!



The current **model of plate tectonics** includes the possibility that at least three forces may be responsible for crustal movements: (1) ridge push, or the force generated by molten rock rising from the earth's core through the mantle at the midoceanic ridges; (2) mantle drag, the tendency of the crust to ride the mantle much like boxes on a conveyor belt; and (3) slab pull, the force generated as subducting crust tends to pull trailing crust after it along the surface. (After Stanley 1987.)

Brown & Lomolino 1998

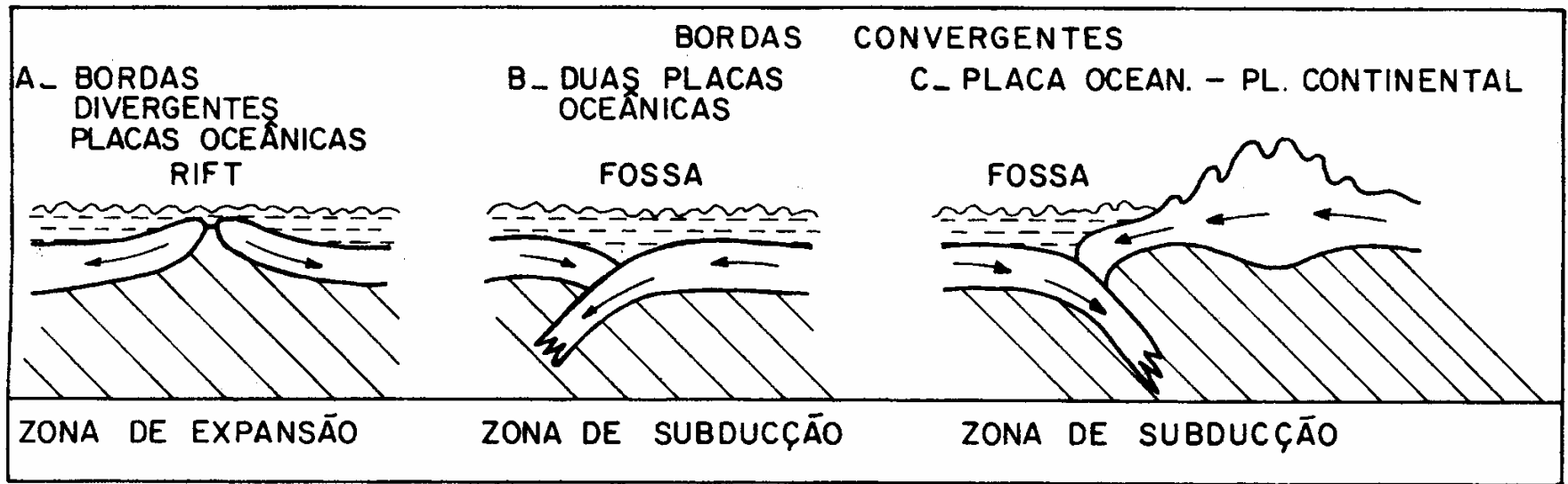
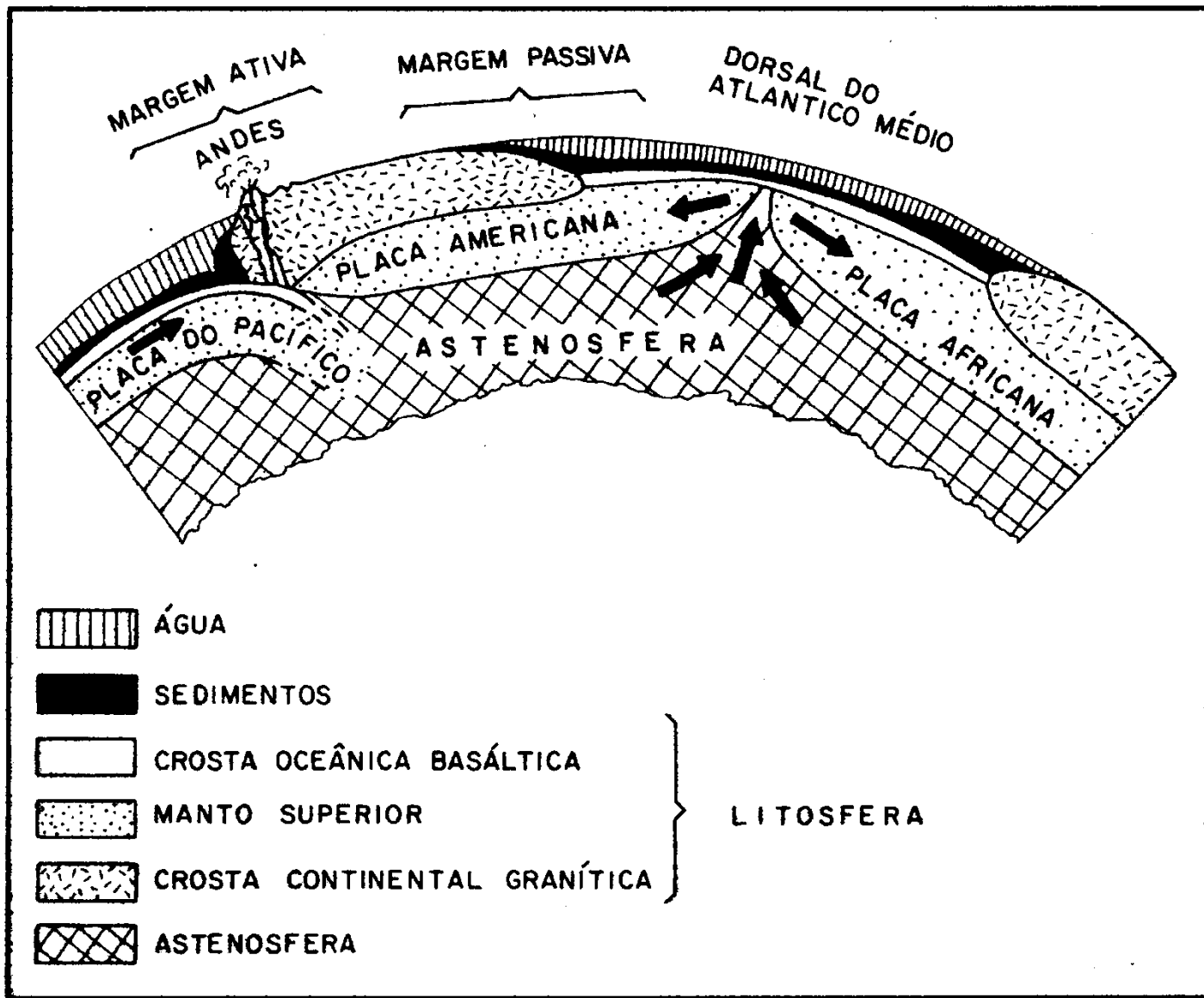


Fig. 3.9. Limites entre placas tectônicas. A - zona de expansão entre duas placas oceânicas; B - zona de convergência entre duas placas oceânicas, onde se forma uma fossa; C - zona de convergência entre uma placa oceânica e uma placa continental, que resulta em uma zona de subdução no mar e no levantamento de montanhas no continente.

Espessura das placas: 100 km

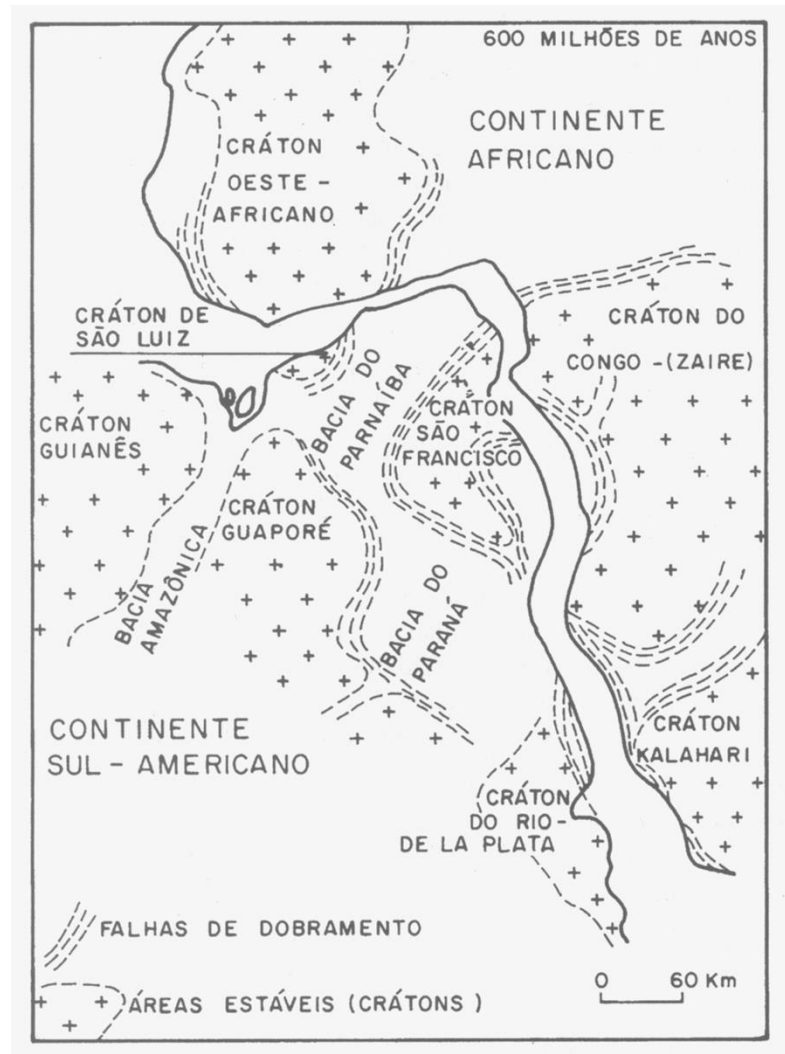
Salgado-Labouriau 1994



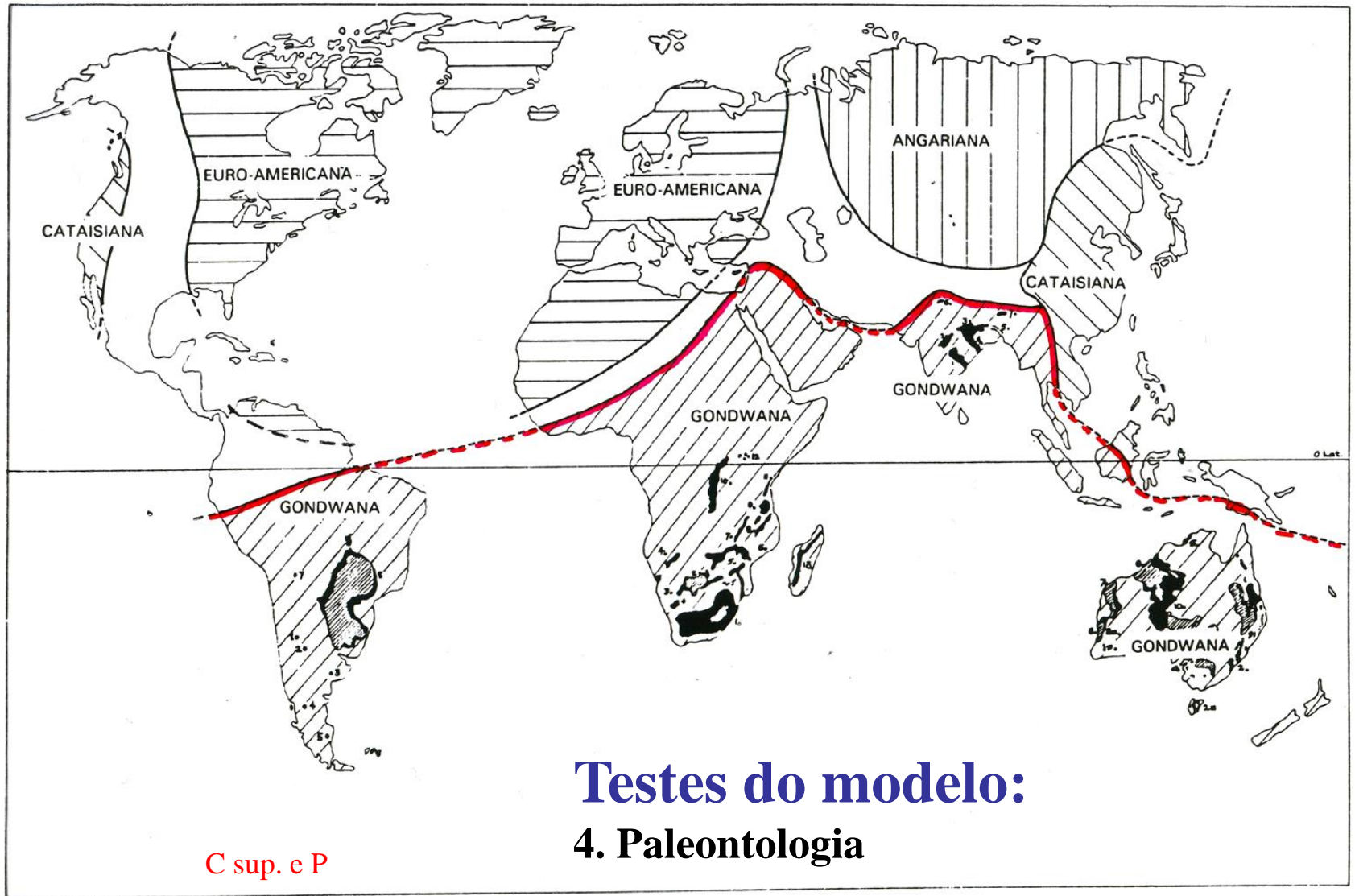
Esquema da Dorsal do Atlântico Médio e da placa sul americana e seus limites, segundo M. Talwani e M. Langseth (1981).

Testes do modelo:

1. “encaixe” geométrico das massas continentais;
2. Paleomagnetismo das lavas do assoalho oceânico;
3. Padrões estratigráficos idênticos nas massas que estiveram unidas: plena correspondência dos escudos pré-cambrianos nos continentes do Hem. Sul.; rochas sedimentares mesozóicas extremamente similares no Brasil e no Gabão.



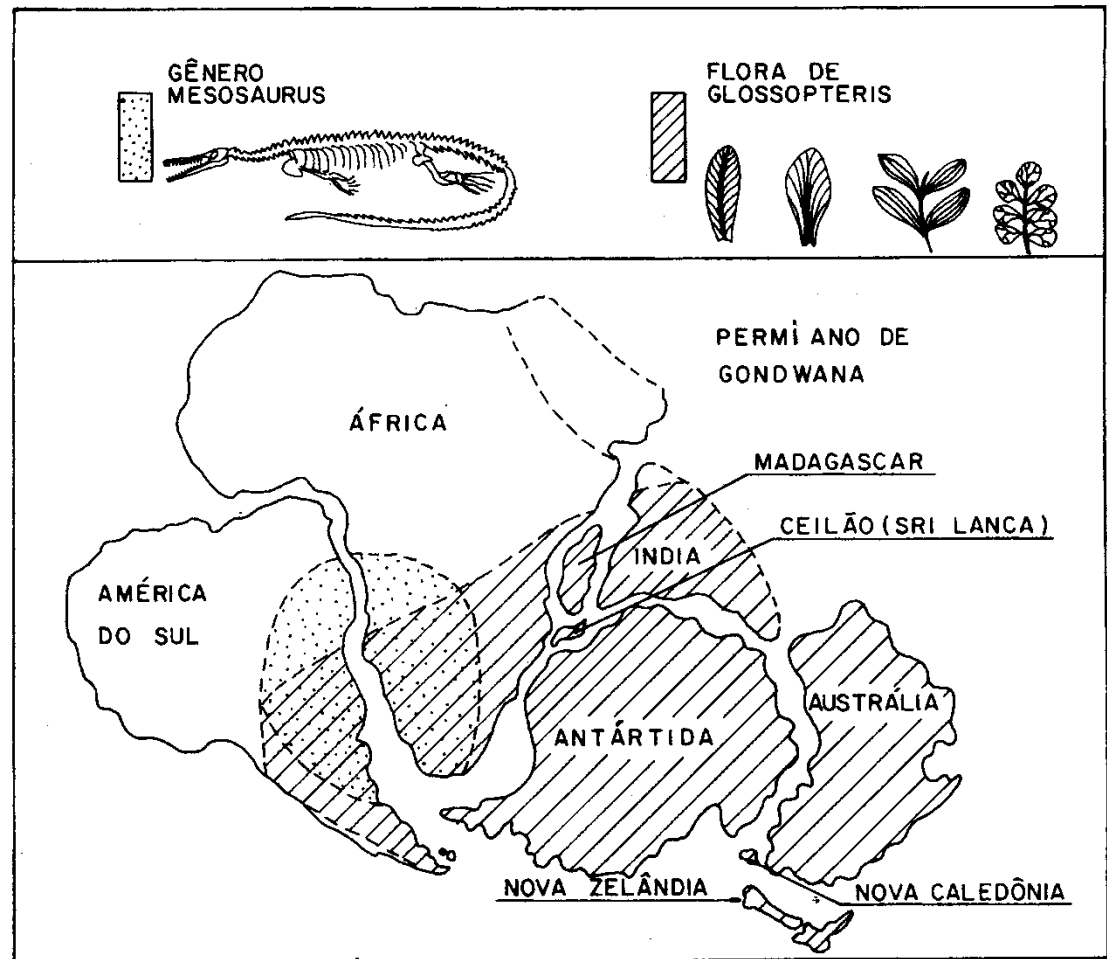
Formações geológicas idênticas na África e na América do Sul evidenciam a ligação destes dois continentes no final do Proterozóico. O contorno dos continentes e a distância entre eles são artifícios de apresentação e não representam a forma e distância que tinham no tempo em que estavam unidos. Informações baseadas em Alvarenga e Trompette, 1992.



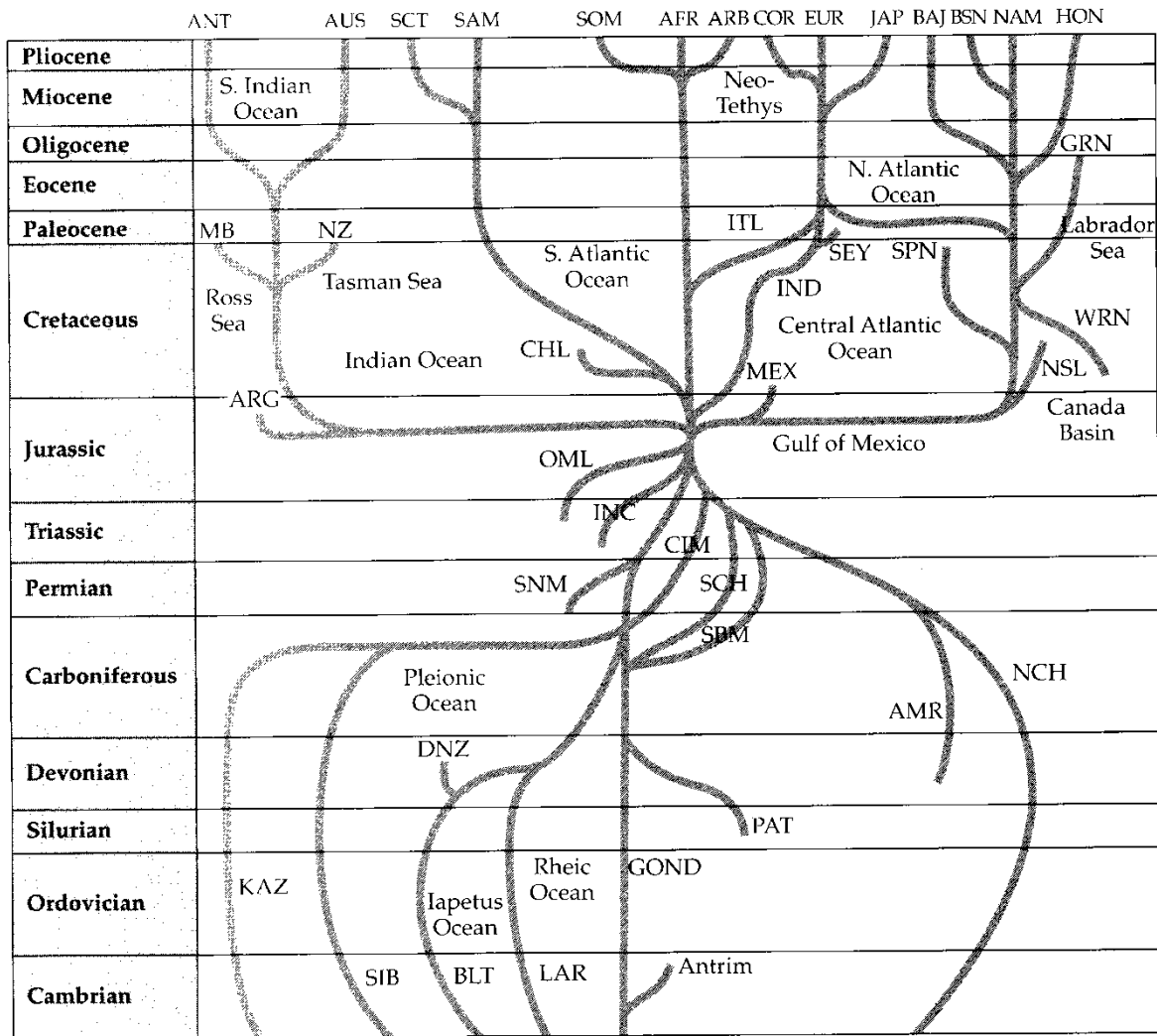
Províncias fitogeográficas do Paleozóico superior. (Segundo Plumstead, 1973). A Antártida não foi delineada, mas inclui-se na **Província Gondwânica** (flora de *Glossopteris*). As áreas em preto correspondem a afloramentos e as demarcadas com hachuras finas a ocorrência de subsuperfície.

Testes do modelo:

4. Paleontologia

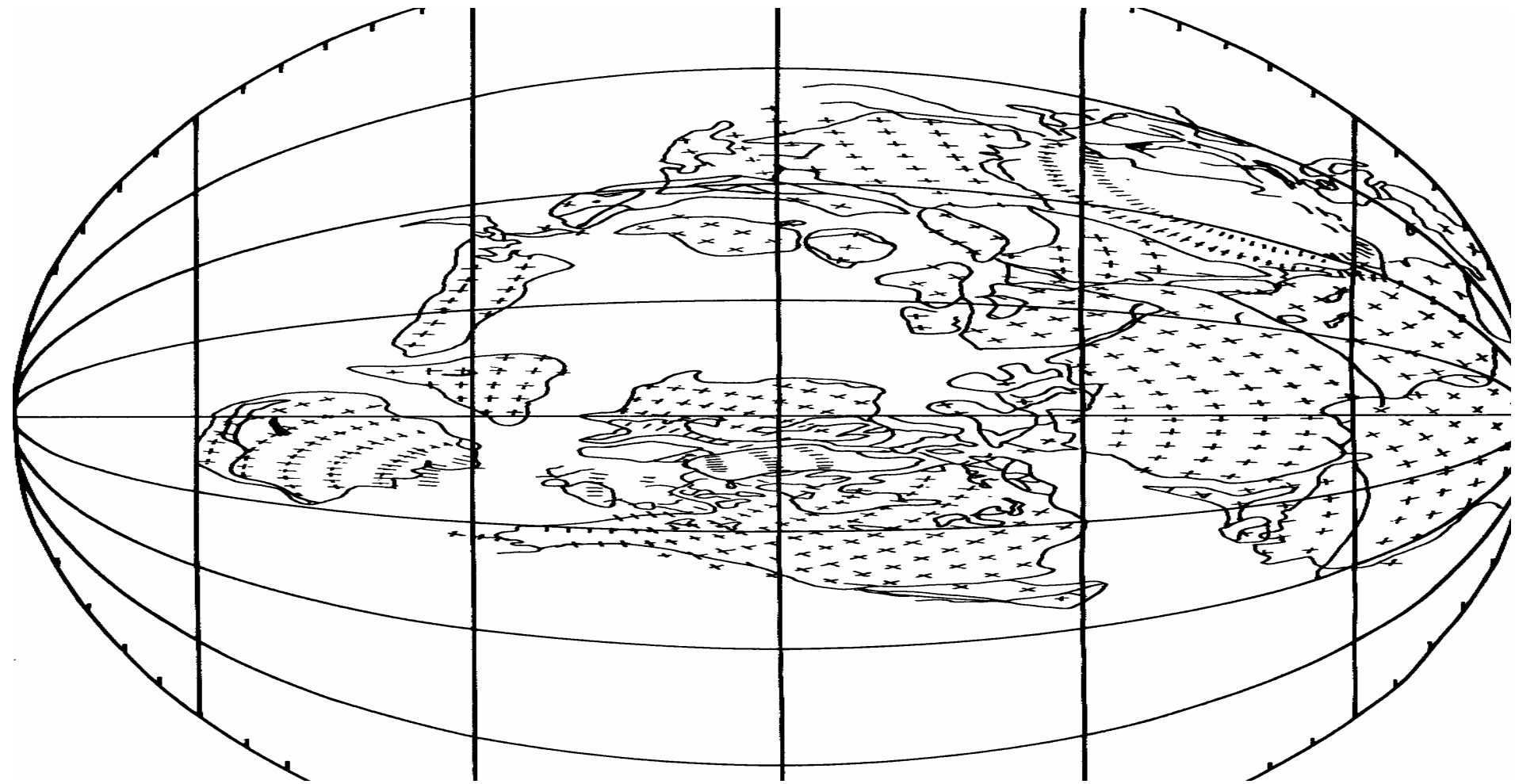


Distribuição de dois importantes grupos de fósseis de Gondwana, a Fauna de Mesosaurus (segundo Tarbuck e Lutgens, 1988) e a Flora de Glossopteris (segundo Archangelsky e Arrondo, 1965). Desta flora estão representadas, da esquerda para a direita, as folhas dos gêneros-forma *Glossopteris*, *Gangamopteris*, *Schizoneura* e *Merianopteris* (segundo Stokes, 1982). Mapa base segundo Lester King (em Holmes, 1965), adaptado.



- AFR = Africa
- AMR = Amuria
- ANT = Antarctica
- ARB = Arabia
- ARG = Argoland
- AUS = Australia
- BAJ = Baja California
- BLT = Baltica
- BSN = Basin and Range
- CHI = Chile
- CIM = Cimmeria
- COR = Corsica and Sandinia
- DNZ = Donetz Basin
- EUR = Europe
- GOND = Gondwana
- GRN = Greenland
- HON = Honduras
- INC = Indochina
- IND = India
- ITL = Italy
- JAP = Japan
- KAZ = Kazakhstan
- LAR = Laurentia
- MEX = Mexico
- MB = Marie Byrdland
- NAM = North America
- NCH = North China
- NSL = North Slope of Alaska
- NZ = New Zealand
- OML = Omolon
- PAT = Patagonia
- SAM = South America
- SBM = Sibumasu
- SCH = South China
- SCT = Scotia Arc
- SEY = Seychelles
- SIB = Siberia
- SNM = Sonomia
- SOM = Somalia
- SPN = Spain
- WRN = Wrangellia

Plate tectonic tree diagram illustrating the episodic formation and breakup of supercontinents, called the **Wegener Cycle** (after the German scientist Alfred Wegener; see Wegener 1912). Branching events represent the breakup of continents and the formation of new ocean basins. "Roots" are continental collisions. A branch that terminates represents an ocean basin that has stopped opening (for example, GRN = Labrador Sea between Greenland and North America) or the cessation of motion along a major strike-slip fault.



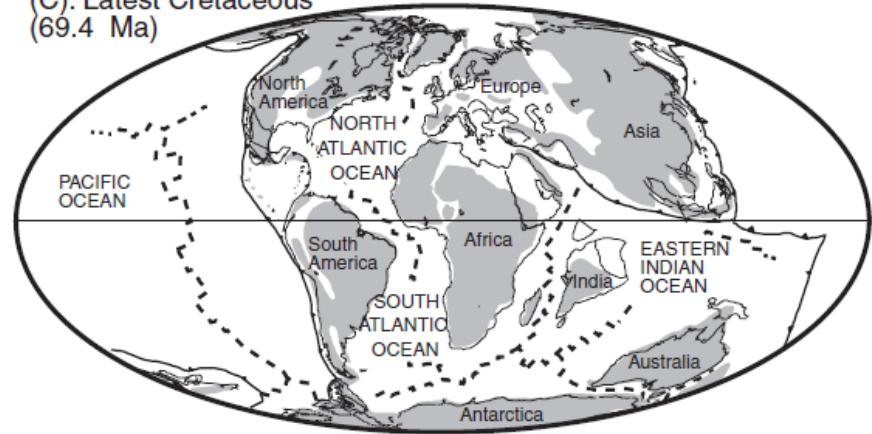
Distribution of Lower Ordovician isograptid (black rectangles) and contemporary non-isograptid immersed platform graptolite biofacies (diagonal shading). After Fortey and Cocks (1986).

Hallam, 1994

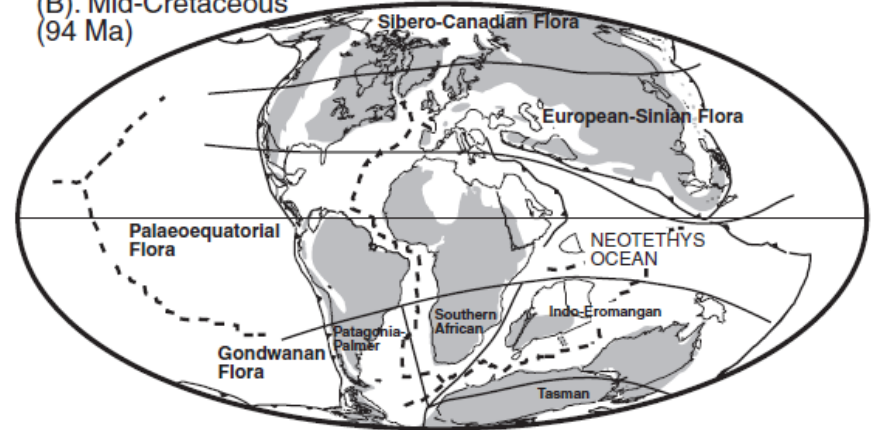
The breakup history of Gondwana and its impact on pre-Cenozoic floristic provincialism

McLoughlin
Austr. J. Bot. 2001

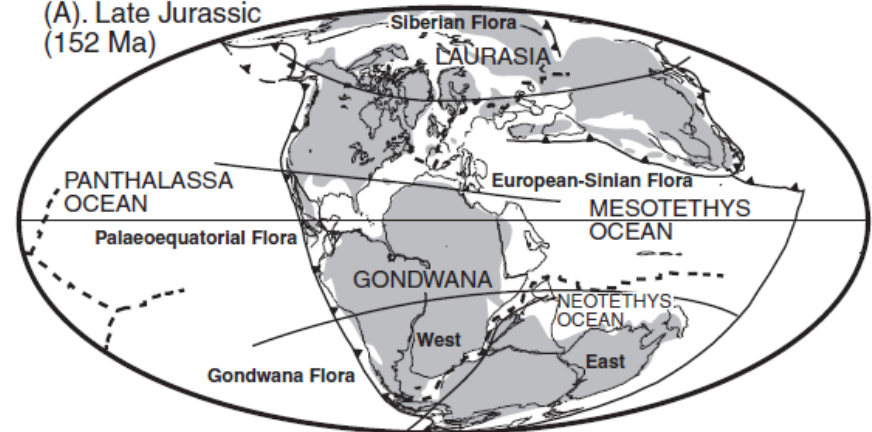
(C). Latest Cretaceous
(69.4 Ma)



(B). Mid-Cretaceous
(94 Ma)



(A). Late Jurassic
(152 Ma)



The breakup history of Gondwana and its impact on pre-Cenozoic floristic provincialism

McLoughlin 2001

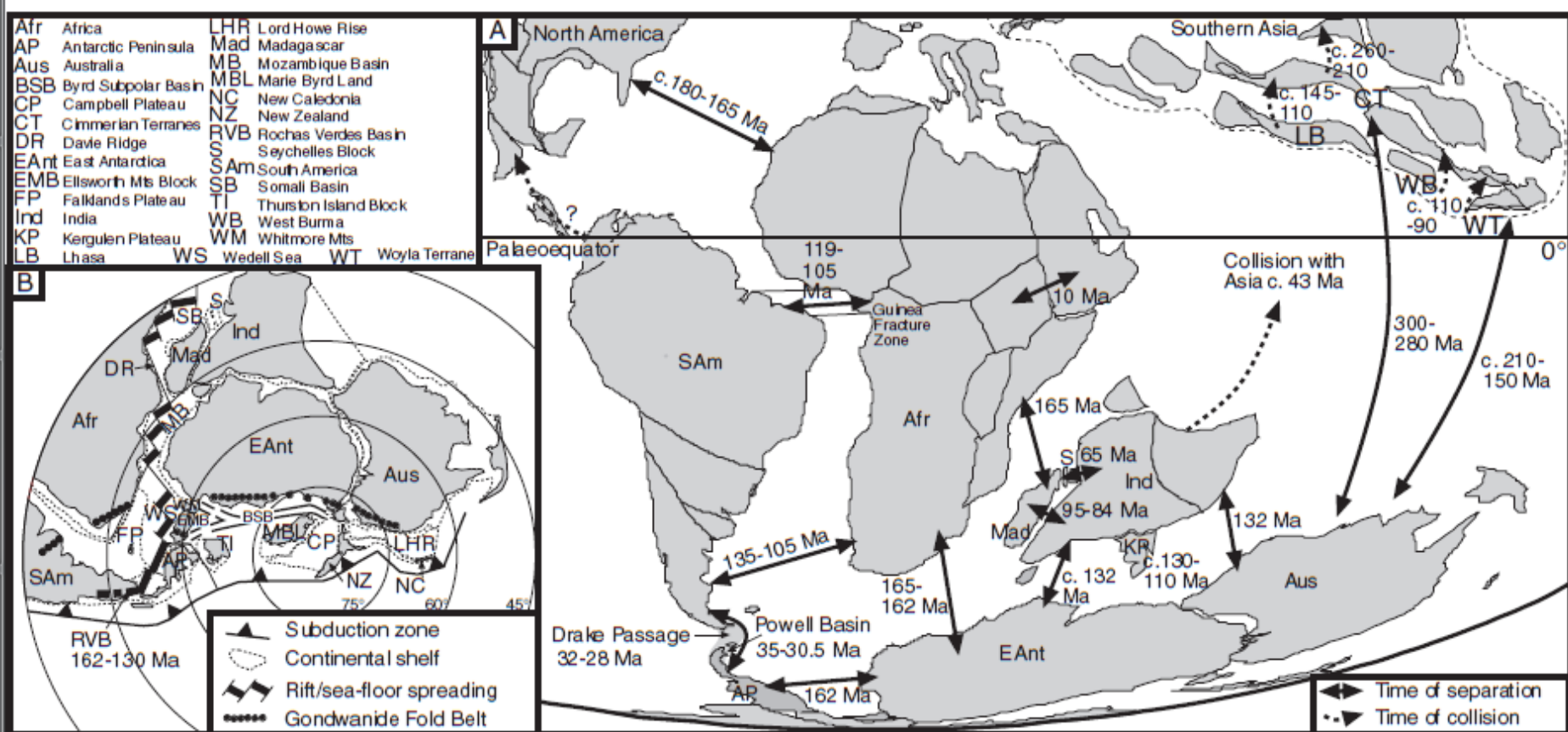
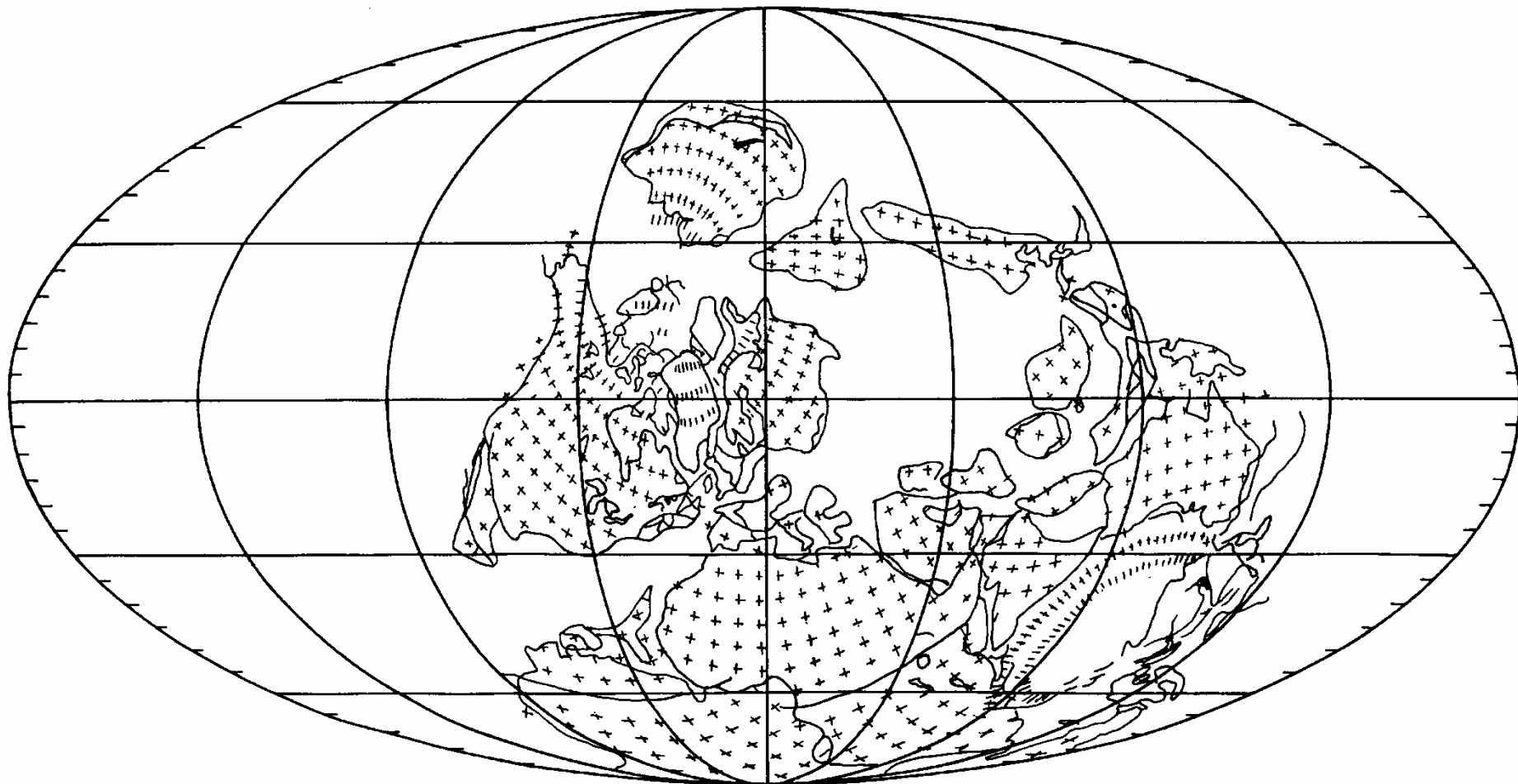


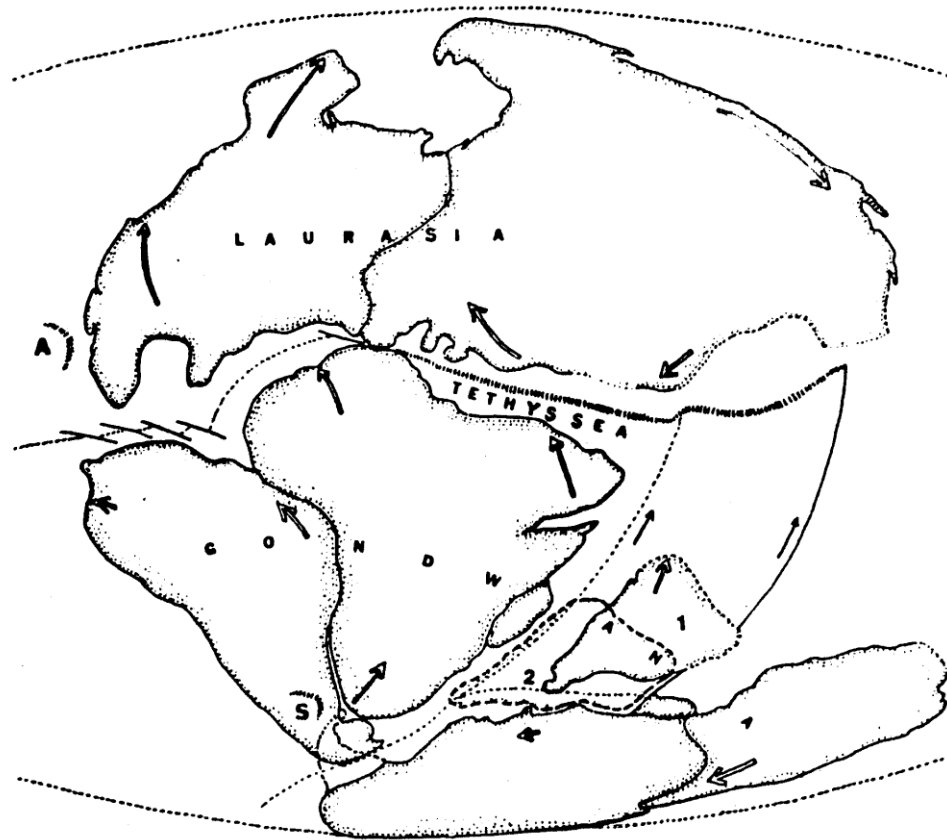
Fig. 4. Gondwanan breakup episodes. (A) Reconstruction of the South Atlantic-Indian Ocean-Neotethys Ocean regions during the late Early Cretaceous (110 million years ago) showing the timing of separation and amalgamation of Gondwanan and Asian terranes (compiled from numerous sources—see text; base map modified from Scotese 1997). (B) Polar projection of southern Gondwana at approximately 150 million years ago illustrating the relationships between west Antarctic terranes and showing the stages of initial *en echelon* rifting between east and west Gondwana (after Grunow *et al.* 1991).



Distribution of continents in mid Devonian (Givetian): After Scotese & McKerrow (1990).

PANGEA – supercontinente ocupava 1/3 da Terra no Paleozóico Superior e Mesozóico Inferior, circundado pelo grande oceano **PANTHALASSA**.

Hallam 1994

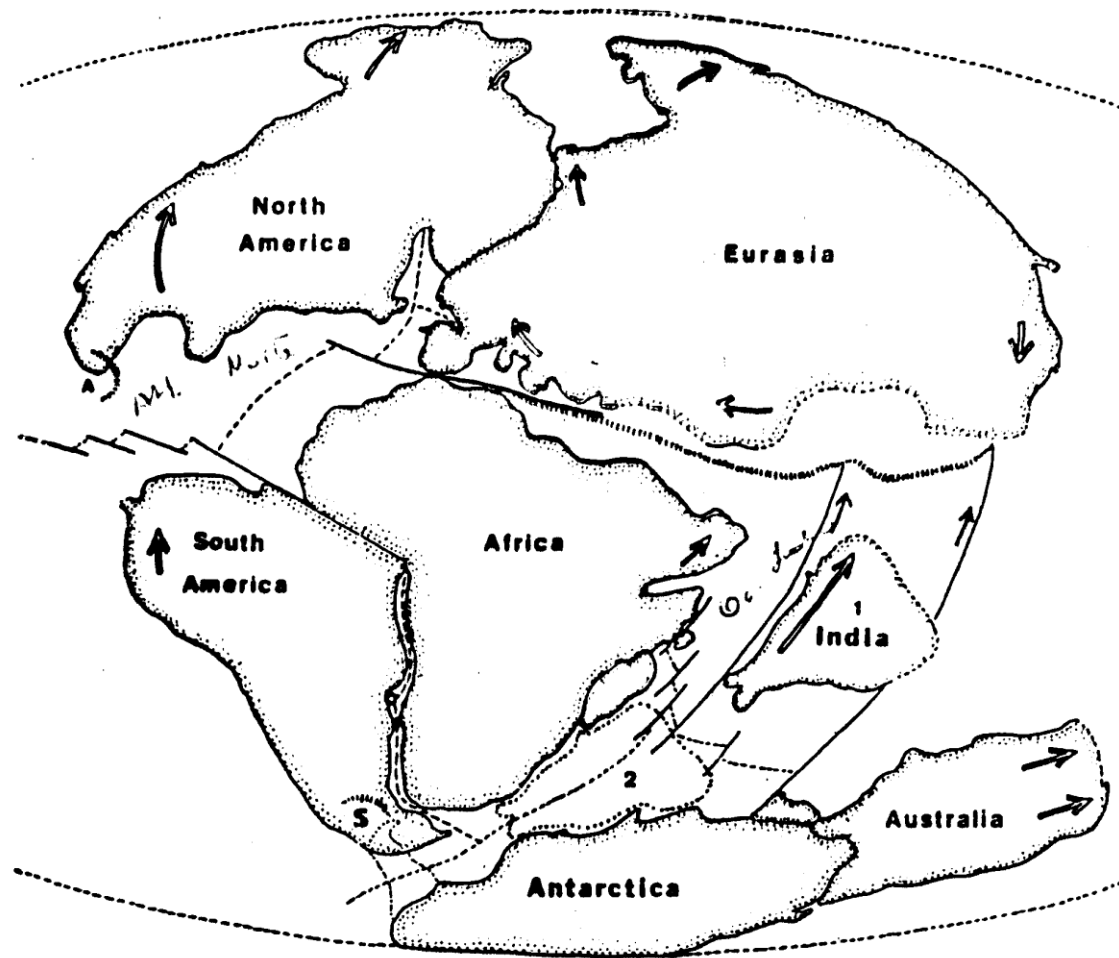


Alexandre Du Toit:
Laurasia e Gondwana.

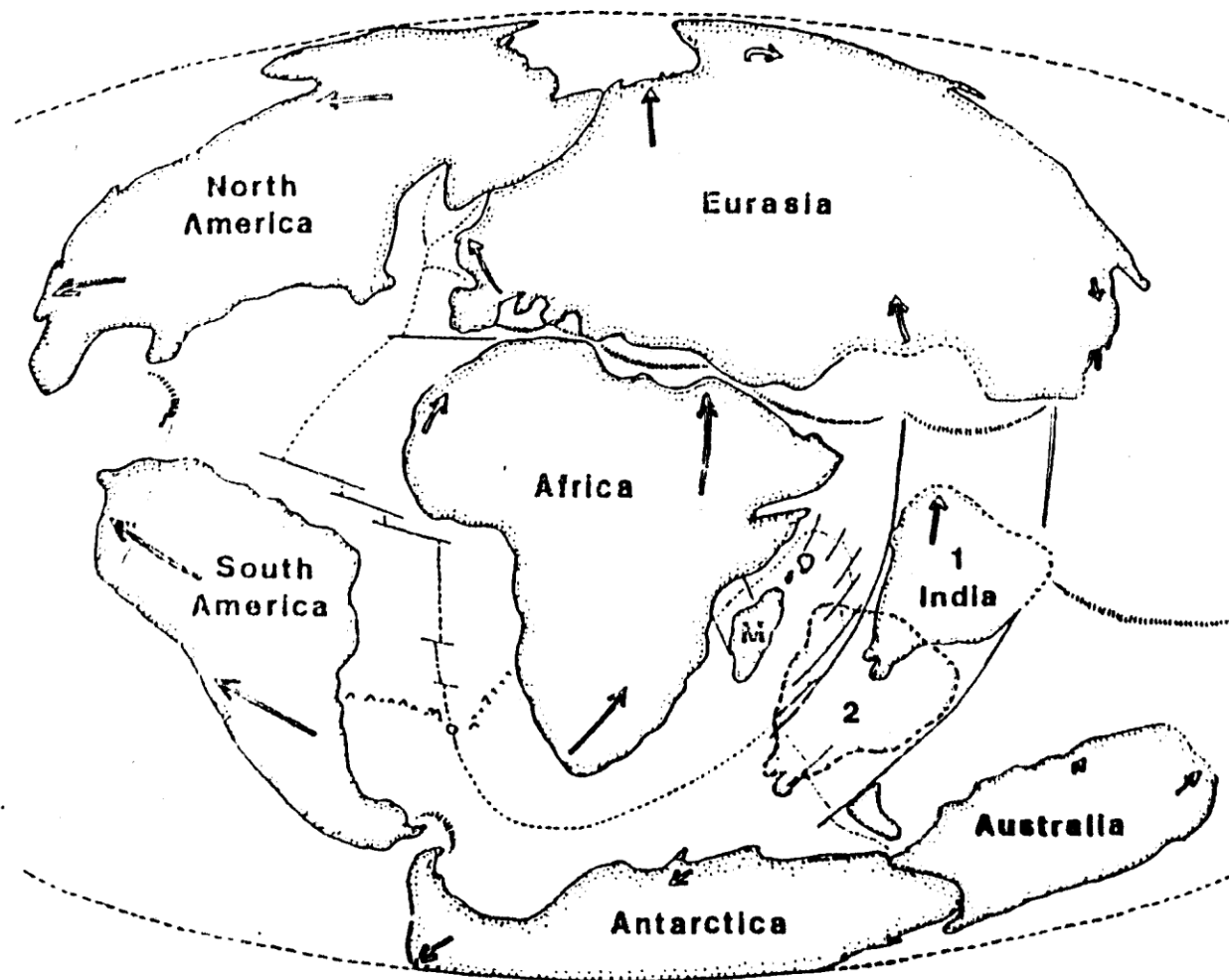
Reconstruction of Laurasia and Gondwanaland at start of the **Jurassic** (180 million years ago). Rift lines are indicated by dotted lines; the Tethyan Trench is shown by hatching; solid arrows and solid lines denote megashears, zones of lateral slippage along plate boundaries; hollow arrows indicate rotation since the breakup of Pangaea. The Antilles and Scotia arcs (A and S) are indicated as modern reference points. Dietz and Holden (1970) indicate a position for India, 1, that is already slightly divorced from Antarctica, but according to McKenzie and Sclater (1973) a position near 2 seems likely. (Modified from Dietz and Holden, 1970.)

Schuster 1970

Schuster 1970



The breakup of Gondwanaland after 65 million years of drift, at the start of the **Cretaceous** (135 million years ago). The North Atlantic and Indian oceans, according to Dietz and Holden, have begun to form: a slight rift indicates the very start of formation of the South Atlantic; Laurasia remains firmly united; according to Dietz and Holden (1970) the Indian plate has undergone about half its northward migration (1), but according to McKenzie and Sclater (1973) it still lies far to the south, perhaps as far as 2; an intermediate position is most likely. (Modified from Dietz and Holden, 1970; symbols as in fig. 1)



Continental plates and their disposition at the start of the **Tertiary** (65 million years ago). The South Atlantic is fully open; Africa is isolated except from Laurasia, a rift having separated Madagascar from Africa. The position of India is questionable: at 1 according to Dietz and Holden (1970), but possibly at or near 2, extrapolating from McKenzie and Sclater (1973). By this time, former connections between South America and North America and Antarctica have been sundered (After Dietz and Holden, 1970).

Schuster 1970

Plate 7
Early Cretaceous
Barremian-Aptian

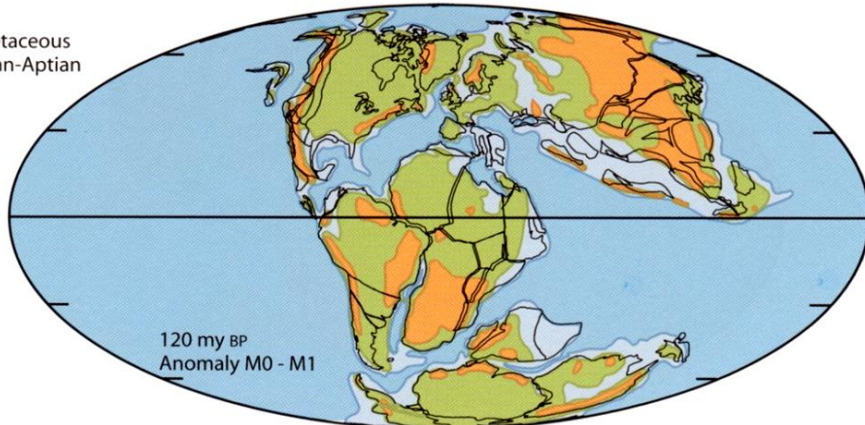


Plate 8
Mid Cretaceous
Albian-Cenomanian

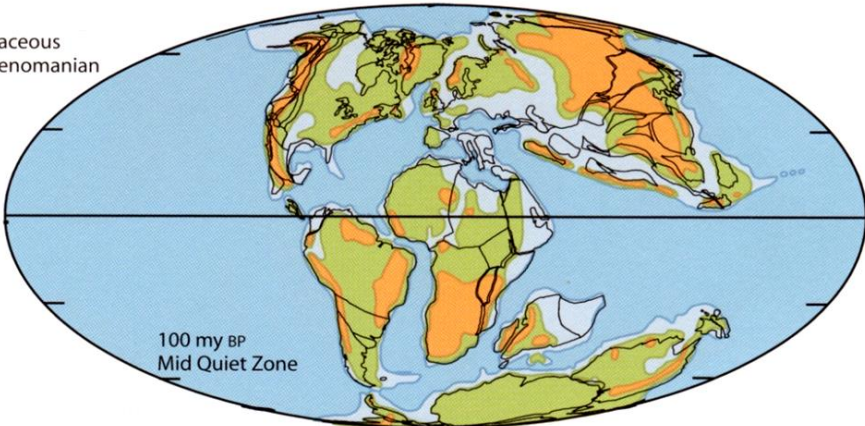
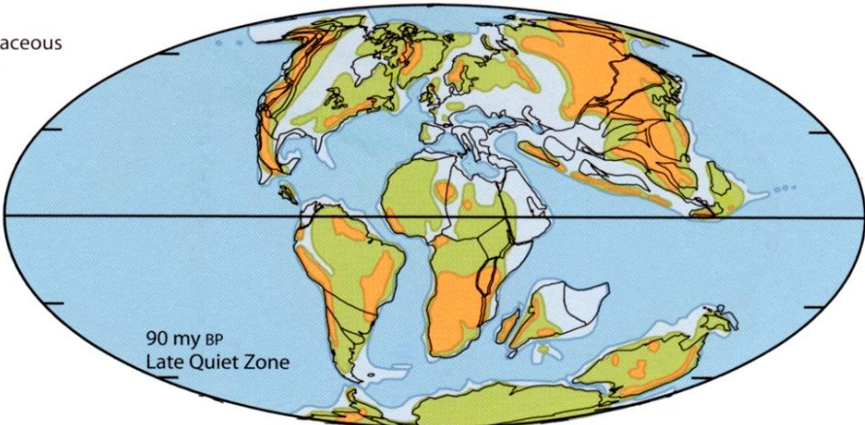
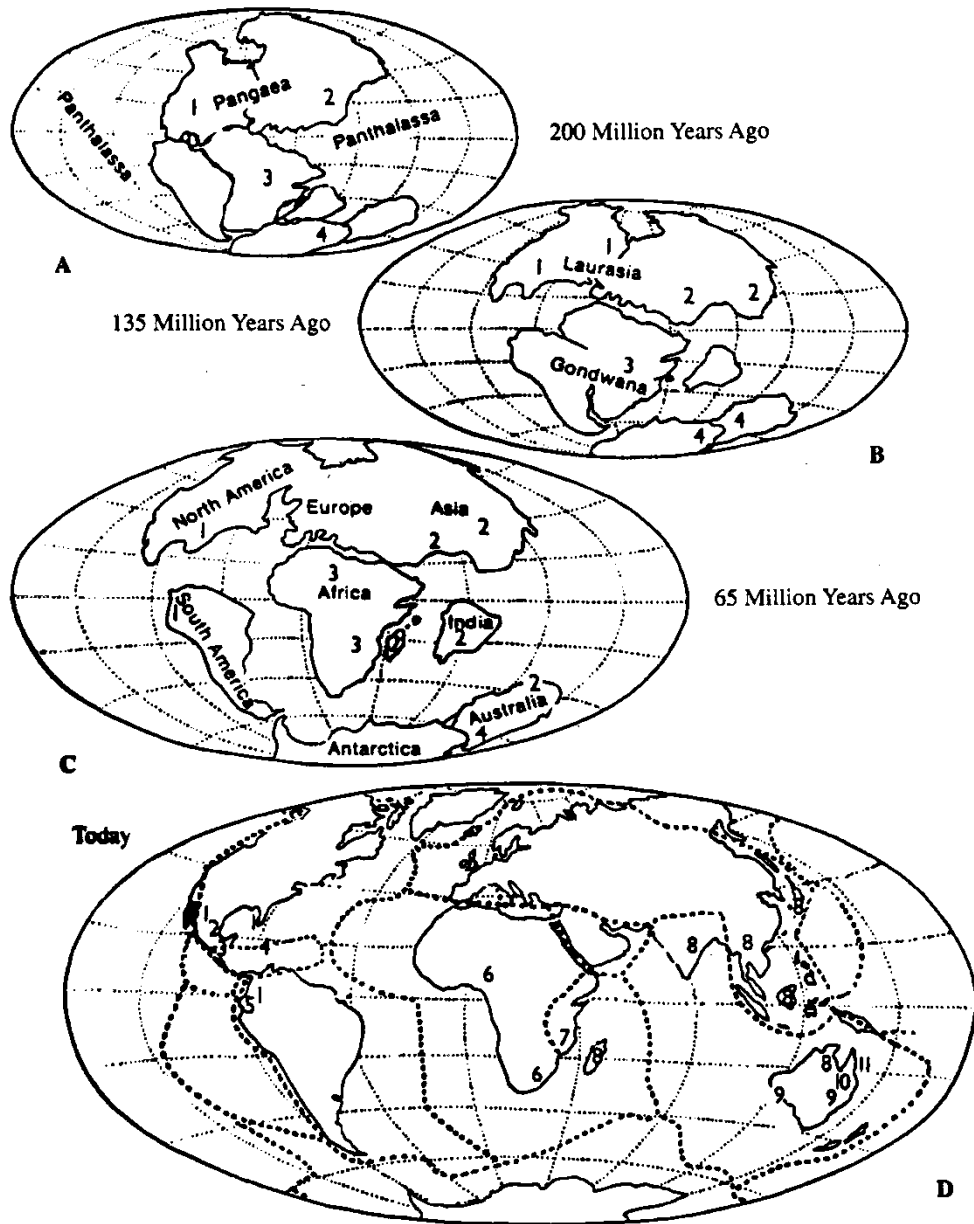


Plate 9
Late Cretaceous
Turonian



PALEOCOROLOGIA de Cicadófitas



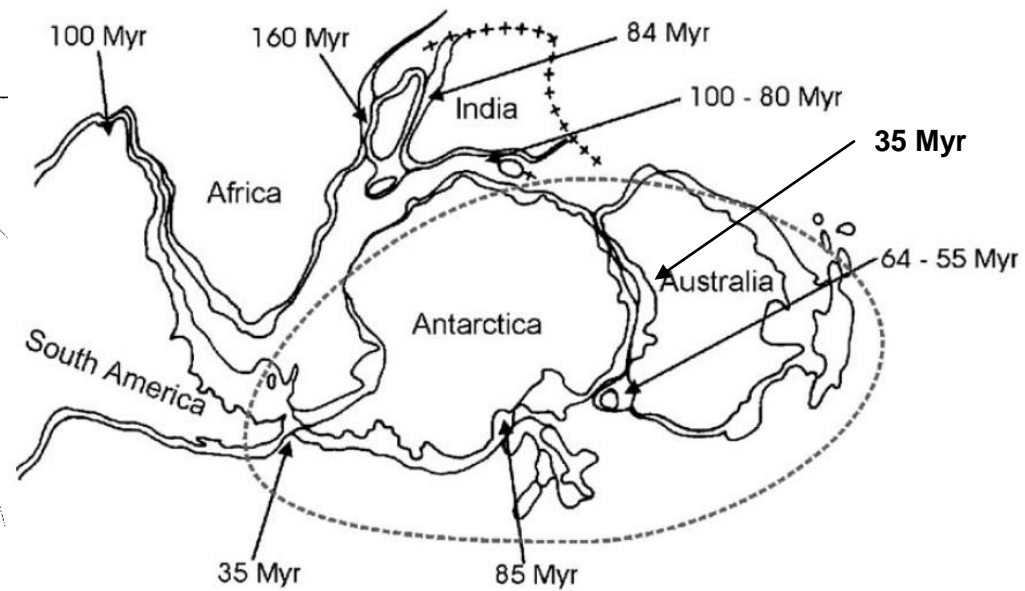
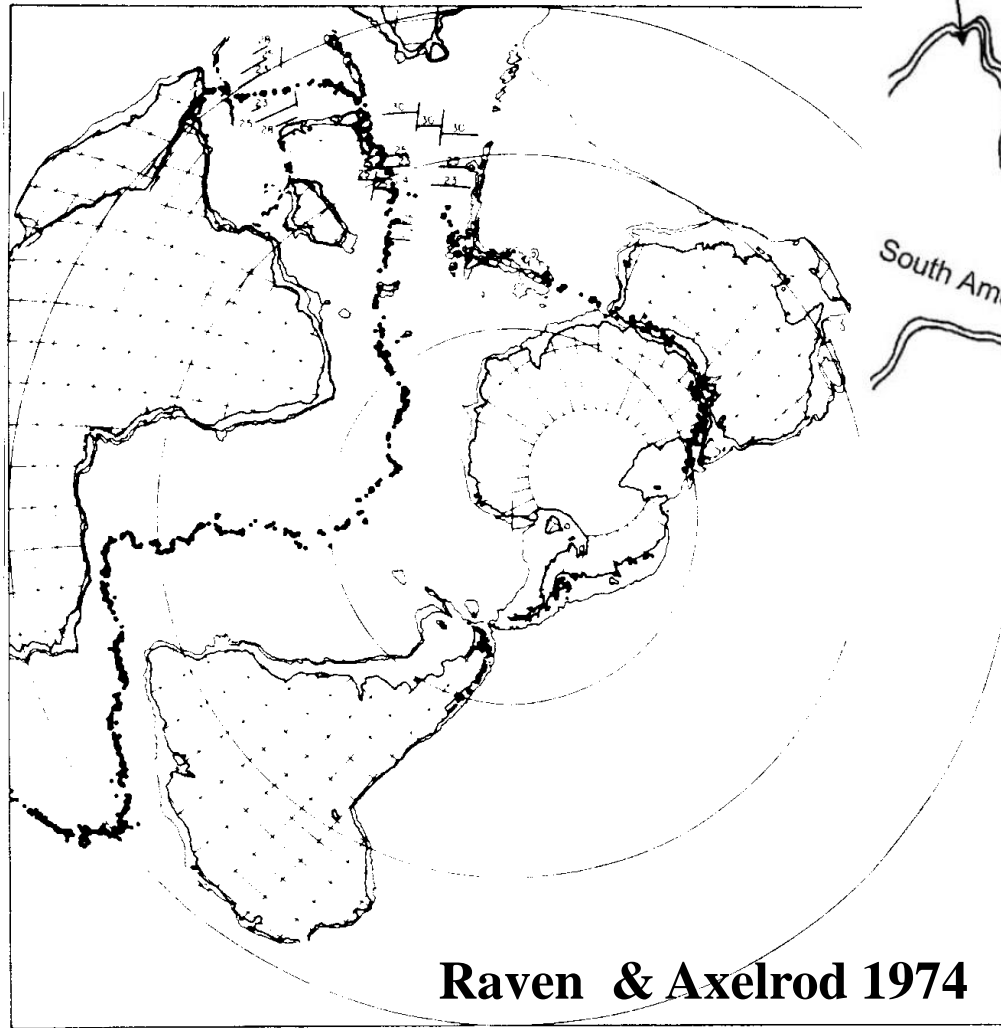
Distribution of the fossil and present-day genera of cycads in relation to continental drift (the heavier dotted lines indicate plate borders):

A, Triassic cycadophytes: 1, ancestors of *Zamia*, *Ceratozamia*, *Microcycas*, *Chigua*, and perhaps *Dioon*; 2, *Cycas* ancestors; 3, ancestors of *Encephalartos* and *Stangeria*; 4, ancestors of *Bowenia*, *Lepidozamia*, and *Macrozamia*.

B, Cretaceous cycadophytes: as in A.

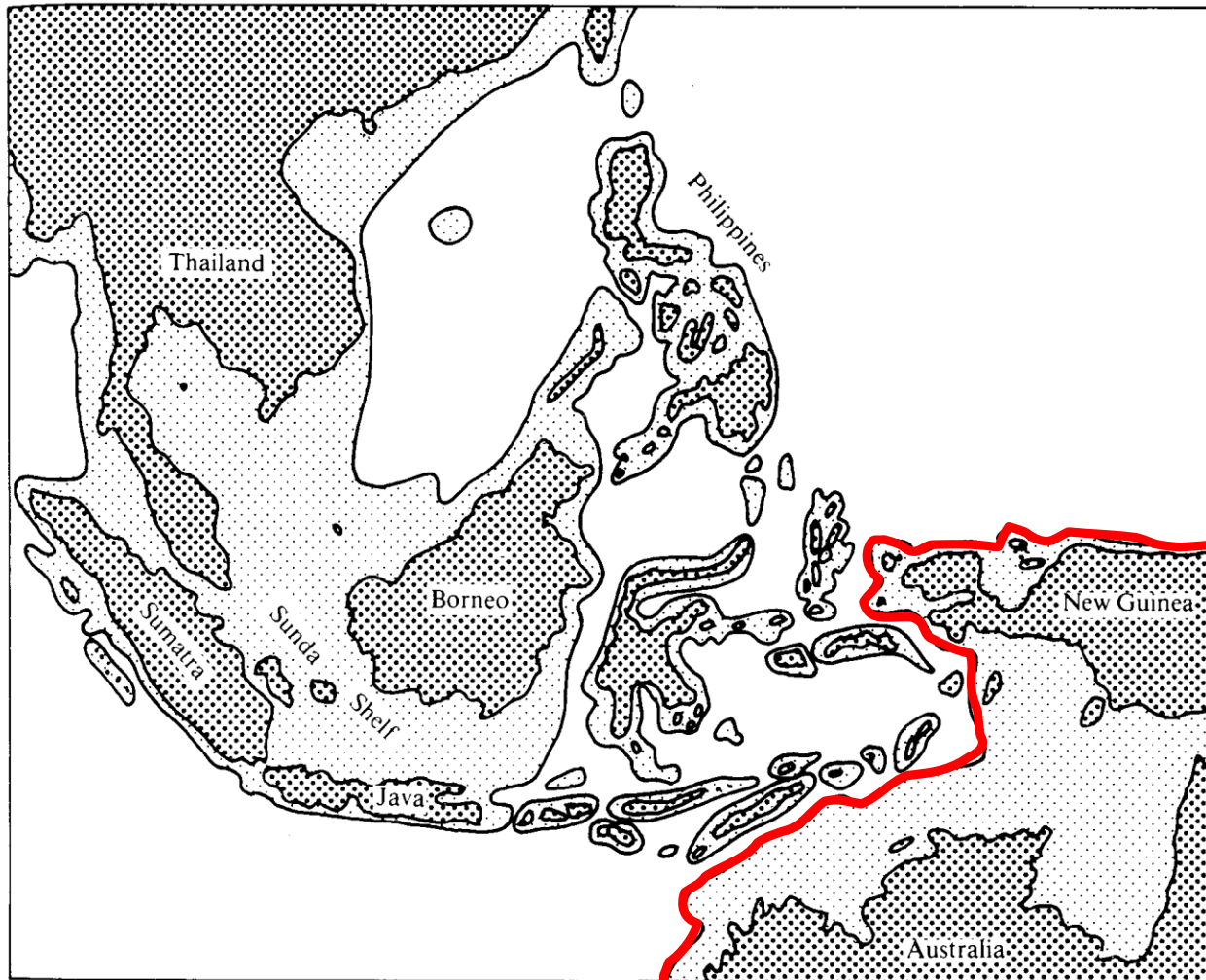
C, Paleocene cycadophytes: 1, ancestors of *Zamia*, *Ceratozamia*, *Dioon*, and *Chigua*; 2, *Cycas* ancestors; 3, ancestors of *Stangeria* and *Encephalartos*; 4, ancestors of *Bowenia*, *Lepidozamia*, and *Macrozamia*.

D, present-day cycads: 1, *Zamia*; 2, *Ceratozamia*; 3, *Dioon*; 4, *Microcycas*; 5, *Chigua*; 6, *Stangeria*; 7, *Encephalartos*; 8, *Cycas*; 9, *Macrozamia*; 10, *Bowenia*; 11, *Lepidozamia*. (After Gaussen, 1950-1952; Norstog, 1976).

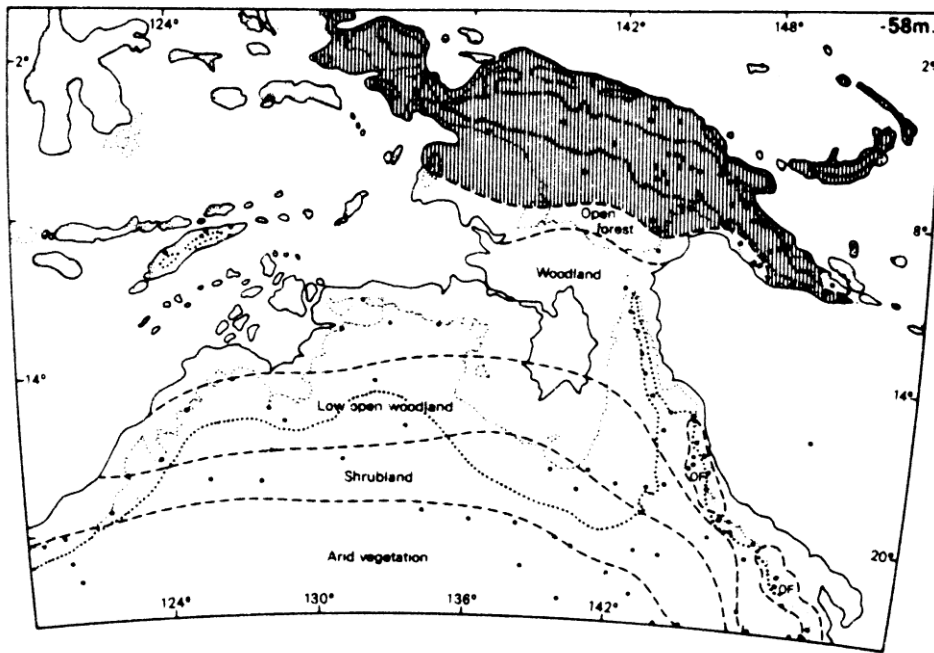


Posadas et al. 2006

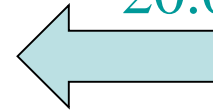
Reconstruction showing early Tertiary configuration of Gondwanan continents. Dots show active plate boundaries at that time. (From Jardine & McKenzie, 1972; reprinted by permission from *Nature* 235: 22. © 1972, Macmillan Journals Ltd.)



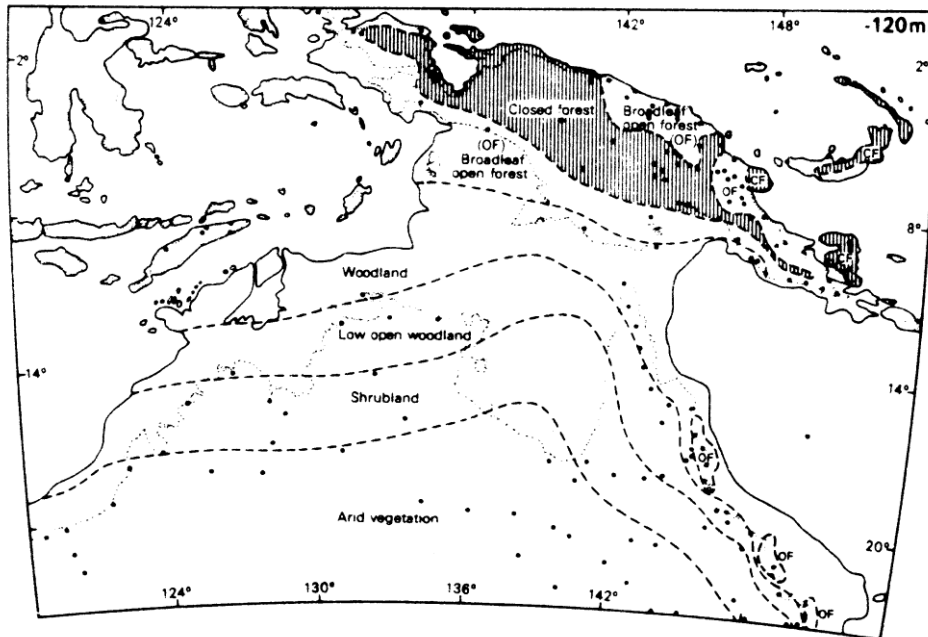
Map of southeast Asia and the western Pacific Basin, showing the position of the 200 m isobathyl (water depth) contour. This depth indicates the location of the continental shelves, and these are of great biogeographic importance because much of them were exposed when sea levels were lowered during the Pleistocene.



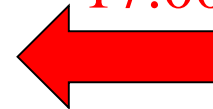
Main structural vegetation types which might have occupied northern Australia, New Guinea and the intervening land about **20.000 years BP.**



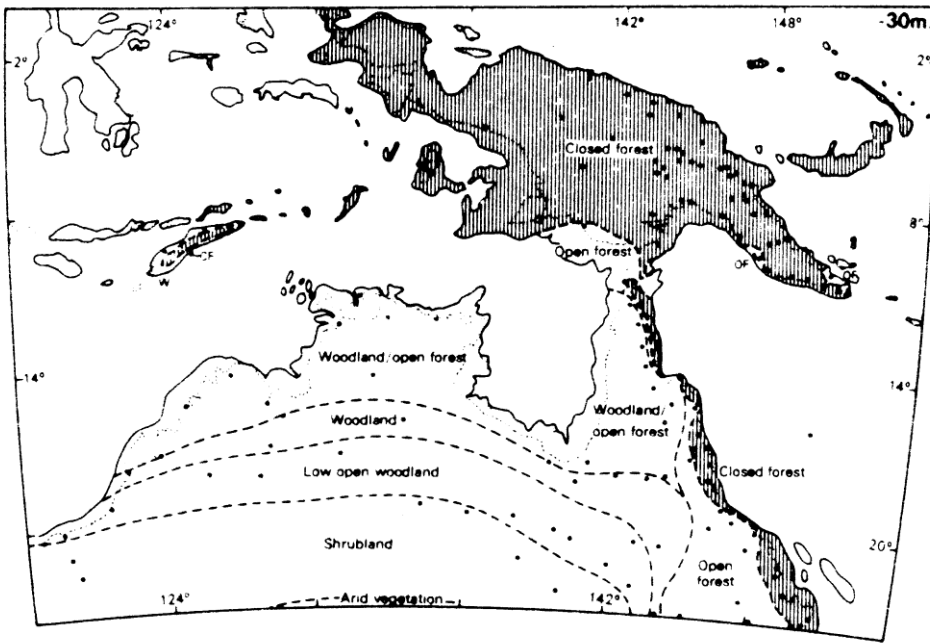
- Tropical/temperate junction
- Estimated coastline
- Closed forest.
- Vegetation zone boundary
- Modern coastline
- Observation station



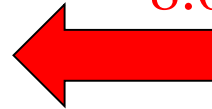
17.000 to 14.000 years BP



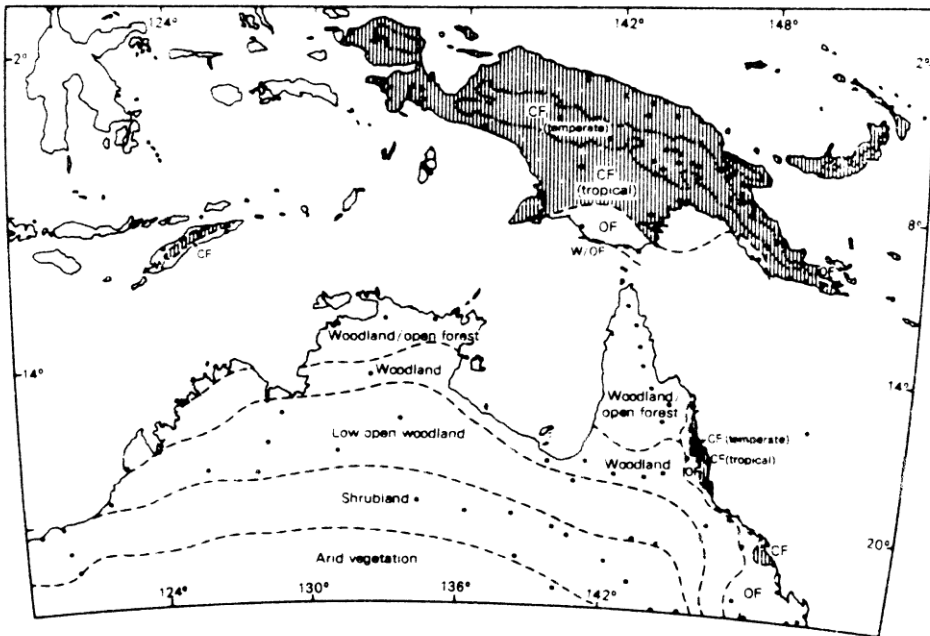
Zenithal Equidistant Minimum Error Projection.



Main structural vegetation types which might have occupied northern Australia, New Guinea and the intervening land about **8.000 years BP.**



- Tropical/temperate junction
- Estimated coastline
- Closed forest.
- Vegetation zone boundary
- Modern coastline
- Observation station



at present.



Robertson *et al.* 1993

Zenithal Equidistant Minimum Error Projection.

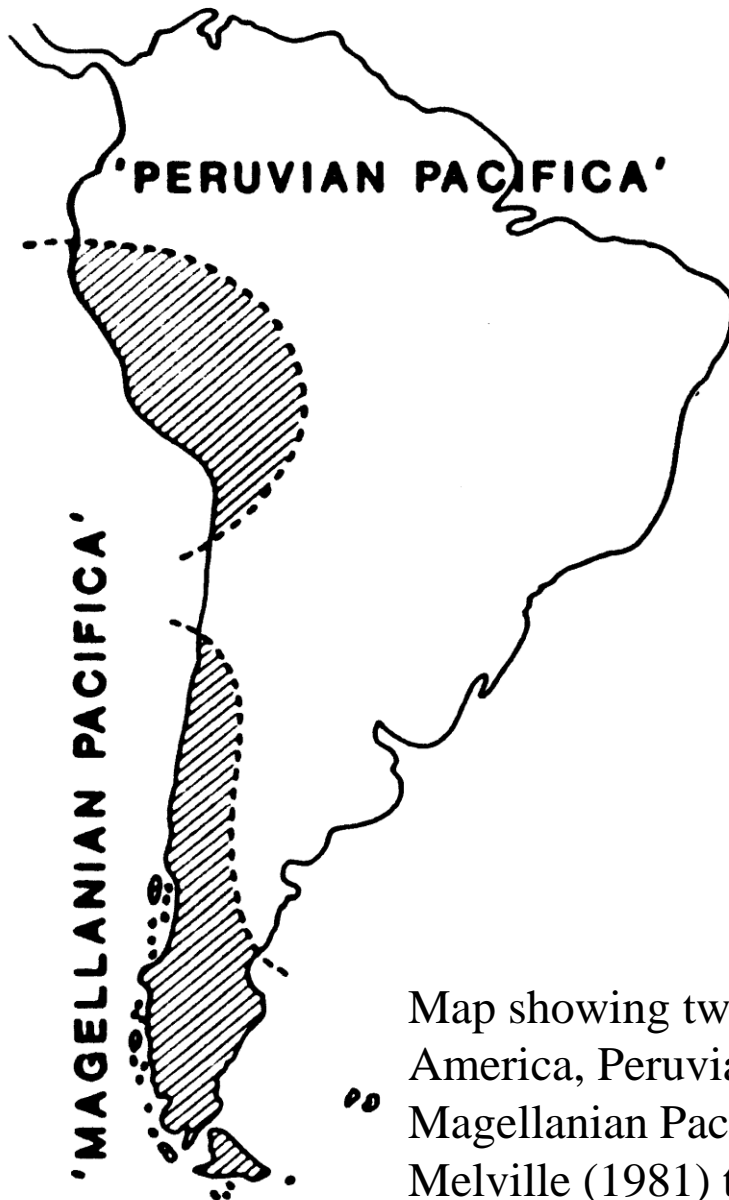
Paleoclimas e paleovegetação:

Usam-se propriedades de fósseis como evidência indireta:

- Presença de corais fósseis – indica áreas rasas e tropicais.**
- Pólen – indica regimes climáticos na Terra.**

Tais reconstituições dependem de se assumir atualismo!

Fauna de *Lystrosaurus*: répteis e anfíbios que viveram na Antártida, África do Sul, Índia e China, mas não na América do Sul.



“Pacifica”:

Continente arcaico que teria sido parte de Gondwana e teria originado blocos que derivaram até a costa oeste da AmS e da AmN e até a costa leste da China

2 blocos na AmS:

Pacifica Peruana e
Pacifica Magelanica.

Map showing two regions of South America, Peruvian, and Magellanian Pacifica, postulated by Melville (1981) to be derived from an ancient Pacific continent.

Melville 1981

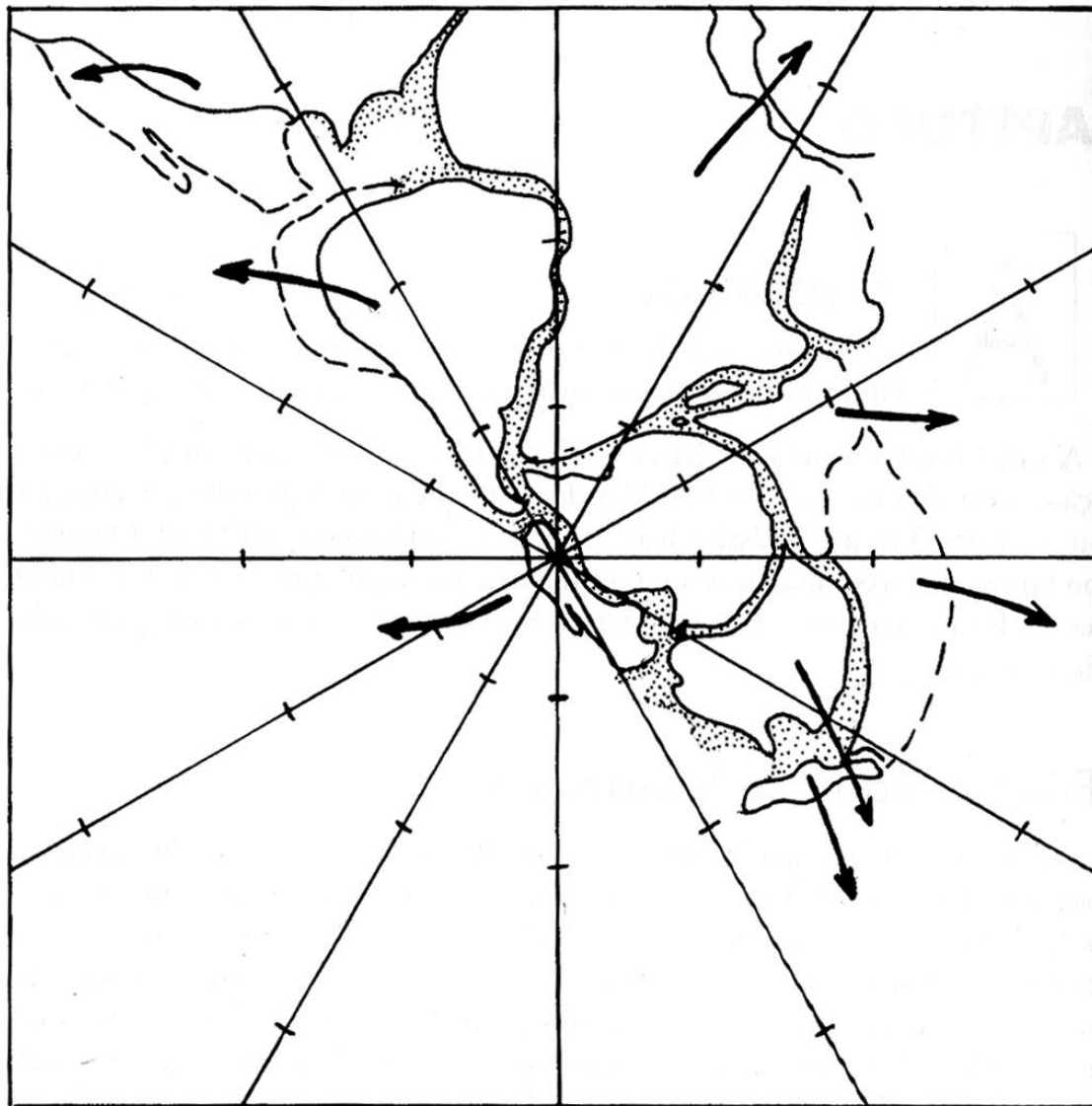
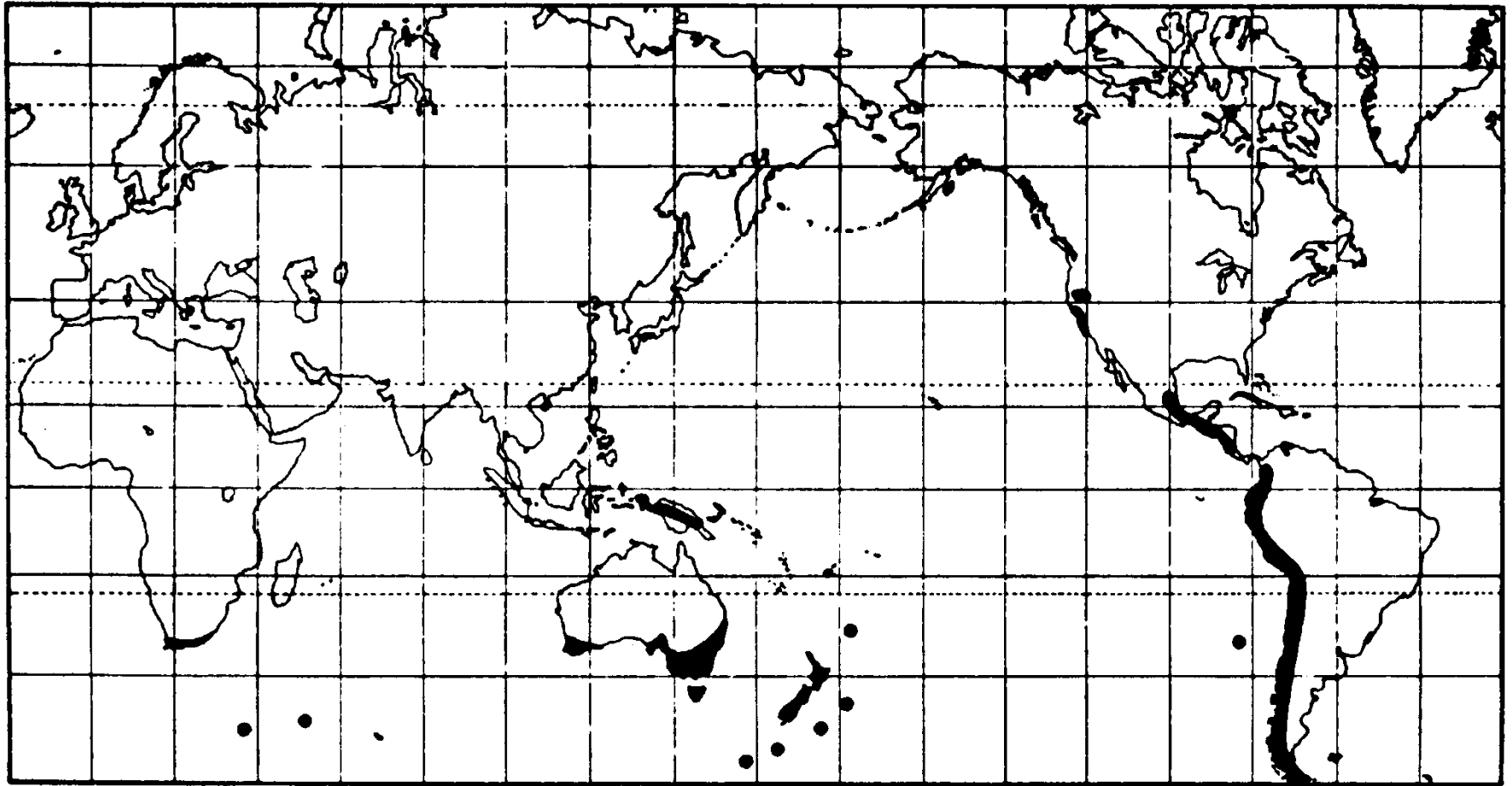


Fig. 5.1. Uma das hipóteses de localização das terras de Gondwana no Triássico inferior. À direita, entre Índia e Austrália, encontra-se a Terra de Pacífica que deve ter formado a região leste da China. À esquerda, entre o cone da América do Sul e a Nova Zelândia, encontra-se uma outra terra, ligada à Antártida, que deve ter formado a costa sudoeste da América do Norte e o Golfo do México (Protocalifórnia). As setas indicam a direção de deriva de cada sub-continente. Mapa base Smith e Briden (1975).

Salgado-Labouriau 1994



Distribution of the genus *Acaena* (Rosaceae)

Thorne 1972

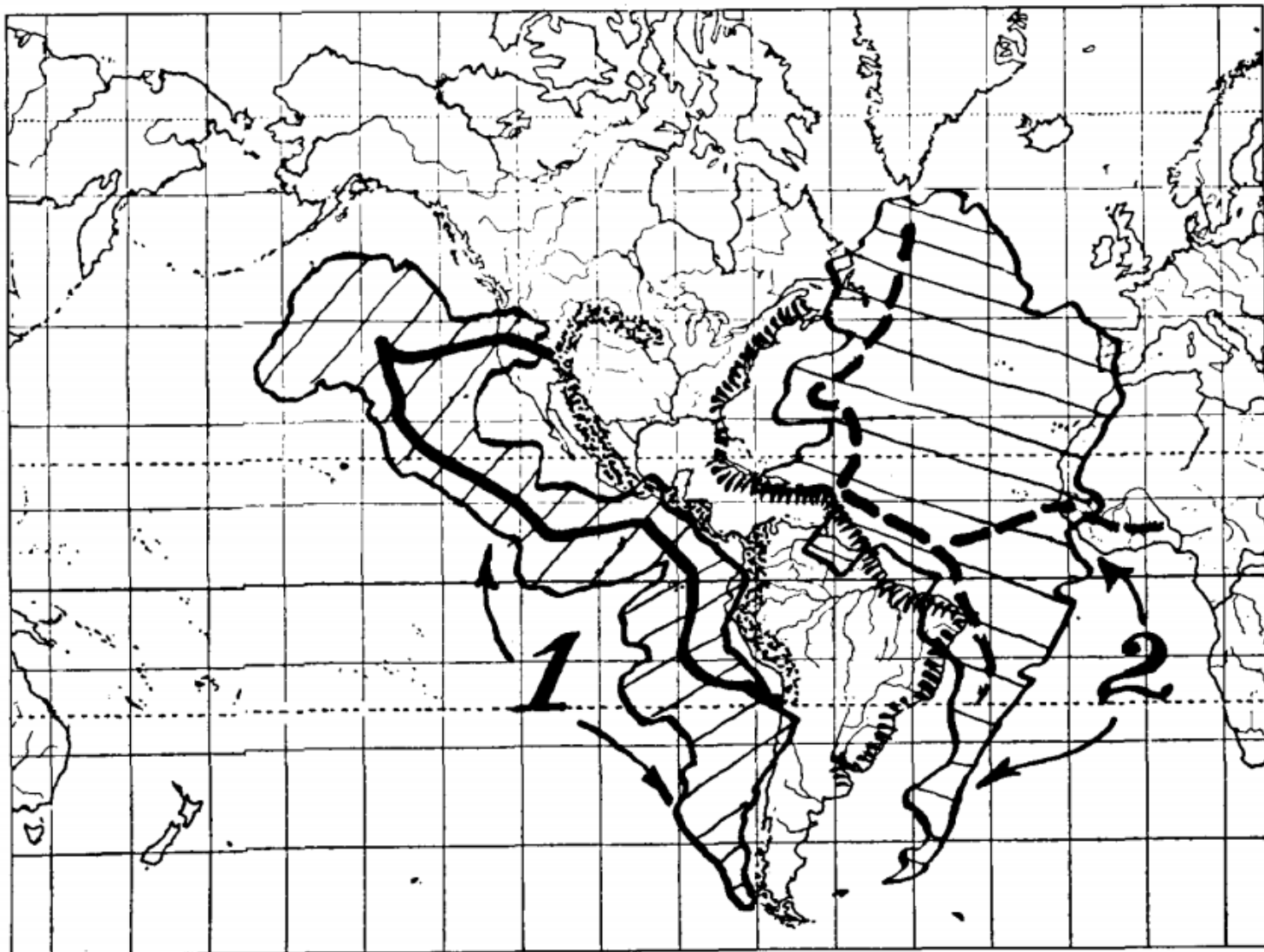


Fig. 4. Croizat's (1960: 79) hypothesis of the composite nature of the North and South American continents. In Croizat's reconstruction both the Atlantic and Pacific Oceans are closed. Croizat's view can be understood as a synthesis of Darwin's early idea of a Pacific continent and Wegener's Pangaea. This novel synthesis was achieved through years of analysis of the distribution records of plants and animals which led Croizat to the realisation that "We may suppose that the New World was originally split into two halves (1 and 2) which later 'floated' to yield the current geography".

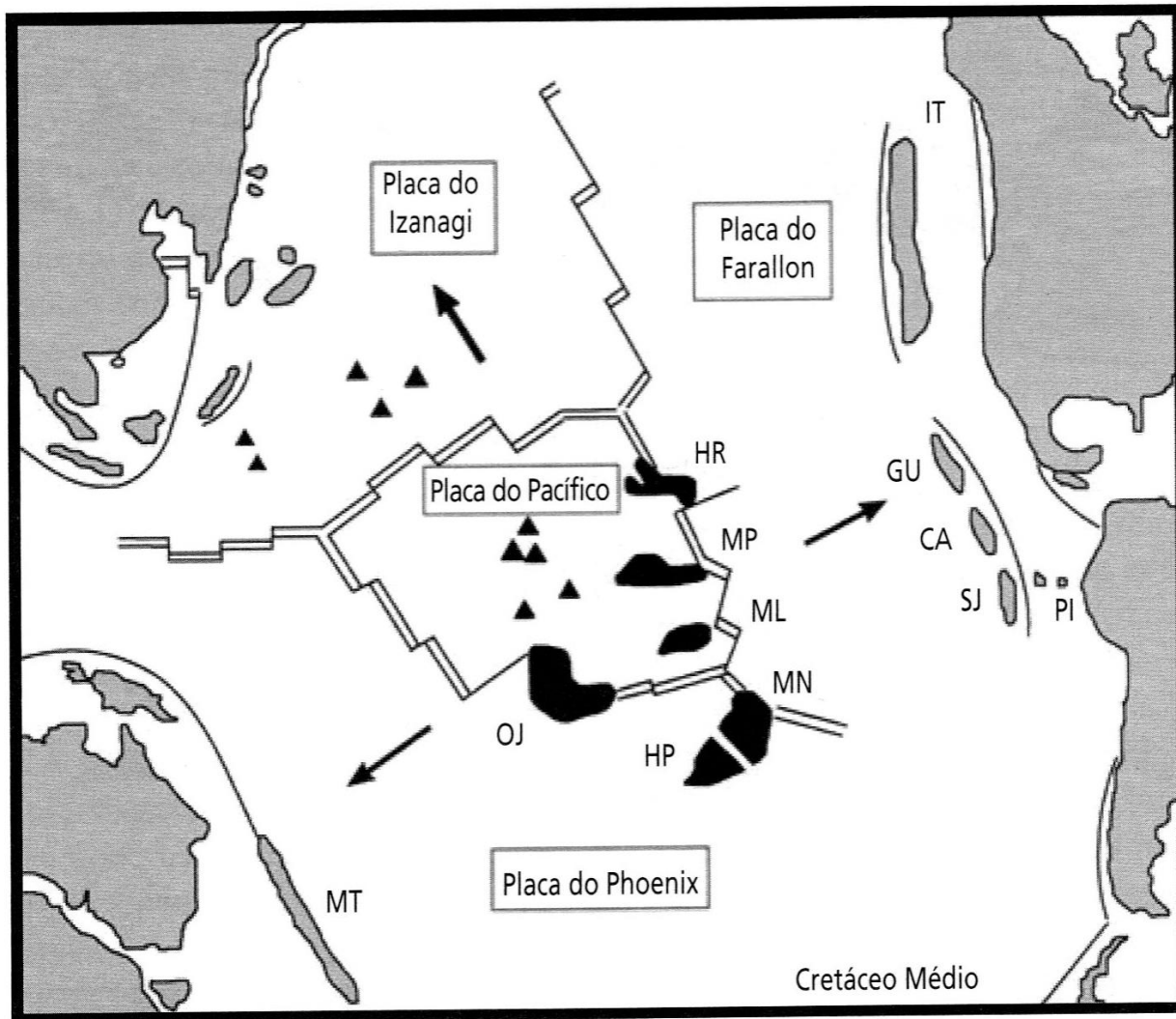


Figura 5.21 – Modelo de placa tectônica para as relações históricas do platô ígneo do Pacífico e arcos das ilhas do Pacífico, que contradiz a popular teoria de placas tectônicas do Pacífico como um oceano permanente com as ilhas oceânicas⁴².

Grehan *in* Carvalho & Almeida 2010

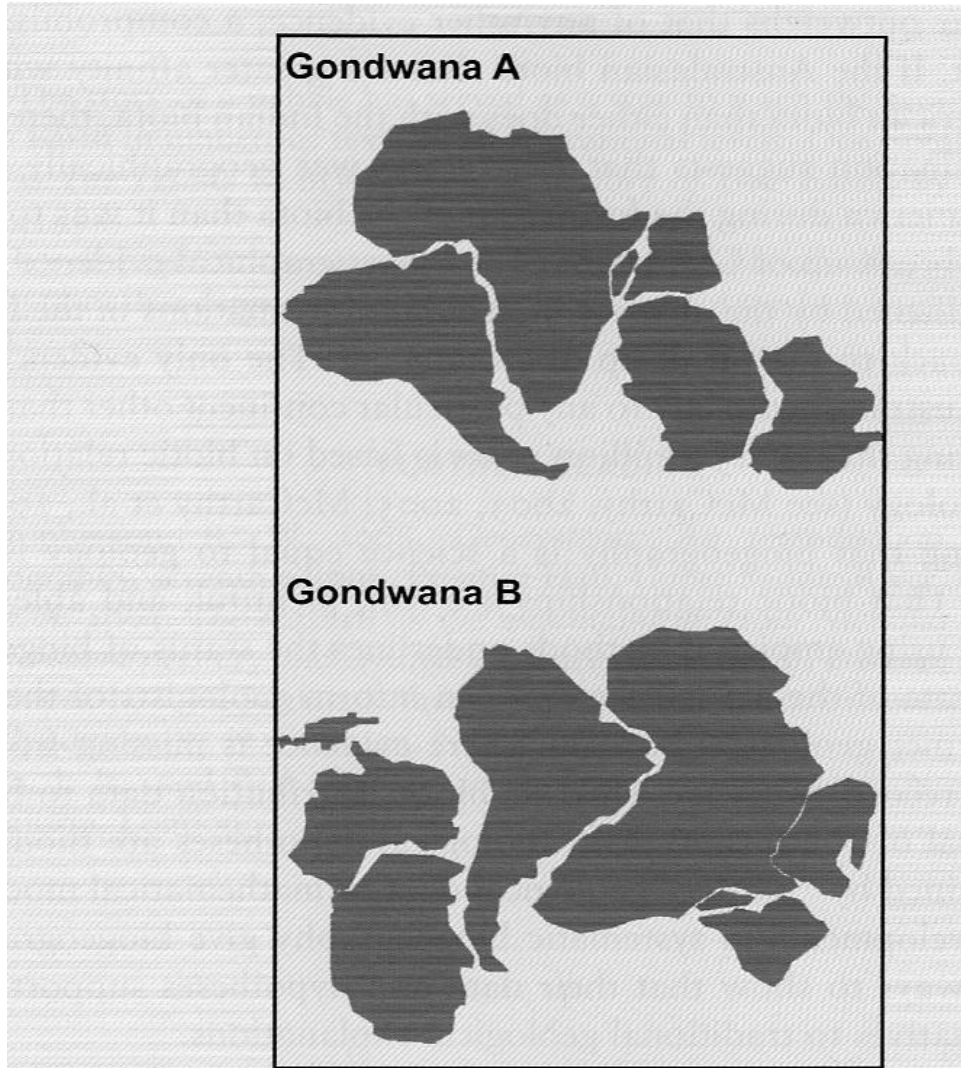


Figure 8.4. Gondwana A: traditional arrangement of Gondwanan continental masses. Gondwana B: alternative arrangement of Gondwanan continental masses, showing relative placement of modern New Guinea, following McCarthy et al. (2007: Figure 4). [Images by Adrian C. Fortino.]

Parenti & Ebach 2009