

GEOLOGIE GENERALĂ

► *an universitar 2023-2024* ◀

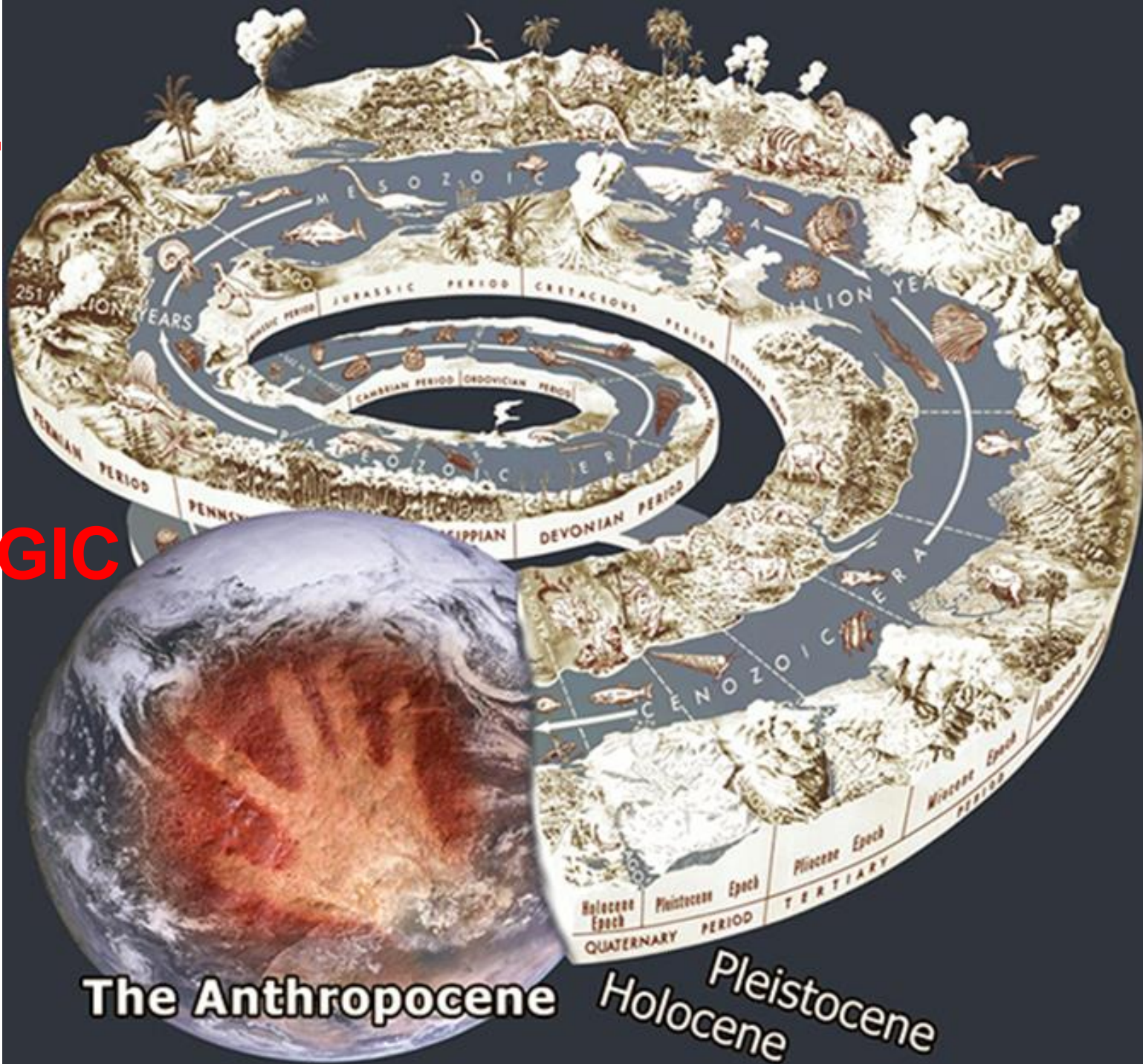
TIMPUL GEOLOGIC

Glen canion

2017 08 22

TIMPUL

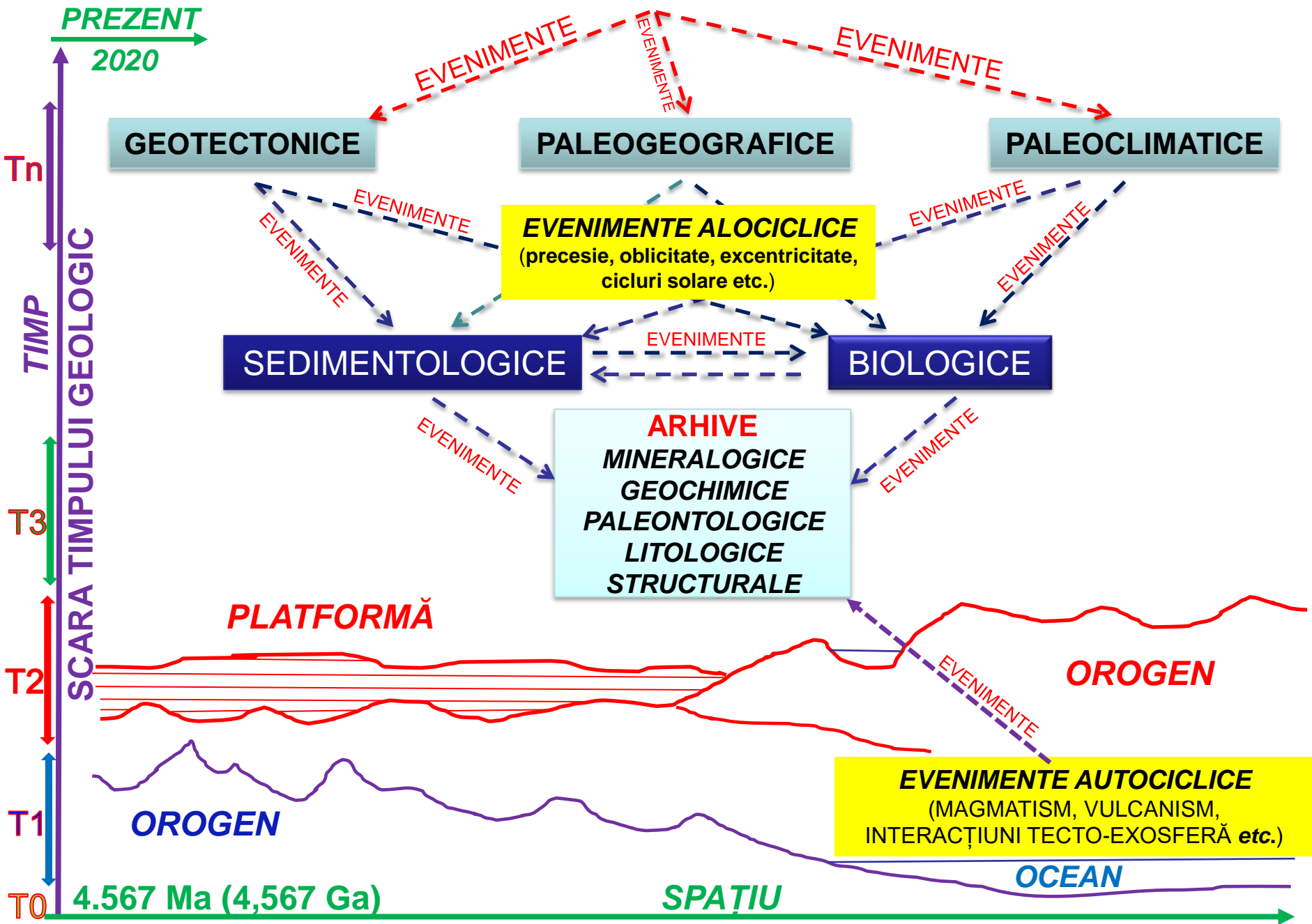
GEOLOGIC



The Anthropocene

Holocene
Pleistocene
Miocene

1. EVOLUȚIE GEOLOGICĂ ≈ (?)EVOLUȚIE PALEOGEOGRAFICĂ



GEOCROLOGIE – CRONOSTRATIGRAFIE

GEOCROMETRIE

Geocronologia este o ramură a stratigrafie care se ocupă cu datarea (stabilirea vârstei) depozitelor geologice și ierarhizarea cronologică a acestora, rezultând *unități geocronologice* (de timp), concretizate în unități cronostratigrafice.

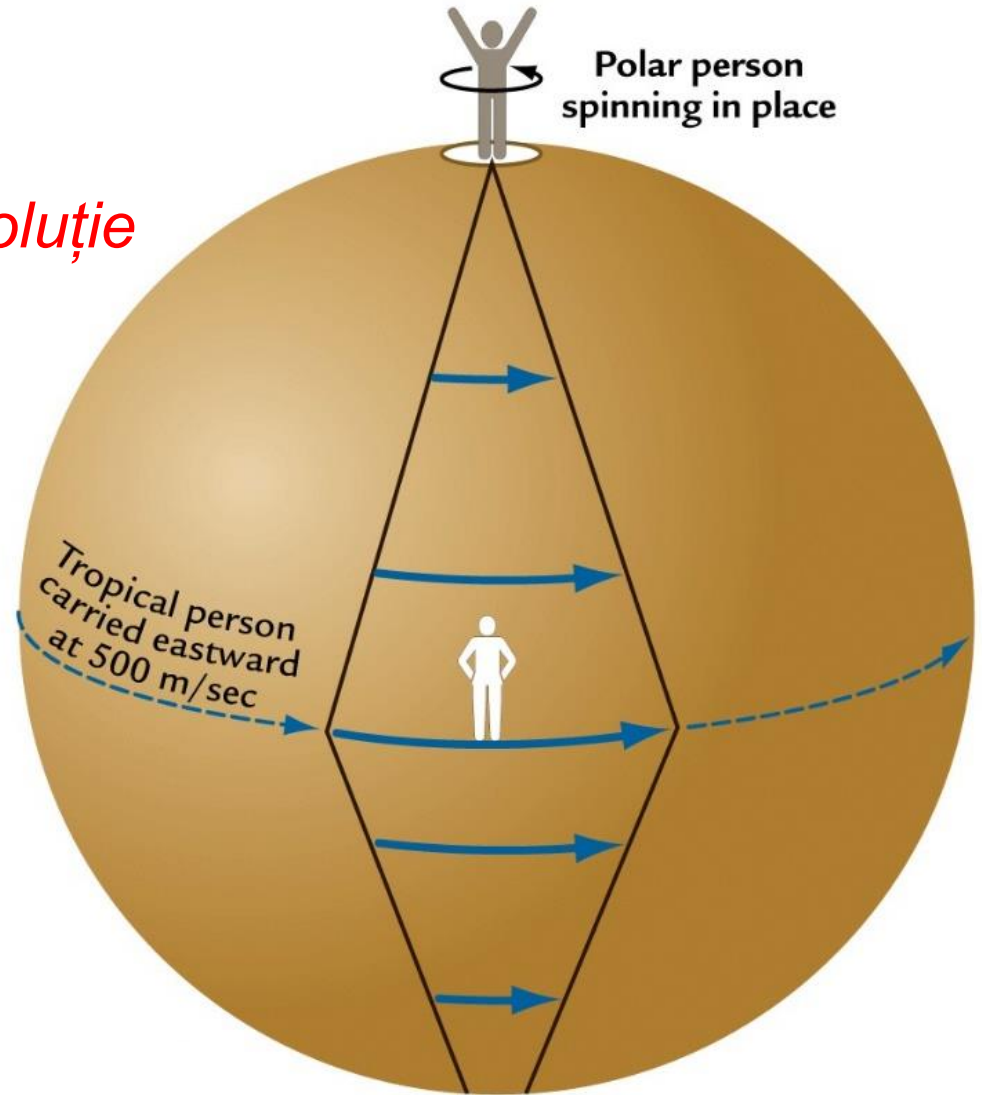
Datarea se poate face relativ, aplicându-se corelările pornind de la principiul superpoziției geometrice a stratelor și evoluției organismelor biologice, sau în mod absolut, folosindu-se metode radiometrice.

UNITĂȚI GEOCRONOLOGICE	UNITĂȚI CRONOSTRATIGRAFICE
EON	EONOTHEM
ERĂ	ERATHEM
PERIOADĂ	SISTEM
EPOCĂ	SERIE
VÂRSTĂ	ETAJ
CRON	CRONOZONĂ

TIMPUL LINIAR (GEOCRONOMETRIC)

Zi – mișcarea de rotație

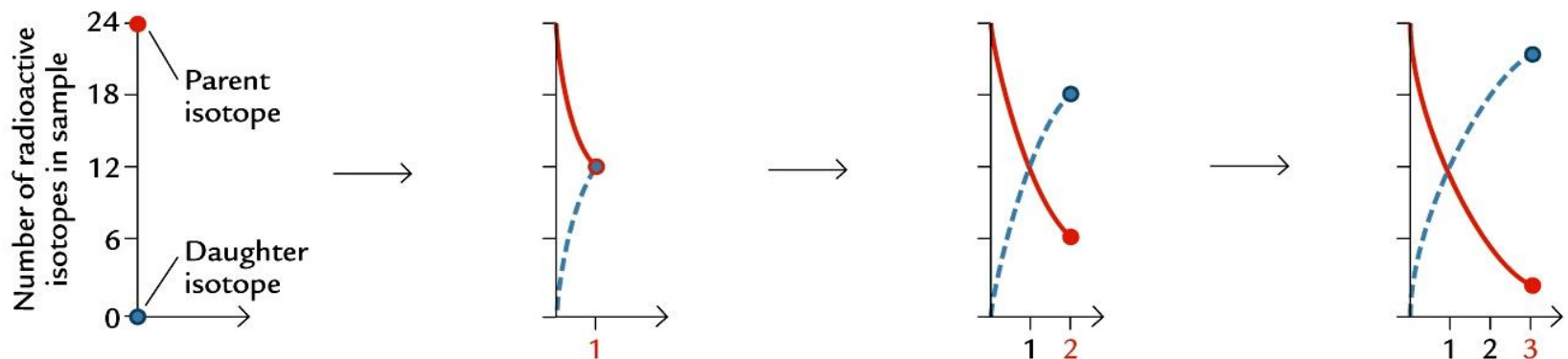
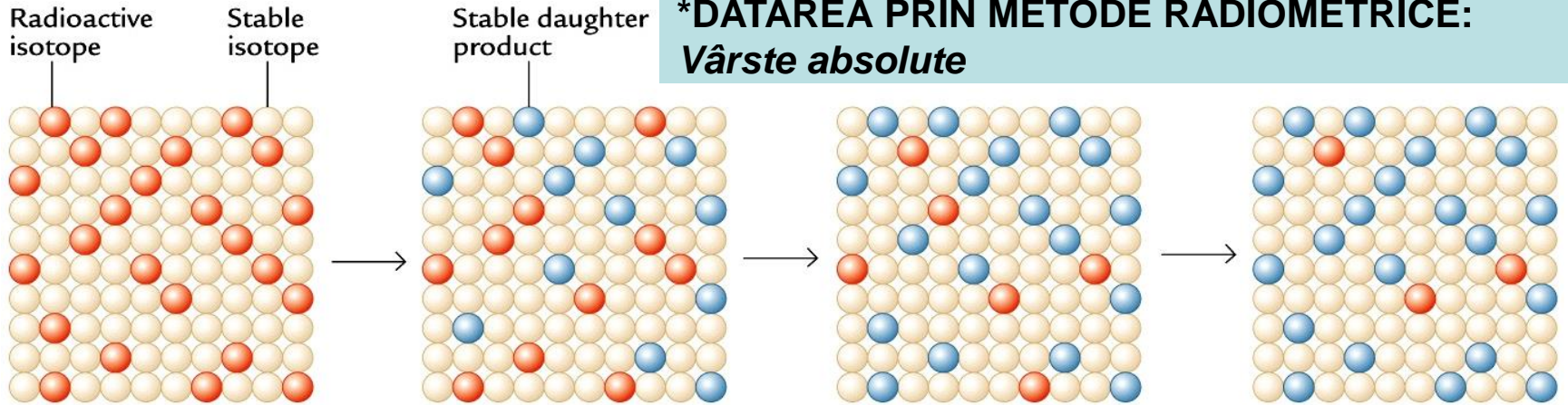
An sideral - mișcarea de revoluție



An galactic – mișcarea sistemului solar în galaxie

***CORELARE ÎN TIMP A EVENIMENTELOR NATURALE, DE ORICE TIP, PRESUPUNE DETERMINAREA VÂRSTEI PRODUSELOR NATURALE, ÎN CAZUL NOSTRU AL ROCILOR, CARE POARTĂ APRENTA PALEOEVENIMENTELOR: CONȚINUTUL ÎN ORGANISME FOSILE, IZOTOPI SPECIFICI, CHIMISMUL ȘI MINERALOGIA, STRUCTURA ȘI TEXTURA ROCILOR, PROPRIETĂȚILE FIZICE (DE EX. MAGNETICE), CARACTERISTICELE GENETICE ALE MINERALELOR / ROCILOR ETC.**

***DATAREA PRIN METODE RADIOMETRICE:
*Vârste absolute***



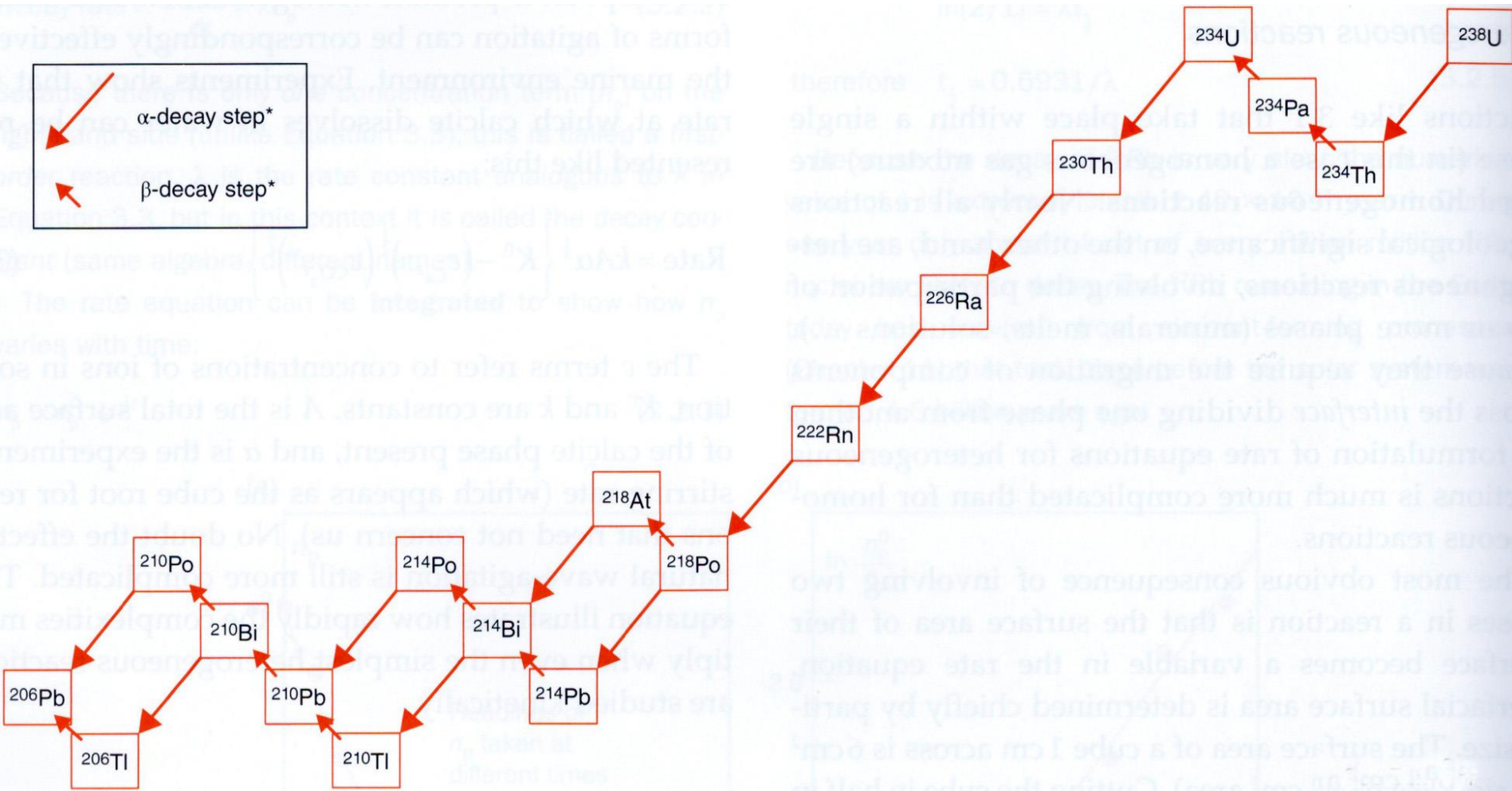
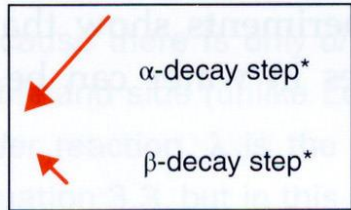
Time (in half-lives)

(Sursa: www.palaeos.com)

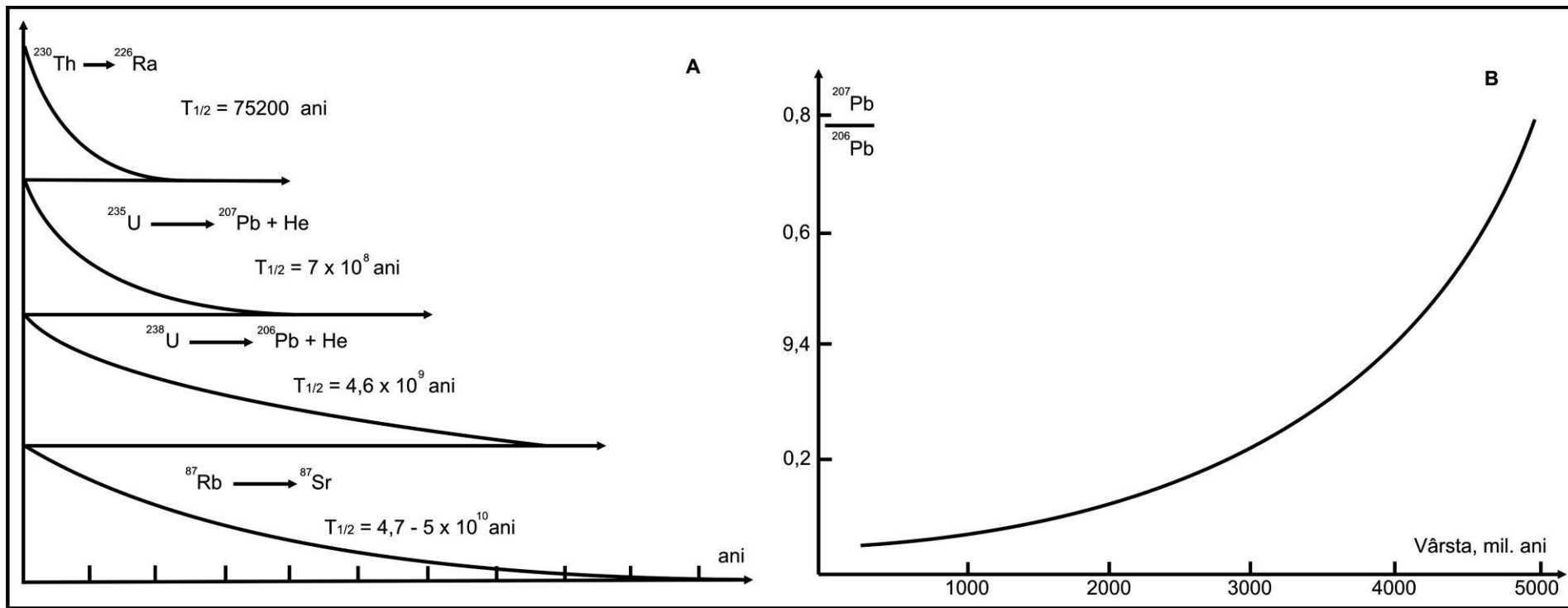
Radiogenic isotope systems

Name	Reaction	Decay constant/ y^{-1}	Half-life/y	Applications [†]
K–Ar	$^{40}\text{K} \rightarrow ^{40}\text{Ar} + \beta^+ + \nu$	$\lambda_{\text{Ar}} = 0.581 \times 10^{-10}\text{s}$	$1.250 \times 10^9\text{s}$	Geochronology of K-bearing minerals
	$^{40}\text{K} \rightarrow ^{40}\text{Ca} + \beta^- + \bar{\nu}$	$\lambda_{\text{Ca}} = 4.962 \times 10^{-10}\text{s}$		
Rb–Sr	$^{87}\text{Rb} \rightarrow ^{87}\text{Sr} + \beta^- + \bar{\nu}$	1.42×10^{-11}	4.88×10^{10}	Geochronology, seawater evolution, sediment correlation, magma genesis
Sm–Nd	$^{147}\text{Sm} \rightarrow ^{143}\text{Nd} + \alpha^{2+}$	6.54×10^{-12}	1.060×10^{11}	Precambrian geochronology, sediment provenance, crustal and mantle evolution, stony meteorite and lunar studies, magma genesis
Lu–Hf	$^{176}\text{Lu} \rightarrow ^{176}\text{Hf} + \beta^- + \bar{\nu}$	1.94×10^{-11}	3.57×10^{10}	Geochronology, mantle evolution, crustal growth models
Re–Os	$^{187}\text{Re} \rightarrow ^{187}\text{Os} + \beta^- + \bar{\nu}$	1.666×10^{-11}	4.16×10^{10}	Geochronology including iron meteorites, mantle and lithosphere evolution
U–Th–Pb	$^{232}\text{Th} \rightarrow ^{208}\text{Pb} + 6\alpha^{2+} + 4\beta^- + 4\bar{\nu}$	4.9475×10^{-11}	14.010×10^9	Geochronology, crustal meteorite studies, magma genesis
	$^{235}\text{U} \rightarrow ^{207}\text{Pb} + 7\alpha^{2+} + 4\beta^- + 4\bar{\nu}$	9.8485×10^{-10}	0.7038×10^9	
	$^{238}\text{U} \rightarrow ^{206}\text{Pb} + 8\alpha^{2+} + 6\beta^- + 6\bar{\nu}^*$	1.55125×10^{-10}	4.468×10^9	

(Din Robin Gill, 2015. *Chemical Fundamentals of Geology and Environmental Geoscience*. WILEY Blackwell)
 (Alan P. Dickin, 2018. *Radioisotopic Isotope Geology*. Cambridge University Press)



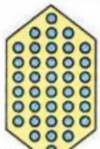
The chain of radioactive decay steps by which ^{238}U (also written 'uranium-238') decays to ^{206}Pb (lead-206).



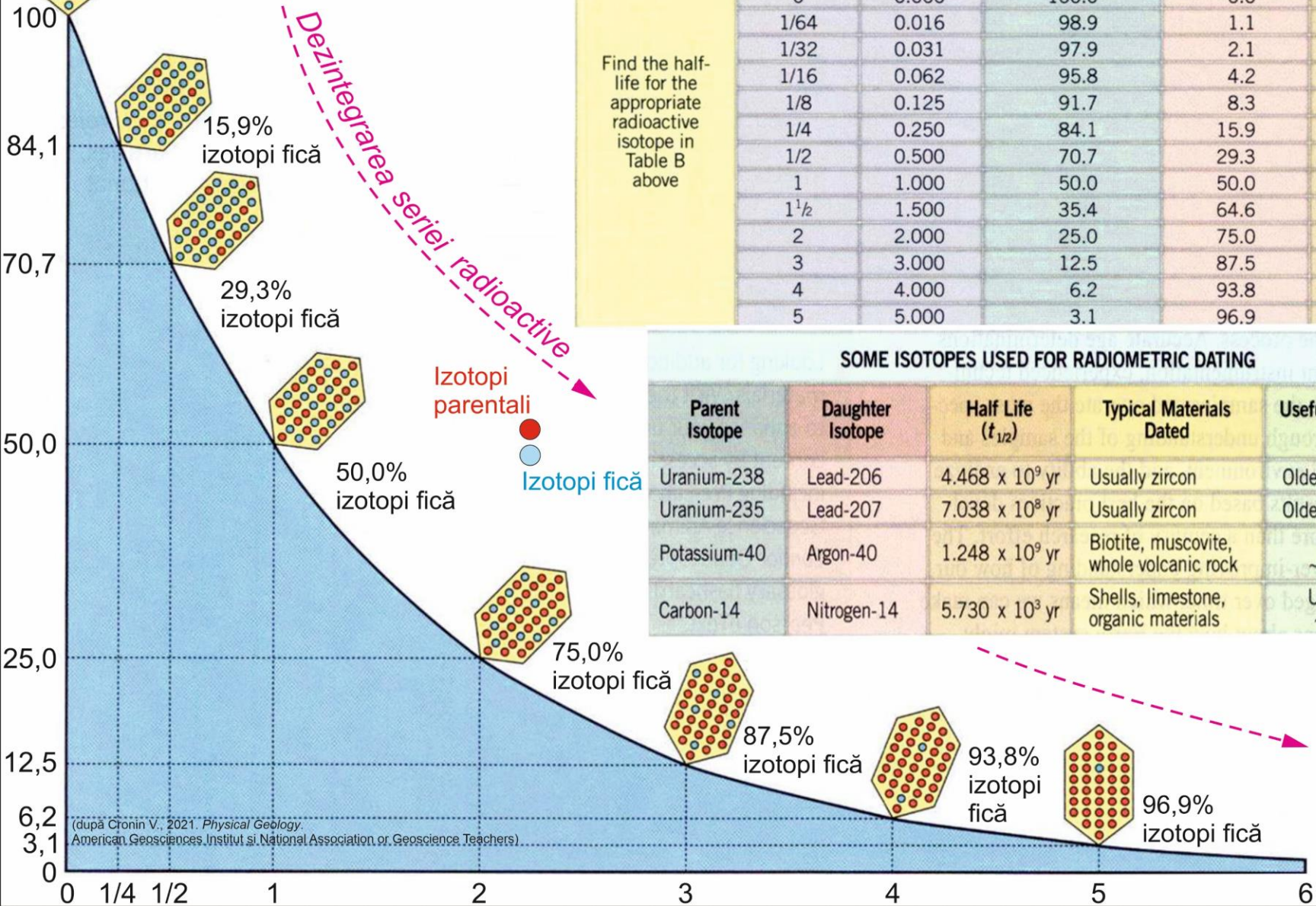
A – Timpii de înjumătățire pentru seriile de izotopi radioactivi

B – Curba de determinare a vârstei absolute folosind raportul izotopilor de $\text{Pb}^{207/206}$

SERIA DE DEZINTEGRARE



Cristal format 100% din izotopi parentali, instabili (radioactivi)



Half-Life of Radioactive Isotope ($t_{1/2}$)	Half-Lives Elapsed (n)		Percent of Radioactive Parent Isotope (P_t)	Percent of Stable Daughter Isotope (D_t)	Age of Specimen (t)
	As a Ratio	As a Decimal number	$P_t = \left(\frac{1}{2}\right)^n$	$D_t = \left(1 - \frac{1}{2}\right)^n$	$t = n \times t_{1/2}$
Find the half-life for the appropriate radioactive isotope in Table B above	0	0.000	100.0	0.0	$0.000 \times t_{1/2}$
	1/4	0.016	98.9	1.1	$0.016 \times t_{1/2}$
	1/32	0.031	97.9	2.1	$0.031 \times t_{1/2}$
	1/16	0.062	95.8	4.2	$0.062 \times t_{1/2}$
	1/8	0.125	91.7	8.3	$0.125 \times t_{1/2}$
	1/4	0.250	84.1	15.9	$0.250 \times t_{1/2}$
	1/2	0.500	70.7	29.3	$0.500 \times t_{1/2}$
	1	1.000	50.0	50.0	$1.000 \times t_{1/2}$
	1 1/2	1.500	35.4	64.6	$1.500 \times t_{1/2}$
	2	2.000	25.0	75.0	$2.000 \times t_{1/2}$
	3	3.000	12.5	87.5	$3.000 \times t_{1/2}$
4	4.000	6.2	93.8	$4.000 \times t_{1/2}$	
5	5.000	3.1	96.9	$5.000 \times t_{1/2}$	

SOME ISOTOPES USED FOR RADIOMETRIC DATING

Parent Isotope	Daughter Isotope	Half Life ($t_{1/2}$)	Typical Materials Dated	Useful Dating Range
Uranium-238	Lead-206	4.468×10^9 yr	Usually zircon	Older than ~10 Myr
Uranium-235	Lead-207	7.038×10^8 yr	Usually zircon	Older than ~10 Myr
Potassium-40	Argon-40	1.248×10^9 yr	Biotite, muscovite, whole volcanic rock	Older than ~100,000 yr
Carbon-14	Nitrogen-14	5.730×10^3 yr	Shells, limestone, organic materials	Usually up to ~50,000 yr

(după Cronin V., 2021. *Physical Geology*. American Geosciences Institut și National Association of Geoscience Teachers)

****DATAREA
PRIN
METODE
PALEONTOLOGICE**

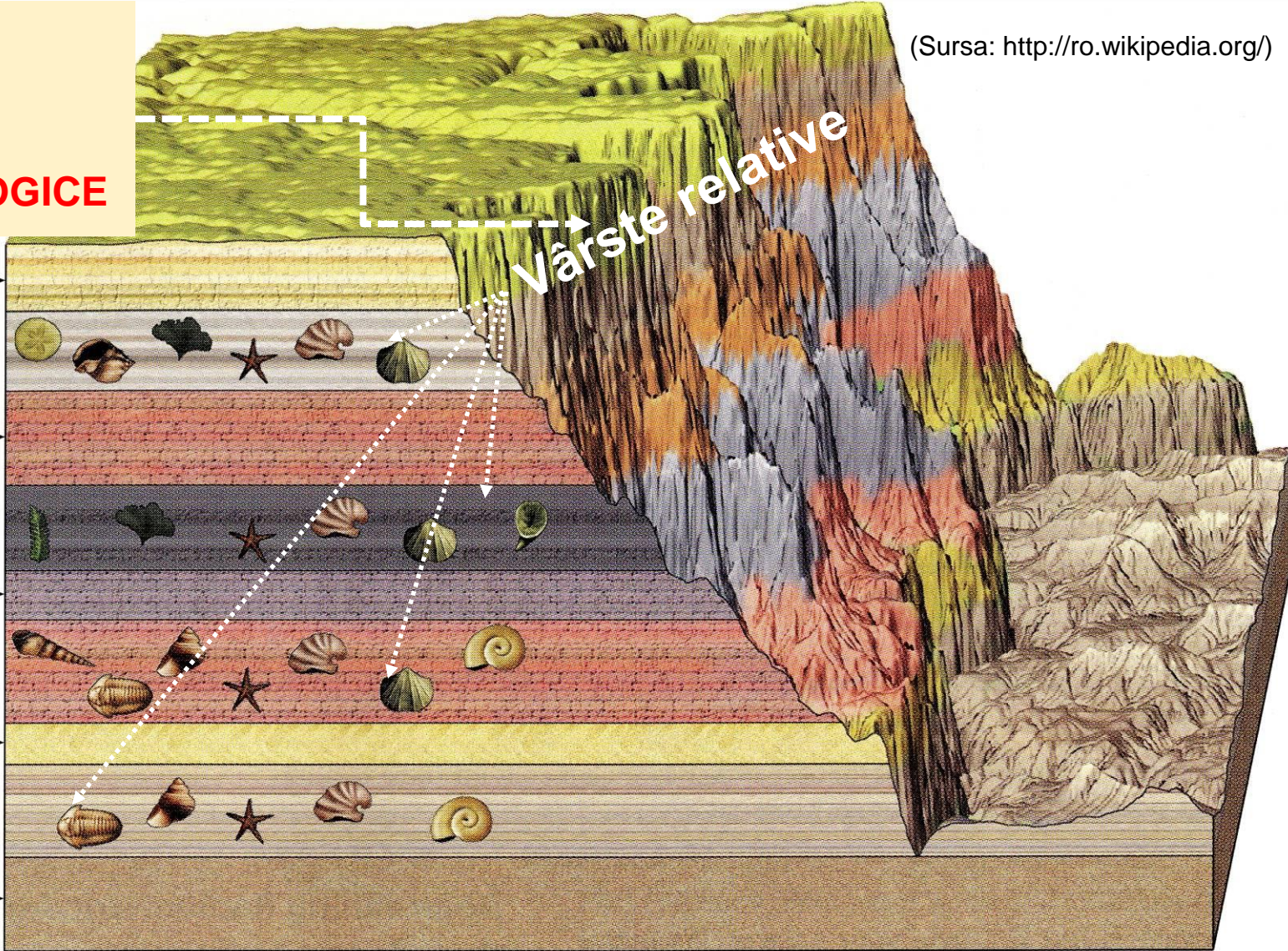
(Sursa: <http://ro.wikipedia.org/>)

Vârste relative

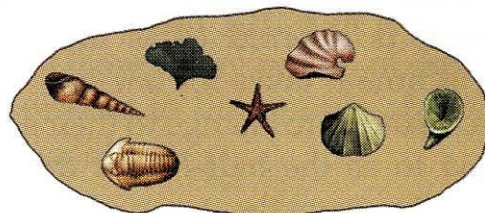
Rock →

Rock →

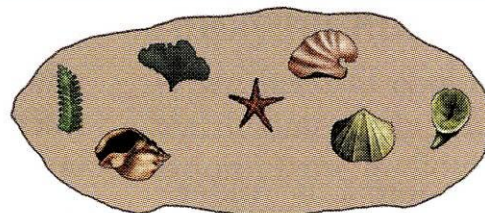
Rock →



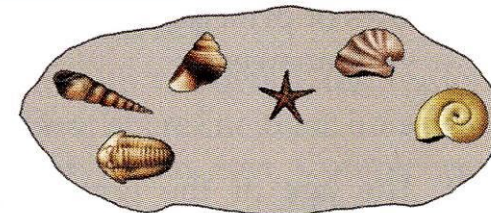
*Specii de
organisme
fosile
animale și
vegetale și
asociații
specifice unei
diviziuni a
timpului
geologic*



Rock 1



Rock 2

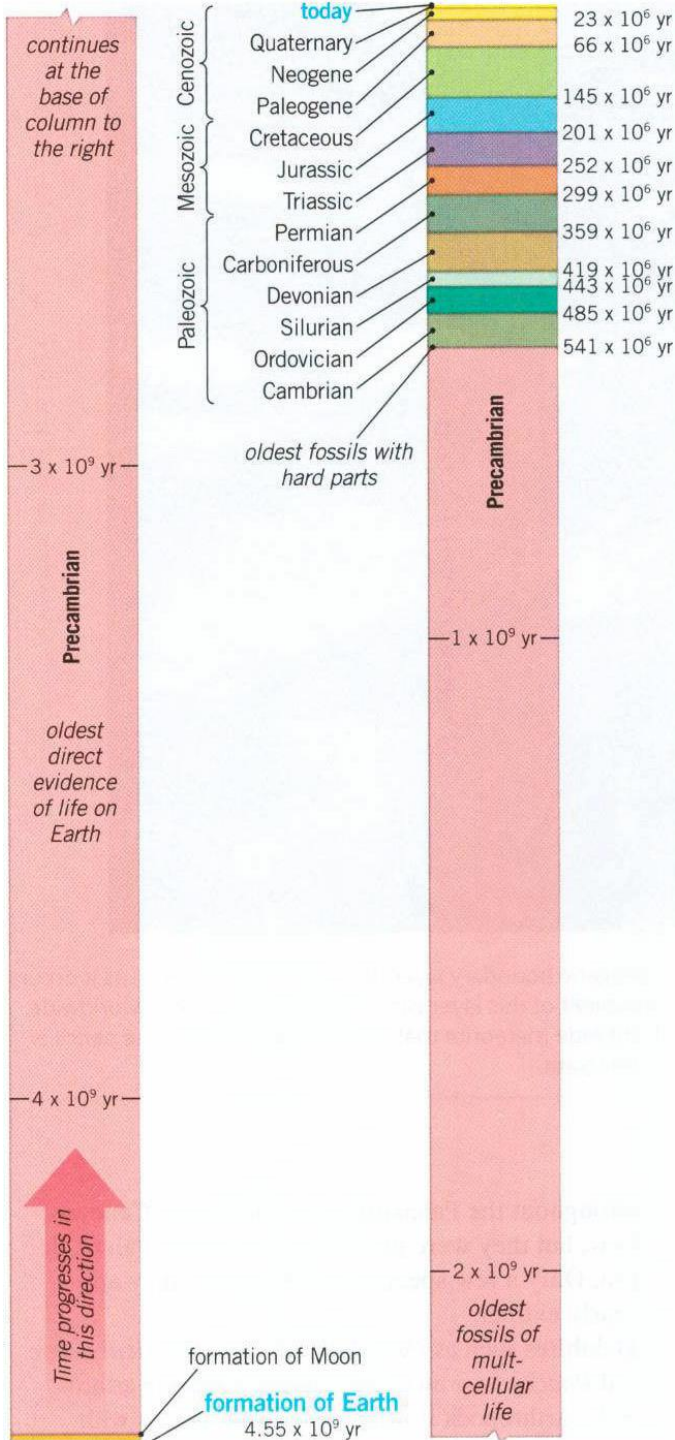


Rock 3

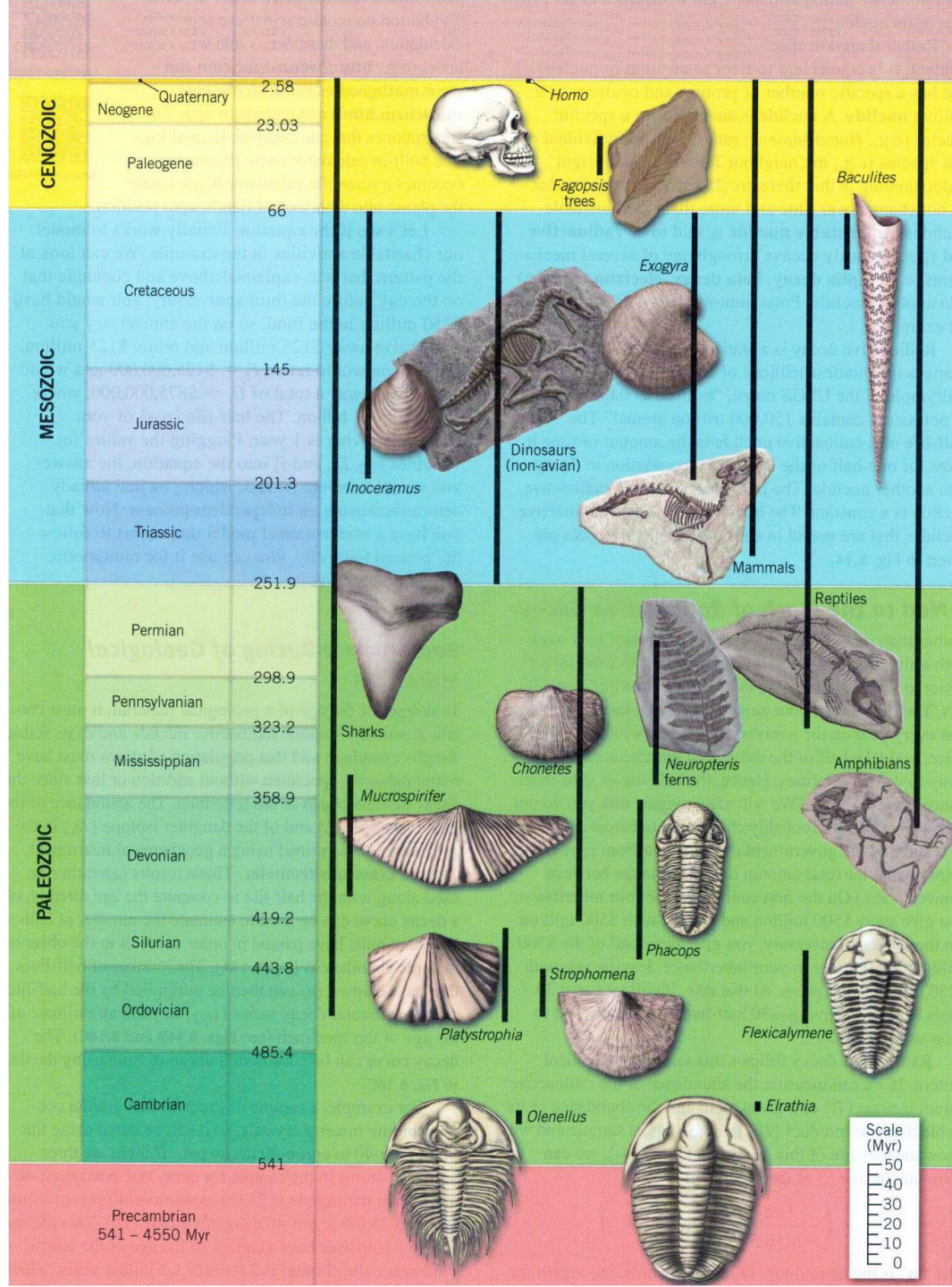
METODE PALEONTOLOGICE

	vegetale						nevertebrate											vertebrate								
	Bacterii si cianoficee	Cloroficee	Rodoficee	Pteridofite	Ciuperci, muschi	Gimnosperme	Angiosperme	Foraminifere	Celenterate	Anelide	Spongien	Arheociatide	Brahiopode	Trilobiti	Crustacee	Echinoderme	Briozoare	Cefalopode	Graptoliti	Gastropode	Bivalve	Pesti	Amfibieni	Reptile	Mamifere	Pasari
Neozoic																										
Cretacic																										
Jurasic																										
Triasic																										
Permian																										
Carbonifer																										
Devonian																										
Silurian																										
Ordovician																										
Cambrian																										
Precambrian																										

Distribuția stratigrafică a principalelor grupe taxonomice (Filipescu, 2002)



(după Cronin V., 2021. Physical Geology. American Geosciences Institut și National Association of Geoscience Teachers)



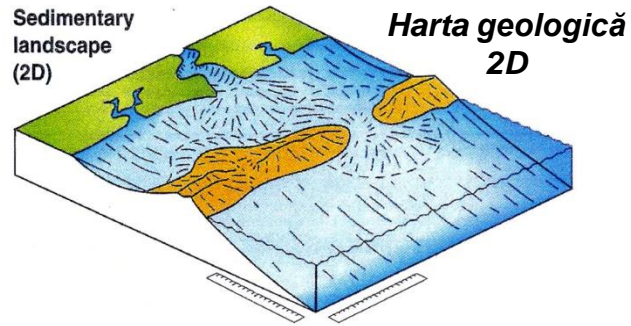


UNITĂȚILE GEOCRONOLOGICE / CRONOSTRATIGRAFICE

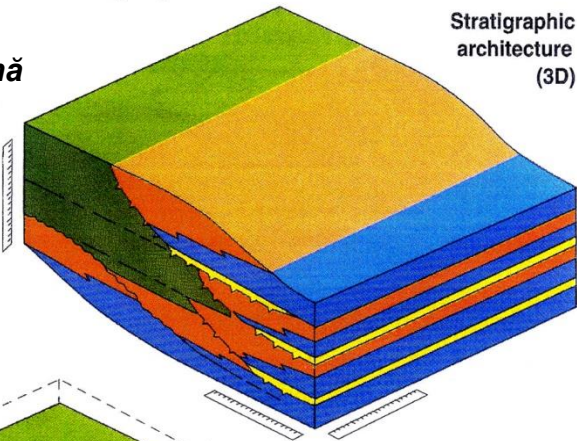
PALEOEVENIMENTE SEMNIFICATIVE

2017 08 15

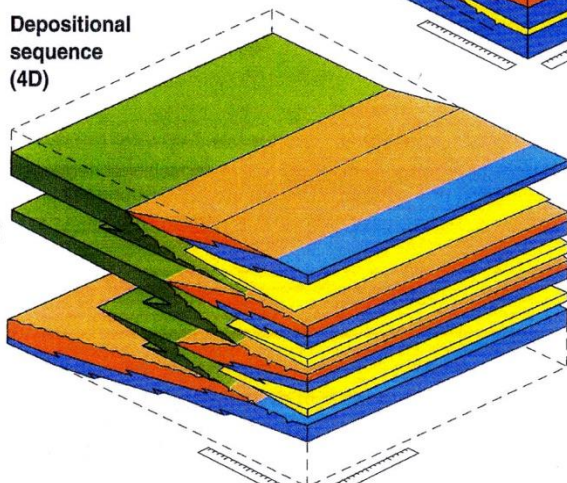
*ANALIZA EVENIMENTELOR ȘI REPREZENTAREA ACESTORA PE MATERIALELE CARTOGRAFICE 2D, 3D, 4D



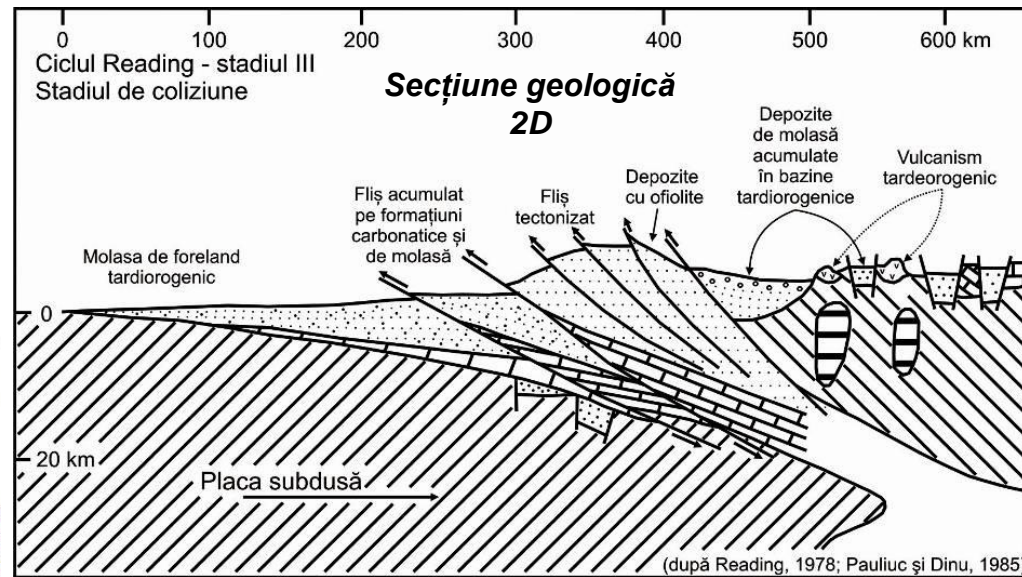
Bloc diagramă 3D



Depositional sequence (4D)



Bloc diagramă 4D

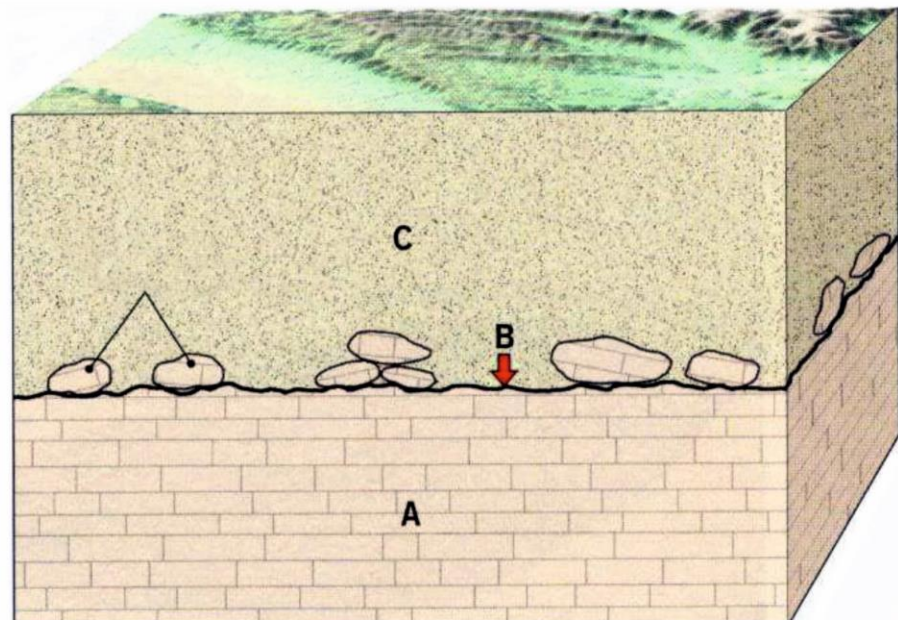
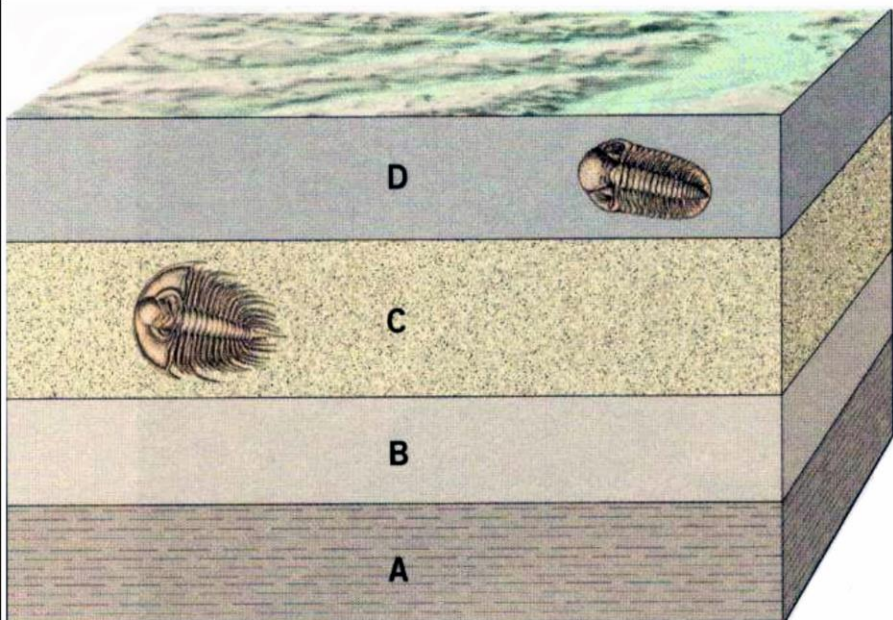


Materialele cartografice permit diferite tipuri de analiză:

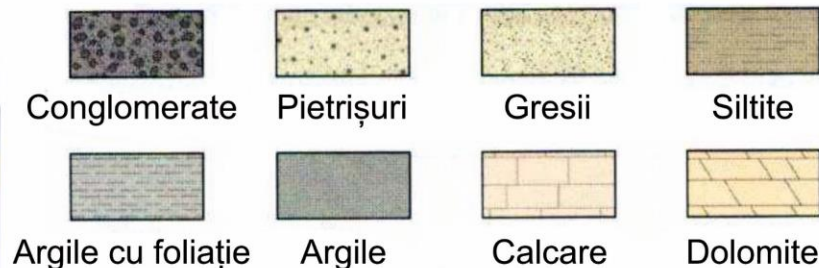
2D - raporturile dintre volumele de roci într-un plan - semnificații: evenimente genetice, evenimente tectonice etc.;

3D - raporturile dintre volumele de roci într-un spațiu - semnificații: evenimente genetice, evenimente tectonice, evenimente paleoclimatice, volumul afectat etc.;

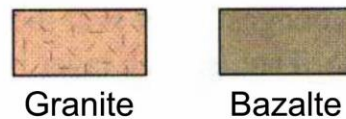
4D - raporturile dintre volumele de roci într-un spațiu - semnificații: suprafața și volumul din scoarța terestră afectat de evenimente ordonate în scara timpului etc.



LEGENDA
Roci sedimentare



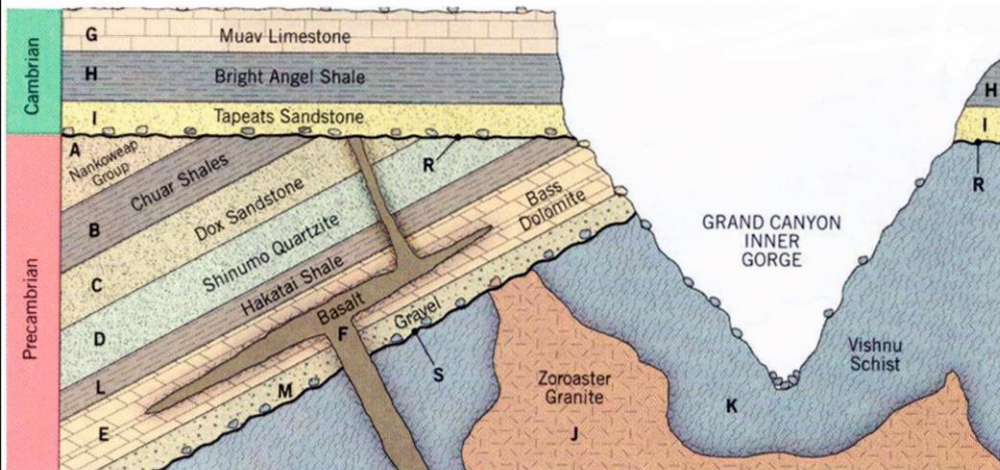
Roci magmatice



Roci metamorfice



Alte semne convenționale



(după Cronin V., 2021. *Physical Geology*.
American Geosciences Institut și National Association of Geoscience Teachers)

Aflorimentul Siccar, Cockburnspath, Scoția

Gresiile roșii continentale, de vârstă
devoniene superioare

Discordanță unghiulară
(paleorelieful pre-Devonian)

Depozite marine, siluriene





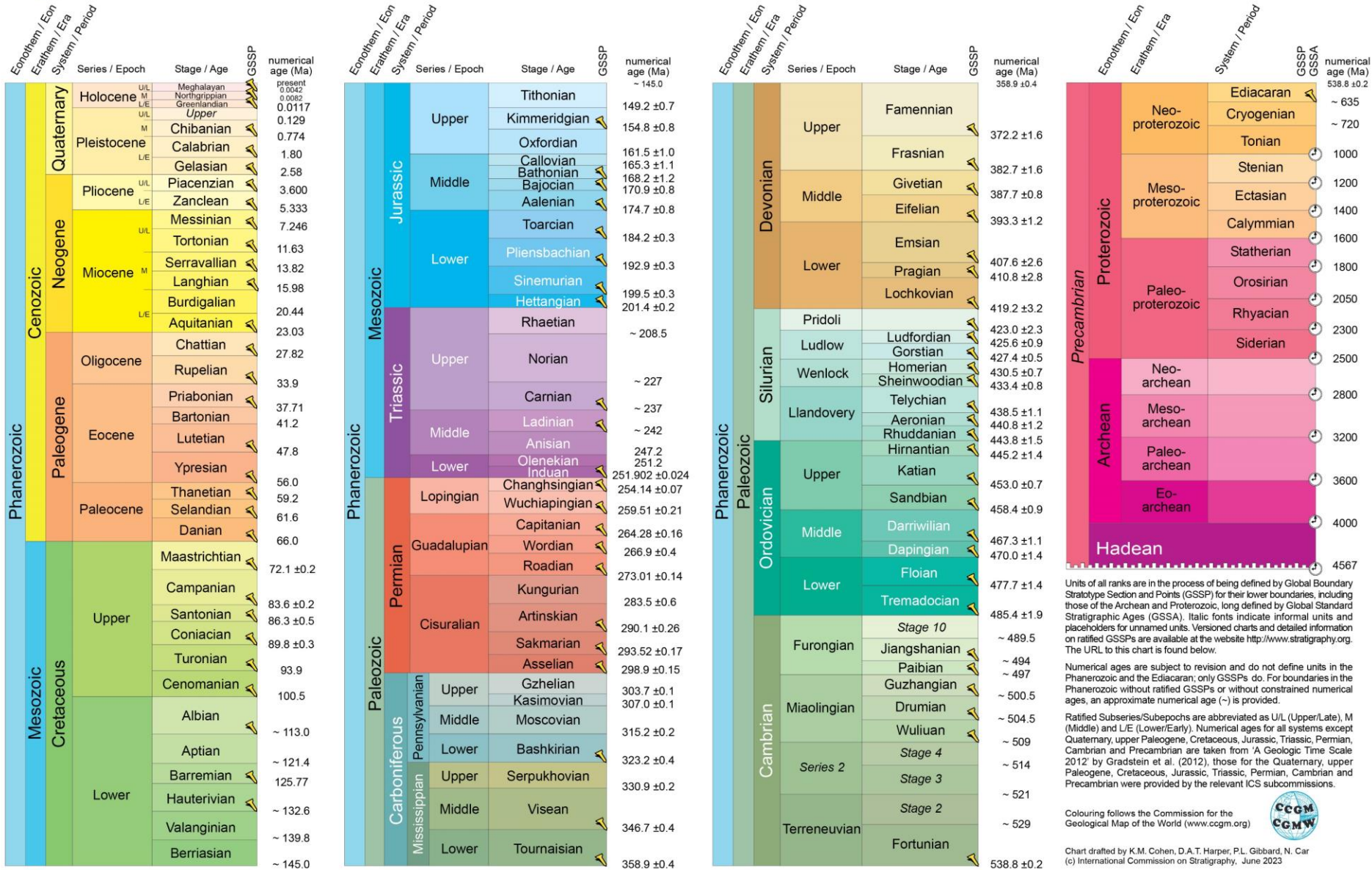
IUGS

INTERNATIONAL CHRONOSTRATIGRAPHIC CHART

www.stratigraphy.org

International Commission on Stratigraphy

v 2023/06



Units of all ranks are in the process of being defined by Global Boundary Stratotype Section and Points (GSSP) for their lower boundaries, including those of the Archean and Proterozoic, long defined by Global Standard Stratigraphic Ages (GSSA). Italic fonts indicate informal units and placeholders for unnamed units. Versioned charts and detailed information on ratified GSSPs are available at the website <http://www.stratigraphy.org>. The URL to this chart is found below.

Numerical ages are subject to revision and do not define units in the Phanerozoic and the Ediacaran, only GSSPs do. For boundaries in the Phanerozoic without ratified GSSPs or without constrained numerical ages, an approximate numerical age (~) is provided.

Ratified Subseries/Subepochs are abbreviated as U/L (Upper/Late), M (Middle) and L/E (Lower/Early). Numerical ages for all systems except Quaternary, upper Paleogene, Cretaceous, Jurassic, Triassic, Permian, Cambrian and Precambrian are taken from 'A Geologic Time Scale 2012' by Gradstein et al. (2012), those for the Quaternary, upper Paleogene, Cretaceous, Jurassic, Triassic, Permian, Cambrian and Precambrian were provided by the relevant ICS subcommissions.

Colouring follows the Commission for the Geological Map of the World (www.cgmw.org)



Chart drafted by K.M. Cohen, D.A.T. Harper, P.L. Gibbard, N. Car (c) International Commission on Stratigraphy, June 2023

To cite: Cohen, K.M., Finney, S.C., Gibbard, P.L. & Fan, J.-X. (2013); updated) The ICS International Chronostratigraphic Chart. Episodes 36: 199-204.

URL: <http://www.stratigraphy.org/ICSchart/ChronostratChart2023-06.pdf>

Denumiri istorice preluate în denumirea unităților geocronologice și cronostratigrafice



IMPERIUL ROMAN ÎN 125 d.Hr.

FRONTIERA IMPERIULUI

BAZĂ LEGIONARĂ

VII CLAUDIA LEGIUNE DESFĂȘURATĂ (125 d.Hr.)

BAZĂ NAVALĂ PRINCIPALĂ

GALATIA PROVINȚE ROMANĂ

ORAȘ ROMAN

Via Appia Velas

DRUM PRINCIPAL

COLCHIS STAT-SATELIT ROMAN

CARPI, RUGI NAȚIUNE/TRIB BARBAR

6000 m
2000 m
1500 m
1000 m
400 m
200 m
0 m

0 250 500 750 1000 kilometri

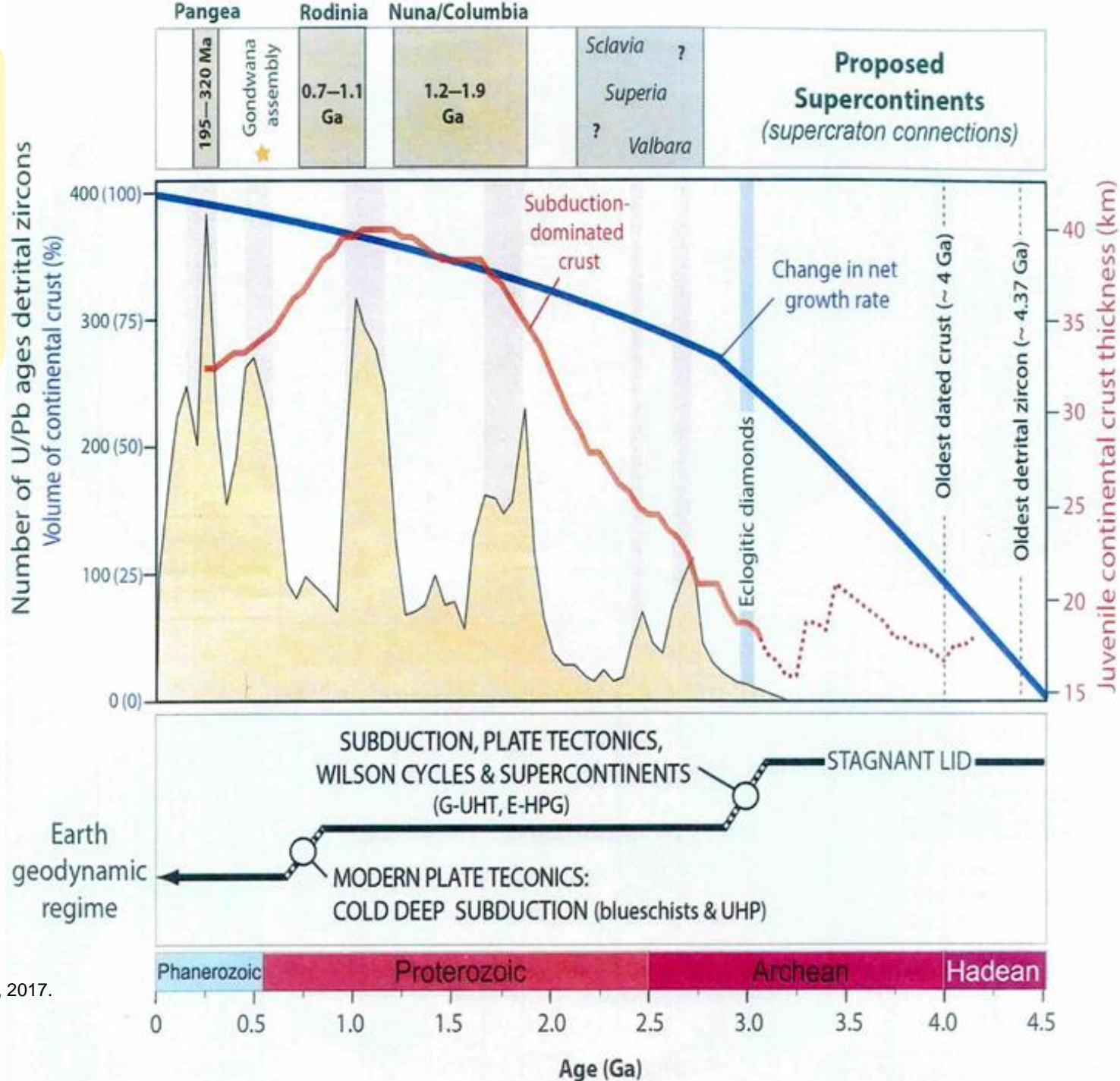


(sursa: wikipedia.ro)

GRUPUS LINGVISTICE PROBABLE:	
GERMANIC	FINO-UGRIC
SLAVIC	CELTIC
DACIC	HANTO-SEMITIC
IRANIC	

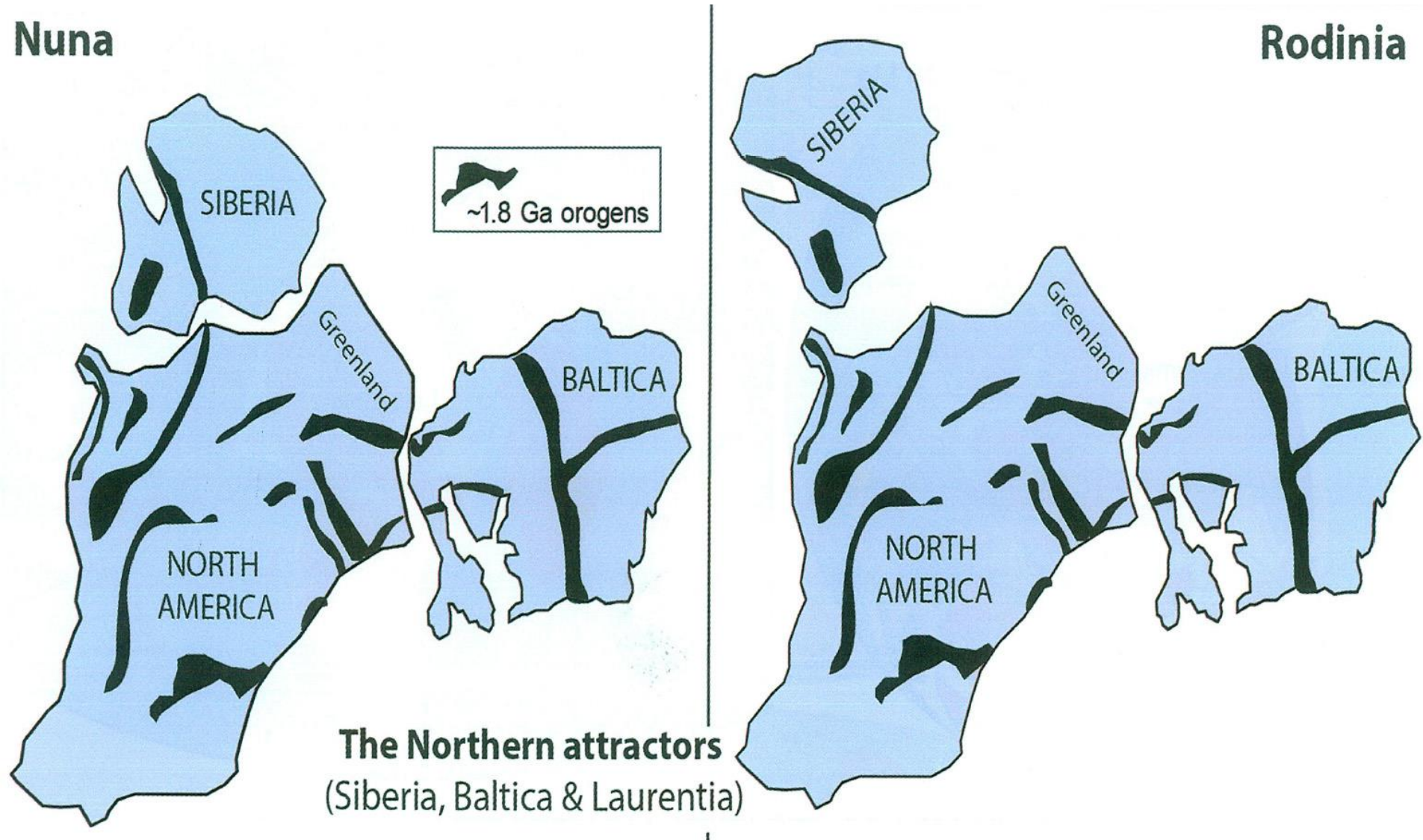
Au DEPOZIT DE AUR	1. ALPES GRAIAE
Ag DEPOZIT DE ARGINT	2. ALPES COTTIAE
	3. ALPES MARITIMAE
	4. GERMANIA INFERIOR

**REGIMUL
GEODINAMIC
AL GLOBULUI
ȘI
FORMAREA
SCORȚEI
CONTINENTALE
ÎN
PRECAMBRIAN**

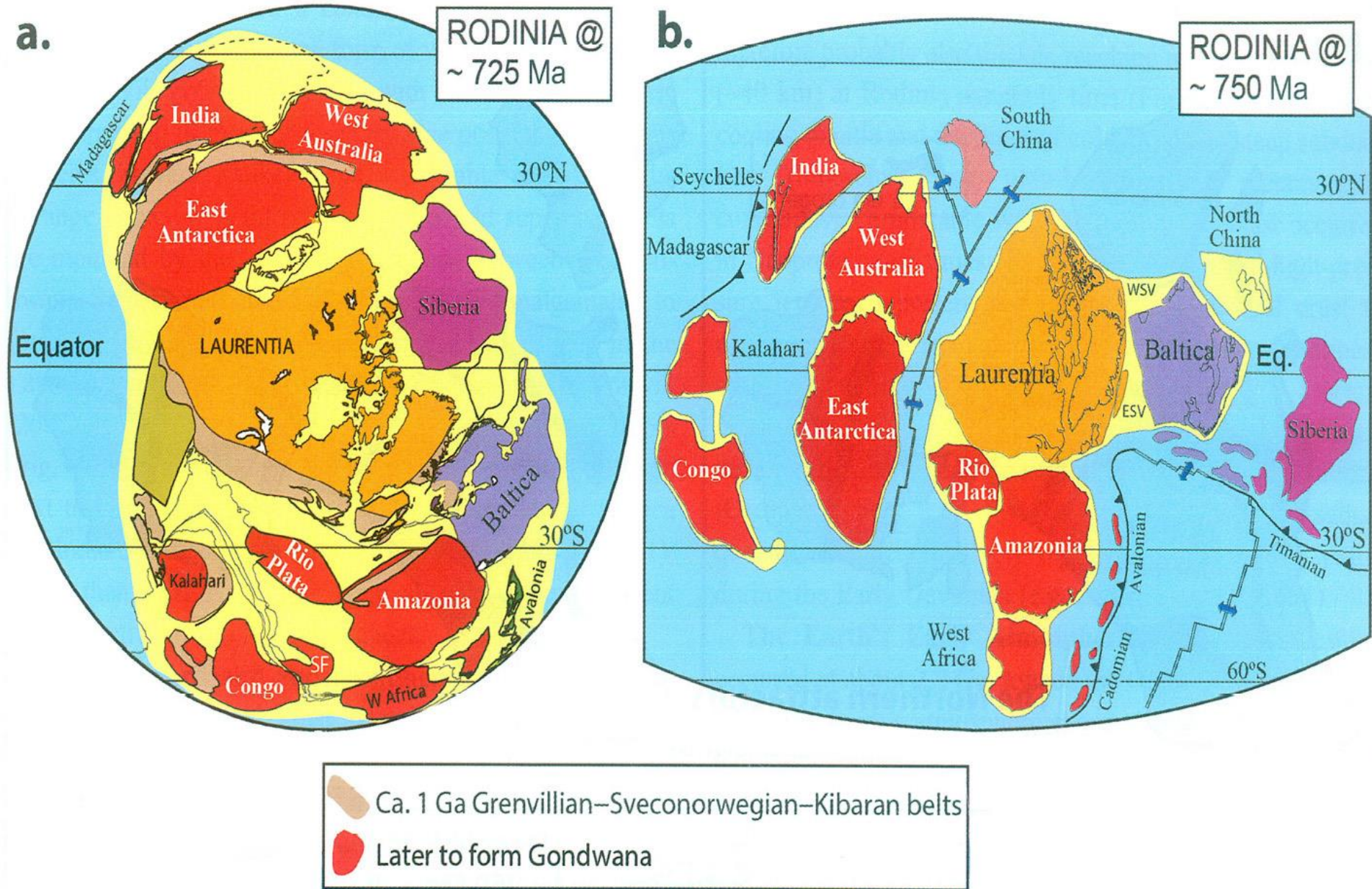


(Sursa: Torvsvik Trond & Cocks Robin, 2017.
Earth History and Palaeogeography.
Cambridge University Press)

DINAMICA LITOSFERICĂ ȘI EVOLUȚIA PALEOGEOGRAFICĂ A GLOBULUI ÎN PRECAMBRIAN



(Sursa: Torvsvik Trond & Cocks Robin, 2017. *Earth History and Palaeogeography*. Cambridge University Press)

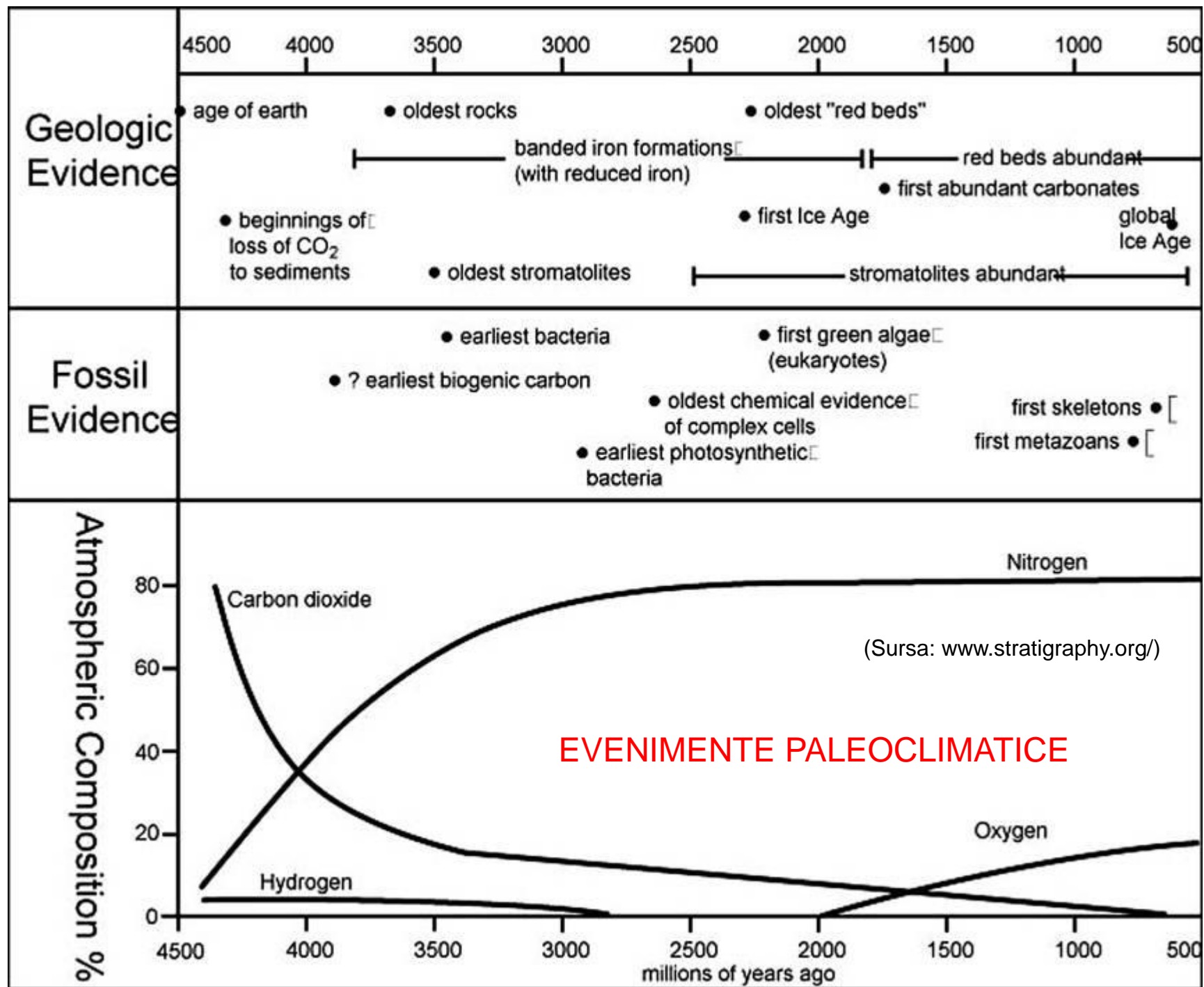


(Sursa: Torvsvik Trond & Cocks Robin, 2017. *Earth History and Palaeogeography*. Cambridge University Press)

PANNOTIA – 545 Ma

Reasamblarea
blocurilor
continentelor
după
fragmentarea
Rodinei (~725 Ma)



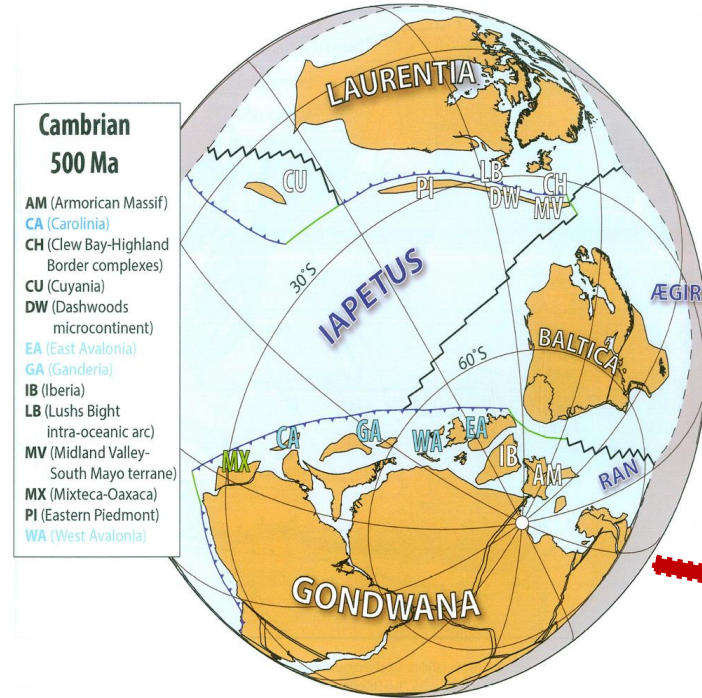


PALEOZOIC (541,0 – 251,902 Ma)

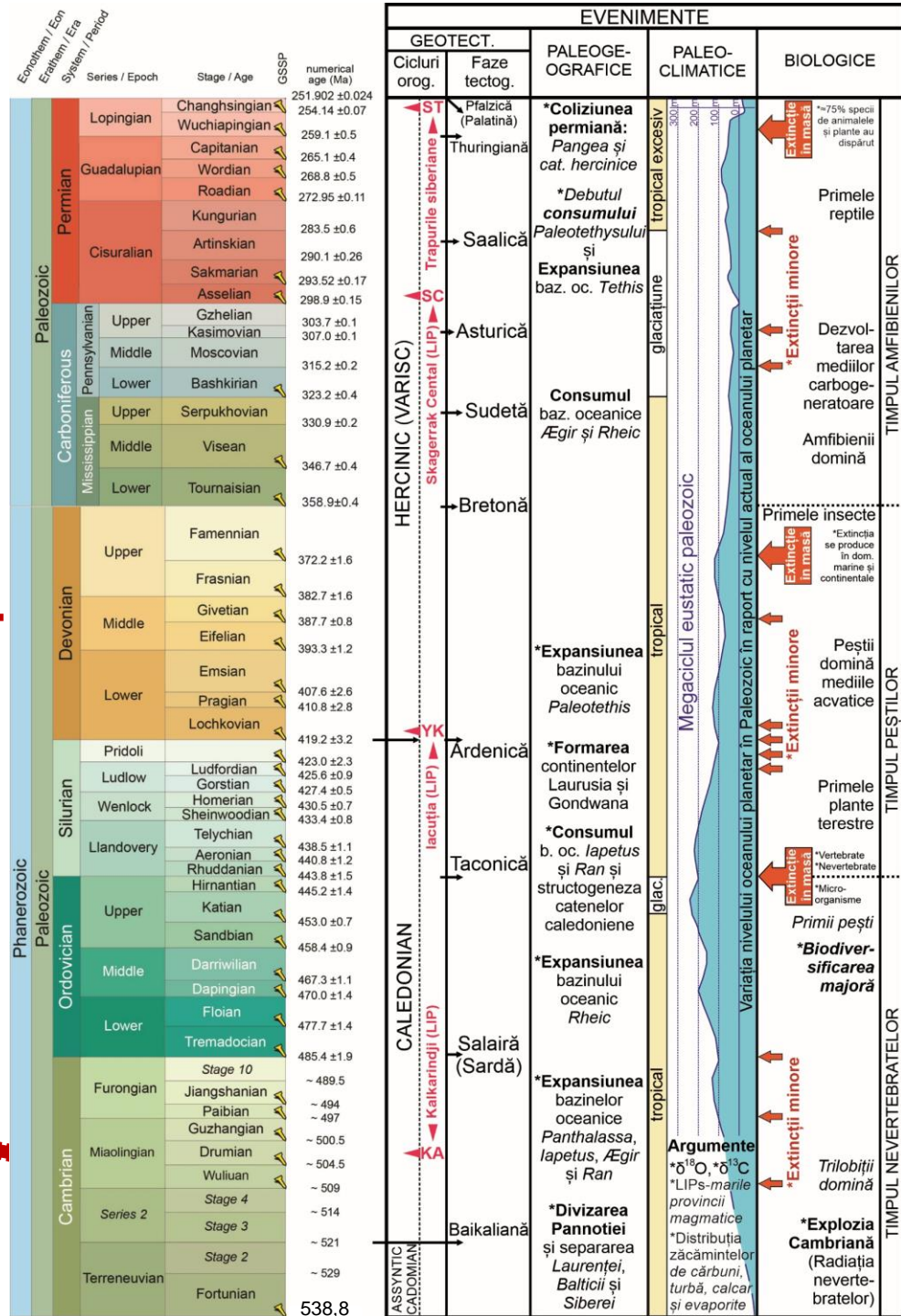
General Scheme of Devonian Tectonics



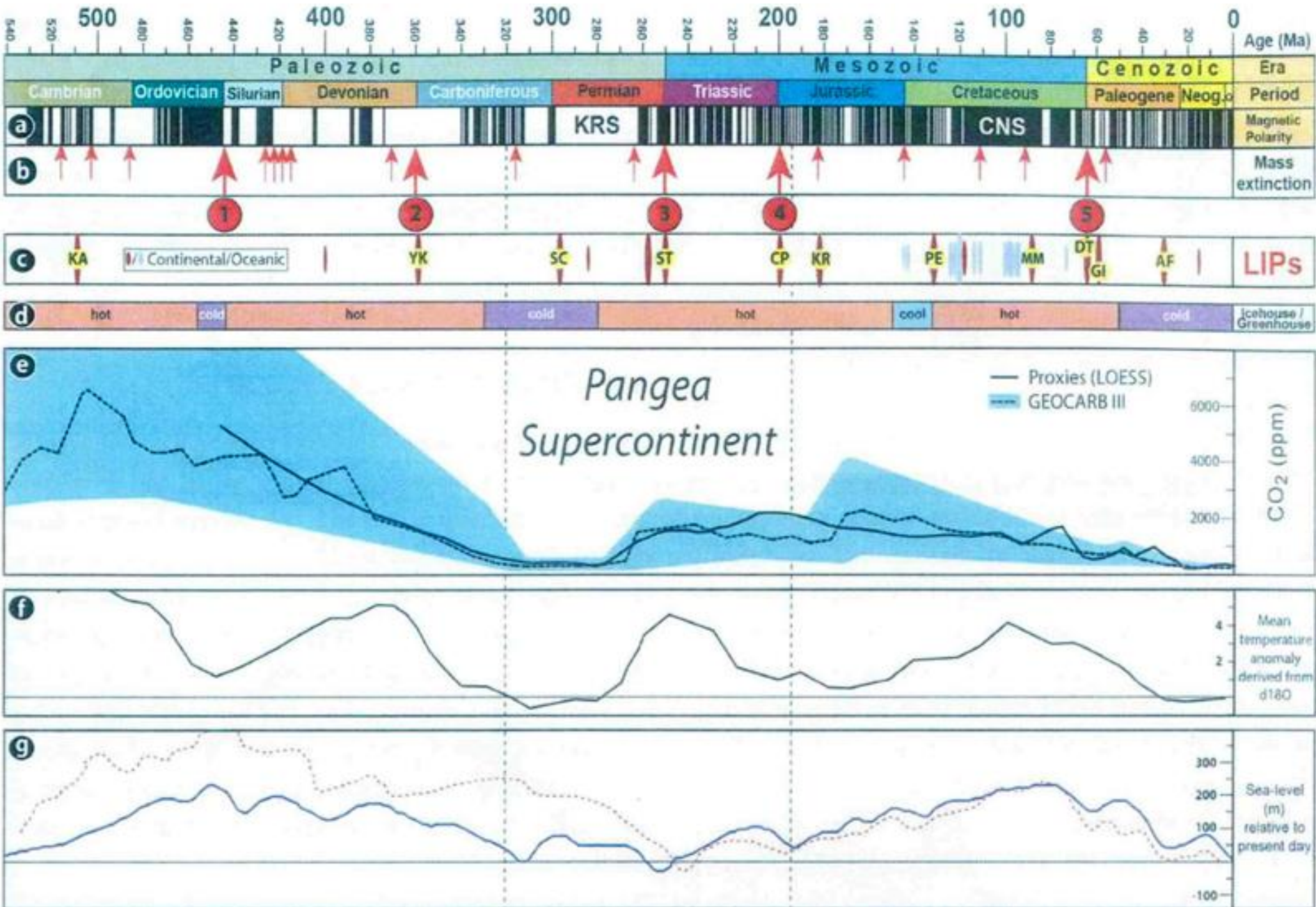
(Sursa: Enciclopedia Geologică Britanică: <http://ro.wikipedia.org/>)



(Sursa: Torsvik Trond & Cocks Robin, 2017)



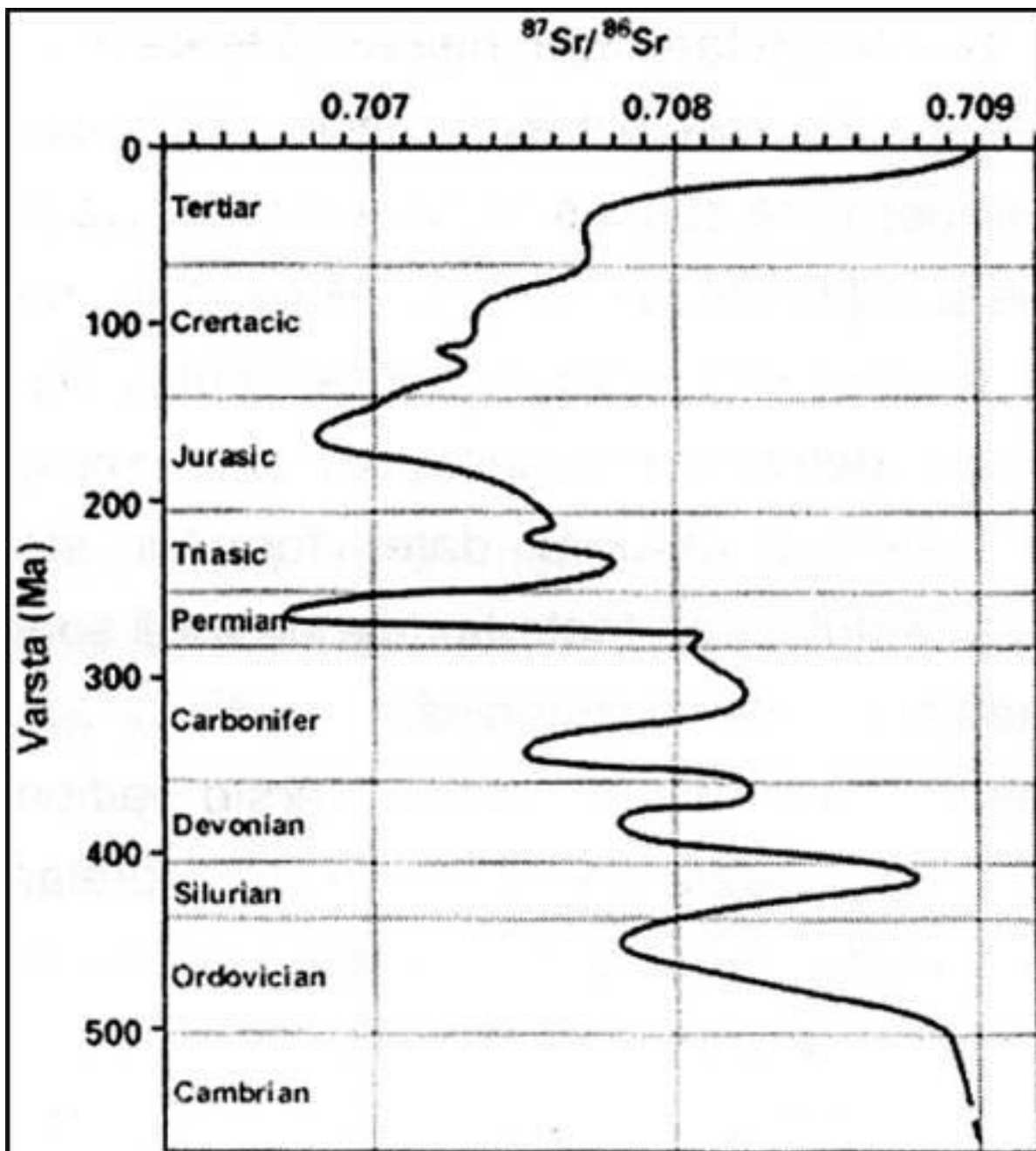
ATMOSFERA: compoziție, paleoclimat, variația eustatică.



(Sursa: Torvsvik Trond & Cocks Robin, 2017. *Earth History and Palaeogeography*. Cambridge University Press)

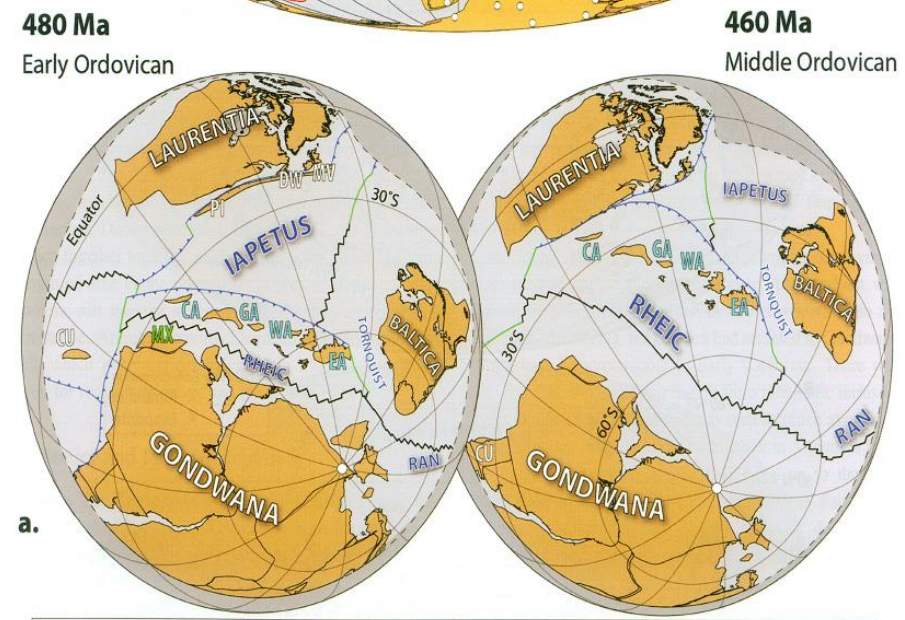
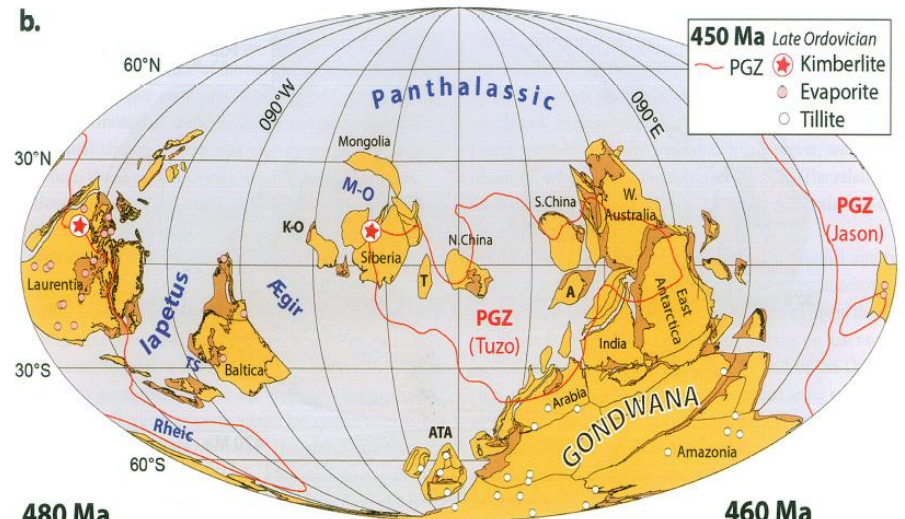
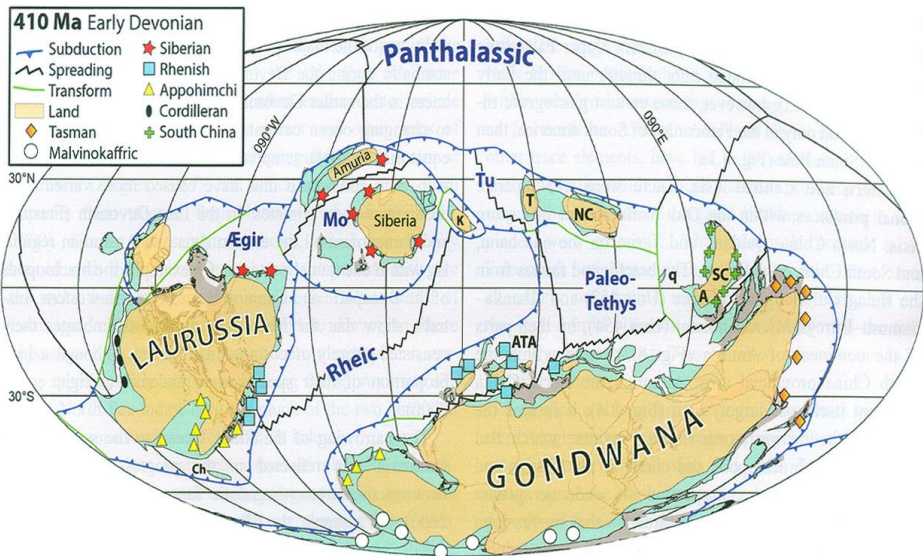
SEMNIFICAȚII ALE EVENIMENTELOR GEOCHIMICE

Raportul izotopilor de
stronțiu ($^{87}\text{Sr}/^{86}\text{Sr}$)
reflectă favorabilitatea
/ restrictivitatea
biologică a
paleomediilor
phanerozoice



Curba izotopilor de stronțiu pentru Phanerozoic
(după Faure, 1986; din Filipescu, 2002)

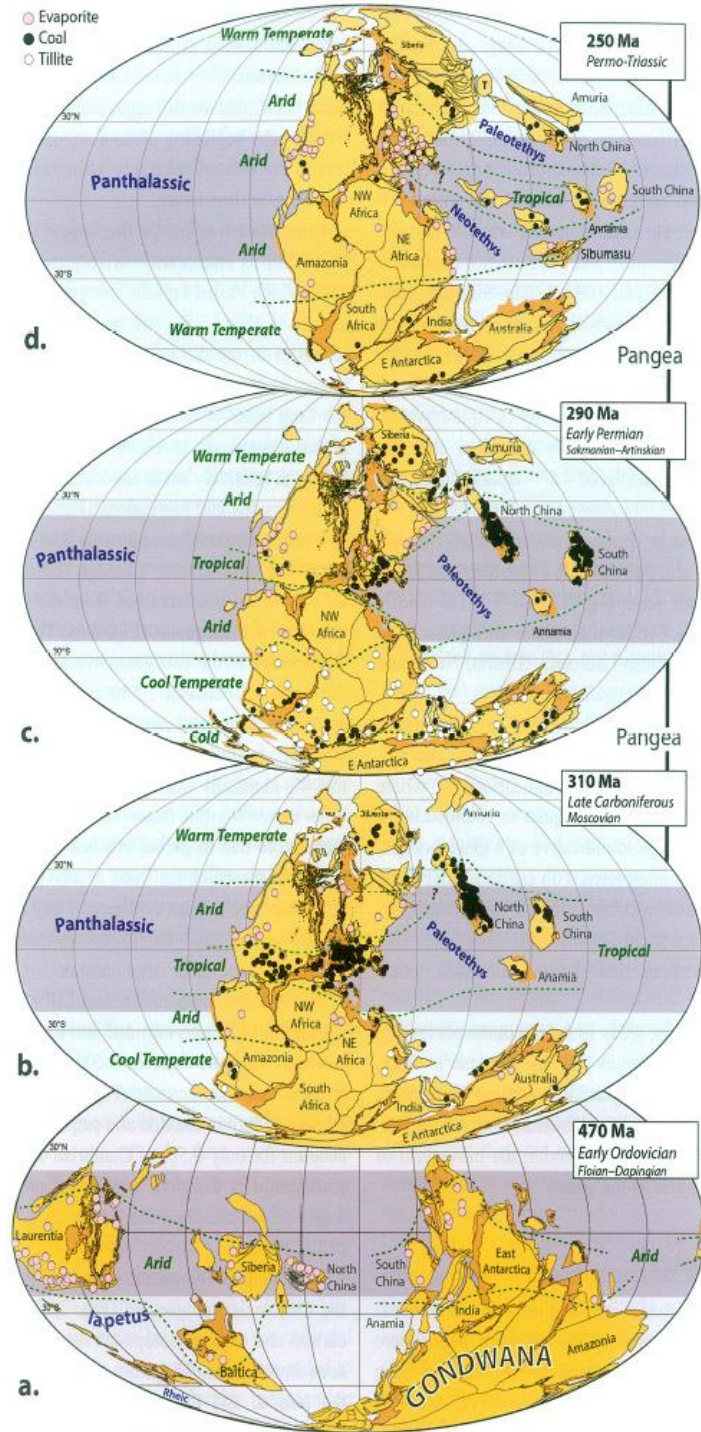
PALEOTECTONICA



CONSUMUL OCEANULUI IAPETUS ȘI FORMAREA CONTINENTULUI LAURSSIA

(Sursa: Torvsvik Trond & Cocks Robin, 2017)

Global distribution of brachiopod provinces in the Emsian at about 400 Ma. A, Annamia; ATA, Armorican Terrane Assemblage; Ch, Chilea Terrane; Mo, Mongol-Okhotsk Ocean; NC, North China; q, Quinling Terrane; SC, South China; T, Tarim; Tu, Turkestan Ocean. New diagram, including sites plotted from Boucot et al. (1969) and Boucot & Blodgett (2001).



(Sursa: Torvsvik Trond & Cocks Robin, 2017)



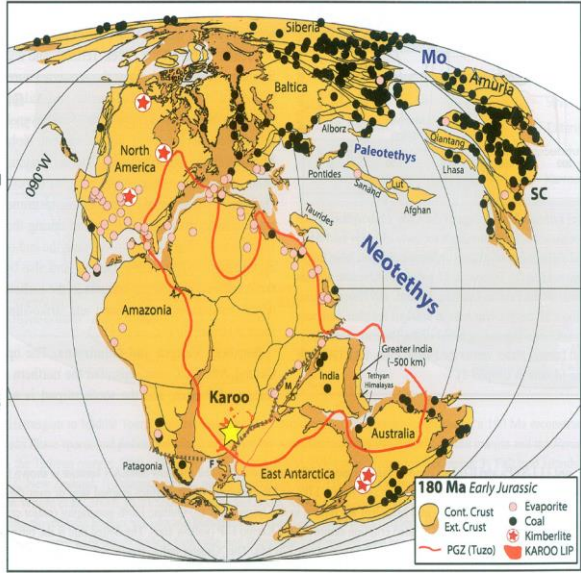
Marea Britanie: Continentul roșu devonian

(Sursa: Enciclopedia Geologică: <http://ro.wikipedia.org/>)

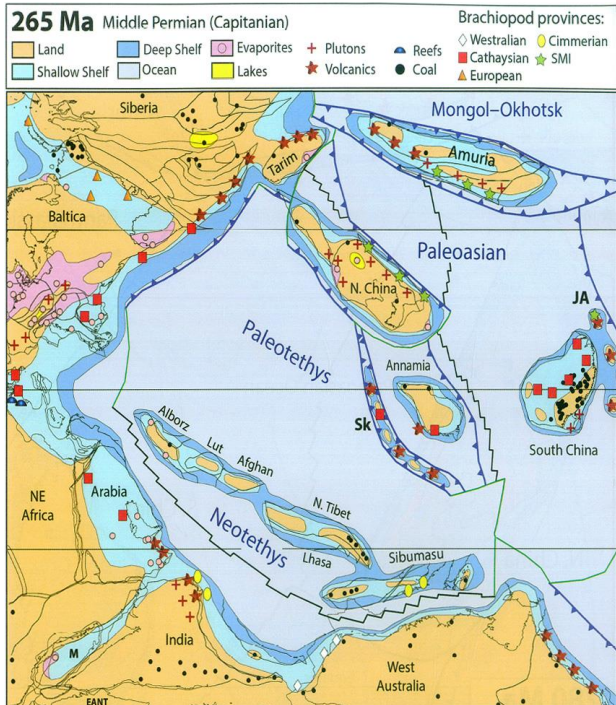
← **Semnificația litologiei în reconstrucția climatelor**



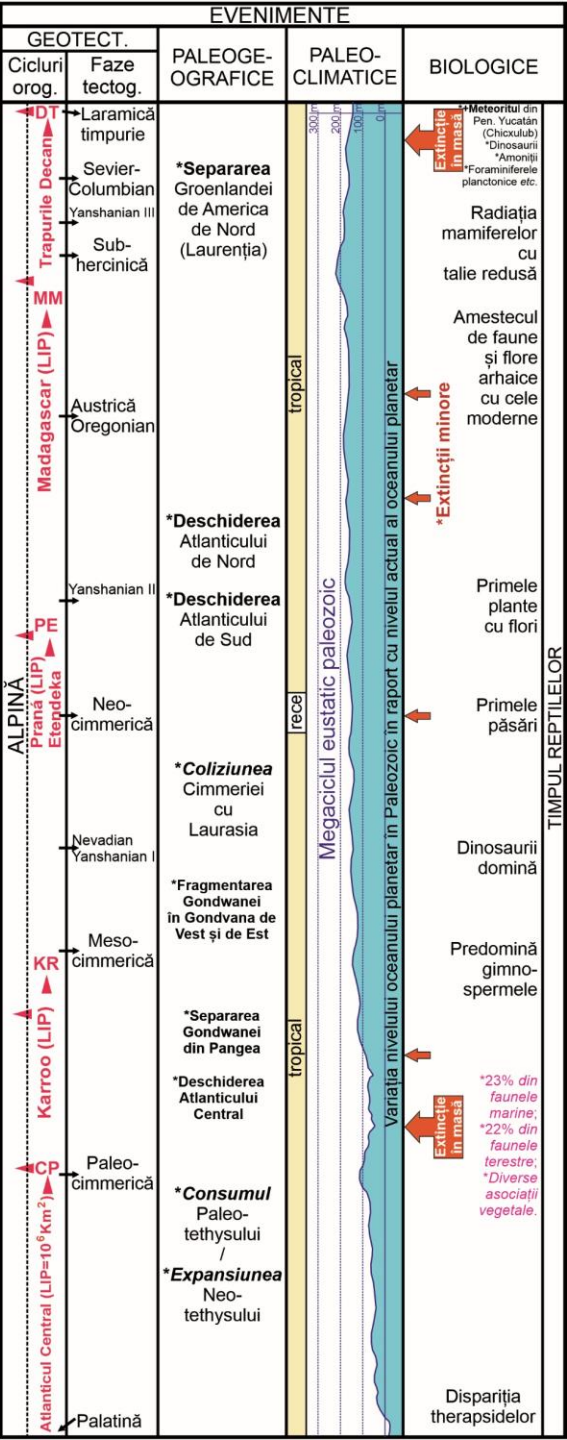
MESOZOIC (251,902 – 66,0 Ma)



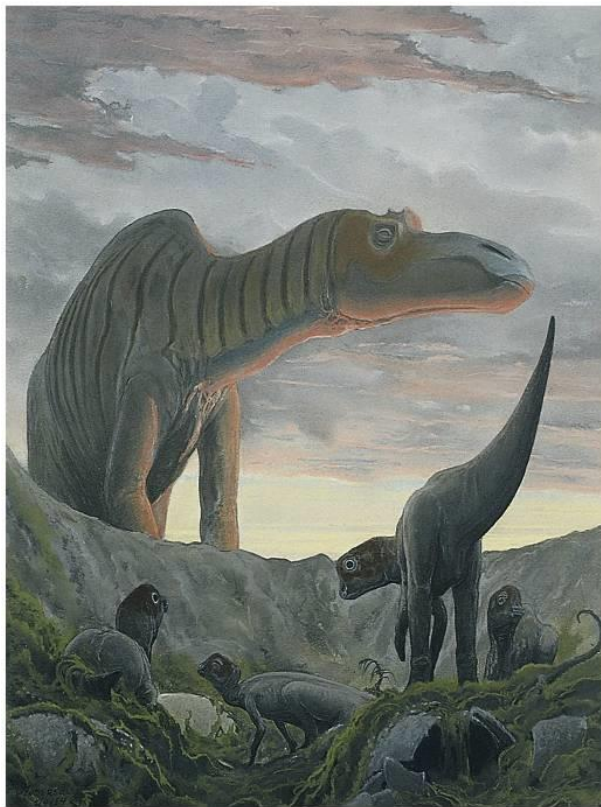
(Sursa: Torvsvik Trond & Cocks Robin, 2017)



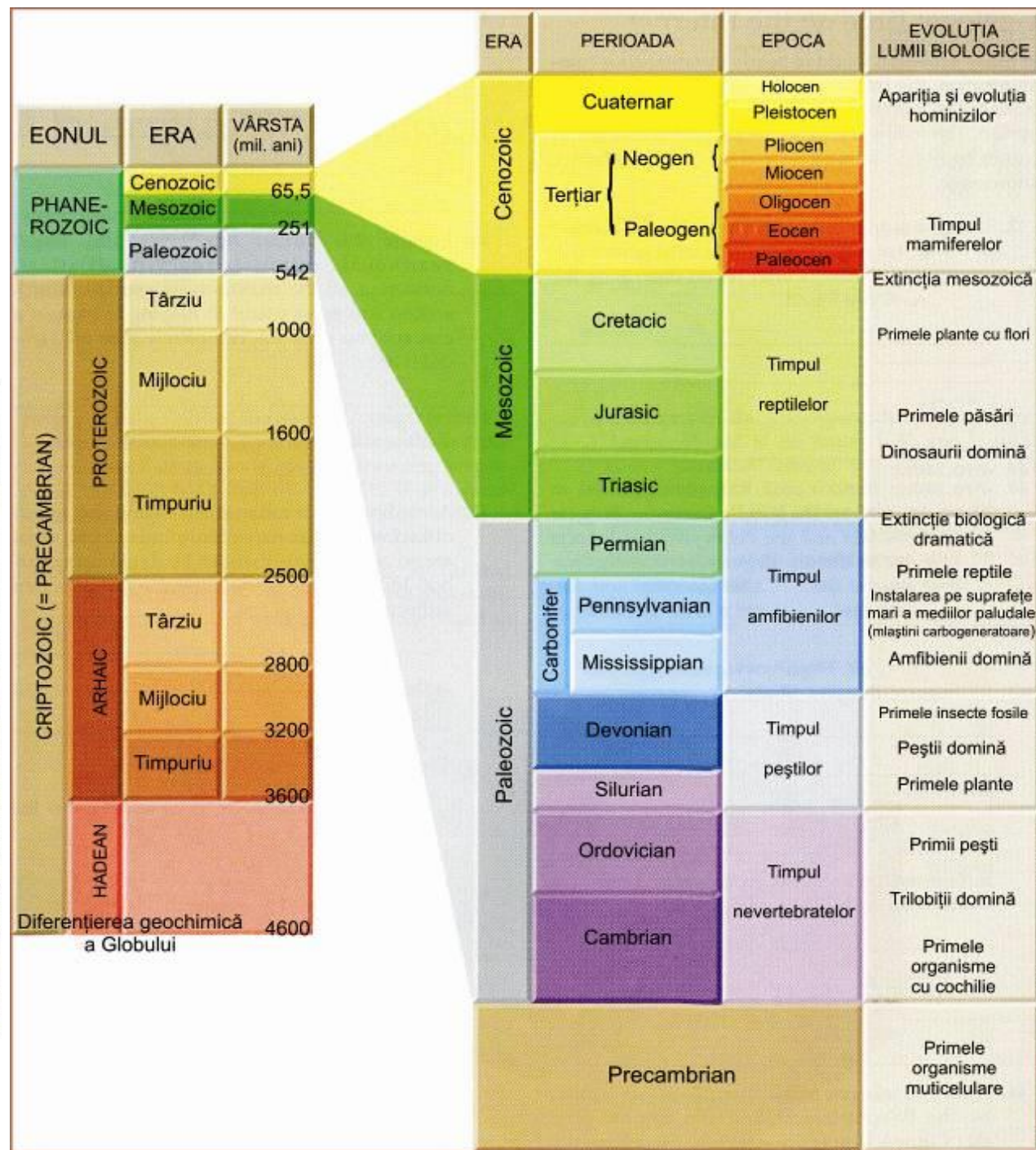
Epoch / Era	Series / Epoch	Stage / Age	GSSP	numerical age (Ma)	
Mesozoic	Cretaceous	Maastrichtian	66.0	72.1 ± 0.2	
		Campanian		83.6 ± 0.2	
		Upper		86.3 ± 0.5	
		Santonian		89.8 ± 0.3	
		Coniacian		93.9	
		Turonian		100.5	
		Cenomanian		~ 113.0	
	Jurassic	Lower	Albian		~ 125.0
			Aptian		~ 129.4
			Barremian		~ 132.9
		Hauterivian		~ 139.8	
		Valanginian		~ 145.0	
		Berriasian		152.1 ± 0.9	
		Triassic	Upper	Tithonian	
Kimmeridgian				163.5 ± 1.0	
Oxfordian				166.1 ± 1.2	
Middle	Callovian			168.3 ± 1.3	
	Bathonian			170.3 ± 1.4	
	Bajocian			174.1 ± 1.0	
Lower	Aalenian			182.7 ± 0.7	
	Toarcian			190.8 ± 1.0	
	Pliensbachian			199.3 ± 0.3	
	Sinemurian			201.3 ± 0.2	
Rhaetian		~ 208.5			
Upper	Norian		~ 227		
	Carnian		~ 237		
	Ladinian		~ 242		
	Anisian		247.2		
Middle	Olenekian		251.2		
	Induan		251.902 ± 0.024		



Timpul mesozoic în "economia" Timpului geologic, cu localizarea unor evenimente majore din lumea biologică

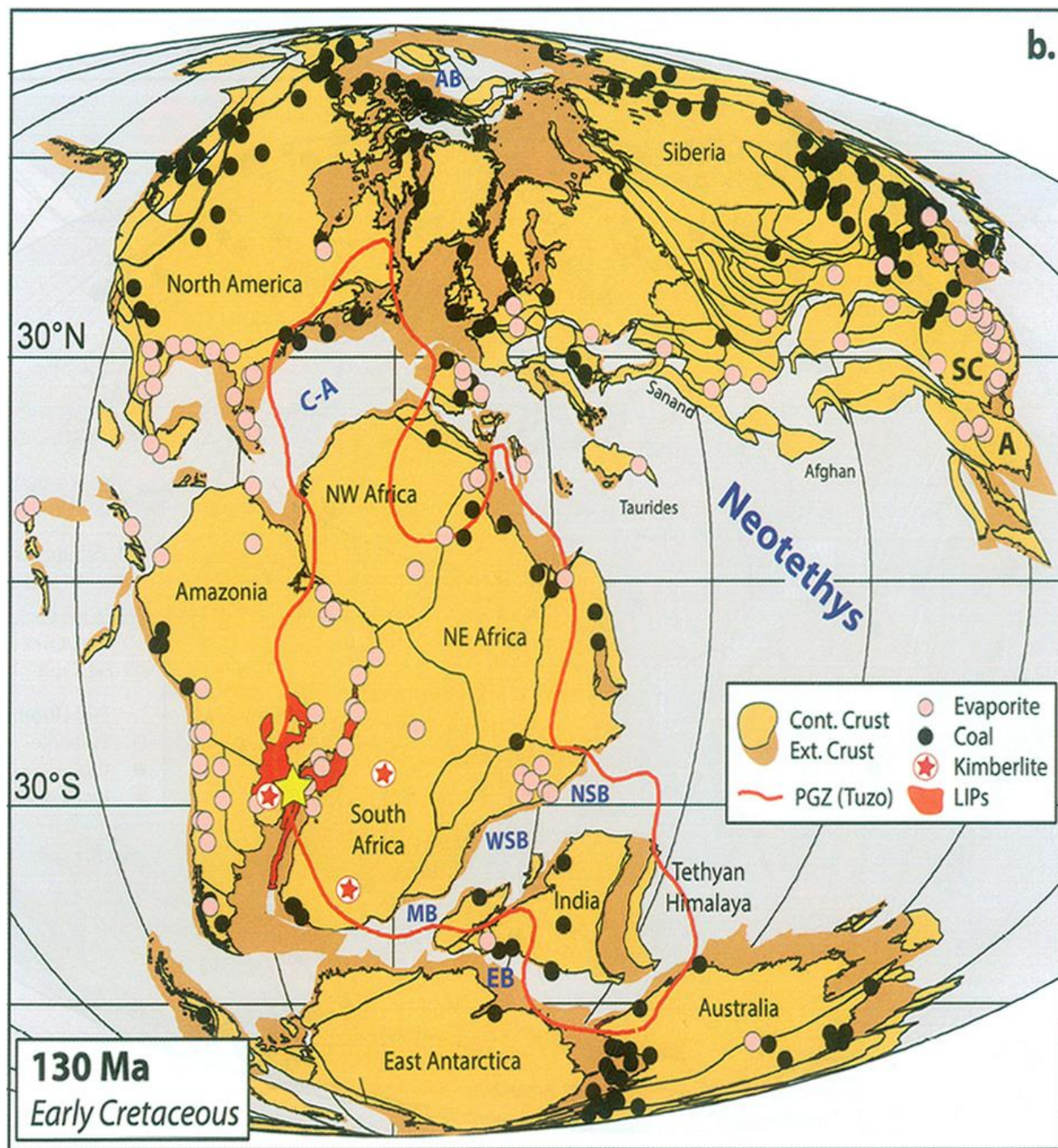


(sursa: wikipedia.ro)

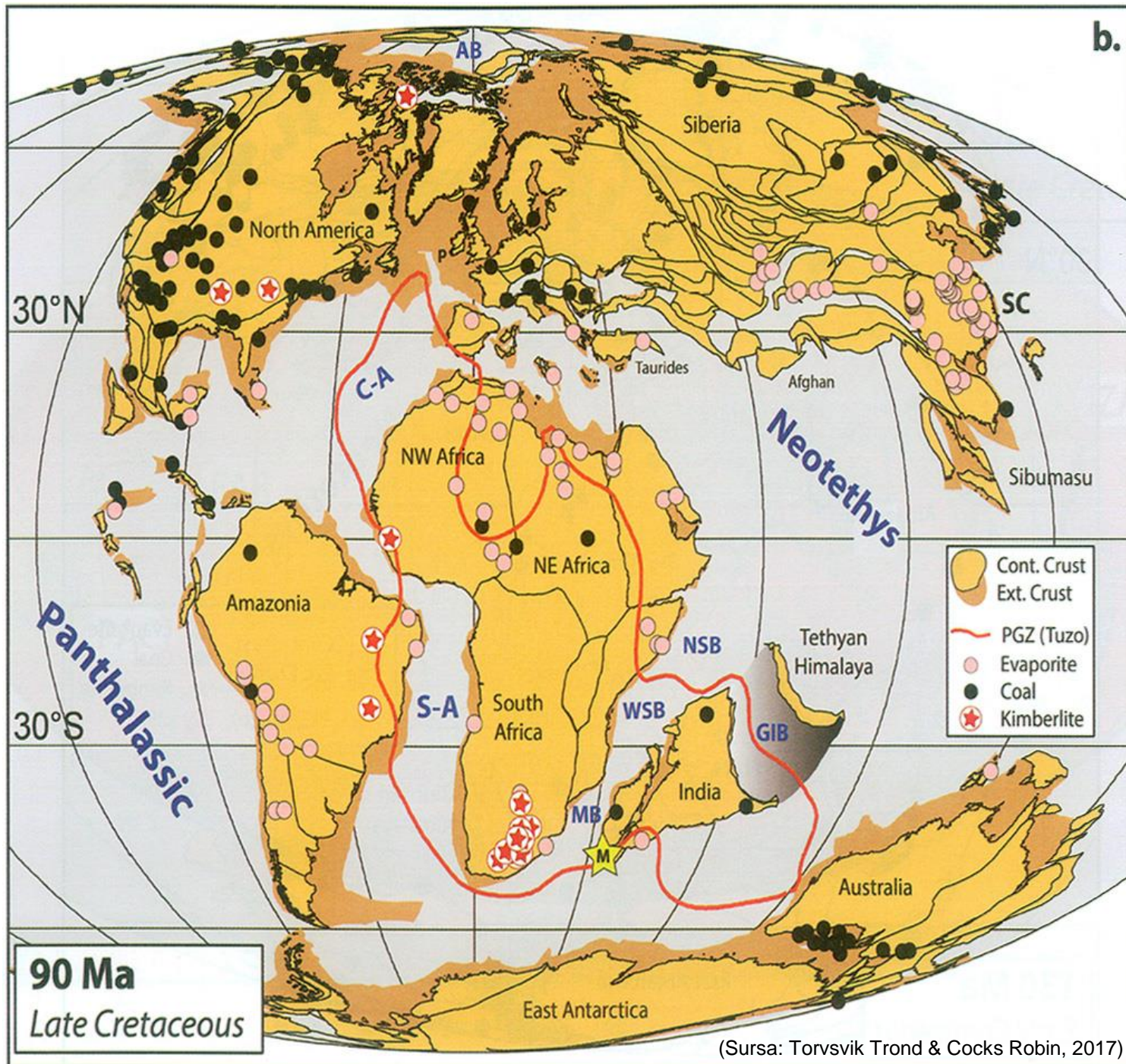


Oceanul Tethys:

- *intră în consum;*
- *se configurează*
catenele orogenetice
alpine;
- *se fragmentează*
Pangaea;
- *se edifică catena*
cimerică;
- *se evoluează spre*
geografia actuală (cu
bazinele oceanice și
blocurile continentale
actuale).



*se configurează Atlanticul central și sudic;
 *se separă India din Gondwana;
 *se formează nucleele cristalino-mezozoice în Carpați;
 *se evoluează spre geografia actuală (cu bazinele oceanice și blocurile continentale actuale).



***ÎN LUMEA BIOLOGICĂ SE PRODUCE EXTINCȚIA MESOZOICĂ ȘI APAR PĂSĂRILE**

Pterosaurus----->

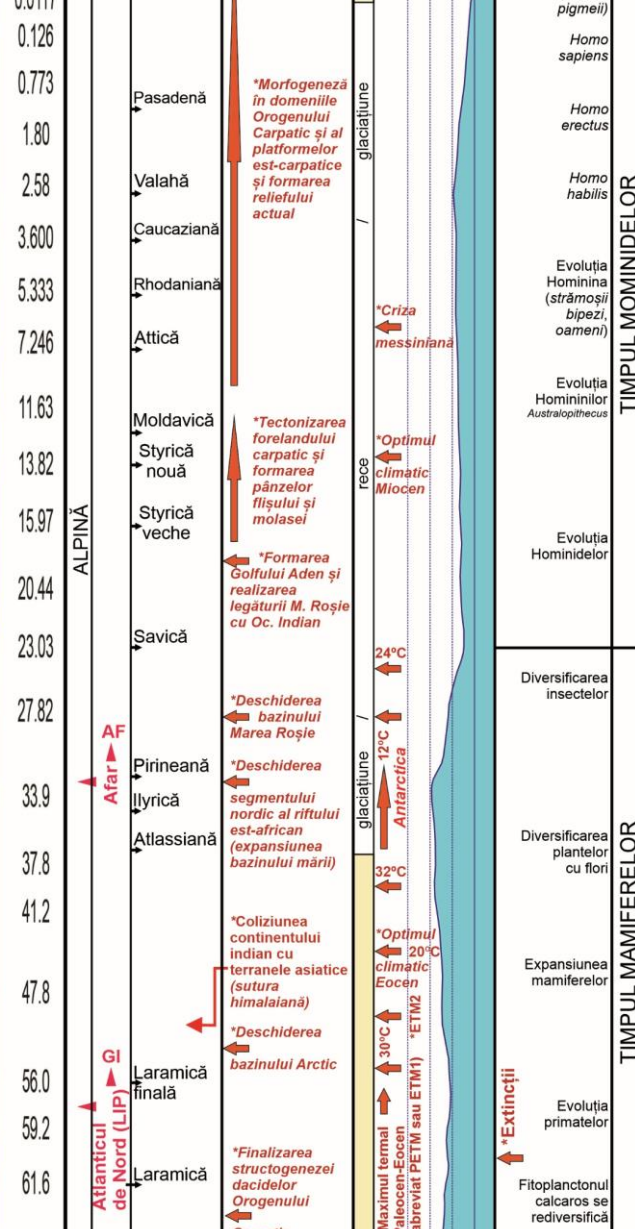
(Sursa: www.palaeos.com)



CENOZOIC (66,0 Ma – prezent – viitor?)

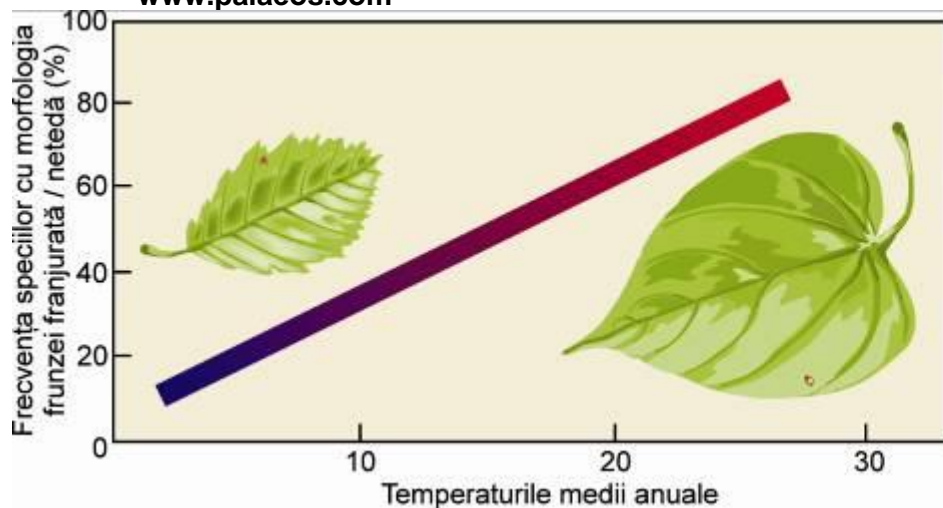
ICS		Paratethys		
Cuaternar	Holocen	<i>mil. ani</i> 0,011	Holocen	
	Pleistocen	Tarantian	0,13	Pleistocen
		Ionian	0,78	
		Calabrian	1,81	
		Gelasian	2,58	
	Pliocen	Piacenzian	3,60	Romanian
		Zanclean	5,33	Dacian
	Neogen	Messinian	7,25	Pontian
		Tortonian	11,61	Meoțian
		Miocen	Serravallian	13,65
Langhian			15,97	Badenian
Burdigalian			20,43	Burdigalian
Aquitanian		23,03	Aquitanian	

Epoch / Era	Series / Epoch	Stage / Age	GSSP
Quaternary	Holocene	Meghalayan	present
		Northgrippian	0.0042
		Greenlandian	0.0082
	Pleistocene	Upper	0.0117
		Middle	0.126
		Calabrian	0.773
		Gelasian	1.80
	Pliocene	Piacenzian	2.58
		Zanclean	3.600
		Messinian	5.333
Tortonian		7.246	
Neogene	Miocene	Serravallian	11.63
		Langhian	13.82
		Burdigalian	15.97
		Aquitanian	20.44
	Oligocene	Chatthian	23.03
		Rupelian	27.82
		Priabonian	33.9
		Bartonian	37.8
Paleogene	Eocene	Lutetian	41.2
		Ypresian	47.8
		Thanetian	56.0
	Paleocene	Selandian	59.2
		Danian	61.6
		Laramic	66.0



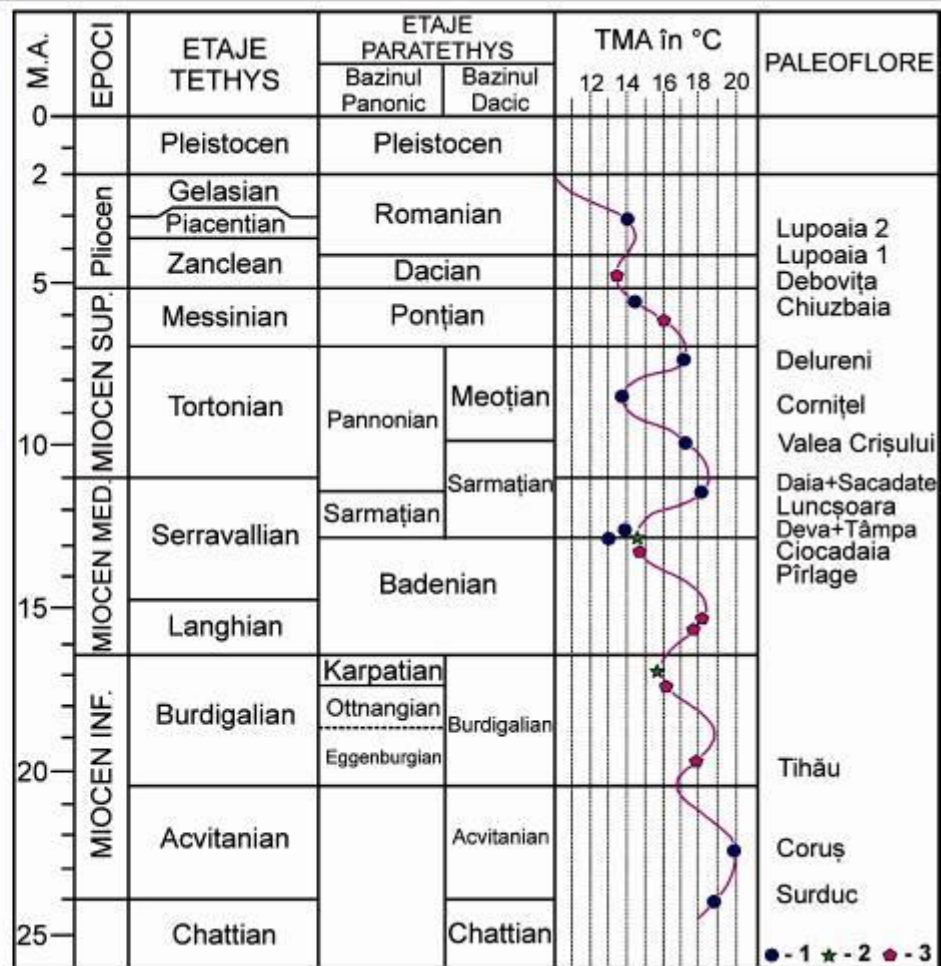
SEMNIIFICAȚIILE ASOCIAȚIILOR PALEOVEGETALE ÎN STABILIREA "OSCIPLAȚIILOR" PALEOCLIMATICE ÎN NEOGEN

www.palaeos.com

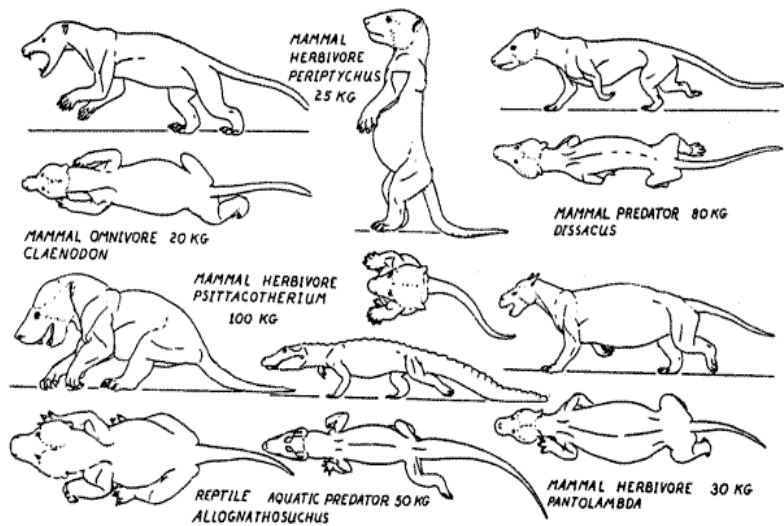


*Marginea franjurată ► *climate temperate reci.*

*Marginea netedă ► *climate calde.*



(după Cârciumar, Givulescu, Petrescu)



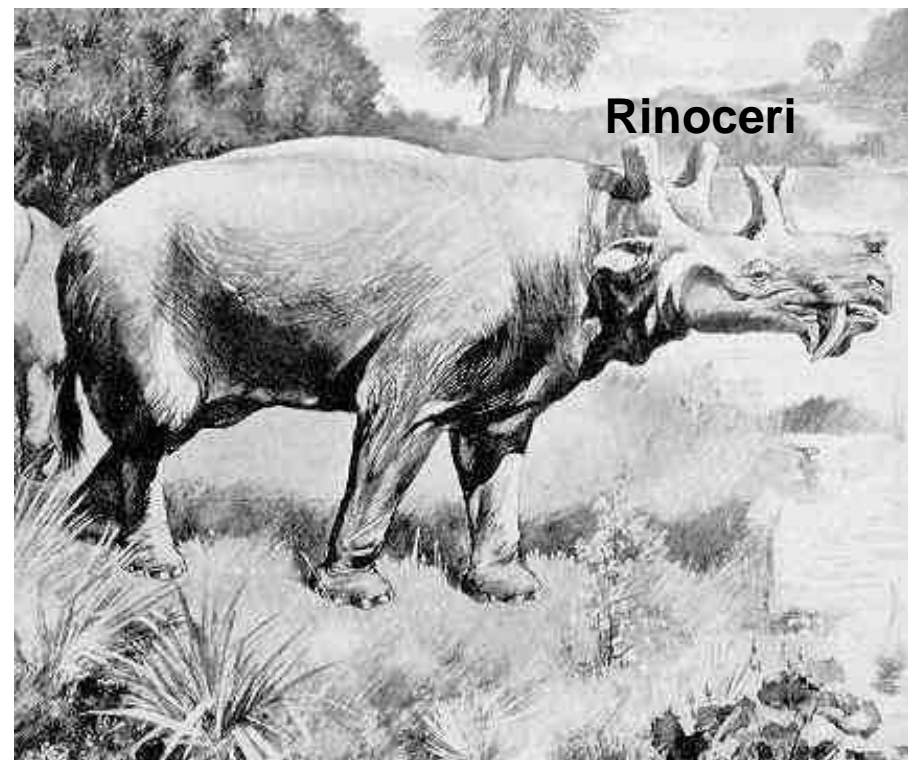
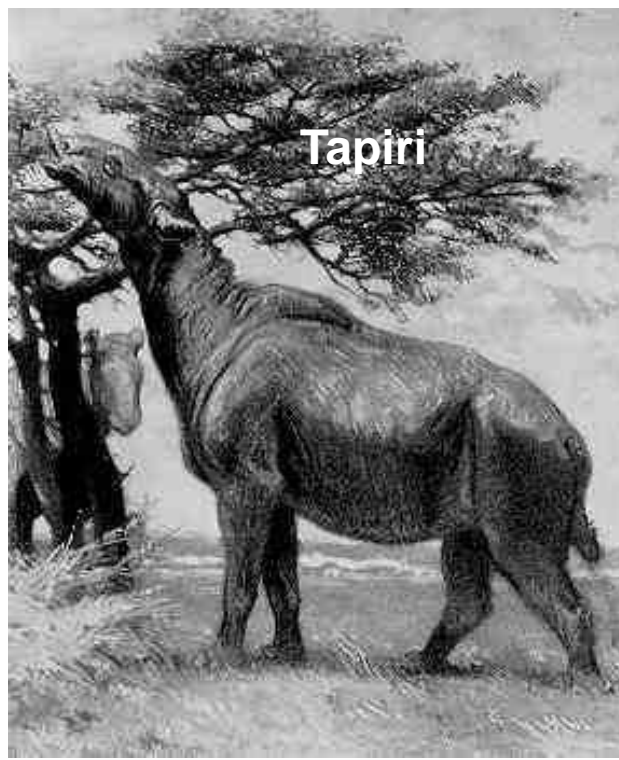
VIAȚA ÎN PALEOCEN

PALEOGENUL TIMPUL MAMIFERELOR



(Sursa: www.palaeos.com)

**VIAȚA ÎN
EOCEN**



(Sursa: www.palaeos.com)

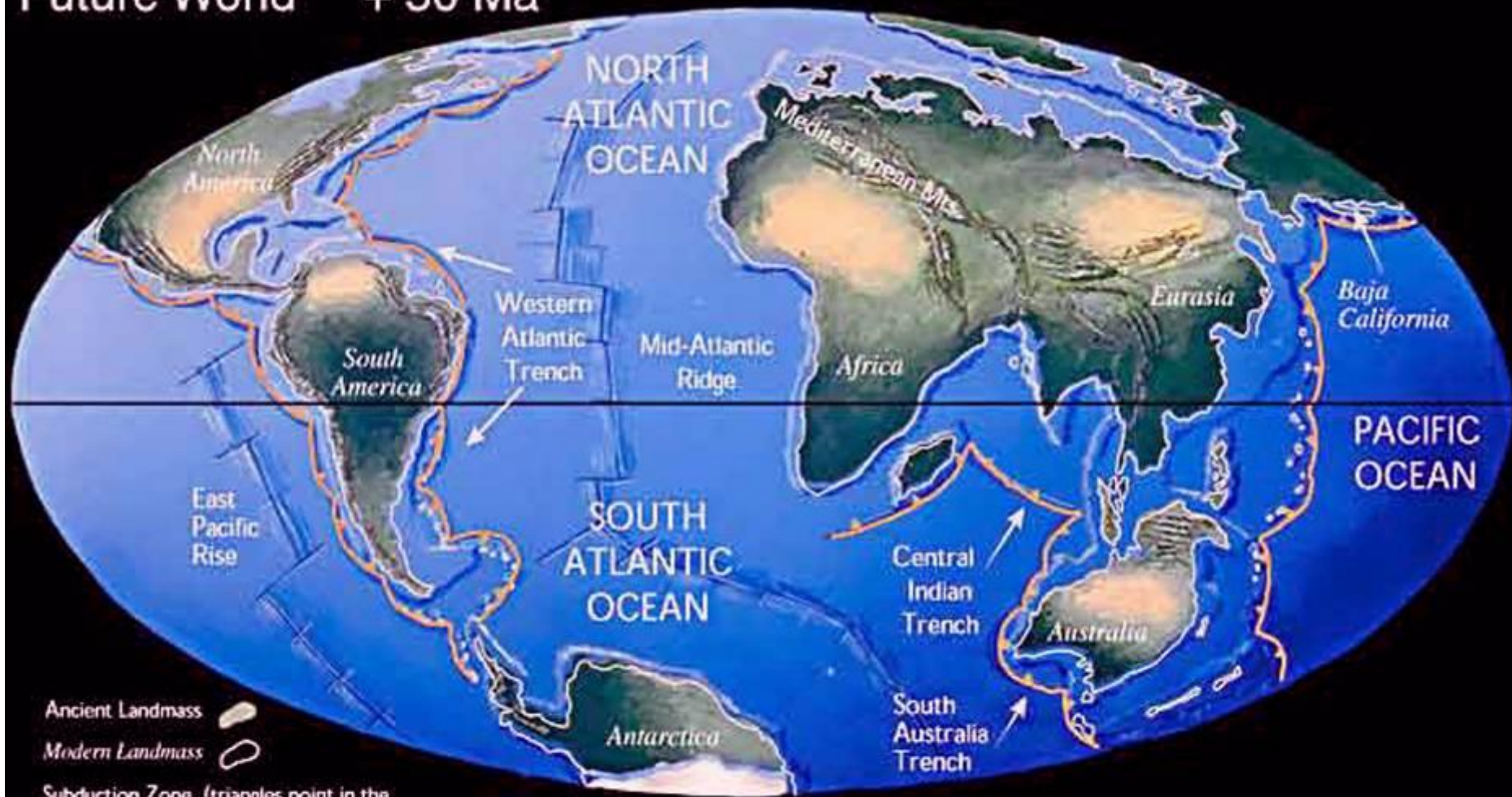





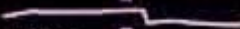
DIN ACTUAL PESTE 250 mil. ani ÎN VIITORUL GEOLOGIC

Modern World

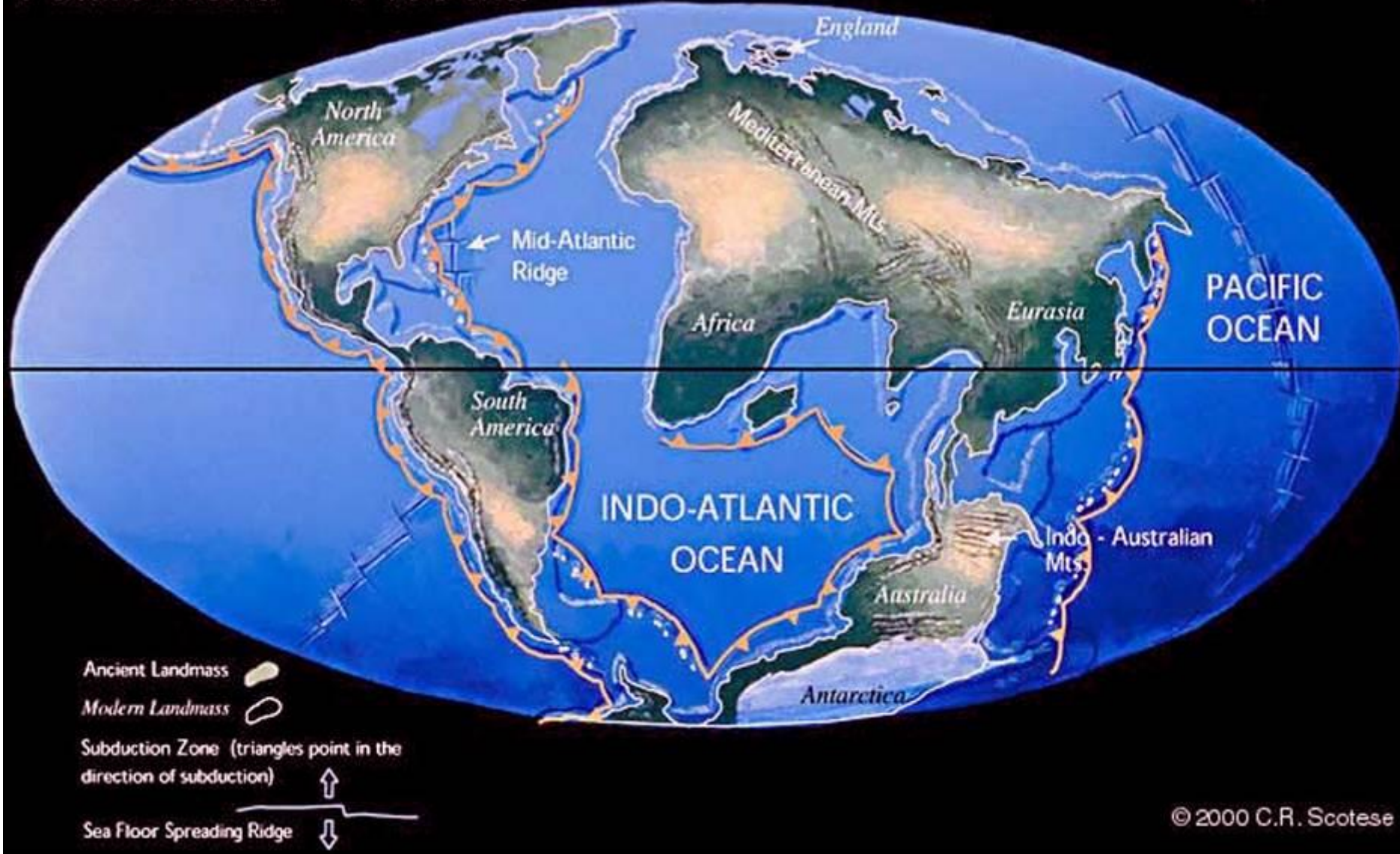


Future World + 50 Ma





- Ancient Landmass 
- Modern Landmass 
- Subduction Zone (triangles point in the direction of subduction) 
- Sea Floor Spreading Ridge 

Future World + 150 Ma



Future World + 250 Ma



- Ancient Landmass 
- Modern Landmass 
- Subduction Zone (triangles point in the direction of subduction) 
- Sea Floor Spreading Ridge 

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(Sursa: www.palaeos.com)

**PEISAJE GEOLOGICE CU SEMNIFICAȚII ÎN
DESCIFRAREA EVOLUȚIEI GEOSISTEMULUI**

EXEMPLIFICĂRI PRIVIND PALEOEVENIMENTE



CALIFORNIA
SIERRA NEVADA
HOT CREEK
ACTIVITATE POSTPAROXISMALĂ

2017 08 15

b. MAGMATICE-VULCANICE



Vulcanism exploziv (700 mii ani)
-activitate postvulcanică-





****Ultimele erupții au avut loc în urmă cu 700000 ani**
*****În prezent, în calderă au loc manifestări postvulcanice,**
cu depuneri de roci cu săruri





RELIEF FORMAT PE CORPURI MAGMATICE BATHOLITICE



CALIFORNIA

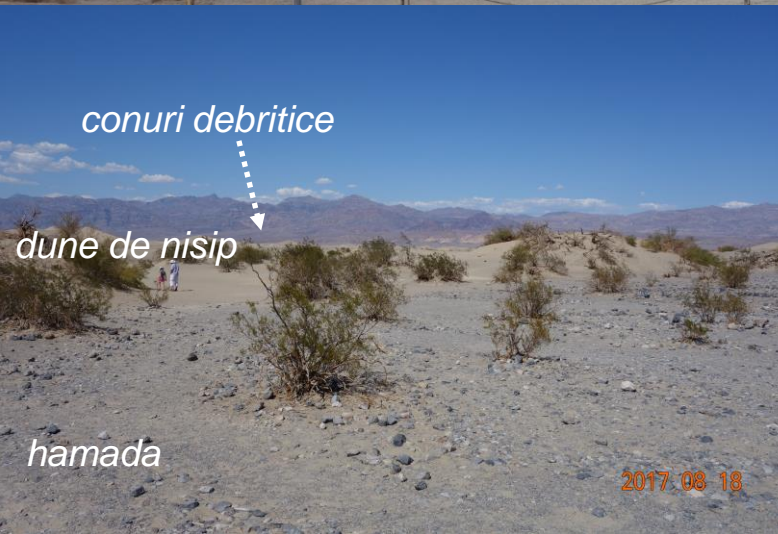
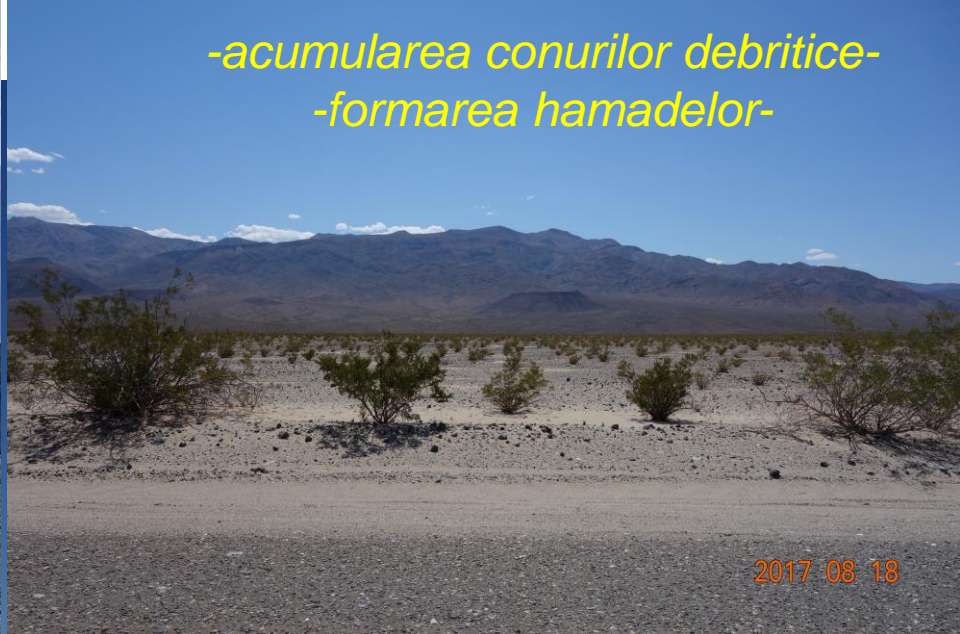
YOSEMITE PARK

BATHOLITE MAGMATICE MESOZOICE

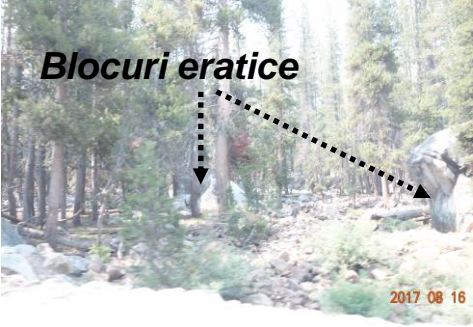
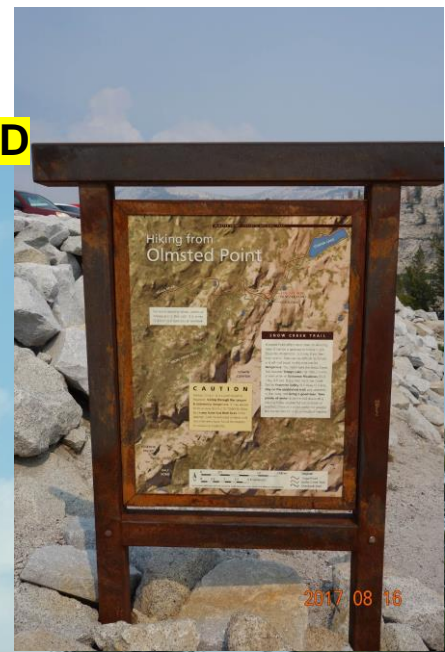
ROCA: GRANITE/GRANODIORITE/DIORITE

2017 08 14

Medii de sedimentare continentale din climate calde-aride



**CALIFORNIA
YOSEMITE PARK
PUNCTUL GLACIAR OLNSTED**



Din "VALEA MORTII"
PRIN DEPOZITE
VULCANICE ȘI
PIROCLASTICE
SPRE "BADLANDS"
(CALIFORNIA)



2017 08 18



2017 08 18



2017 08 18

CALIFORNIA
PUNCTUL ZABRISKIE
PĂMÂNTURI RELE (BADLANDS)
MEDII DEPOZIȚIONALE ARIDE, DEBRITICE



2017 08 18

PUNCTUL ZABRISKIE



2017 08 18

PUNCTUL ZABRISKIE



2017 08 18

ARIZONA
CANIONUL ANTILPE
DEPOZITE JURASICE



FORMAȚIUNEA NAVAJO



DUNE DE NISIP, CU
STRATIFICAȚIE
ÎNCRUCIȘATĂ
TRANSFORMATE PRIN
PROCESE DIAGENETICE ÎN
STRATE GRESII



2017 08 23



2017 08 23



2017 08 23

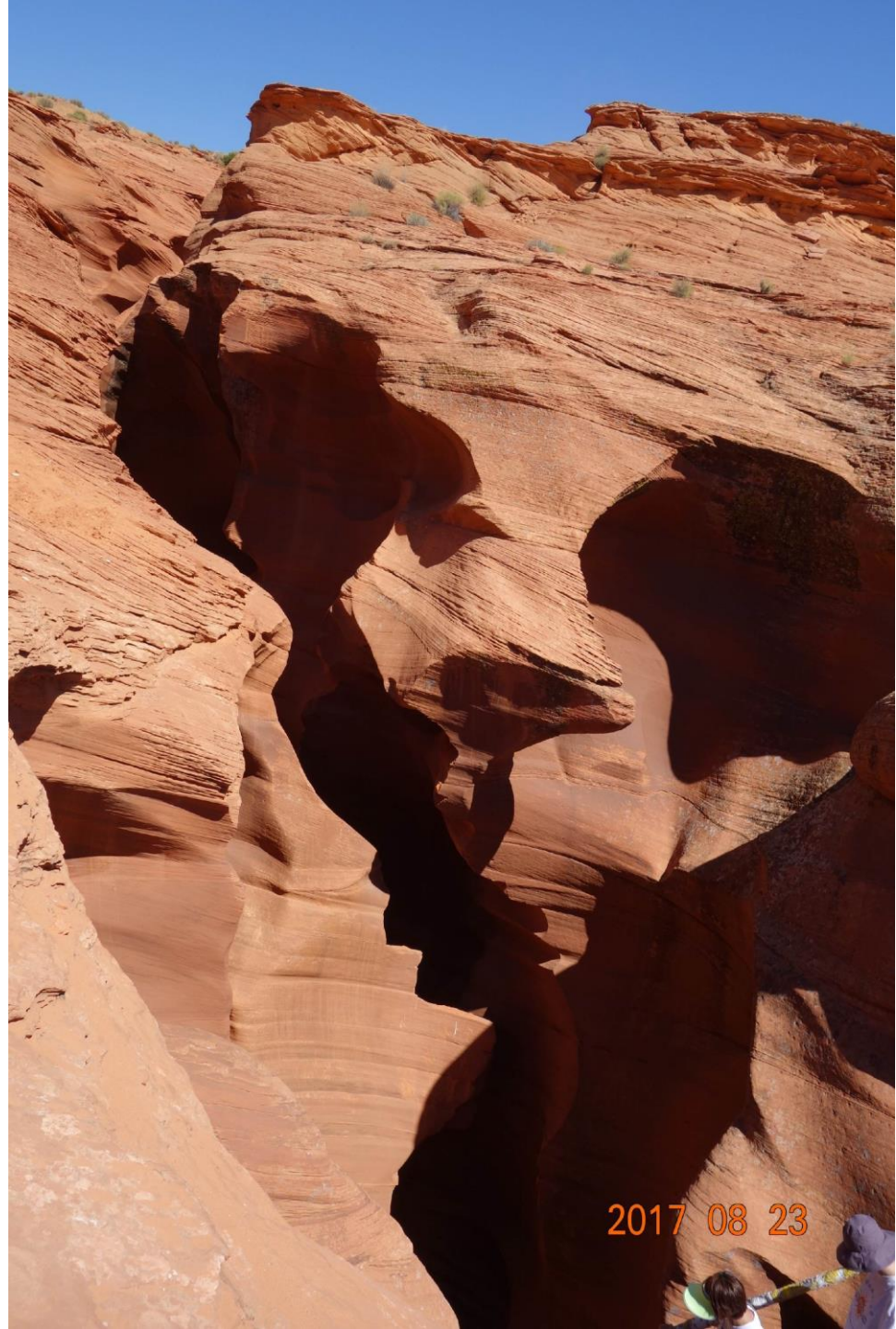


INTRAREA ÎN SEGMENTUL
SUBTERAN AL CANYONULUI
ANTYLOPE



2017 08 23

**INTRAREA ÎN SEGMENTUL
SUBTERAN AL
CANYONULUI ANTYLOPE**





2017 08 23



2017 08 23





2017 08 23



2017 08 23



2017 08 23



2017 08 23





2017 08 23



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2017 08 23



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SFÂRȘIT

