

Tatort Plattengrenze

Renée Heilbronner

5. Nov. 12. Nov. 19. Nov. 26. Nov.

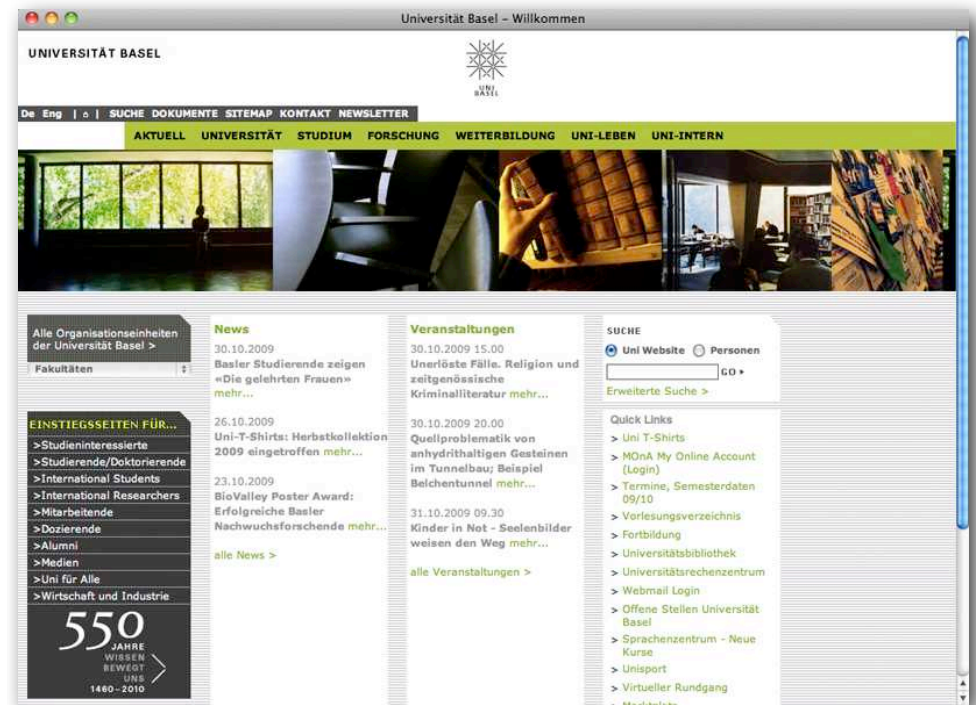
Universität Basel

Naturwissenschaftliche Fakultät

Departement Umweltwissenschaften

Geologisch-Paläontologisches Institut

Rock Deformation and Structure Analysis



Universität Basel

Naturwissenschaftliche Fakultät

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Geologisch-Paläontologisches Institut

Rock Deformation and Structure Analysis

The screenshot displays the website for the Faculty of Arts and Sciences (Philosophisch-Naturwissenschaftliche Fakultät) at the University of Basel. The page is in German and features a navigation menu at the top with links for 'AKTUELL', 'UNIVERSITÄT', 'STUDIUM', 'FORSCHUNG', 'WEITERBILDUNG', 'UNI-LEBEN', and 'UNI-INTERN'. A search bar is located in the top right corner. The main content area is titled 'Übersicht' and provides contact information for the faculty, including the address (Klingelbergstrasse 50, 4056 Basel), the dean (Prof. Dr. Eberhard Parlow), and contact details for Marianne Hess. A list of departments is also provided, including Biozentrum, Chemie, Informatik, Mathematik, Pharmazeutische Wissenschaften, Physik, and Umweltwissenschaften. The page footer includes the copyright notice '©Universität Basel | Impressum | swissuniversity.ch' and the date '29/10/2009'.

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Übersicht

Philosophisch-Naturwissenschaftliche Fakultät

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Situationsplan: [MAP](#)

Departement:

- Departement Biozentrum
- Departement Chemie
- Departement Informatik
- Departement Mathematik
- Departement Pharmazeutische Wissenschaften
- Departement Physik
- Departement Umweltwissenschaften

Suche

Suche im Institutsfinder

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29/10/2009

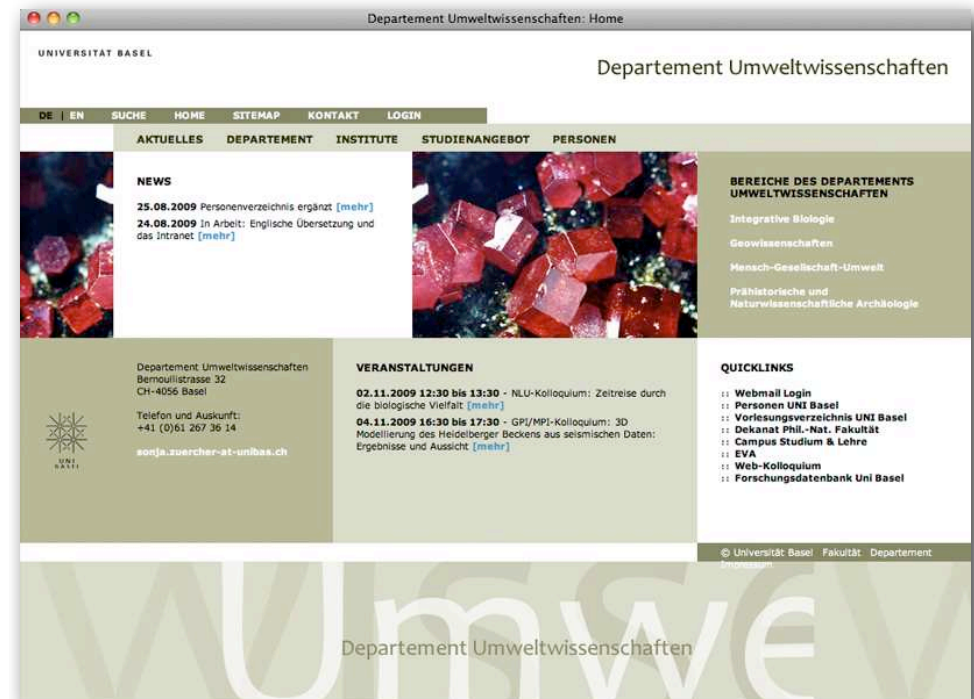
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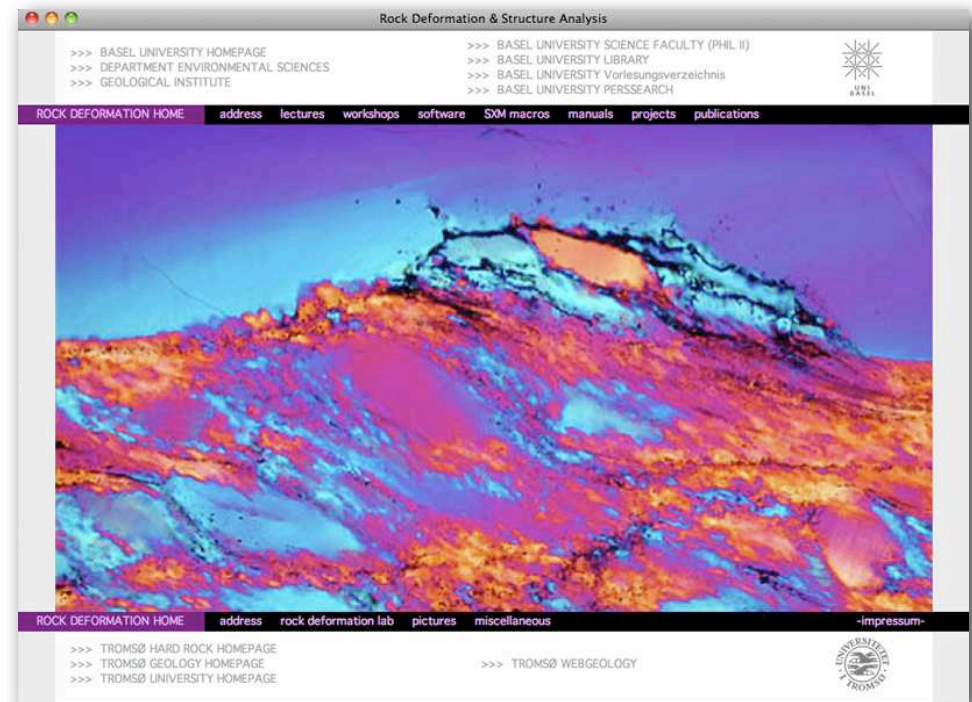
Rock Deformation and Structure Analysis

The screenshot shows a web browser window with the title "Basel University - Geology and Paleontology". The page has a dark blue background with white text. At the top right, it says "Department of Environmental Sciences" and "Institute of Geology & Paleontology". Below this is a navigation bar with links: "HOME", "STUDYING GEOSCIENCES", "CURRENT SEMESTER", and "GEO @ BERNOULLIANUM". The main content area is divided into several sections:

- Group Links:** Applied Geology, Paleontology, Rock Deformation, Sedimentology.
- Tectonics:** EJCOR URGENT project.
- Department:** Environmental Sciences Faculty and staff.
- Institut für Geologie und Paläontologie:** Department Umweltwissenschaften Universität Basel.
- Institute of Geology and Paleontology:** Department of Environmental Sciences Basel University.
- Address:** Bernoullistrasse 32, CH-4056 Basel, Schweiz / Switzerland.
- Sekretariat / Secretary:** ++41-61-267 35 91 (Telefon / phone), ++41-61-267 36 13 (Fax / fax), e-mail.
- ANNUAL REPORTS:** Jahresberichte der Erdwissenschaftlichen Institute. A list of reports from 2001 to 2007 with their respective PDF file sizes (e.g., 2001: 196KB, 2007: 664KB).

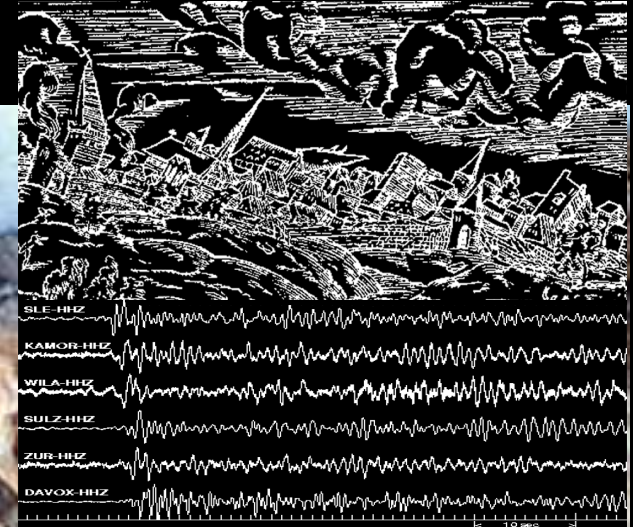
At the bottom right, there is a small image of a landscape and the text "Garus Thrust, Switzerland." The bottom of the page features a large, wide image of a mountain range under a blue sky.

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Rock Deformation and Structure Analysis



Rock Deformation and Structure Analysis

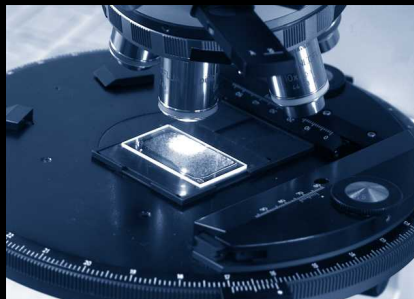
DYNAMIC EARTH



EXPERIMENTAL
ROCK DEFORMATION



LABORATORY - FIELDWORK



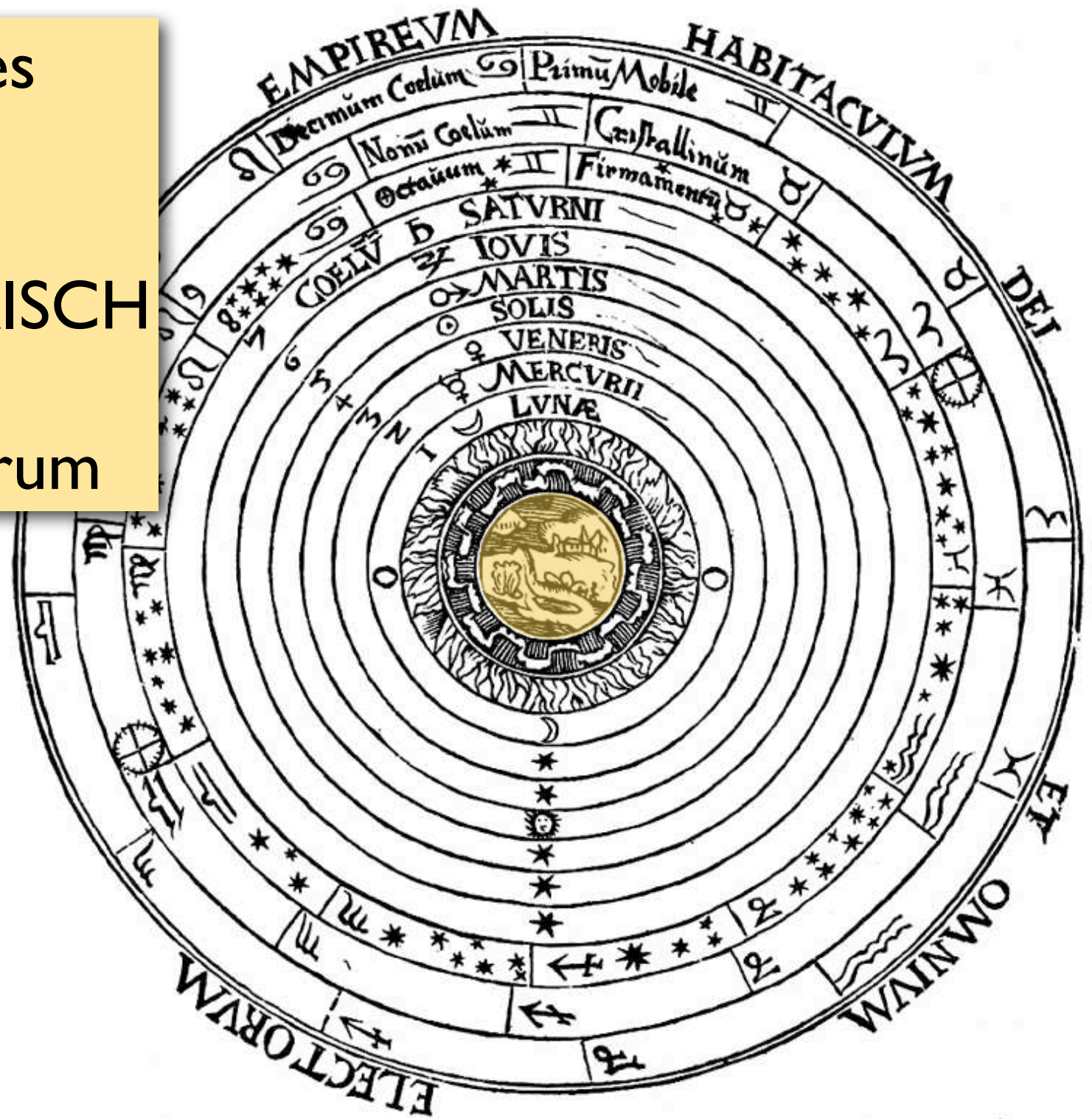


1. allgemeine Einführung in die Plattentektonik
2. konstruktive Plattengrenzen
3. destruktive Plattengrenzen
4. konservative Plattengrenzen

Ptolemäisches
Weltbild:

GEOZENTRISCH

Erde = Zentrum



Ptolemäisches
Weltbild:

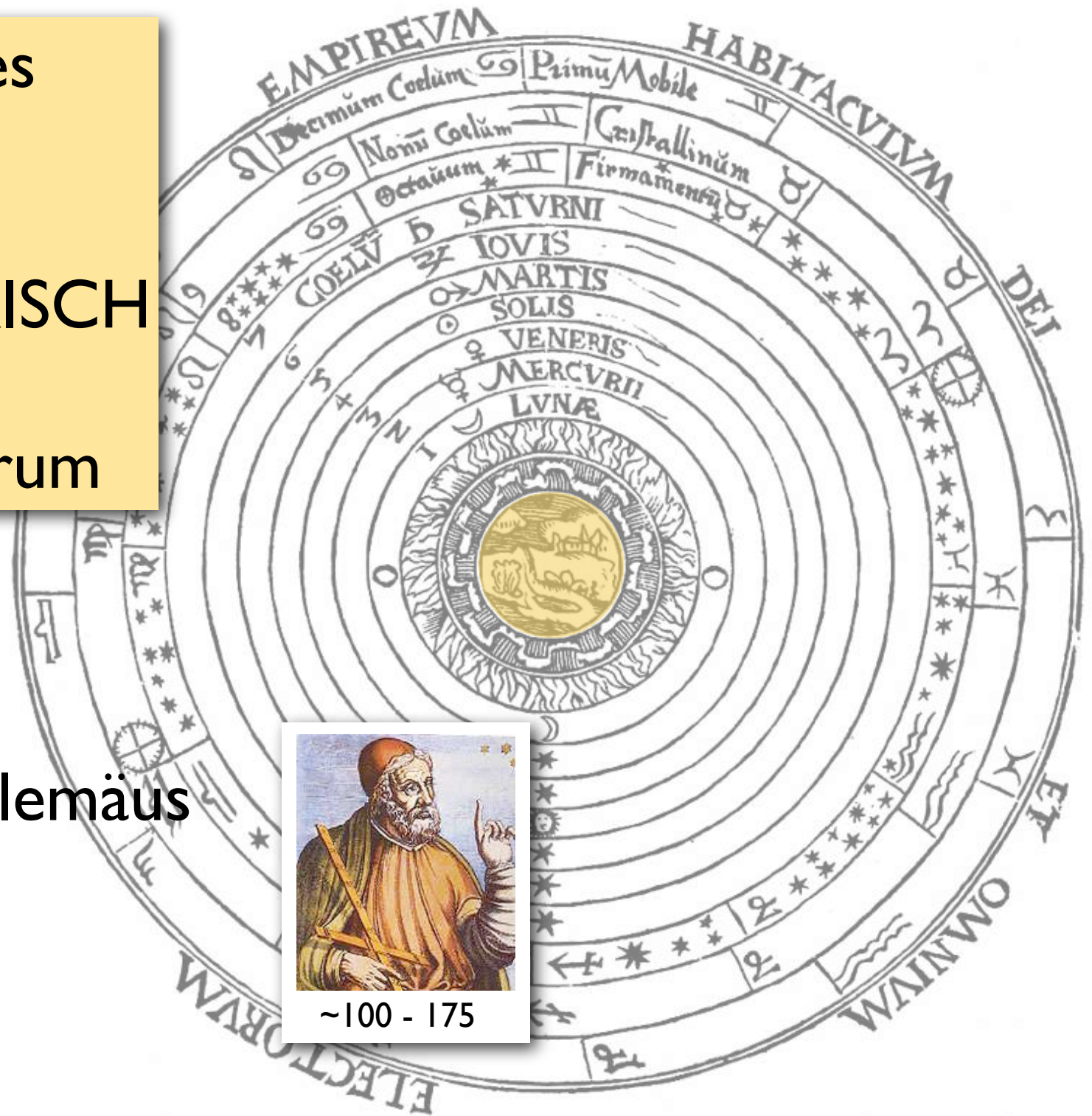
GEOZENTRISCH

Erde = Zentrum

Claudius Ptolemäus



~100 - 175



Kopernikanisches Weltbild:

HELIOZENTRISCH

Sonne = Zentrum



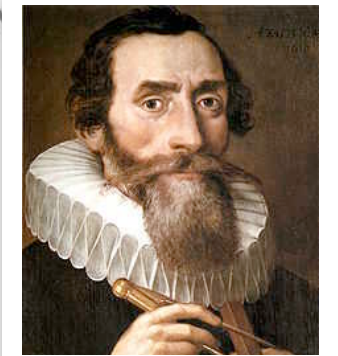
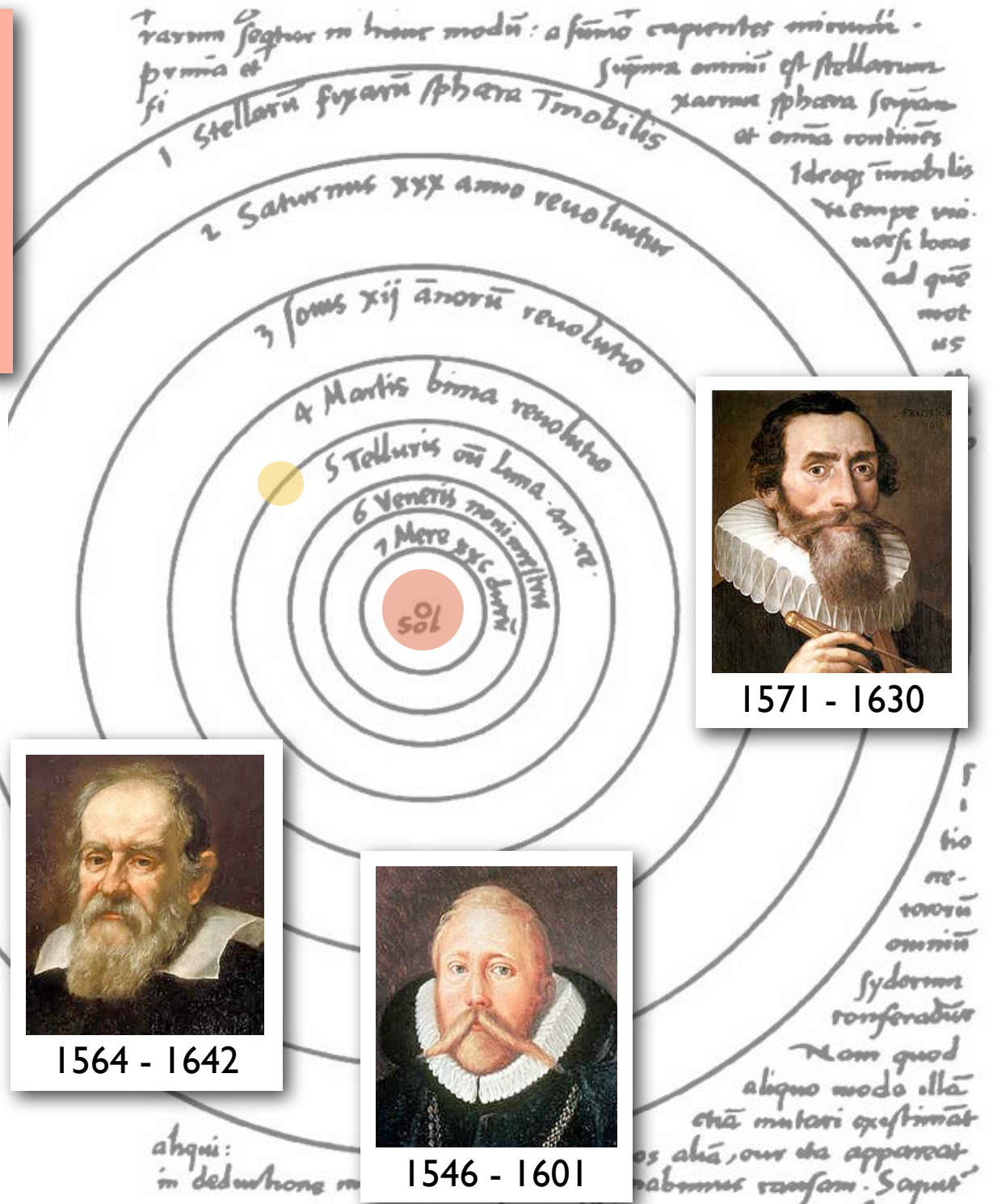
Kopernikanisches Weltbild:

HELIOZENTRISCH

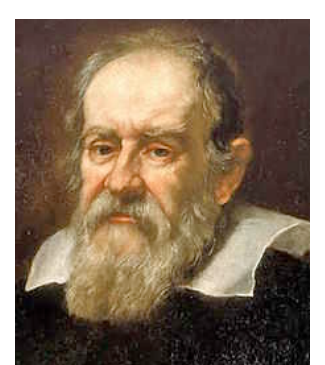
Johannes Kepler
Sonne = Zentrum
(elliptische Bahnen)

Gallileo Gallilei

Tycho Brahe



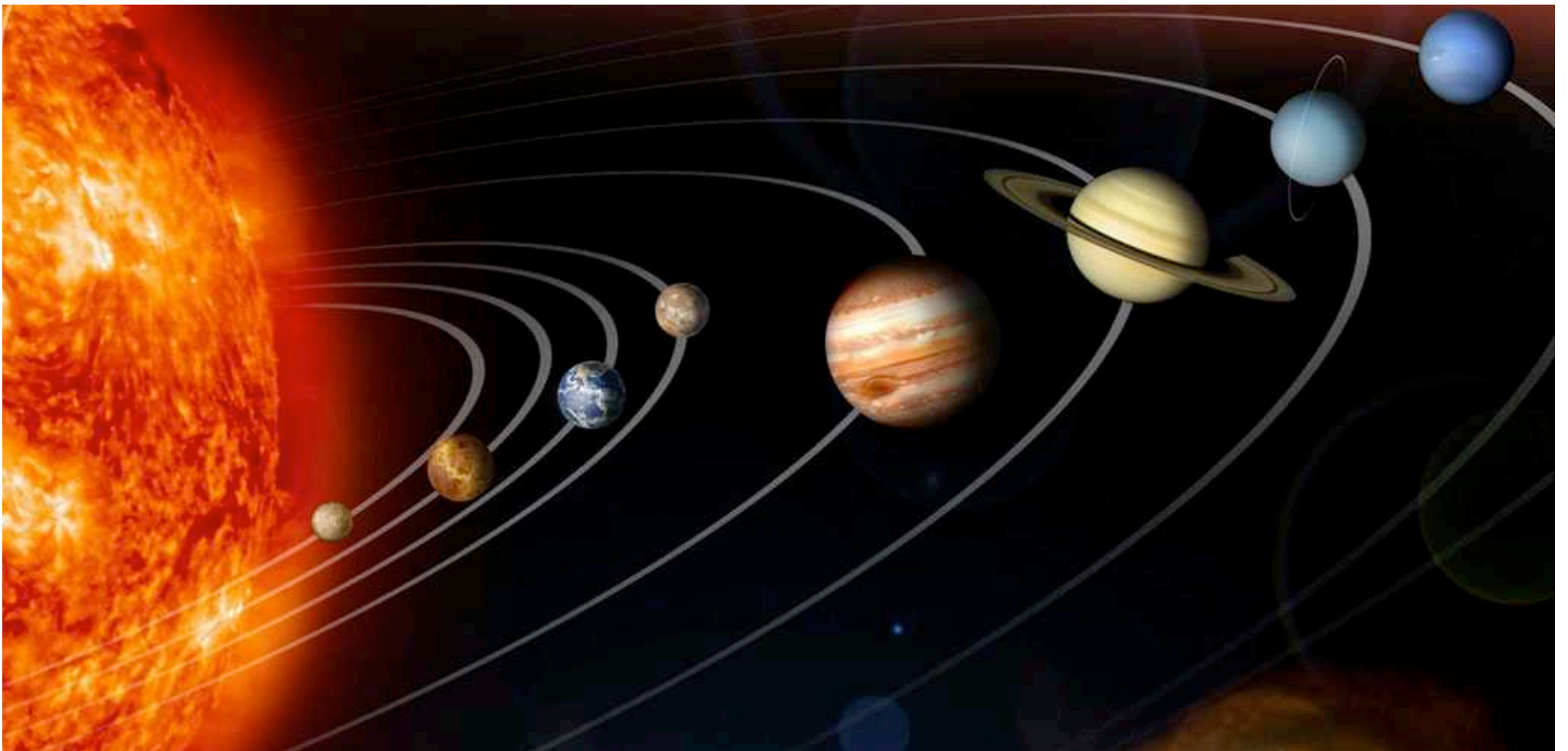
1571 - 1630



1564 - 1642

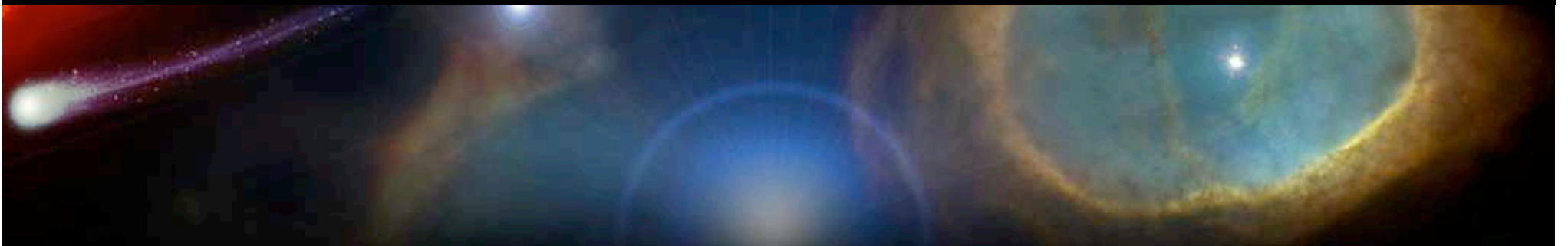


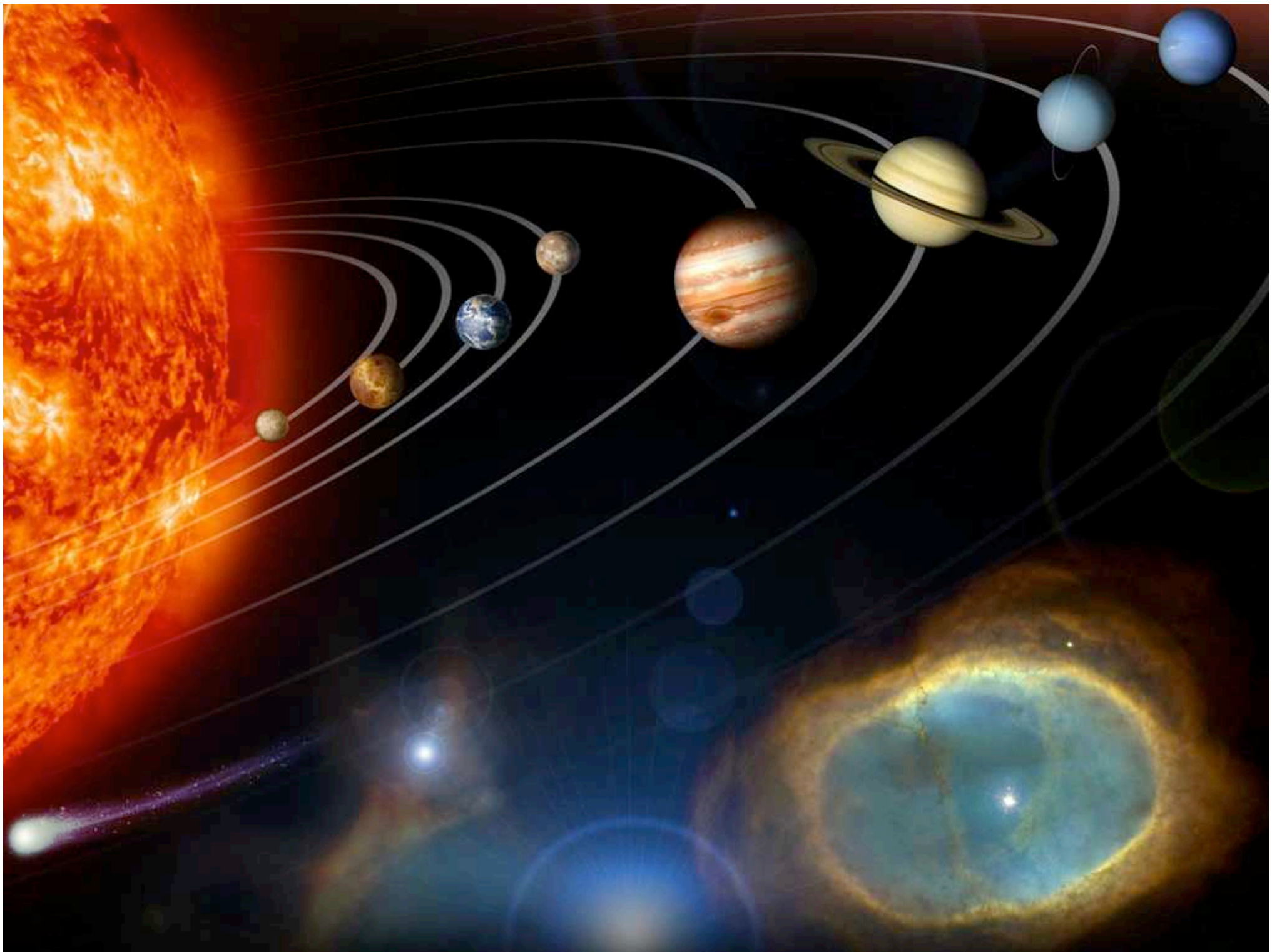
1546 - 1601



Merkur, **V**enus, **E**rde, **M**ars, **J**upiter, **S**aturn, **U**ranus, **N**eptun, **P**luto

"Mein Vater erklärt mir jeden Sonntag unsere neun Planeten"





... vom big bang bis heute

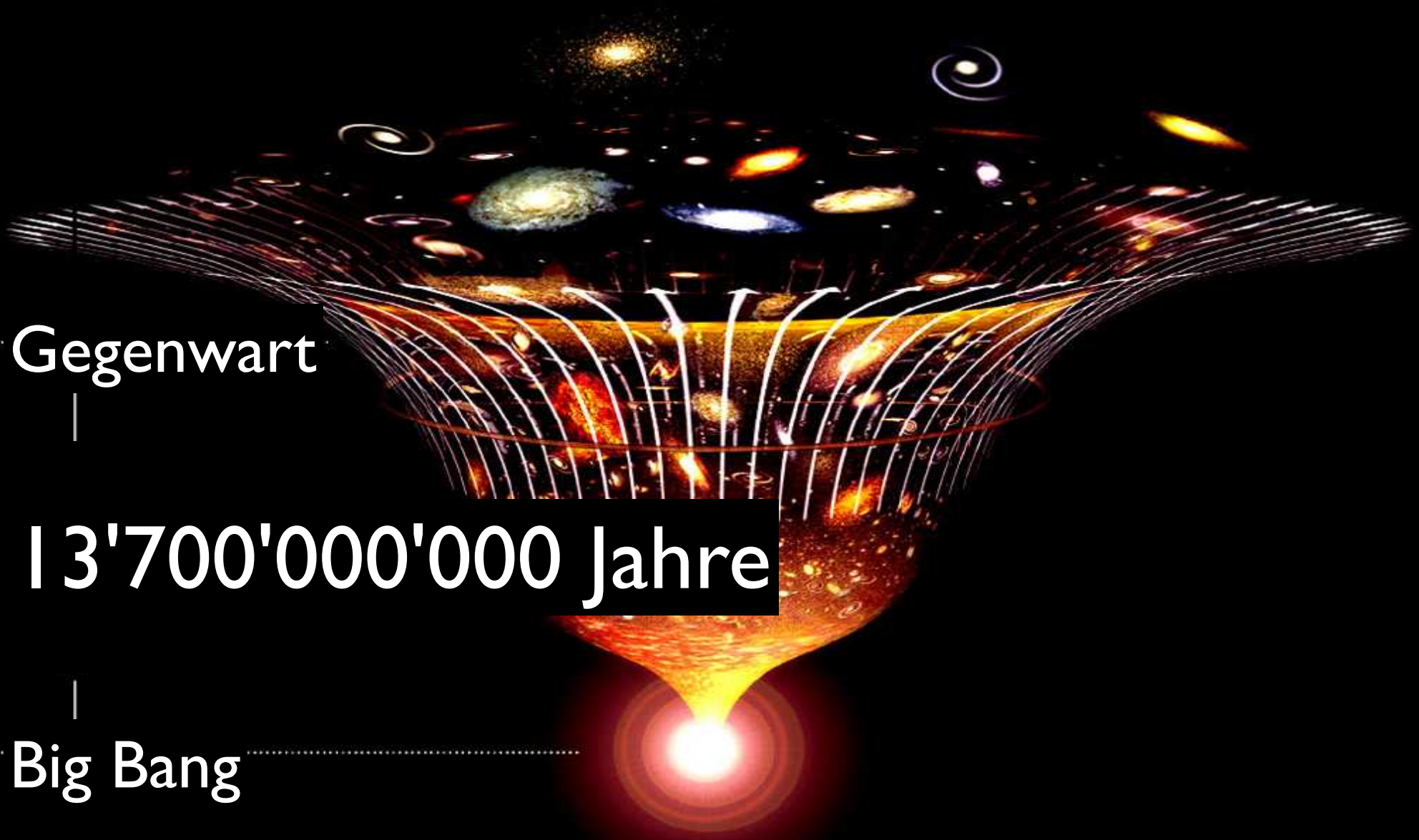
Gegenwart



13'700'000'000 Jahre



Big Bang



Zeitliche Dimensionen

Gegenwart

13.7 Ga

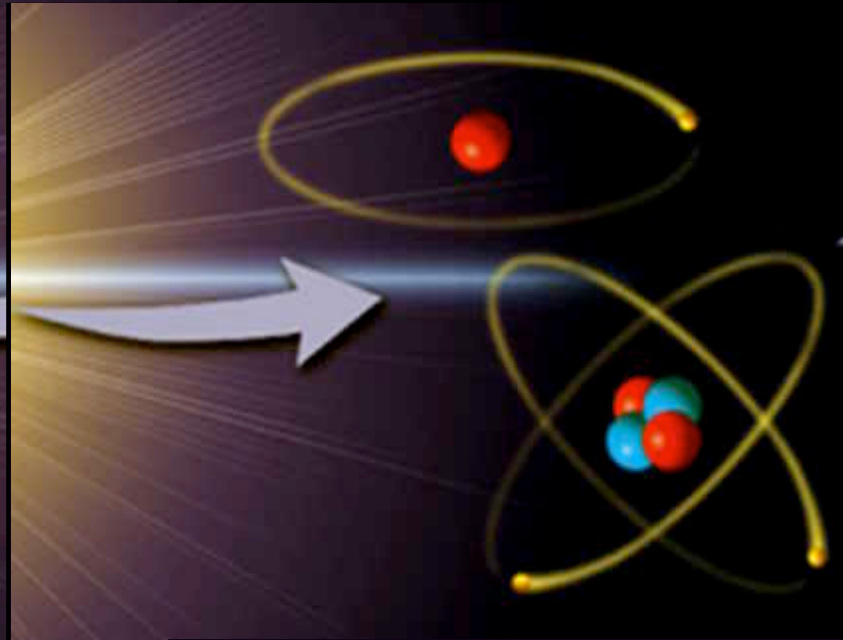
Big Bang

			Jahr
			a
kilo	1'000	$1 \cdot 10^3$	
mega	1'000'000	$1 \cdot 10^6$	Ma
giga	1'000'000'000	$1 \cdot 10^9$	Ga

Entstehung des Universums



13.7 Ga: Big Bang

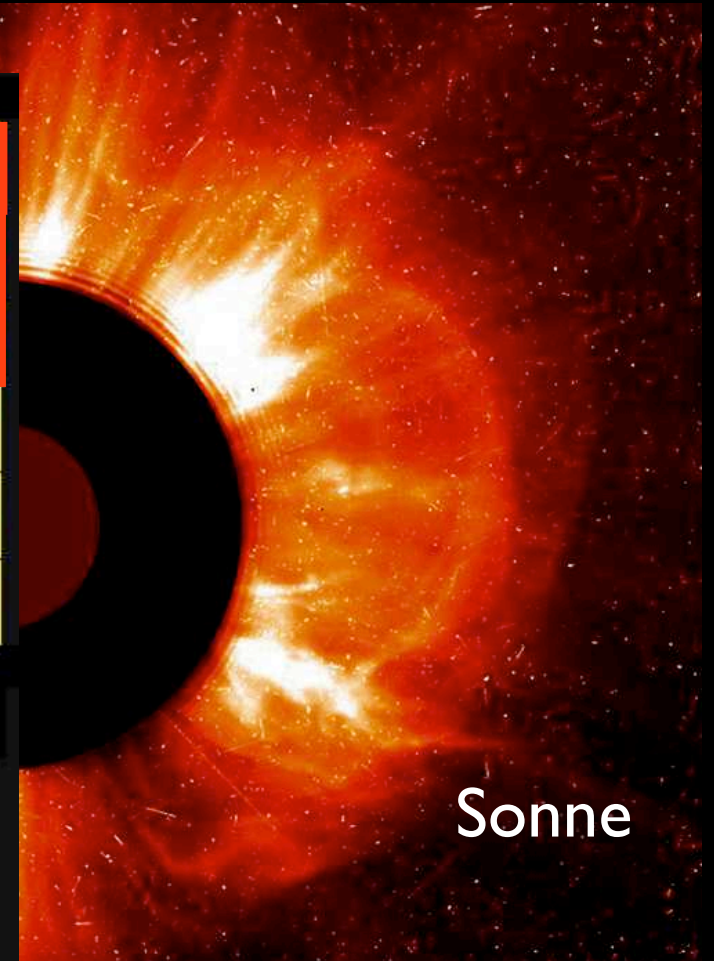


Wasserstoff- und
Helium- Atome
entstehen

Entstehung des Universums

1	2											10						
H Wasserstoff 1.01											He Helium 4.00							
3	4											5	6	7	8	9	10	
Li Lithium 6.94	Be Beryllium 9.01											B Bor 10.81	C Kohlenstoff 12.01	N Stickstoff 14.01	O Sauerstoff 15.999	F Fluor 18.998	Ne Neon 20.18	
11	12											13	14	15	16	17	18	
Na Natrium 22.99	Mg Magnesium 24.31											Al Aluminium 26.98	Si Silicium 28.09	P Phosphor 30.97	S Schwefel 32.07	Cl Chlor 35.45	Ar Argon 39.95	
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
K Kalium 39.10	Ca Calcium 40.08	Sc Scandium 44.96	Ti Titan 47.88	V Vanadium 50.94	Cr Chrom 52.00	Mn Mangan 54.94	Fe Eisen 55.85	Co Cobalt 58.93	Ni Nickel 58.70	Cu Kupfer 63.55	Zn Zink 65.41	Ga Gallium 69.72	Ge Germanium 72.64	As Arsen 74.92	Se Selen 78.96	Br Brom 79.90	Kr Krypton 83.80	
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
Rb Rubidium 85.47	Sr Strontium 87.62	Y Yttrium 88.91	Zr Zirkonium 91.22	Nb Niobium 92.91	Mo Molybdän 95.94	Tc Technetium [98]	Ru Ruthenium 101.07	Rh Rhodium 102.91	Pd Palladium 106.42	Ag Silber 107.87	Cd Cadmium 112.41	In Indium 114.82	Sn Zinn 118.71	Sb Antimon 121.76	Te Tellur 127.60	I Iod 126.90	Xe Xenon 131.29	
55	56	La-Lu		72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs Cäsium 132.91	Ba Barium 137.33			Hf Hafnium 178.49	Ta Tantal 180.95	W Wolfram 186.84	Re Rhenium 186.21	Os Osmium 190.23	Ir Iridium 192.22	Pt Platin 195.08	Au Gold 196.97	Hg Quecksilber 200.59	Tl Thallium 204.38	Pb Blei 207.2	Bi Bismut 208.98	Po Polonium [209]	At Astat [210]	Rn Radon [222]
87	88	Ac-Lr		104	105	106	107	108	109	110	111							
Fr Francium [223]	Ra Radium [226]			Rf Rutherfordium [261]	Db Dubnium [262]	Sg Seaborgium [263]	Bh Bohrium [264]	Hs Hassium [265]	Mt Meitnerium [266]	Ds Darmstadtium [268]	Rg Roentgenium [272]							

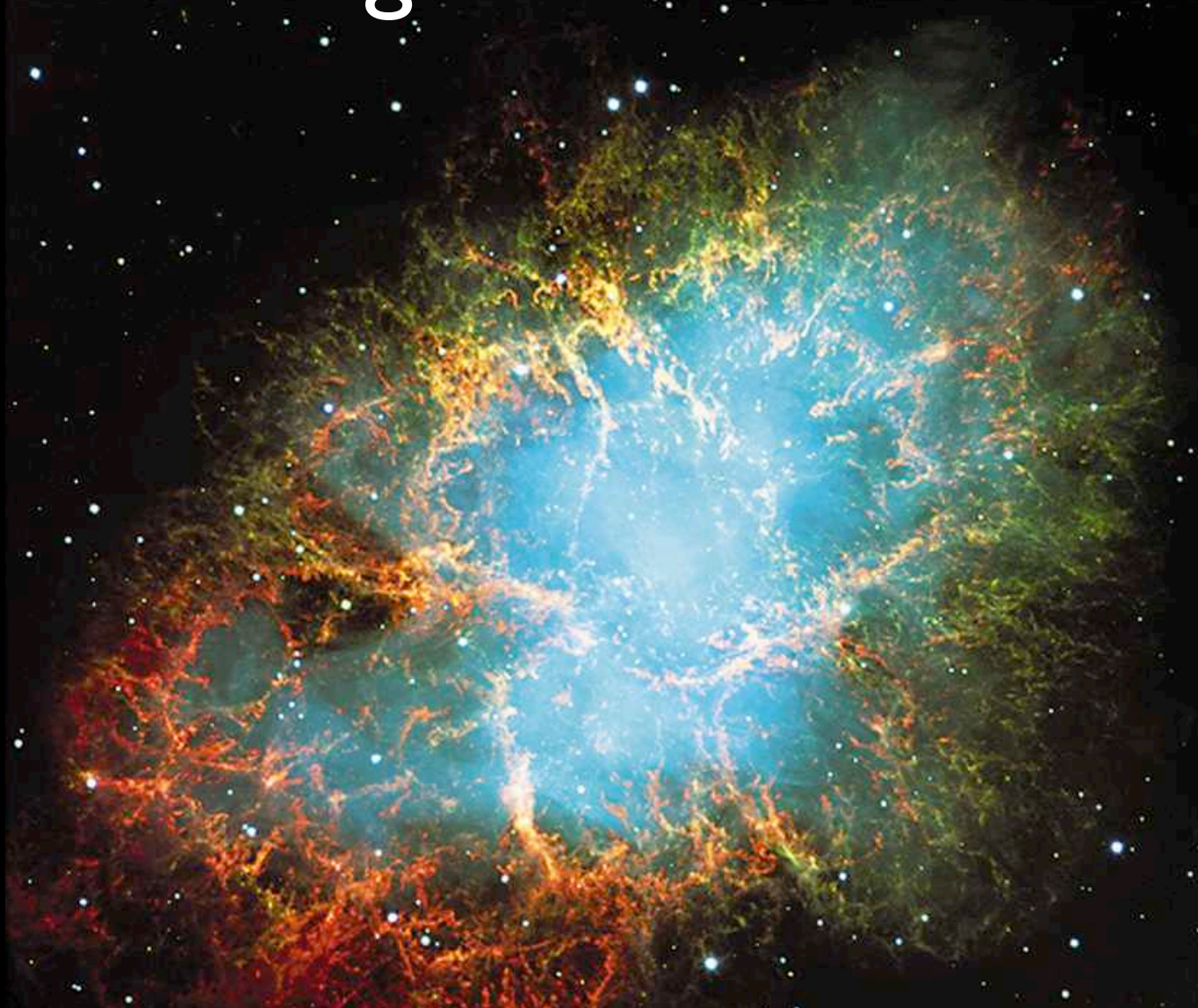
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La Lanthan 138.91	Ce Cer 140.12	Pr Praseodym 140.91	Nd Neodym 144.24	Pm Promethium [147]	Sm Samarium 150.36	Eu Europium 151.97	Gd Gadolinium 157.25	Tb Terbium 158.93	Dy Dysprosium 162.50	Ho Holmium 164.93	Er Erbium 167.26	Tm Thulium 168.93	Yb Ytterbium 173.04	Lu Lutetium 174.97
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac Actinium 227.03	Th Thorium 232.04	Pa Protactinium 231.04	U Uran 238.03	Np Neptunium [237]	Pu Plutonium [244]	Am Americium [243]	Cm Curium [247]	Bk Berkelium [247]	Cf Californium [251]	Es Einsteinium [252]	Fm Fermium [257]	Md Mendelevium [258]	No Nobelium [259]	Lr Lawrencium [262]



Sonne

Sterne wirken als "Element-Fabriken"
kleine Sterne (10 Ga): Elemente mit $N < 6$
grosse Sterne (20 Ma): Elemente mit $N < 26$

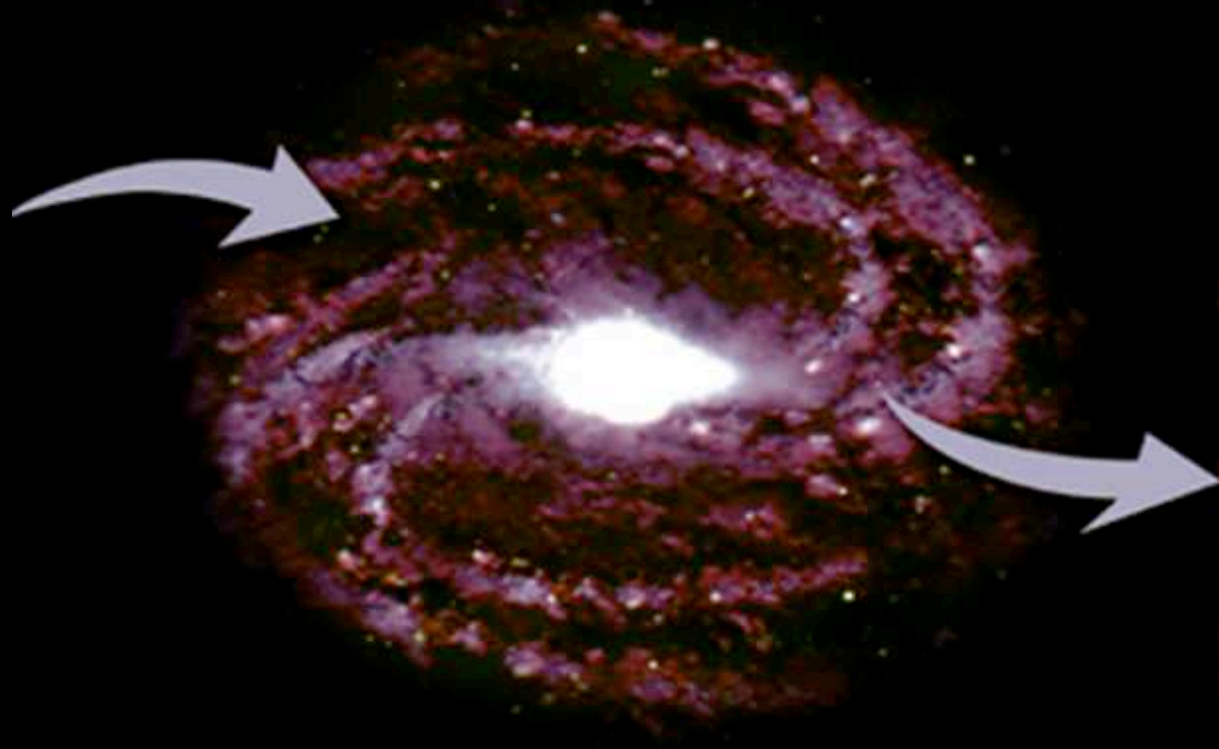
Entstehung des Universums



Crab Nebula

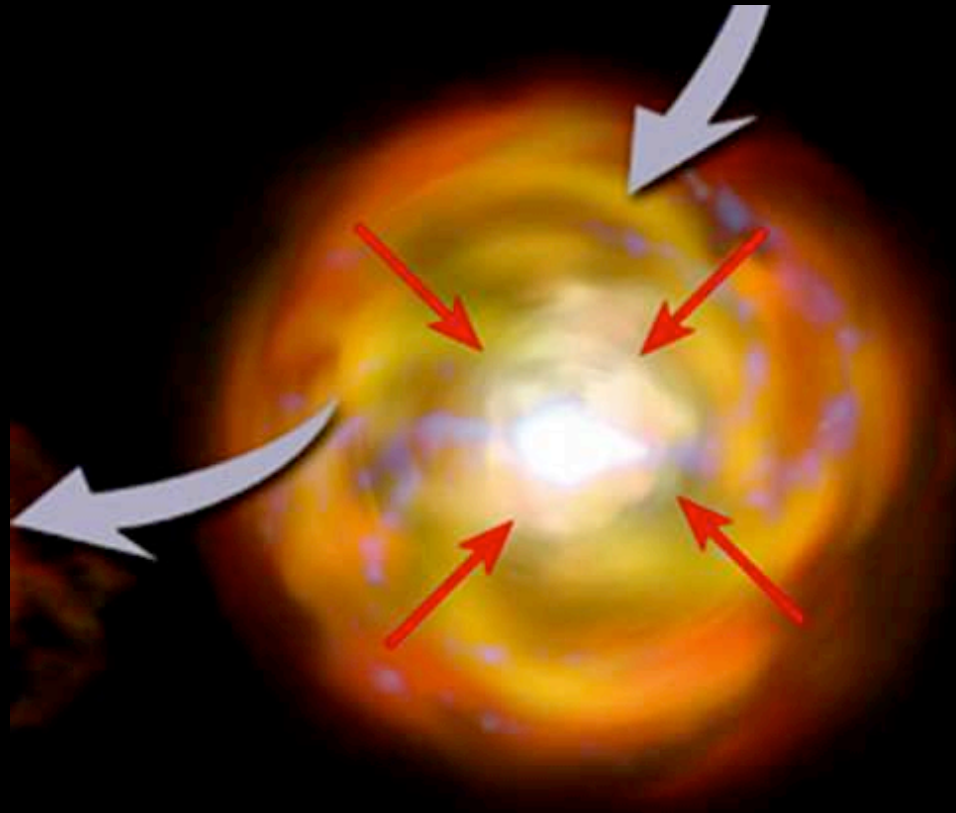
schwere Elemente ($Z > 26$) werden
in Supernova - Explosionen synthetisiert

Entstehung des Universums



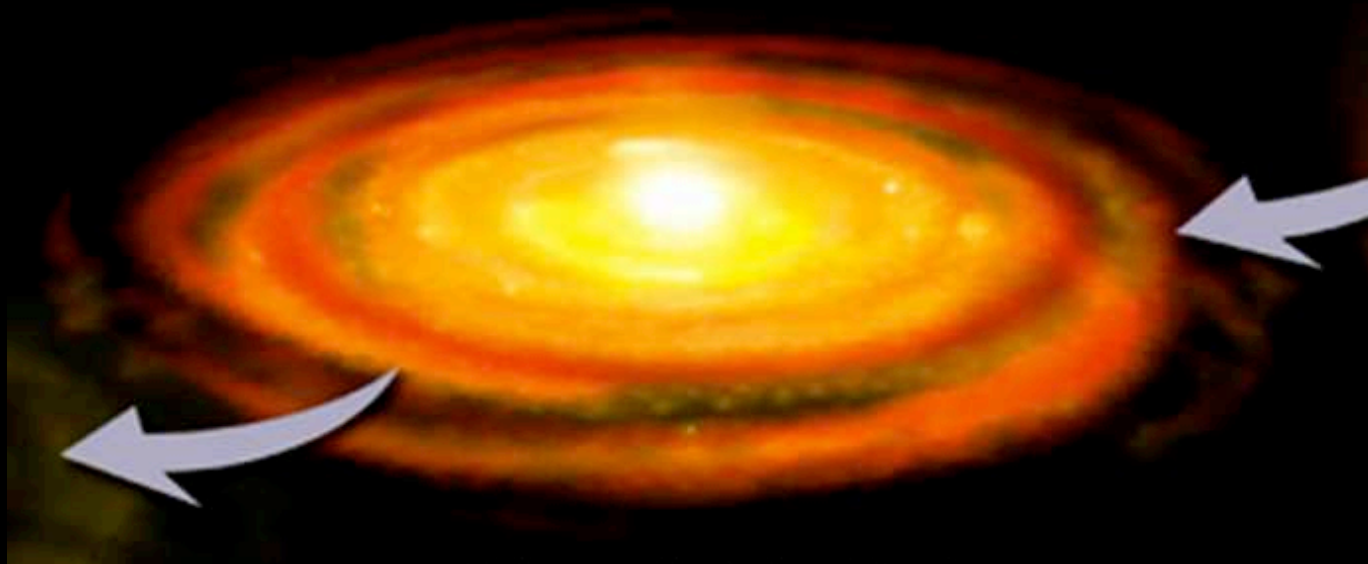
10 Ga: unsere Galaxis entsteht

Entstehung des Sonnensystems



4.7 Ga: Solarnebel beginnt
sich zusammenzuziehen

Entstehung des Sonnensystems



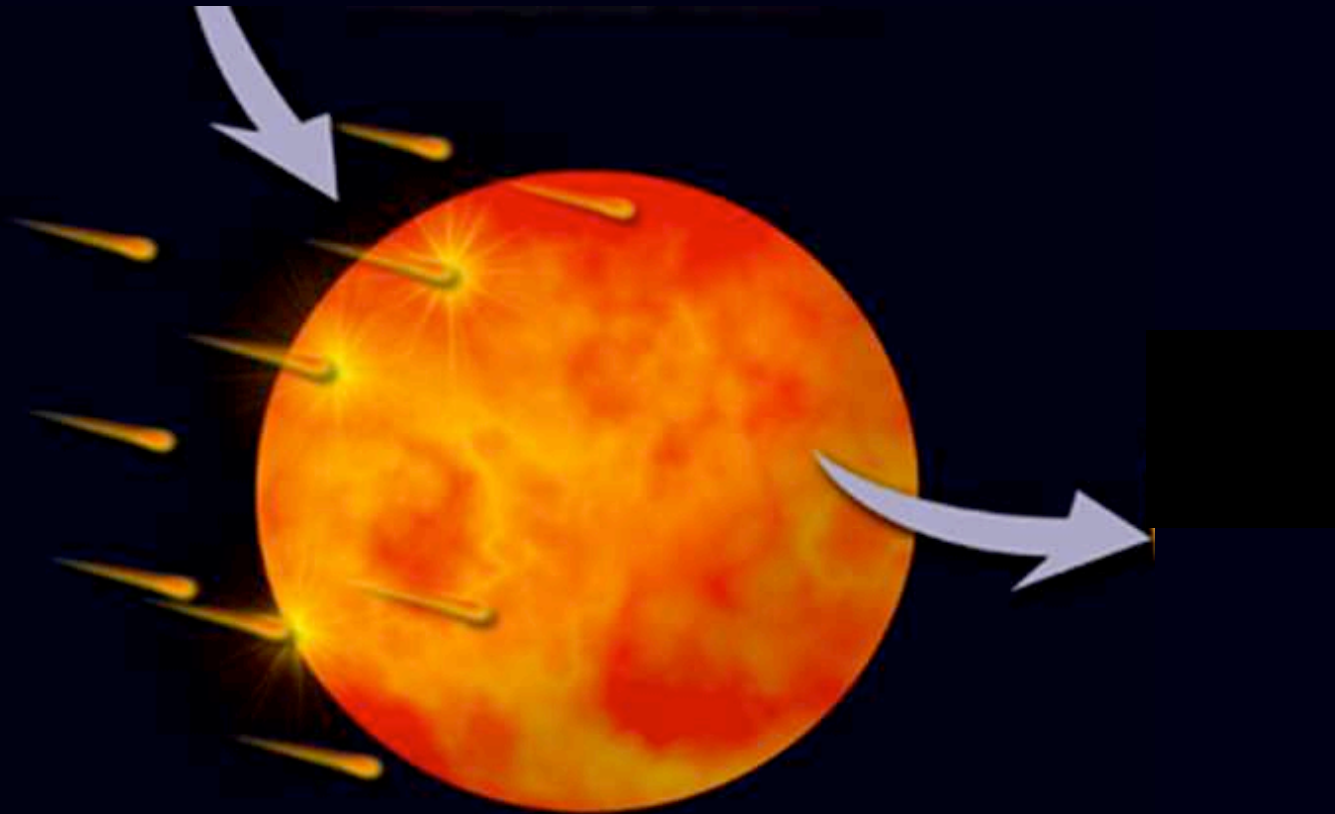
Abplattung durch Rotation -
Material sammelt sich auf Scheibe

Entstehung des Sonnensystems

Akkretion von Vorläufern ('Planetesimals')
führt zur Entstehung von Planeten

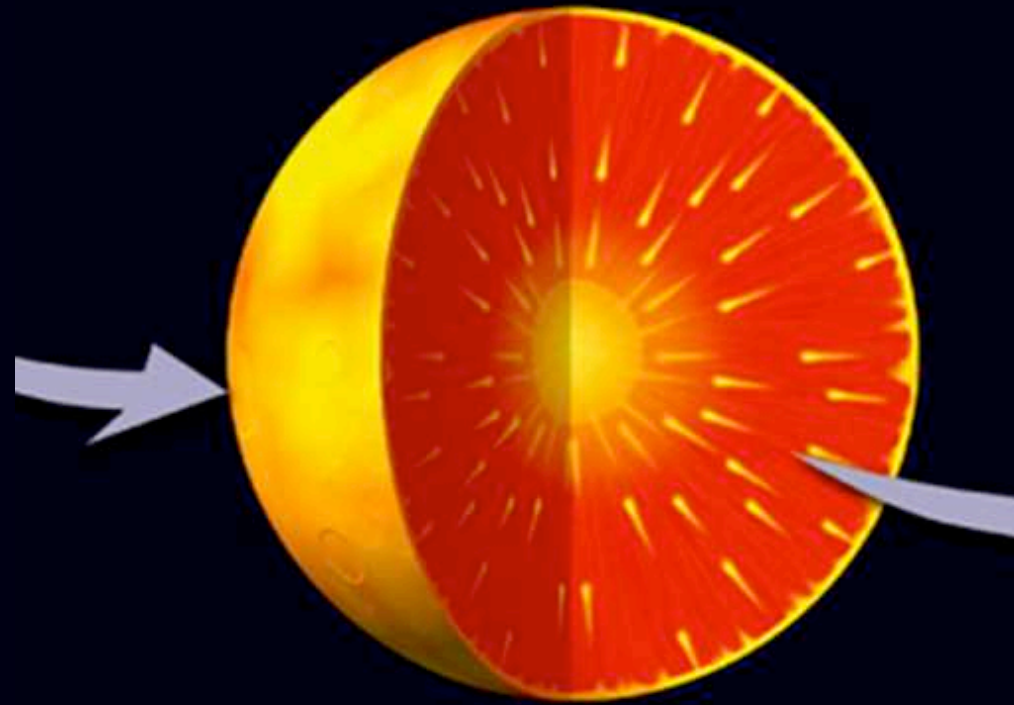


Entstehung der Erde



Fortgesetztes Bombardement und Zerfall von radioaktiven Elementen führen zur Entstehung eines Magma-Ozeans

Entstehung der Erde



Chemische Differenzierung führt
zum Schalenbau der Erde

Entstehung der Erde

nach oben \Rightarrow Kruste:

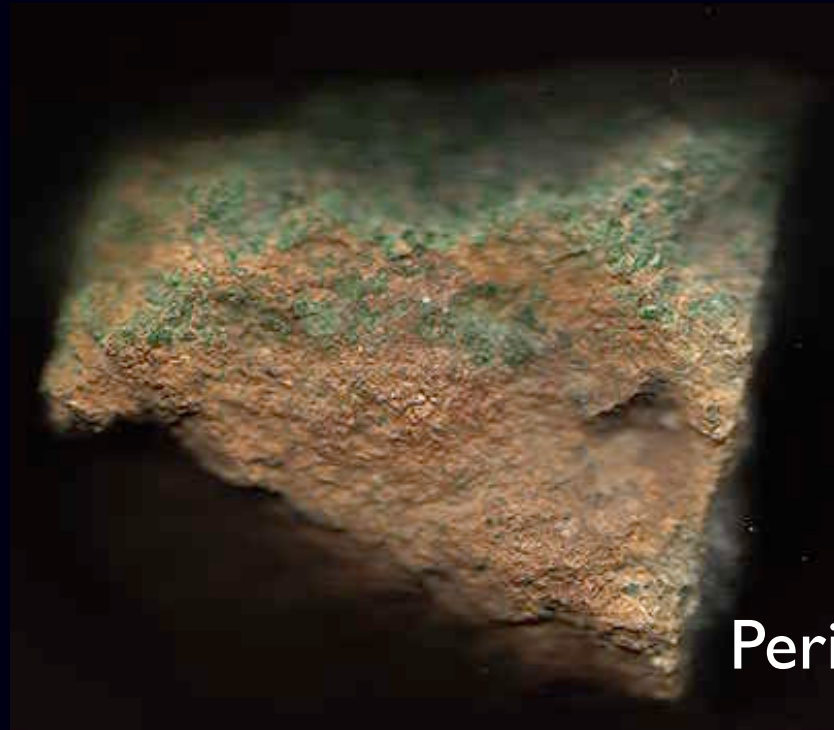
Si Al



Granodiorit

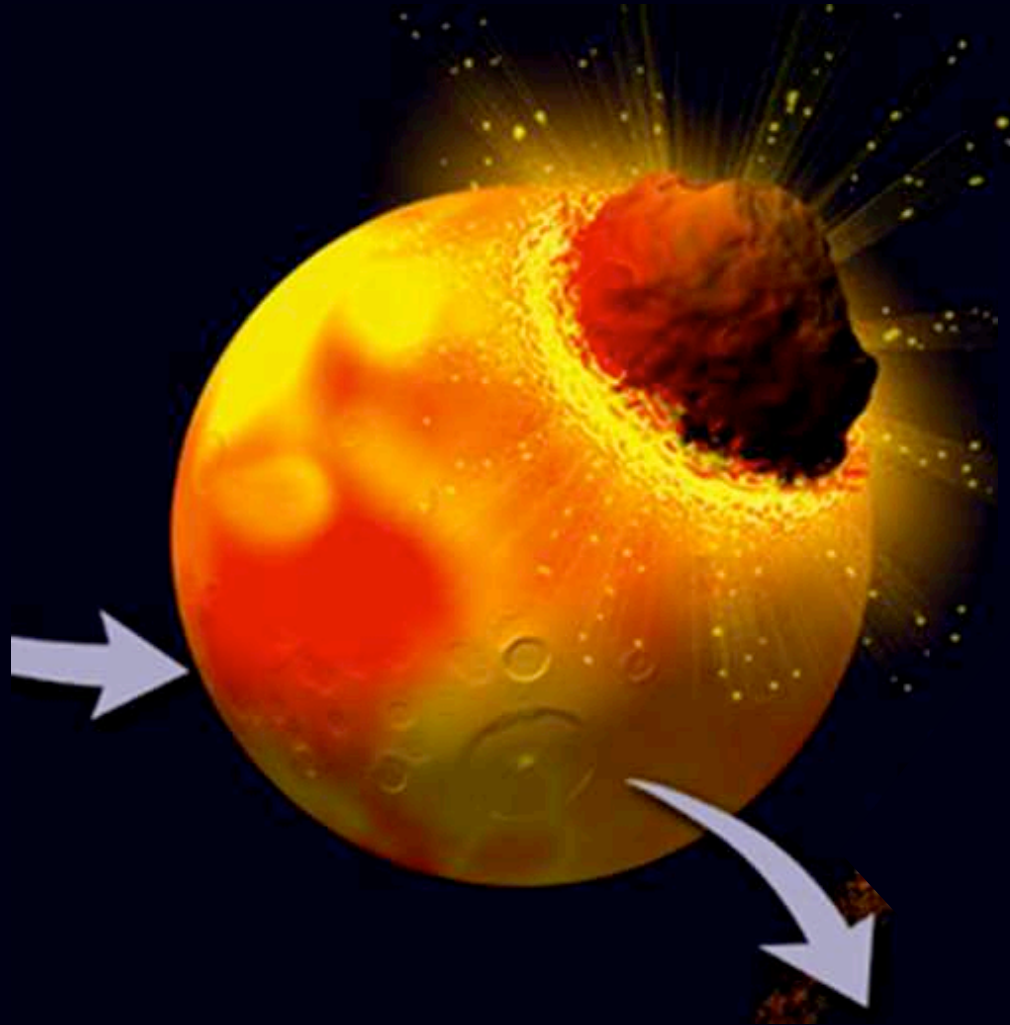
nach unten \Rightarrow Mantel:

Fe Mg



Peridotit

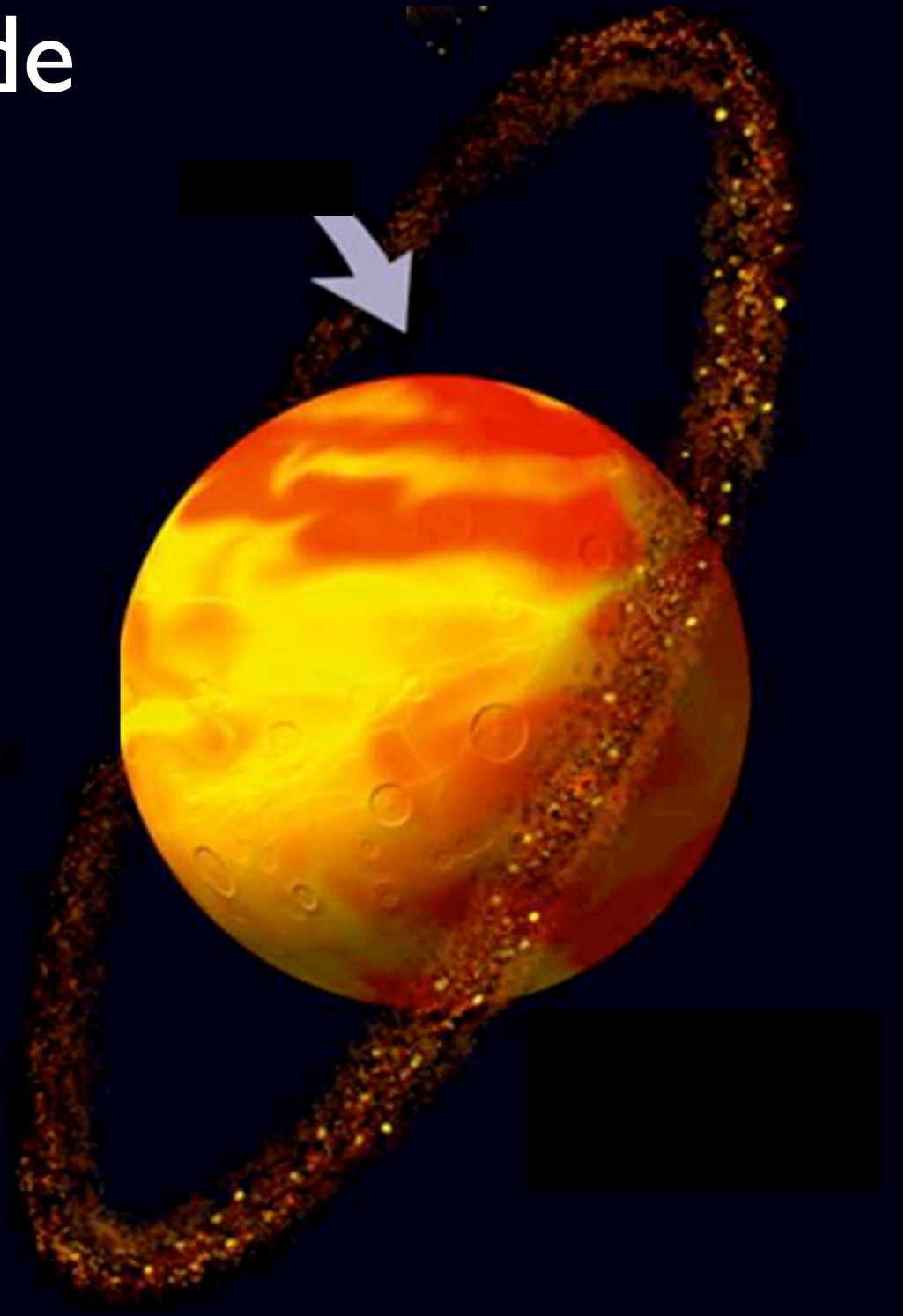
Entstehung der Erde



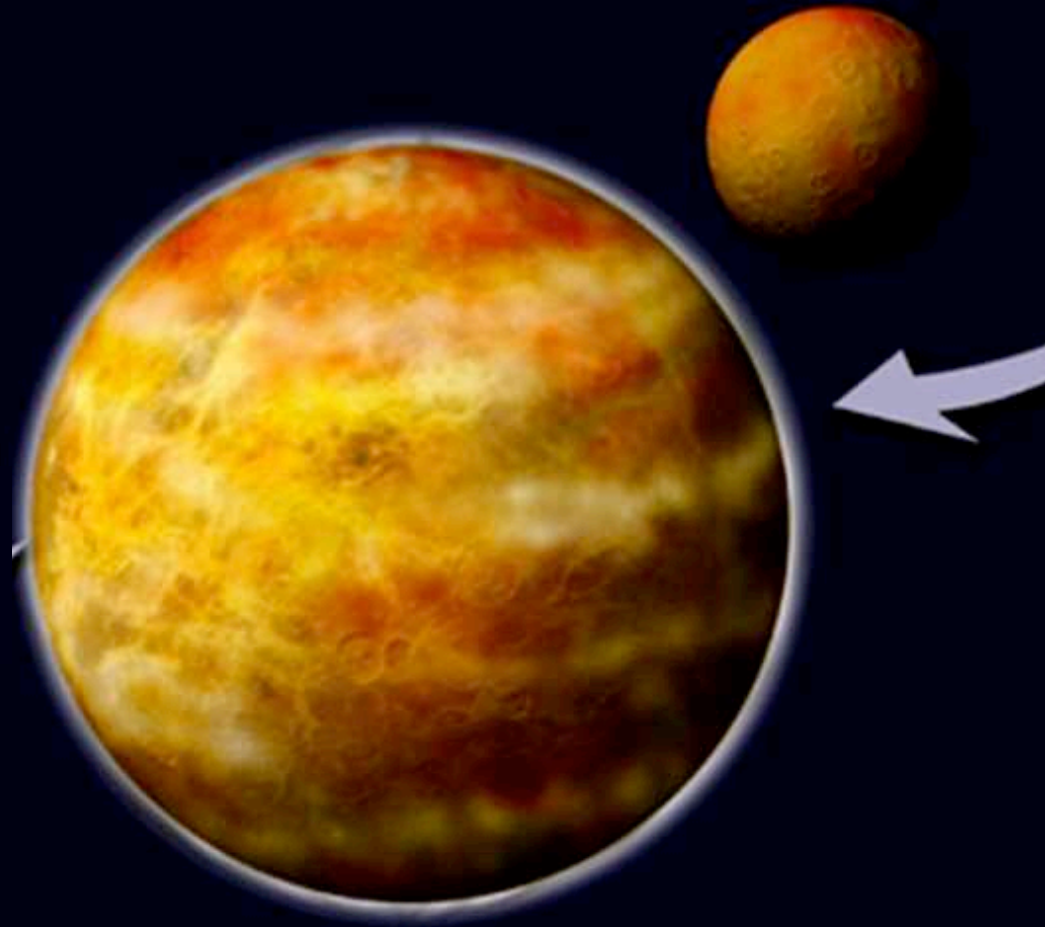
4.6 Ga: Objekt von
Marsgrösse kollidiert
mit Erde

Entstehung der Erde

Trümmer sammeln
sich auf Umlaufbahn
und akkretieren

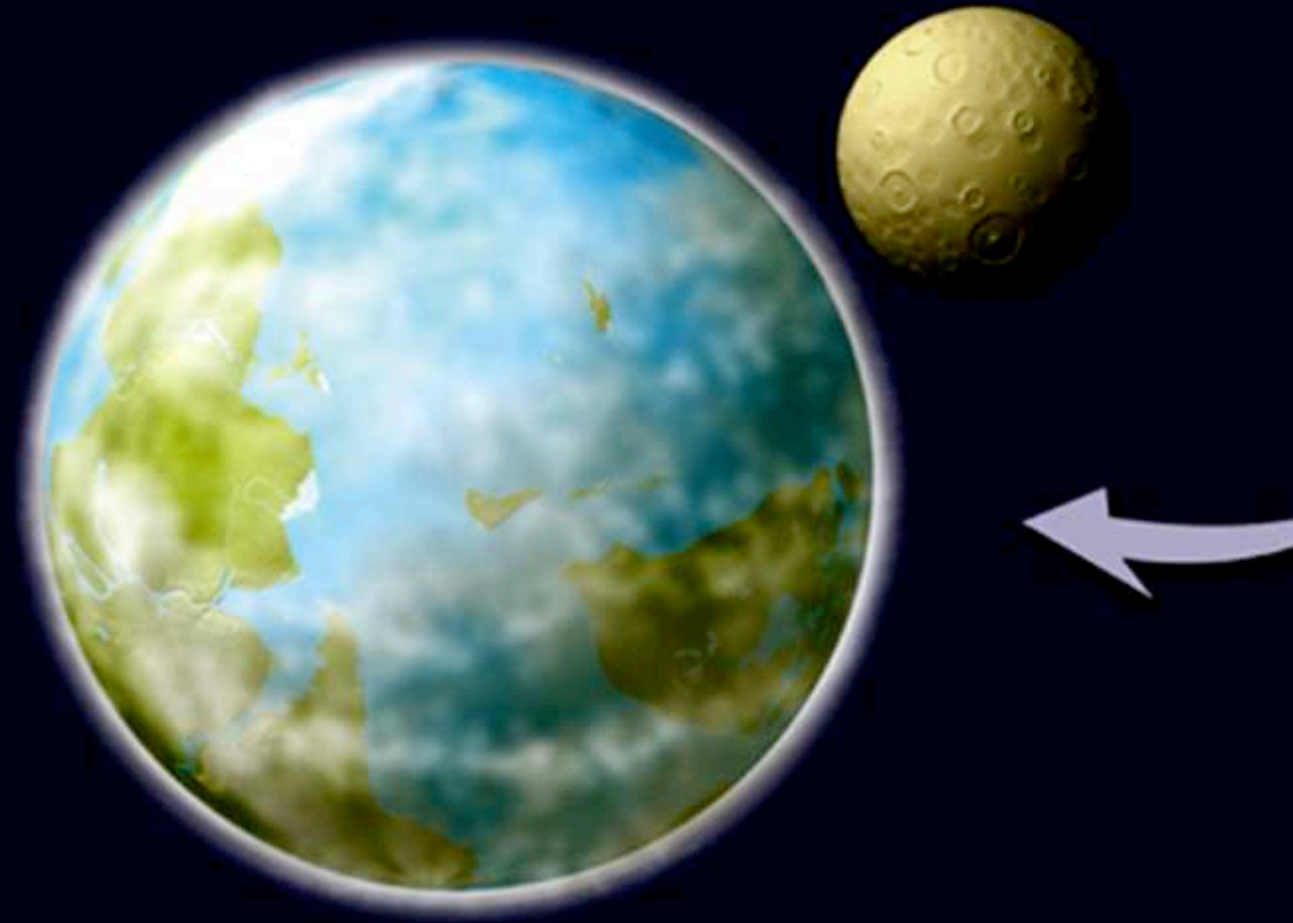


Entstehung der Erde



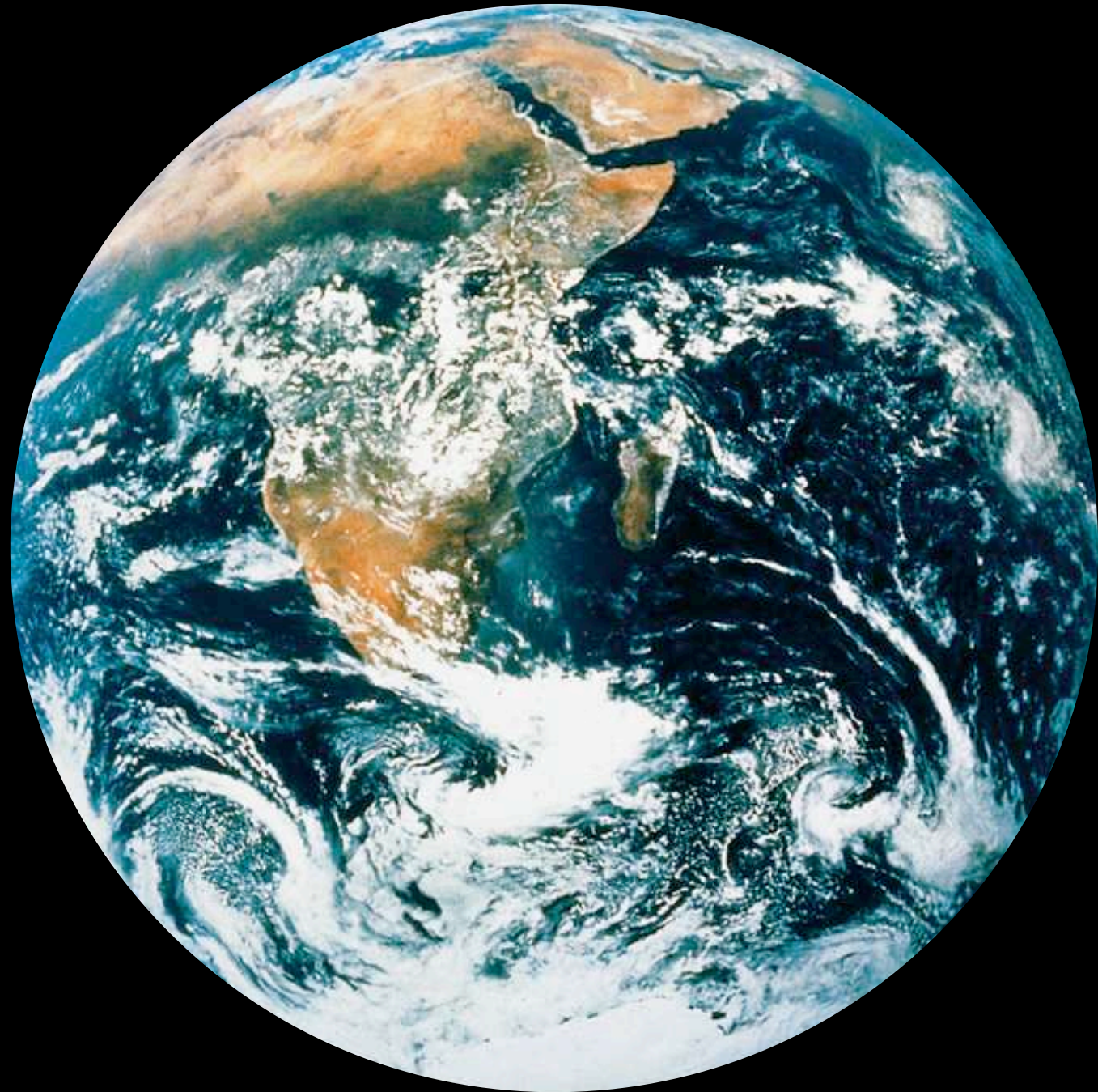
4.5 Ga: Entstehung des Erde-Mond Systems

Entstehung der Erde



Durch Entgasung entsteht die
erste Atmosphäre der Erde

heute



Technische Daten

Sonnenradius = $6.957 \cdot 10^8$ m (695'700 km) (= 109 · Erdradius)

Masse = $1,989 \cdot 10^{30}$ kg (99.85% des Sonnensystems)

mittlere Distanz Erde Sonne = $1.50 \cdot 10^{11}$ m (150'000'000 km)

Erde, mittlerer Radius = $6.371 \cdot 10^6$ m (6'371 km)

Erdradius: Äquator: $6.378 \cdot 10^6$ m - Pol: $6.357 \cdot 10^6$ m

Masse = $5.9736 \cdot 10^{24}$ kg

Jährlicher Zuwachs (Meteorite, Staub) $\approx 10^7$ kg (10'000 t)

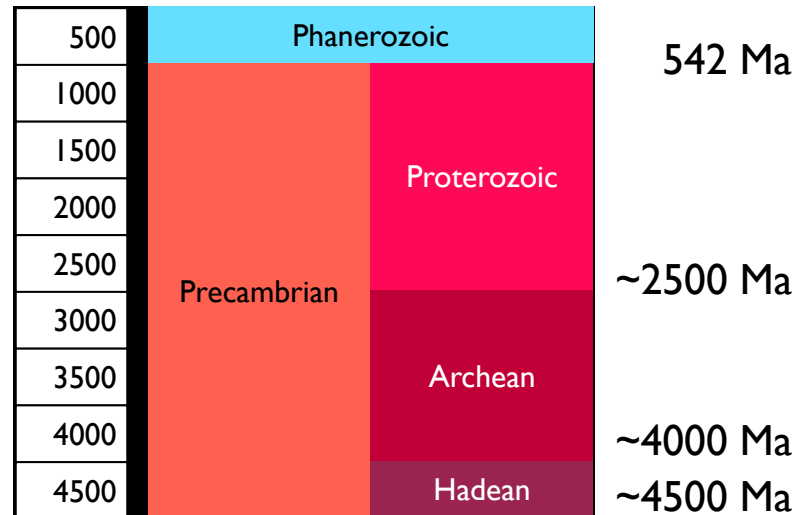
Mittlere Dichte = $5'500 \text{ kgm}^{-3}$



Geologische Zeiträume

Entstehung ...

... der Erde
~ 4.5 Ga



supernova

big bang

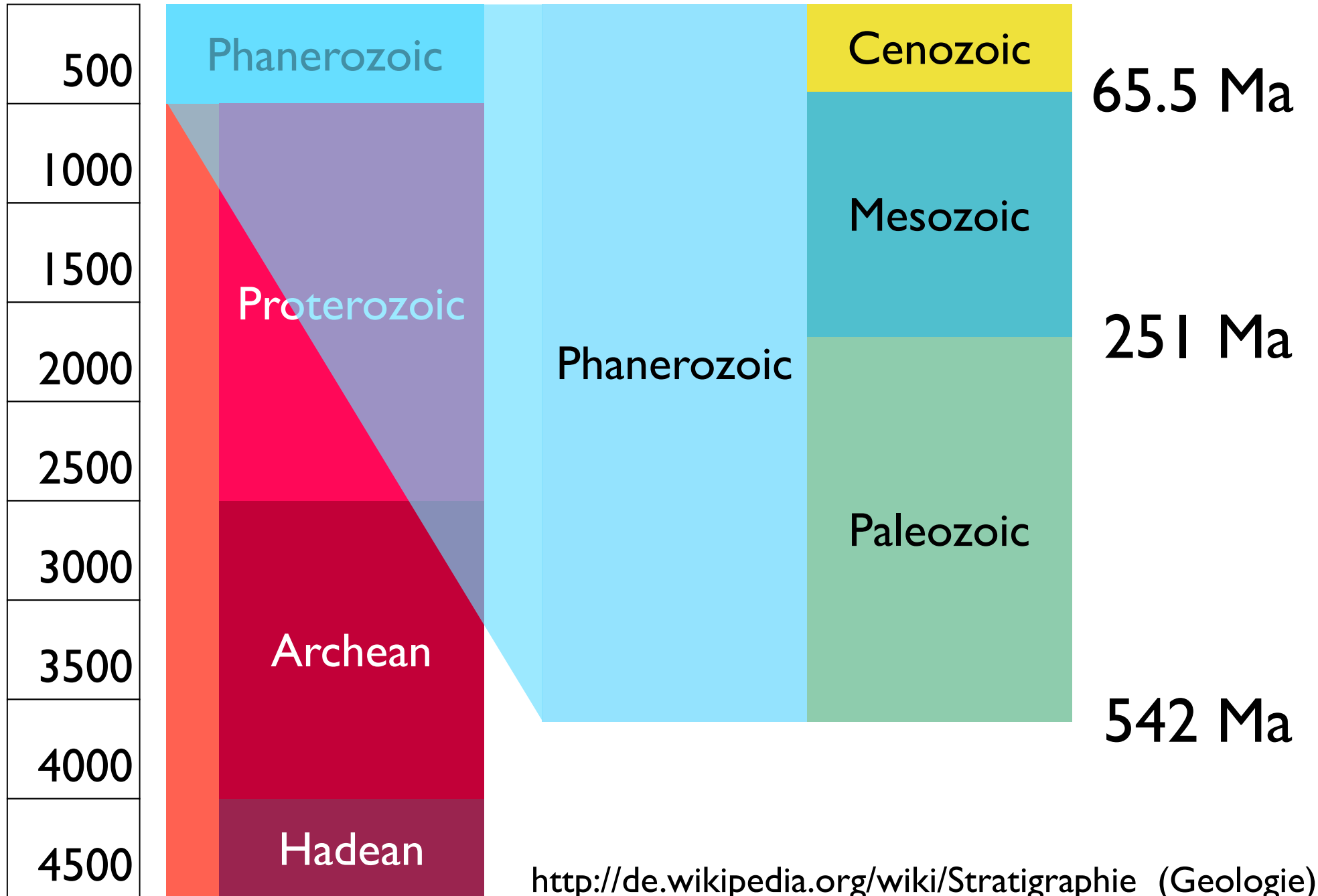
1 a	1 Jahr
1 Ma	10^6 Jahre
1 Ga	10^9 Jahre

... des Universums
~13.7 Ga

1 a	$\sim 3 \cdot 10^7$ s
-----	-----------------------

Äon

Ära (Zeitalter)



[http://de.wikipedia.org/wiki/Stratigraphie_\(Geologie\)](http://de.wikipedia.org/wiki/Stratigraphie_(Geologie))

4.7 Ga Erdgeschichte in 365 Tagen

Eonothem Eon	Erathem Era	System Period	Series Epoch	Stage Age	Age Ma	GSSP	
Phanerozoic	Cenozoic	Quaternary *	Holocene		0.0117	👉	
			Pleistocene	Upper		0.126	
				"Ionian"		0.781	
			Pliocene	Calabrian		1.806	👉
				Gelasian		2.588	👉
		Neogene	Miocene	Piacenzian		3.600	👉
				Zanclean		5.332	👉
				Messinian		7.246	👉
				Tortonian		11.608	👉
				Serravallian		13.82	👉
			Oligocene	Langhian		15.97	👉
				Burdigalian		20.43	👉
				Aquitanian		23.03	👉
				Chattian		28.4 ± 0.1	👉
				Rupelian		33.9 ± 0.1	👉
	Eocene	Priabonian		37.2 ± 0.1	👉		
		Bartonian		40.4 ± 0.2	👉		
		Lutetian		48.6 ± 0.2	👉		
		Ypresian		55.8 ± 0.2	👉		
		Thanetian		58.7 ± 0.2	👉		
	Paleocene	Selandian		~ 61.1	👉		
		Danian		65.5 ± 0.3	👉		
		Maastrichtian		70.6 ± 0.6	👉		
		Campanian		83.5 ± 0.7	👉		
		Santonian		85.8 ± 0.7	👉		
	Mesozoic	Cretaceous	Upper	Coniacian		~ 88.6	👉
				Turonian		93.6 ± 0.8	👉
				Cenomanian		99.6 ± 0.9	👉
				Albian		112.0 ± 1.0	👉
				Aptian		125.0 ± 1.0	👉
		Lower	Barremian		130.0 ± 1.5	👉	
			Hauterivian		~ 133.9	👉	
			Valanginian		140.2 ± 3.0	👉	
			Berriasian		145.5 ± 4.0	👉	

Eonothem Eon	Erathem Era	System Period	Series Epoch	Stage Age	Age Ma	GSSP	
Phanerozoic	Mesozoic	Jurassic	Upper	Tithonian		145.5 ± 4.0	
				Kimmeridgian		150.8 ± 4.0	
				Oxfordian		~ 155.6	
			Middle	Callovian		161.2 ± 4.0	
				Bathonian		164.7 ± 4.0	👉
		Lower	Bajocian		167.7 ± 3.5	👉	
			Aalenian		171.6 ± 3.0	👉	
			Toarcian		175.6 ± 2.0	👉	
			Pliensbachian		183.0 ± 1.5	👉	
			Sinemurian		189.6 ± 1.5	👉	
		Triassic	Upper	Hettangian		196.5 ± 1.0	👉
				Rhaetian		199.6 ± 0.6	👉
				Norian		203.6 ± 1.5	👉
			Middle	Carnian		~ 228.7	👉
				Ladinian		216.5 ± 2.0	👉
	Lower		Anisian		~ 237.0 ± 2.0	👉	
			Olenekian		~ 245.9	👉	
			Induan		~ 249.5	👉	
			Changhsingian		251.0 ± 0.4	👉	
			Wuchiapingian		253.8 ± 0.7	👉	
	Paleozoic	Permian	Lopingian		260.4 ± 0.7	👉	
			Guadalupian		265.8 ± 0.7	👉	
			Wordian		268.0 ± 0.7	👉	
			Roadian		270.6 ± 0.7	👉	
			Kungurian		275.6 ± 0.7	👉	
Carboniferous		Cisuralian	Artinskian		284.4 ± 0.7	👉	
			Sakmarian		294.6 ± 0.8	👉	
			Asselian		299.0 ± 0.8	👉	
			Gzhelian		303.4 ± 0.9	👉	
			Kasimovian		307.2 ± 1.0	👉	
Carboniferous	Pennsylvanian	Upper		311.7 ± 1.1	👉		
		Middle		318.1 ± 1.3	👉		
	Mississippian	Lower		328.3 ± 1.6	👉		
		Upper		345.3 ± 2.1	👉		
		Lower		359.2 ± 2.5	👉		

Eonothem Eon	Erathem Era	System Period	Series Epoch	Stage Age	Age Ma	GSSP	
Phanerozoic	Paleozoic	Devonian	Upper	Famennian		359.2 ± 2.5	👉
				Frasnian		374.5 ± 2.6	👉
			Middle	Givetian		385.3 ± 2.6	👉
				Eifelian		391.8 ± 2.7	👉
				Emsian		397.5 ± 2.7	👉
		Lower	Pragian		407.0 ± 2.8	👉	
			Lochkovian		411.2 ± 2.8	👉	
			Pridoli		416.0 ± 2.8	👉	
			Ludlow		418.7 ± 2.7	👉	
			Ludfordian		421.3 ± 2.6	👉	
		Silurian	Wenlock	Gorstian		422.9 ± 2.5	👉
				Homerian		426.2 ± 2.4	👉
			Llandovery	Telychian		428.2 ± 2.3	👉
				Aeronian		436.0 ± 1.9	👉
				Rhuddanian		439.0 ± 1.8	👉
	Ordovician	Upper	Hirnantian		443.7 ± 1.5	👉	
			Katian		445.6 ± 1.5	👉	
		Middle	Sandbian		455.8 ± 1.6	👉	
			Darriwilian		460.9 ± 1.6	👉	
			Dapingian		468.1 ± 1.6	👉	
	Cambrian	Lower	Floian		471.8 ± 1.6	👉	
			Tremadocian		478.6 ± 1.7	👉	
		Furongian	Stage 10		488.3 ± 1.7	👉	
			Stage 9		~ 492 *	👉	
			Stage 8		~ 496 *	👉	
Cambrian	Series 3	Paibian		~ 499	👉		
		Guzhangian		~ 503	👉		
		Drumian		~ 506.5	👉		
		Stage 5		~ 510 *	👉		
		Stage 4		~ 515 *	👉		
Cambrian	Series 2	Stage 3		~ 521 *	👉		
		Stage 2		~ 528 *	👉		
		Fortunian		542.0 ± 1.0	👉		

Eonothem Eon	Erathem Era	System Period	Age Ma	GSSP GSSA	
Precambrian	Proterozoic	Neoproterozoic	Ediacaran	542	
			Cryogenian	~ 635	👉
		Mesoproterozoic	Tonian	850	👉
			Stenian	1000	👉
			Ectasian	1200	👉
			Calymmian	1400	👉
			Statherian	1600	👉
			Orosirian	1800	👉
		Paleoproterozoic	Rhyacian	2050	👉
			Siderian	2300	👉
	Neoproterozoic		2500	👉	
	Mesoarchean		2800	👉	
	Paleoarchean		3200	👉	
	Archean	Hadean (informal)	Eoarchean	3600	👉
			~ 4000	👉	
~ 4600			👉		

4.7 Ga Erdgeschichte in 365 Tagen

Eonothem Eon	Erathem Era	System Period	Series Epoch	Stage Age	Age Ma	GSSP	
Phanerozoic	Cenozoic	Quaternary *	Holocene		0.0117	👉	
			Upper				
			Pleistocene	"Ionian"	0.126		
			Calabrian		0.781	👉	
			Gelasian		1.806	👉	
		Neogene	Pliocene	Piacenzian		2.588	👉
				Zanclean		3.600	👉
				Messinian		5.332	👉
			Miocene	Tortonian		7.246	👉
				Serravallian		11.608	👉
	Langhian				13.82	👉	
	Burdigalian				15.97	👉	
	Aquitanian				20.43	👉	
	Chattian				23.03	👉	
	Rupelian				28.4 ± 0.1	👉	
	Paleogene		Oligocene	Priabonian		33.9 ± 0.1	👉
				Bartonian		37.2 ± 0.1	👉
				Lutetian		40.4 ± 0.2	👉
		Eocene	Ypresian		48.6 ± 0.2	👉	
			Thanetian		55.8 ± 0.2	👉	
			Selandian		58.7 ± 0.2	👉	
		Paleocene	Danian		~ 61.1	👉	
			Maastrichtian		65.5 ± 0.3	👉	
			Campanian		70.6 ± 0.6	👉	
			Santonian		83.5 ± 0.7	👉	
	Mesozoic	Cretaceous	Upper	Coniacian		85.8 ± 0.7	👉
				Turonian		~ 88.6	👉
				Cenomanian		93.6 ± 0.8	👉
Lower			Albian		99.6 ± 0.9	👉	
			Aptian		112.0 ± 1.0	👉	
Jurassic		Lower	Barremian		125.0 ± 1.0	👉	
			Hauterivian		130.0 ± 1.5	👉	
			Valanginian		~ 133.9	👉	
		Upper	Valanginian		140.2 ± 3.0	👉	
			Berriasian		145.5 ± 4.0	👉	

Eonothem Eon	Erathem Era	System Period	Series Epoch	Stage Age	Age Ma	GSSP		
Phanerozoic	Mesozoic	Cretaceous	Upper	Tithonian		145.5 ± 4.0	👉	
				Kimmeridgian		150.8 ± 4.0	👉	
				Oxfordian		~ 155.6	👉	
			Lower	Callovian		161.2 ± 4.0	👉	
				Bathonian		164.7 ± 4.0	👉	
		Paleozoic	Permian	Upper	Bajocian		171.6 ± 3.0	👉
					Wuchiapingian		~ 251.0	👉
					Wuchiapingian		253.8 ± 0.7	👉
				Middle	Lopingian		260.4 ± 0.7	👉
					Guadalupian		265.8 ± 0.7	👉
	Triassic		Lower	Roadian		268.0 ± 0.7	👉	
				Kungurian		270.6 ± 0.7	👉	
				Artinskian		275.6 ± 0.7	👉	
			Upper	Sakmarian		284.4 ± 0.7	👉	
				Asselian		294.6 ± 0.8	👉	
	Carboniferous	Pennsylvanian	Upper	Gzhelian		299.0 ± 0.8	👉	
				Kasimovian		303.4 ± 0.9	👉	
			Middle	Moscovian		307.2 ± 1.0	👉	
				Bashkirian		311.7 ± 1.1	👉	
		Mississippian	Upper	Serpukhovian		318.1 ± 1.3	👉	
				Visean		328.3 ± 1.6	👉	
			Lower	Visean		345.3 ± 2.1	👉	
				Tournaisian		359.2 ± 2.5	👉	

Mitte Dez.
Dinosauriere

Eonothem Eon	Erathem Era	System Period	Series Epoch	Stage Age	Age Ma	GSSP	
Phanerozoic	Paleozoic	Devonian	Upper	Famennian		359.2 ± 2.5	👉
				Frasnian		374.5 ± 2.6	👉
			Middle	Givetian		385.3 ± 2.6	👉
				Eifelian		391.8 ± 2.7	👉
				Emsian		397.5 ± 2.7	👉
		Lower	Pragian		407.0 ± 2.8	👉	
			Lochkovian		411.2 ± 2.8	👉	
			Pridoli		416.0 ± 2.8	👉	
			Ludlow		418.7 ± 2.7	👉	
			Ludfordian		421.3 ± 2.6	👉	
	Paleo-ozoic	Silurian	Upper	Gorstian		422.9 ± 2.5	👉
				Homerian		426.2 ± 2.4	👉
				Sheinwoodian		428.2 ± 2.3	👉
			Middle	Telychian		436.0 ± 1.9	👉
				Aeronian		439.0 ± 1.8	👉
		Lower	Rhuddanian		443.7 ± 1.5	👉	
			Himantian		445.6 ± 1.5	👉	
			Katian		445.8 ± 1.6	👉	
		Ordovician	Upper	Sandbian		455.8 ± 1.6	👉
				Darriwilian		460.9 ± 1.6	👉
	Dapingian				468.1 ± 1.6	👉	
	Middle		Floian		471.8 ± 1.6	👉	
			Tremadocian		478.6 ± 1.7	👉	
	Cambrian	Furongian	Stage 10		488.3 ± 1.7	👉	
			Stage 9		~ 492 *	👉	
			Stage 8		~ 496 *	👉	
		Lower	Paibian		~ 499	👉	
			Guzhangian		~ 503	👉	

Ende Nov.
Landpflanzen
und Tiere

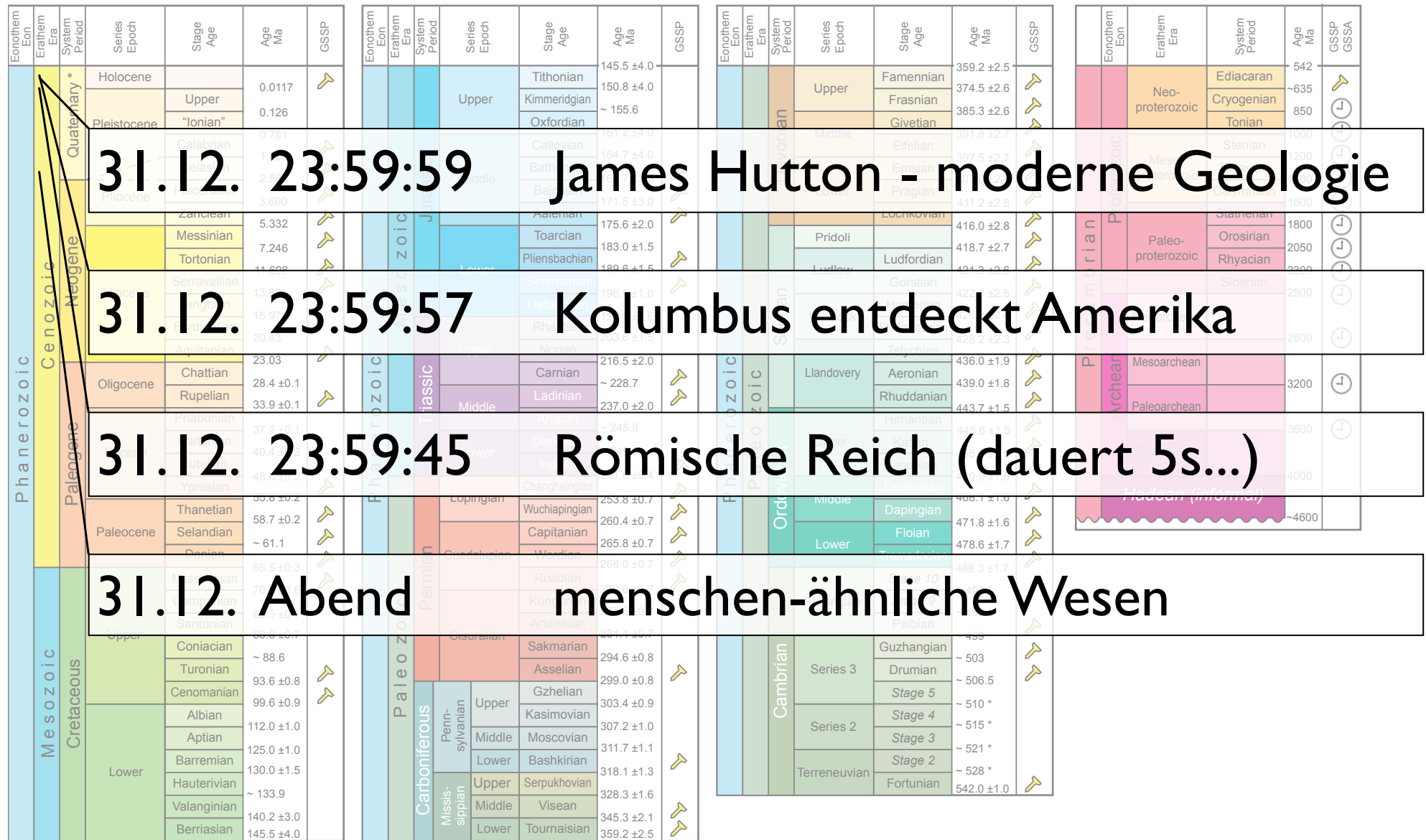
Eonothem Eon	Erathem Era	System Period	Series Epoch	Stage Age	Age Ma	GSSP GSSA
Proterozoic	Neo-proterozoic	Cryogenian	Ediacaran		542	👉
			Tonian		~ 635	👉
			Stenian		850	👉
		Mesoproterozoic	Ectasian		1000	👉
			Calyptan		1200	👉
	Archaean	Gaskiers	Statherian		1400	👉
			Statherian		1600	👉
			Rhyacian		~ 2050	👉
		Eoarchean	Siderian		2300	👉
			Siderian		2800	👉

Anfang Mai
Leben im
Wasser

Mitte März
Ältestes
Gestein

I. Januar
Entstehung
der Erde

4.7 Ga Erdgeschichte in 365 Tagen



Die Erde - ein spezieller Planet



Die Erde - ein spezieller Planet

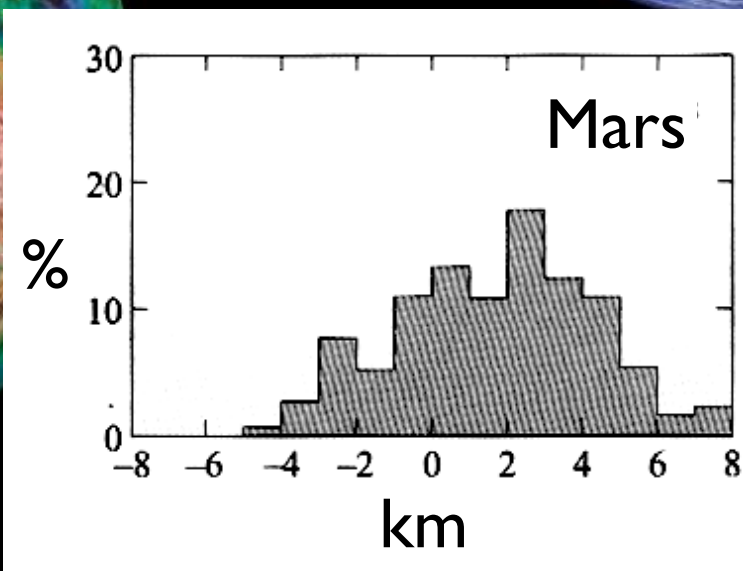
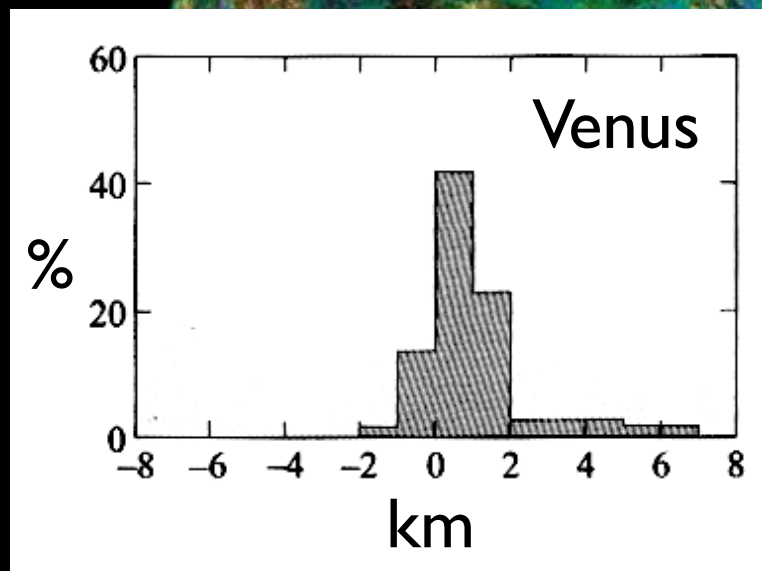
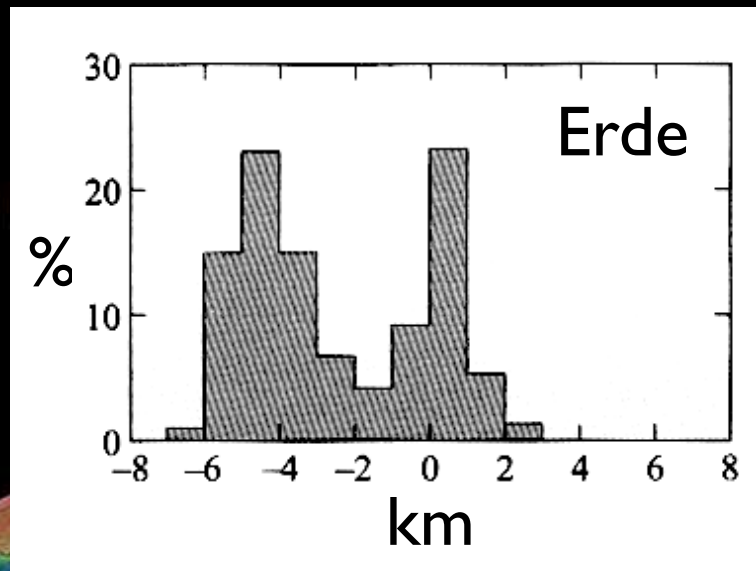


Mond

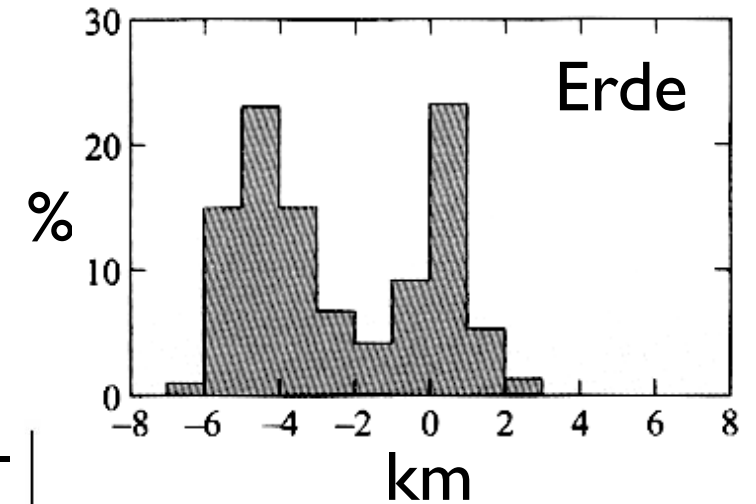
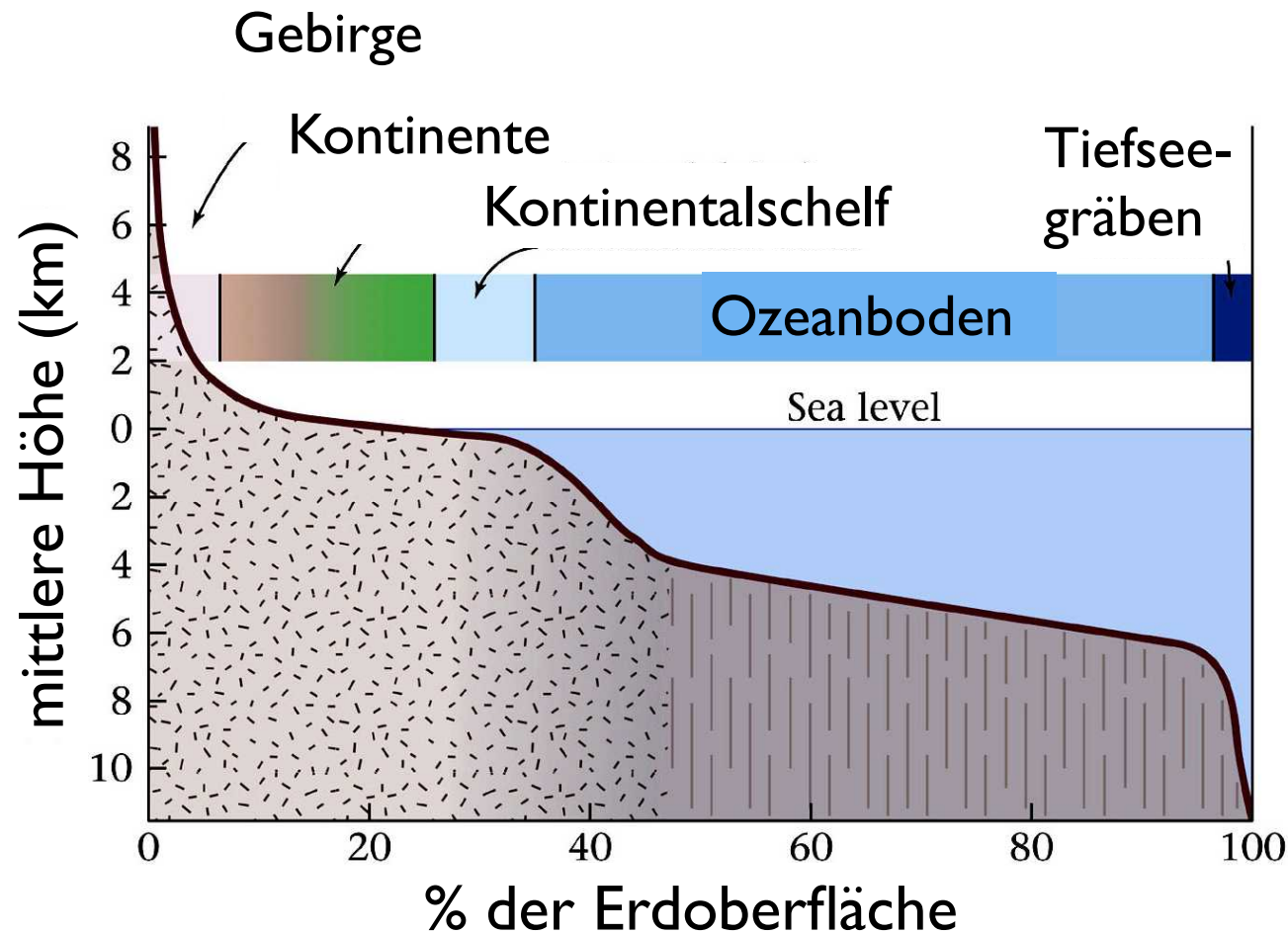


Erde

Die Erde - ein spezieller Planet

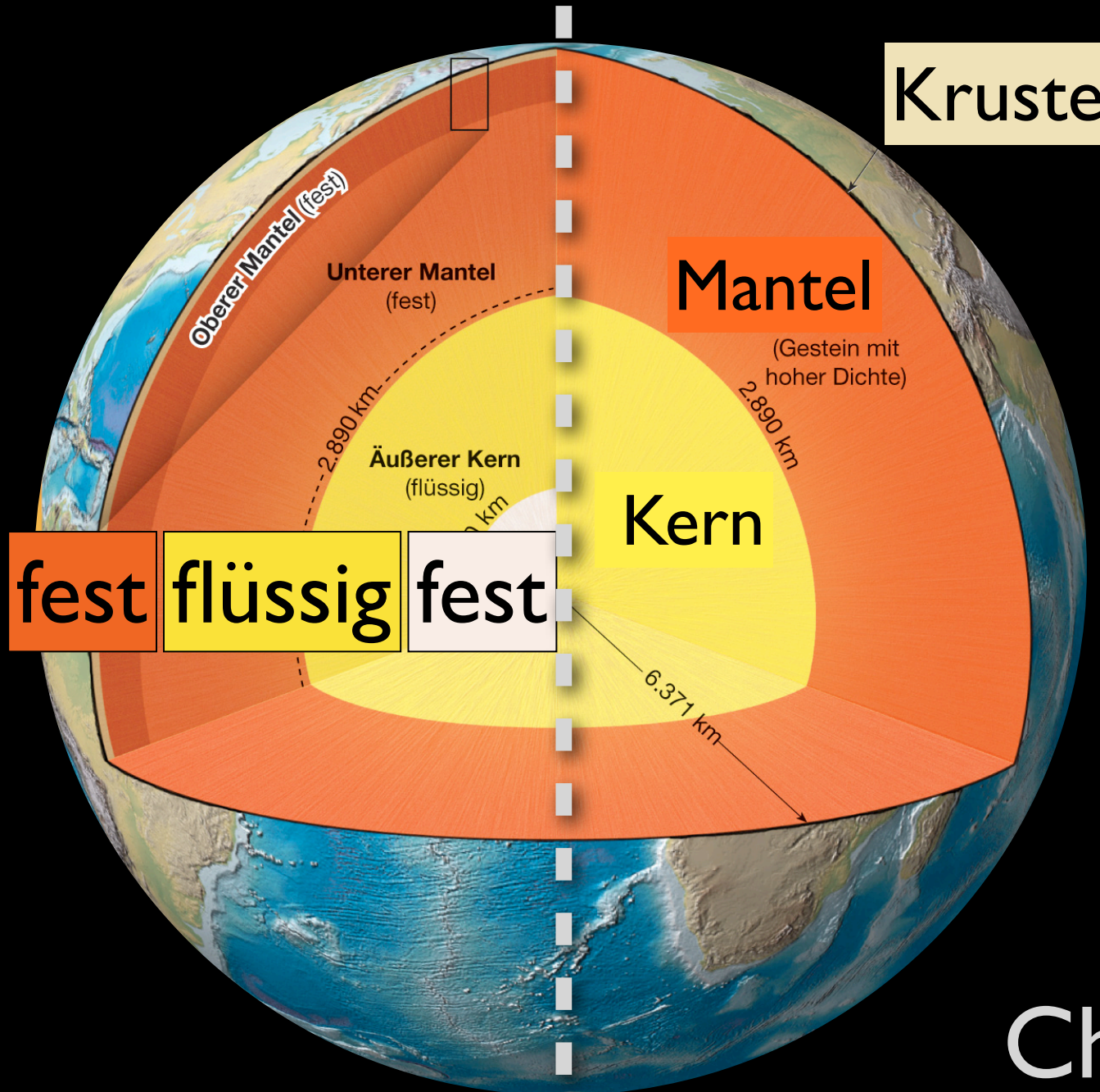


Hypsometrisches Histogramm



- 2 Typen von Oberflächen:
- ozeanisch
 - kontinental

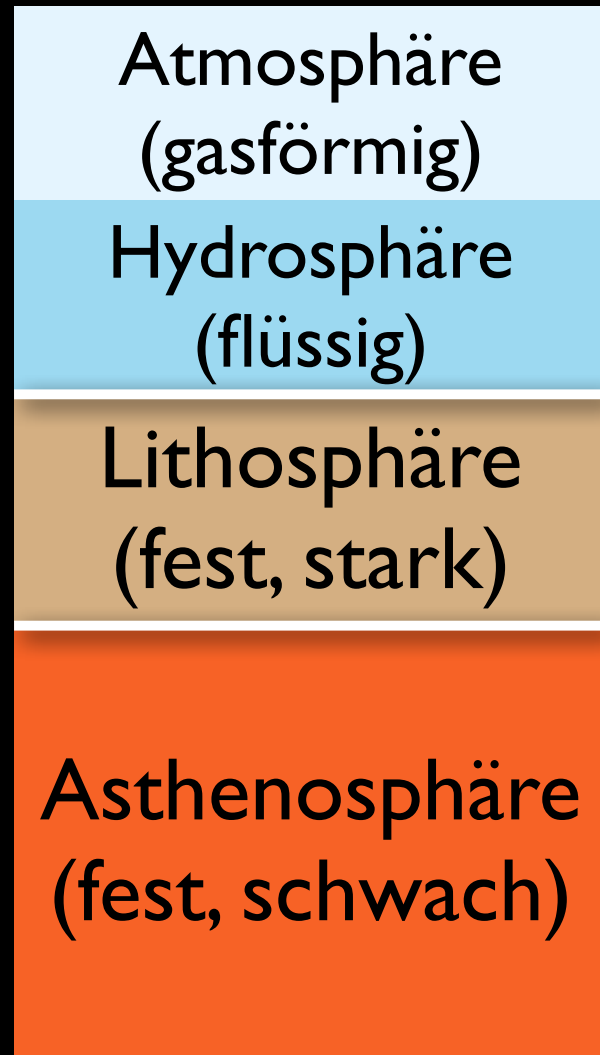
Schalenbau der Erde



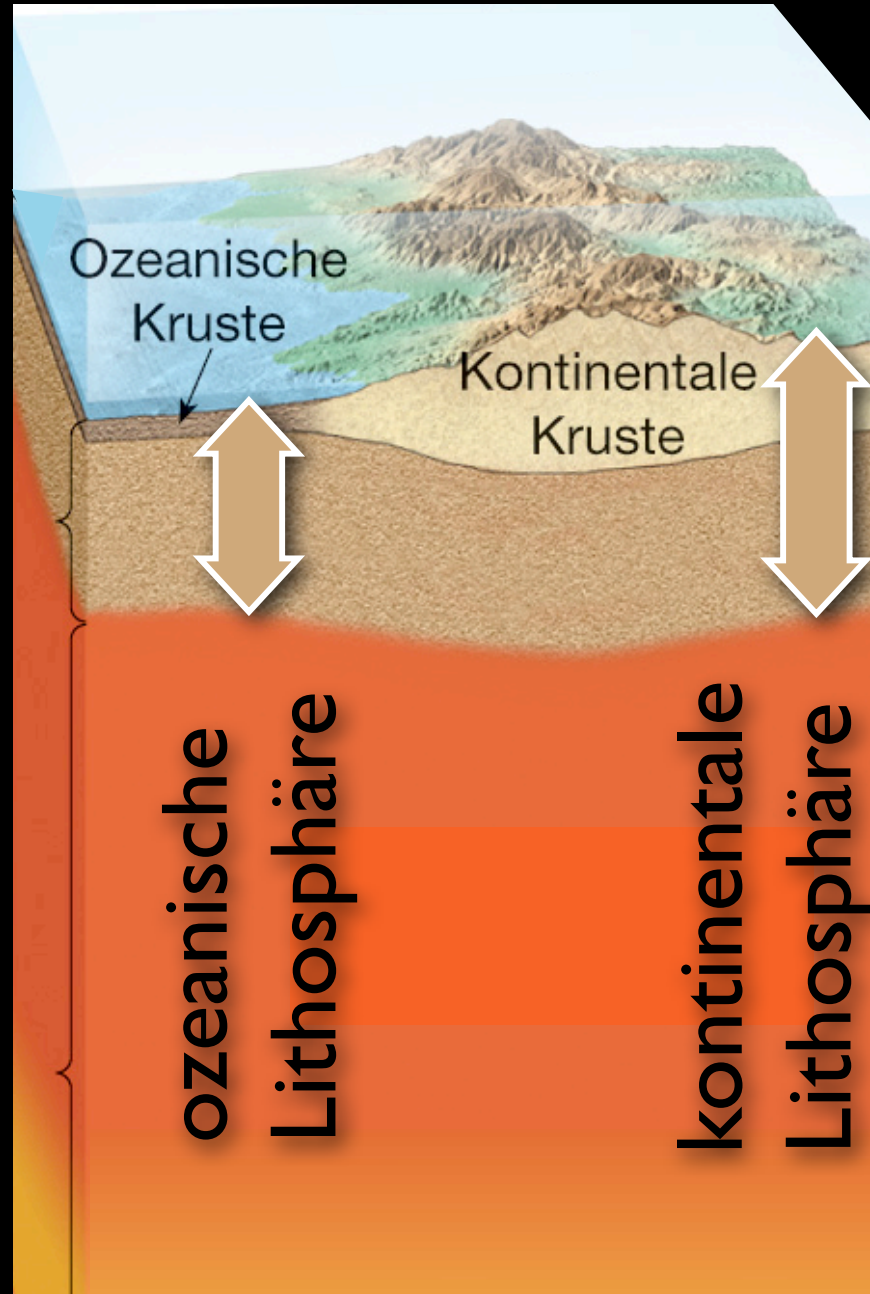
Physik

Chemie

Schalenbau - Rheologie



Physik

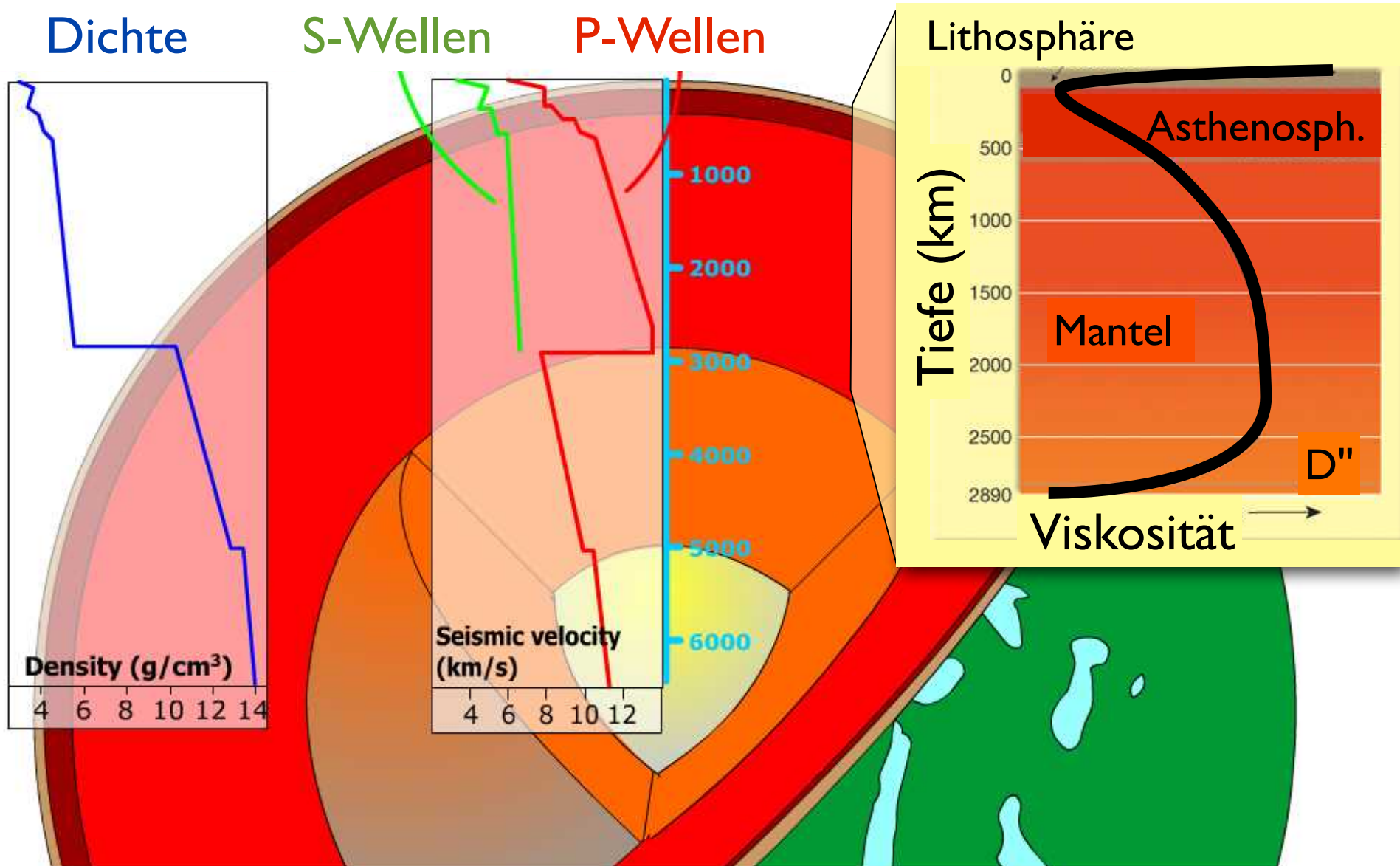


Chemie

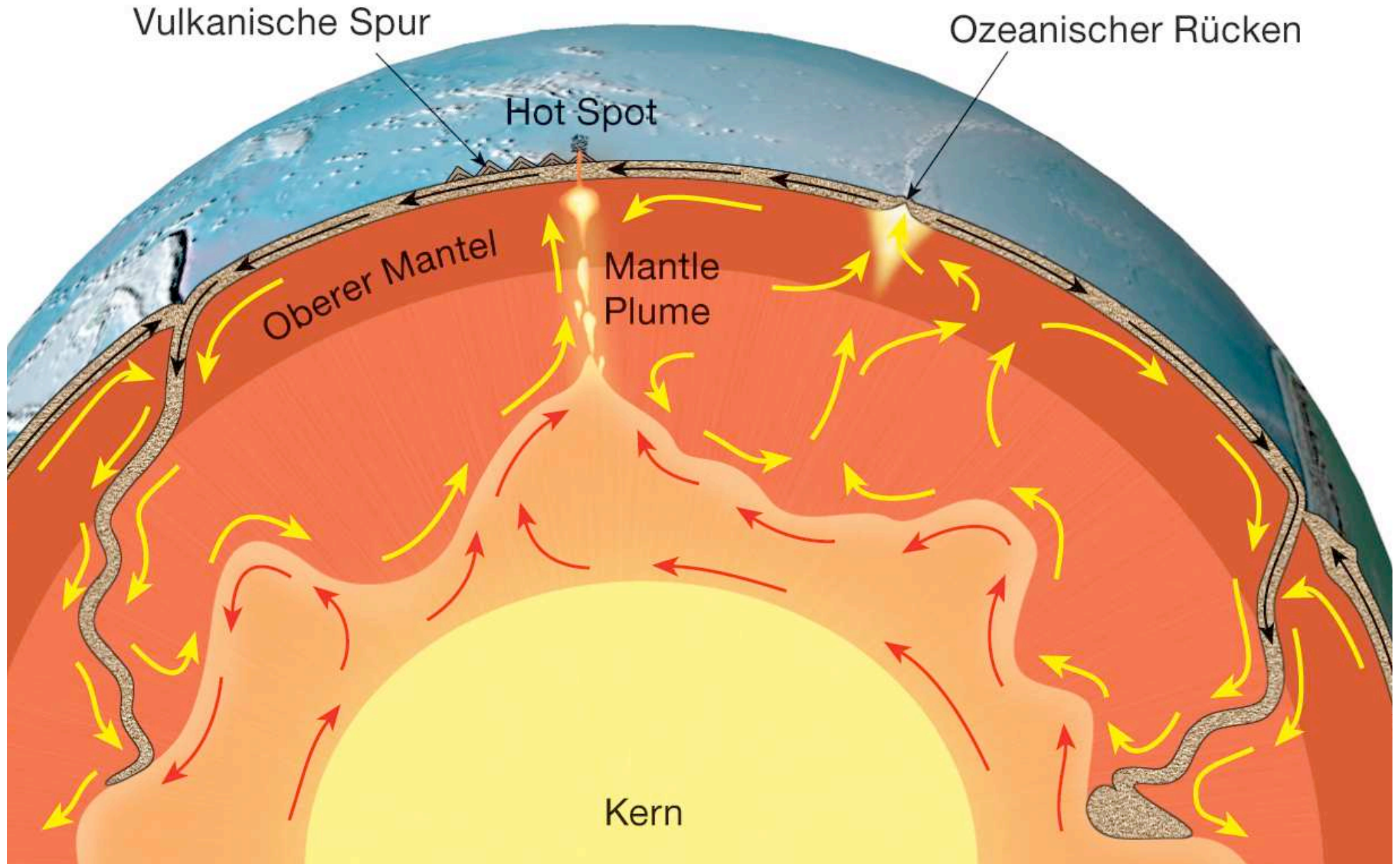
Schalenbau - Zusammensetzung

	Zusammen- setzung	Dicke	Dichte (kgm ⁻³)	Alter
Kruste				
- kontinental	Granodiorit	35 - 40 km (up to 70 km)	2700	≤ 4 Ga
- ozeanisch	Basalt	~7 km	3000	≤ 180 Ma
Mantel	Peridotit (Fe-Mg-Silikat)	82 % (Erdvolumen)	3000-5000	± Erde (4.5 Ga)
Kern	Fe-Ni Legierung		11'000	± Erde (4.5 Ga)

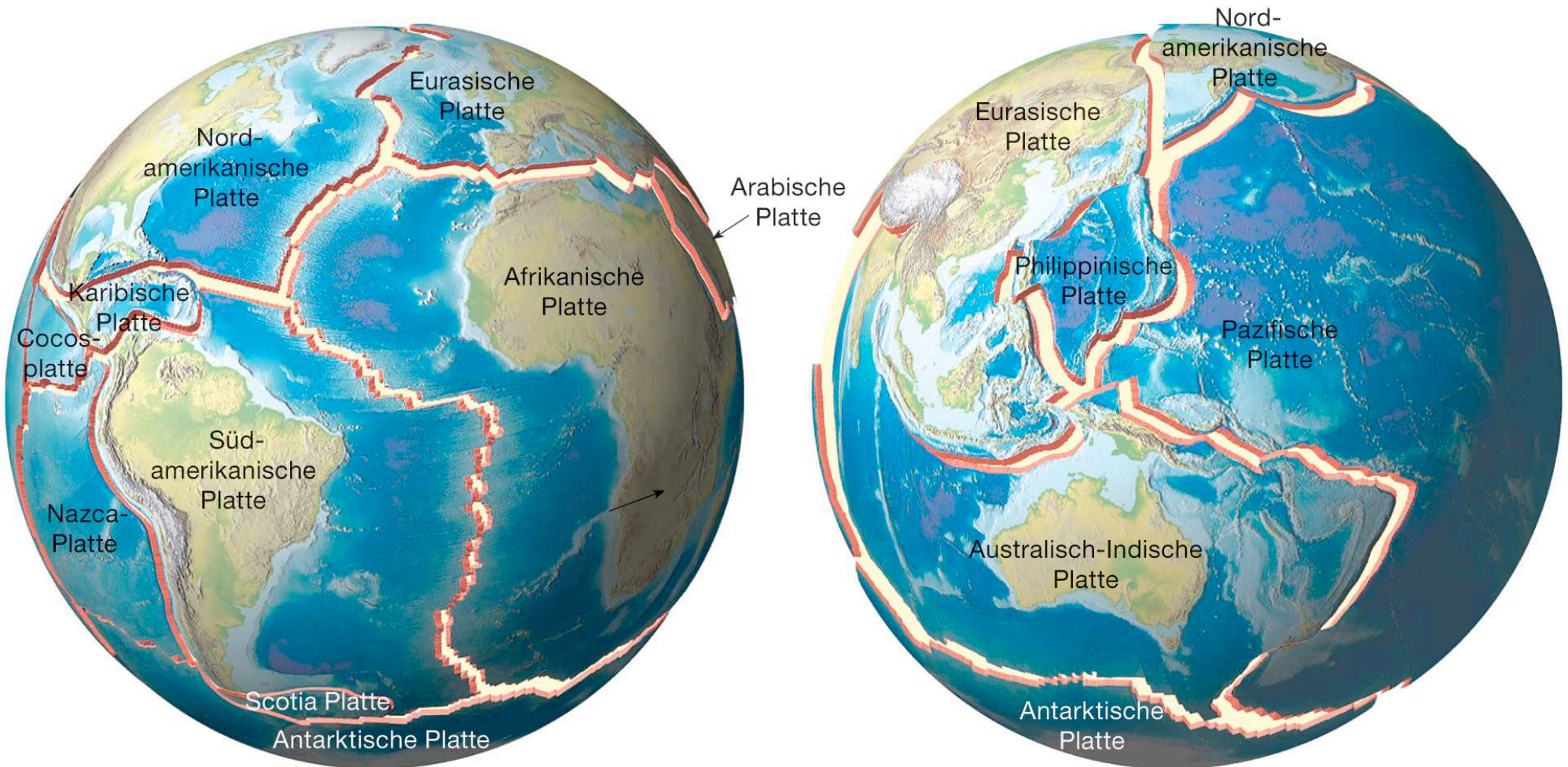
Physikalische Eigenschaften



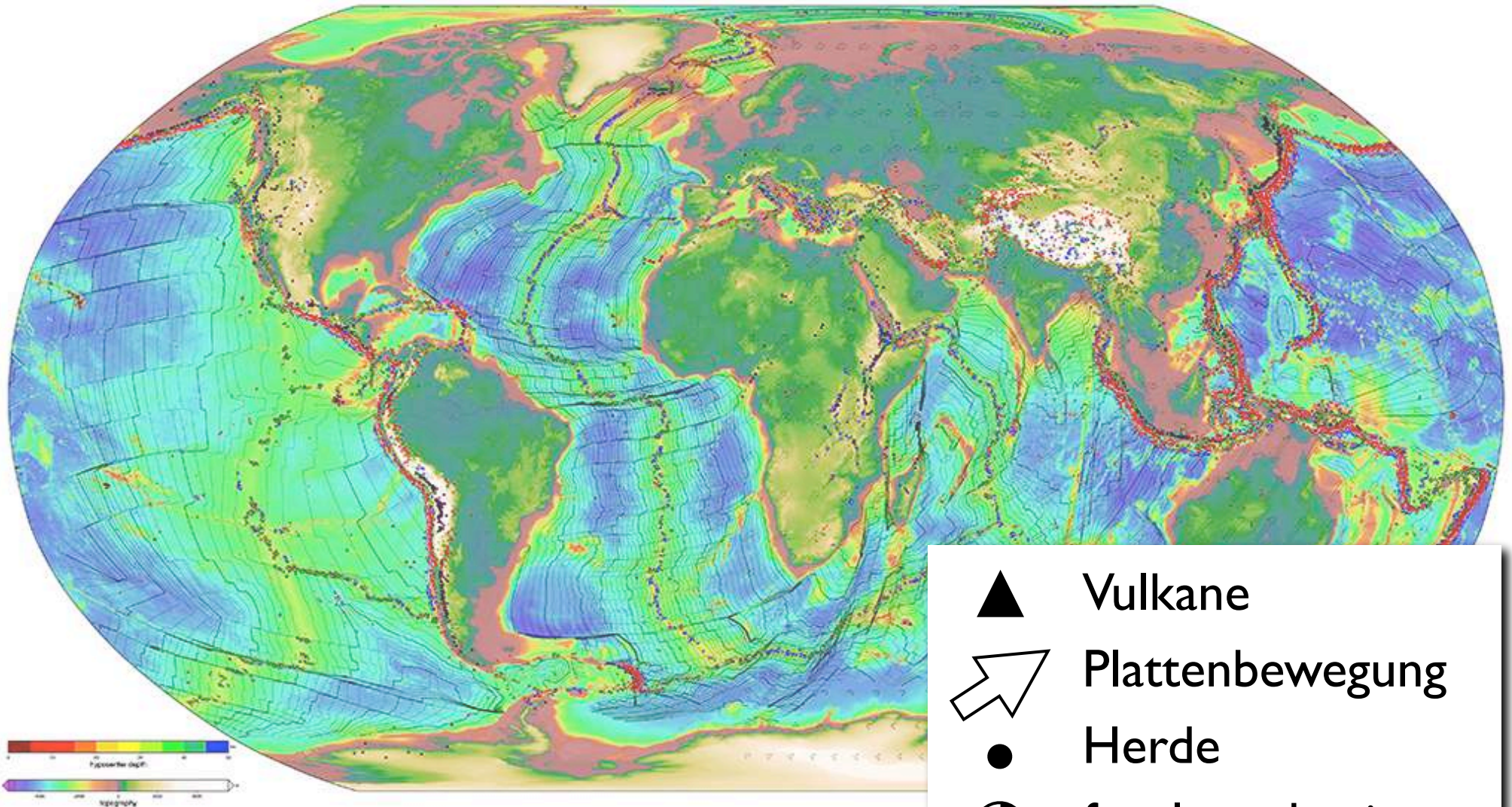
eppur si muove ...



Platten sind Lithosphärenplatten



Plattengrenzen - Erdbebenherde

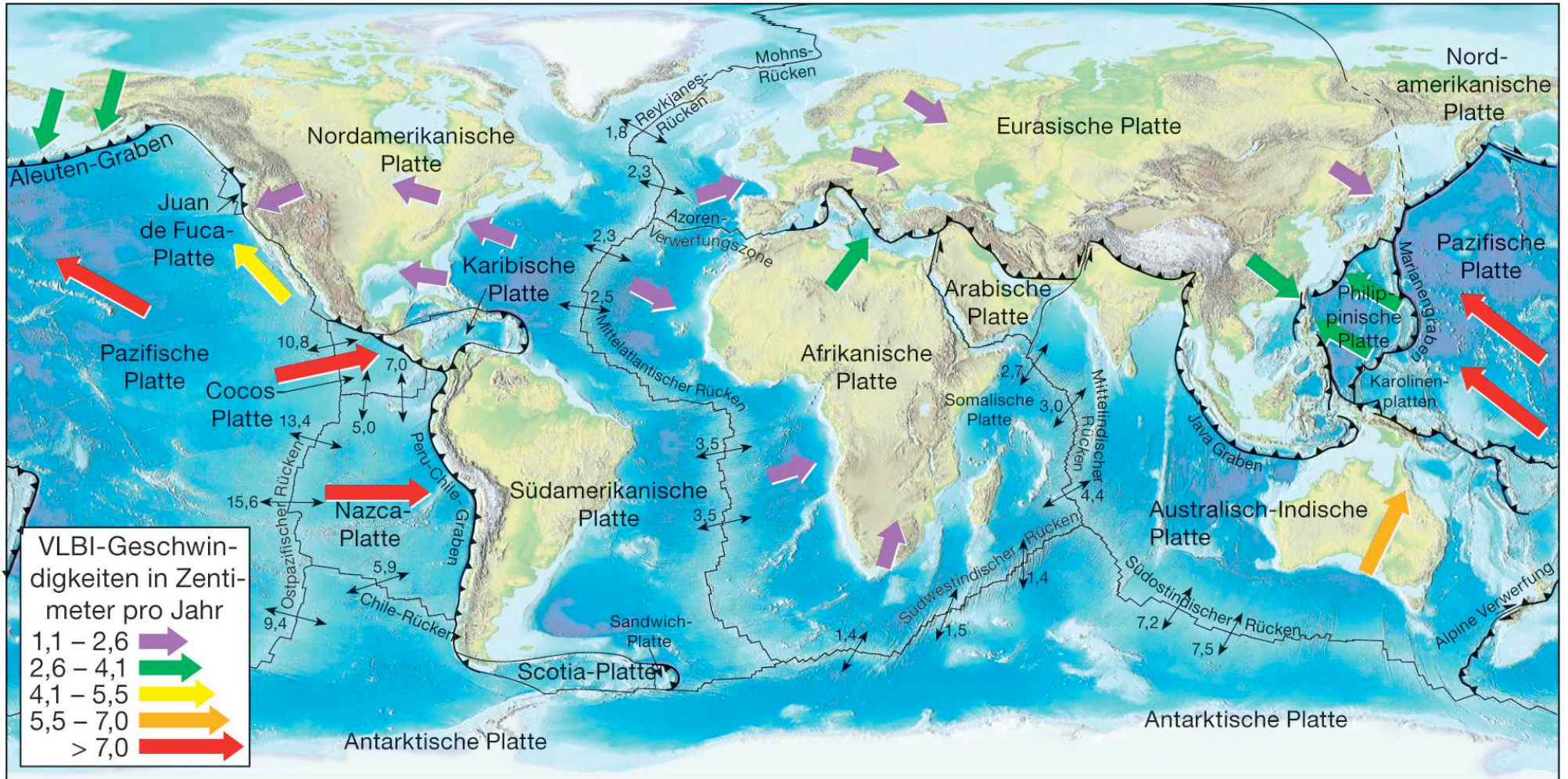


- ▲ Vulkane
- Plattenbewegung
- Herde
- ⊕ focal mechanisms

<http://www.seismo.ethz.ch/>

<http://earthquake.usgs.gov/earthquakes/>

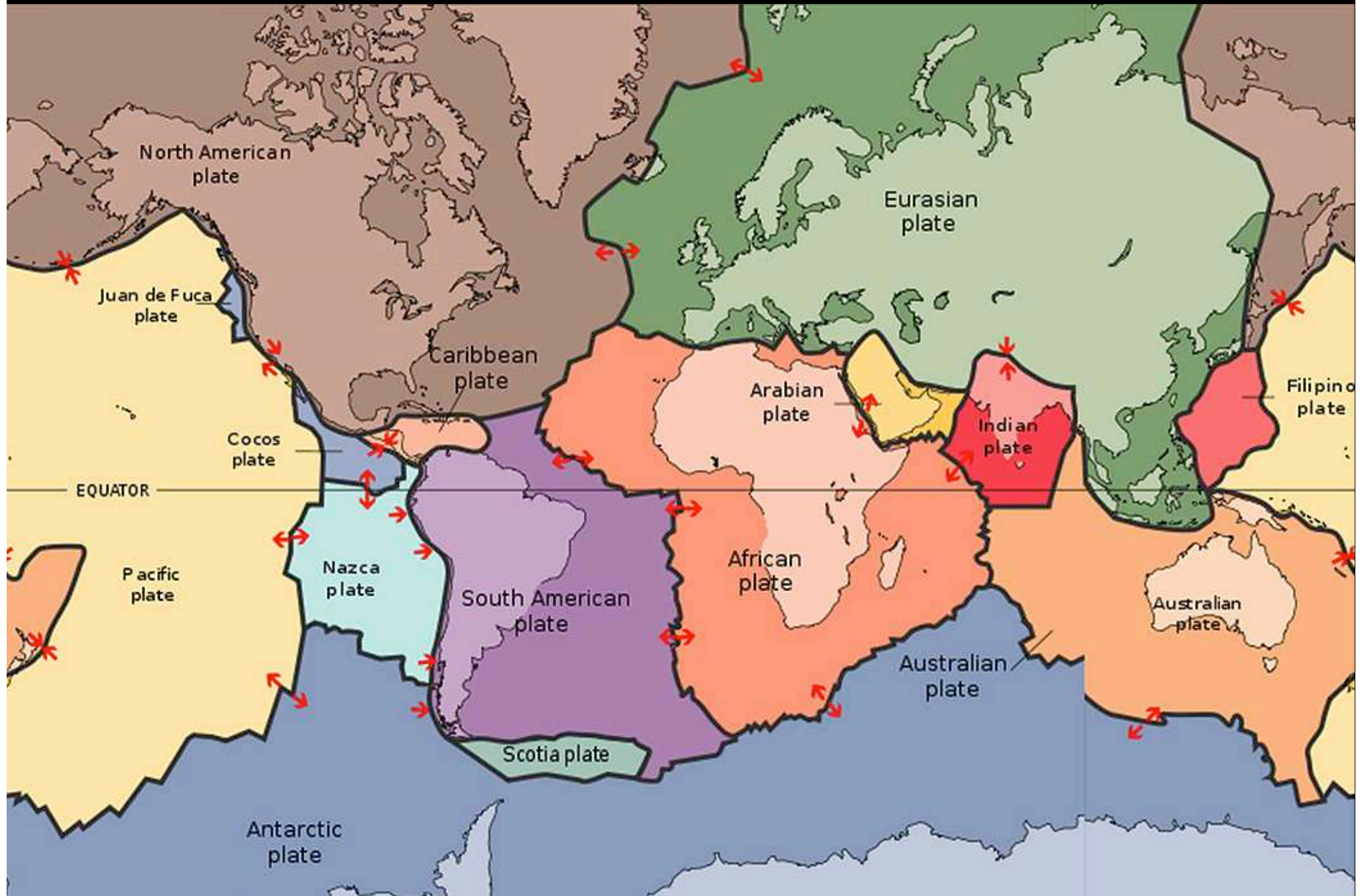
Plattenbewegungen



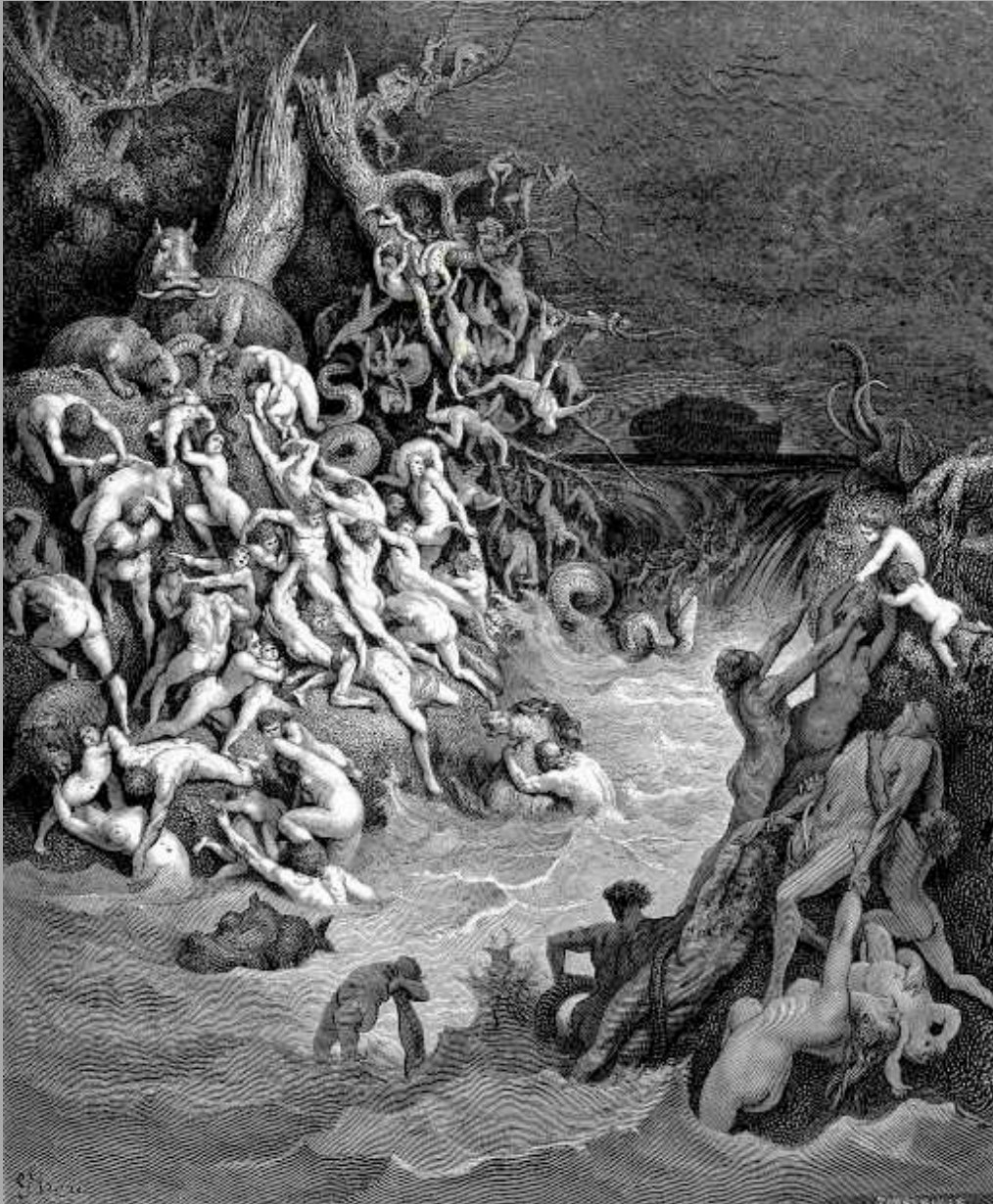
↔ Relativbewegungen aus Ozeanbodenspreizung

➔ Absolutbewegung aus Very Long Base Interferometrie

Plattentektonisches Puzzle

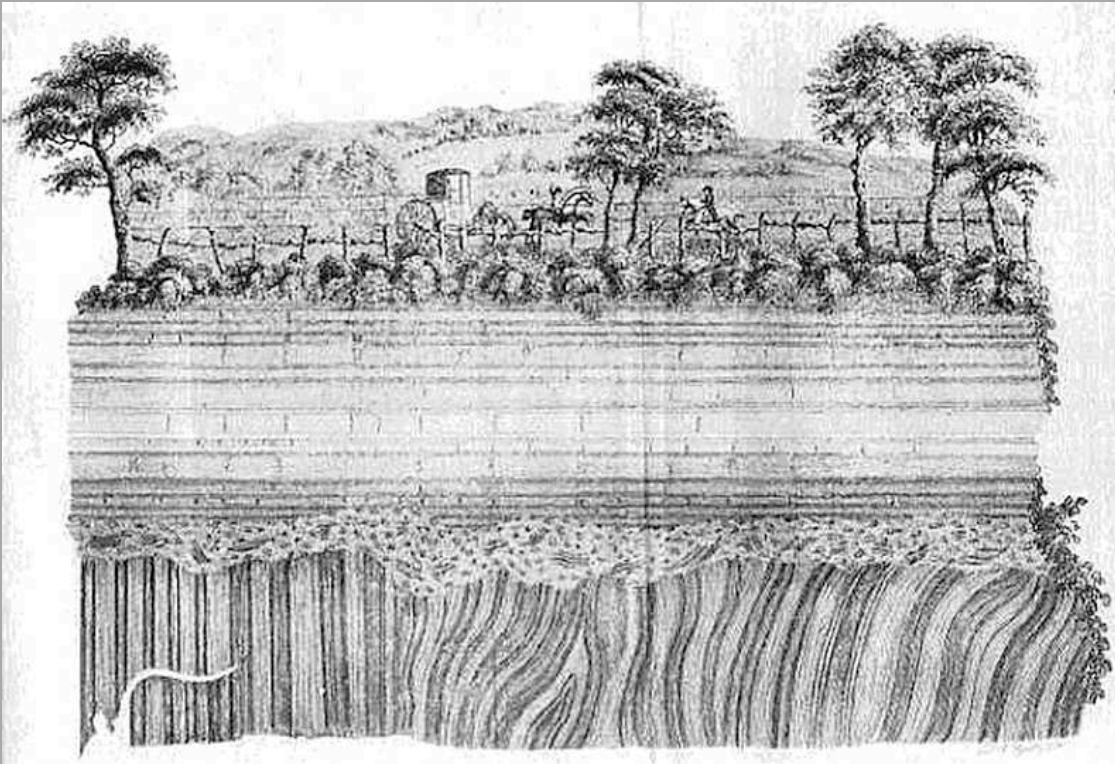


Katastrophismus



Baron Georges Léopold
Chrétien Frédéric
Dagobert Cuvier
(1769-1832)

Aktualismus



Jedburgh Unconformity

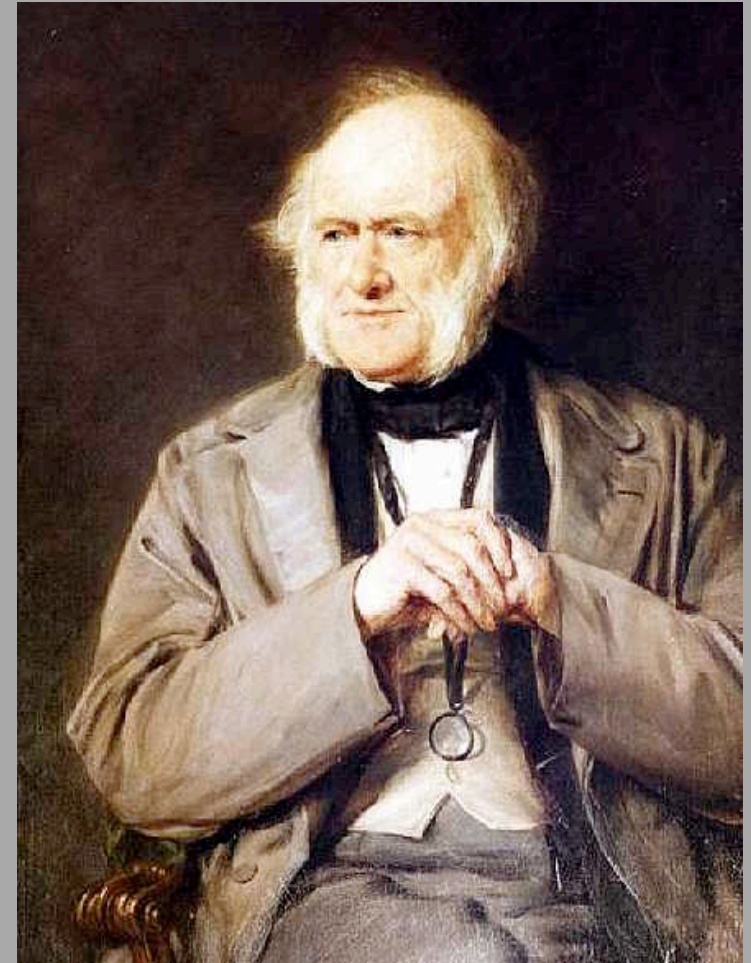
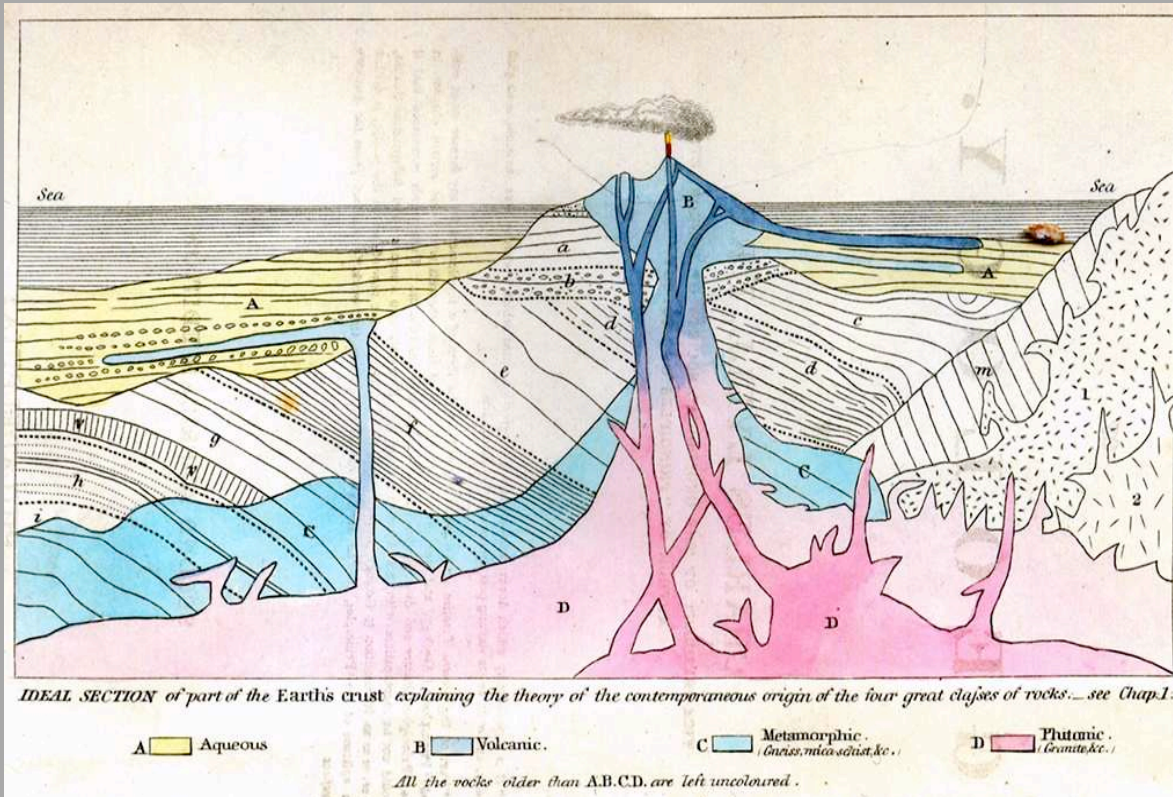
“Theory of the Earth” (1785)

“... we find no vestige of a beginning, no prospect of an end”



James Hutton
(1726 - 1797)

“the present is the key to the past”



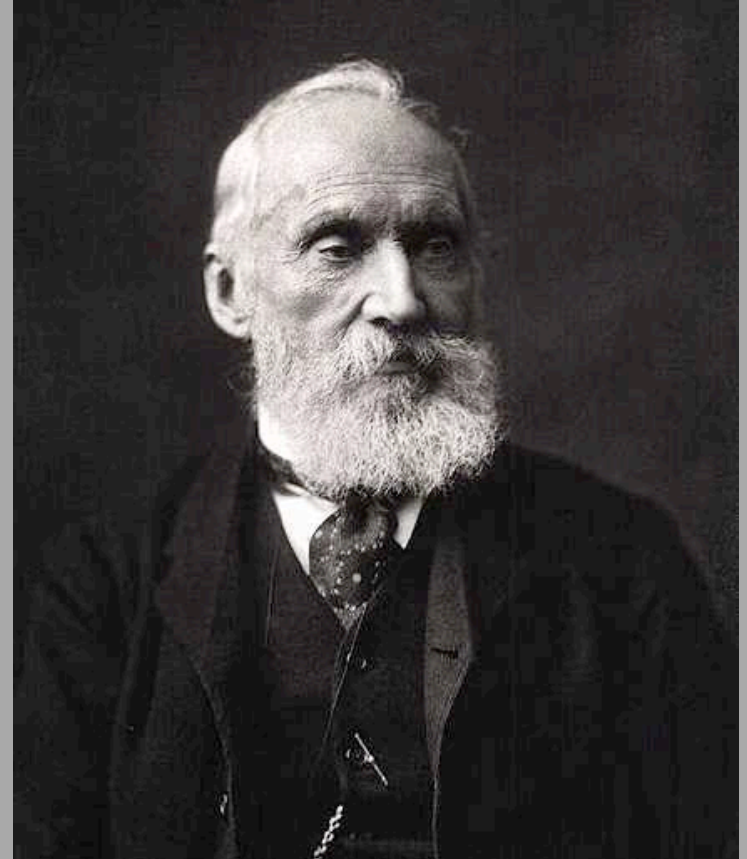
Charles Lyell
(1797 - 1875)

“The Principles of Geology”
(1830 - 1833)

Abschätzung des Erdalters

auf 20 - 400 Ma geschätzt
aufgrund der Abkühlung
der Erde

(1862)



William Thomson,
1st Baron Kelvin of Largs
(1824 - 1907)

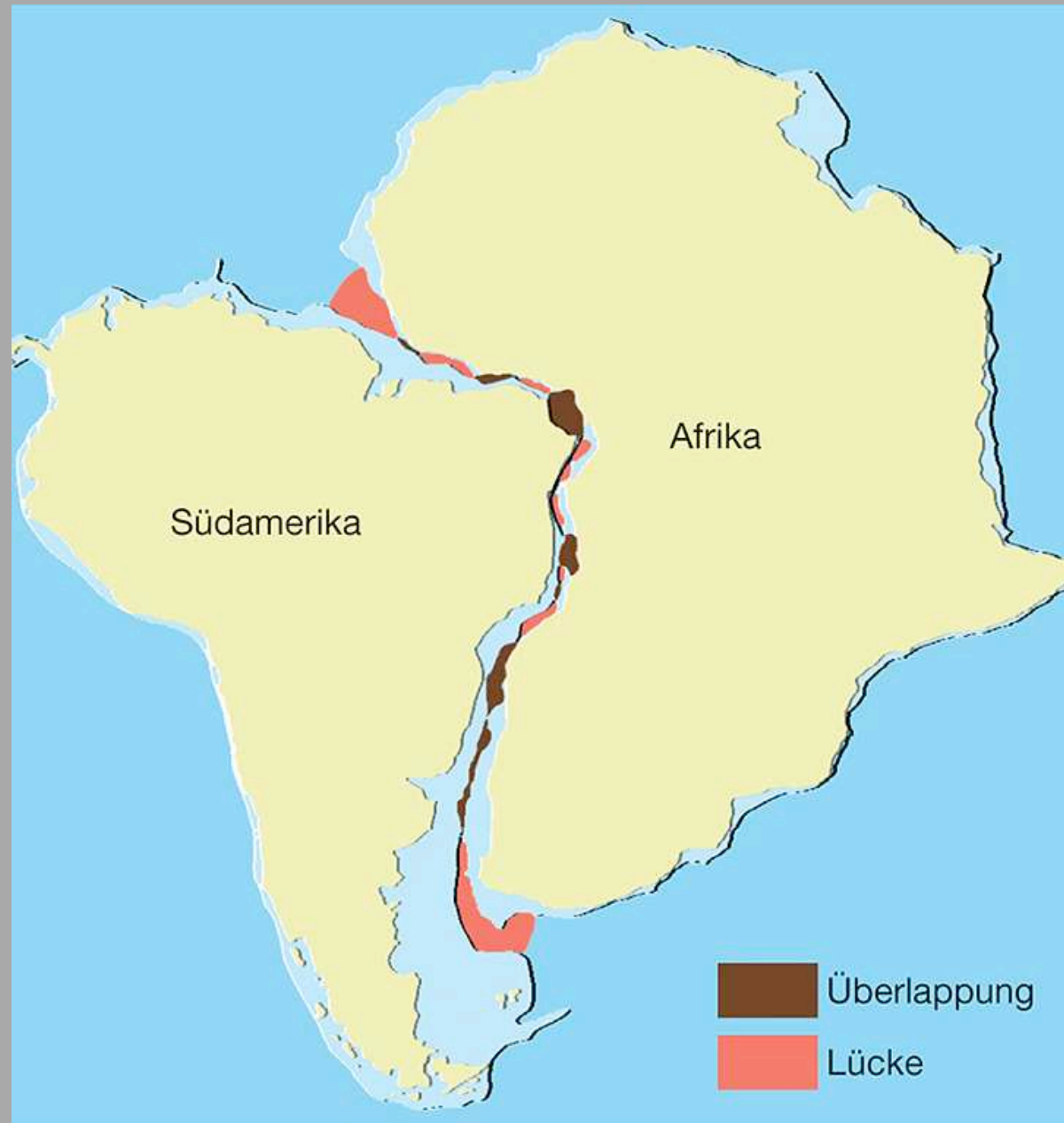
Kontinentaldrift



Alfred Wegener
(1880 - 1930)

Hypothese (1912):
Superkontinent Pangäa bricht
auseinander - vor 200 Ma

Evidenz für die Existenz von Pangäa



Anpassung entlang
Kontinental sockel
(900 m)

Evidenz für die Existenz von Pangäa



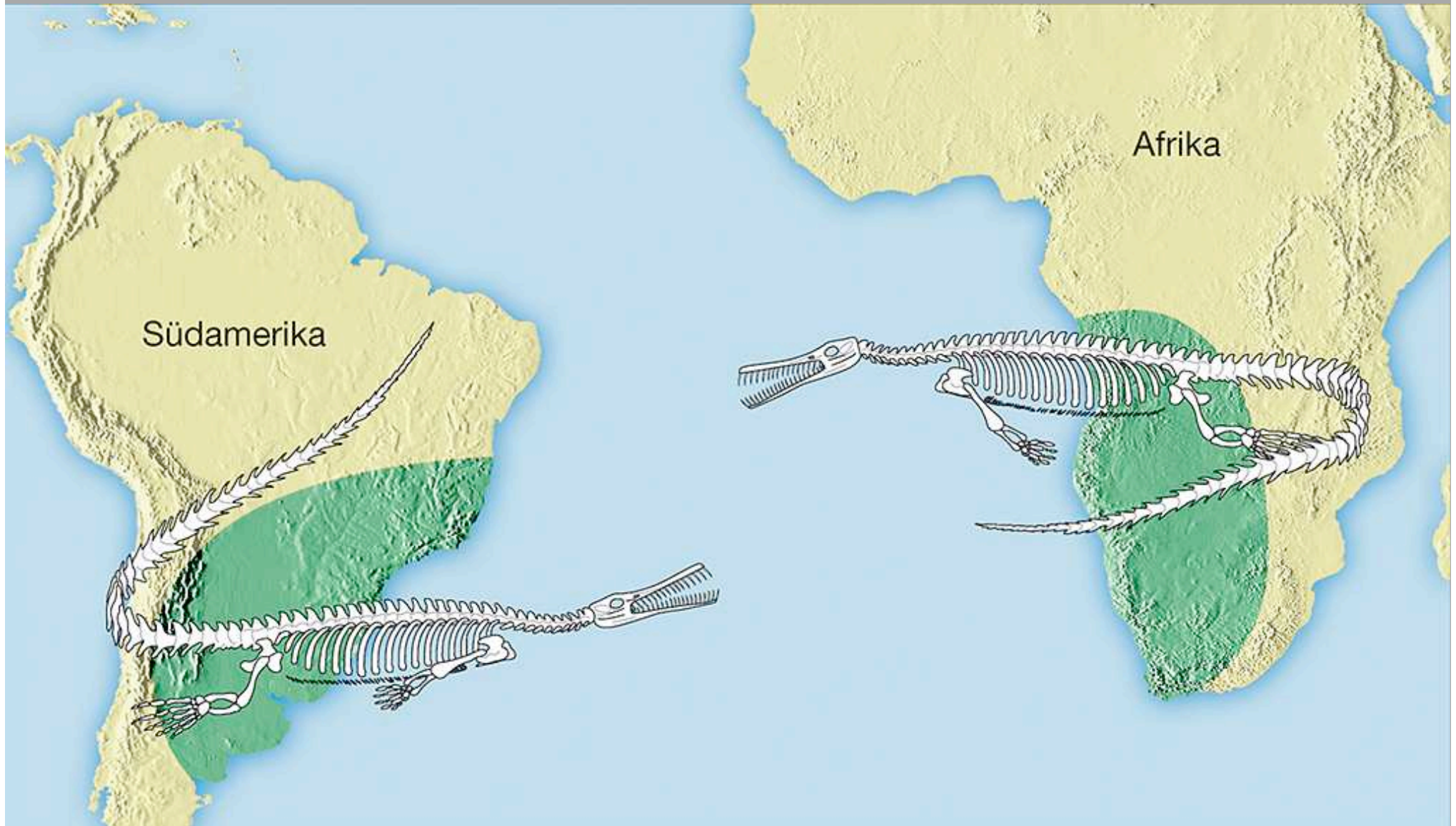
Appalachen
(USA)

=

Kaledoniden
(UK, NO)

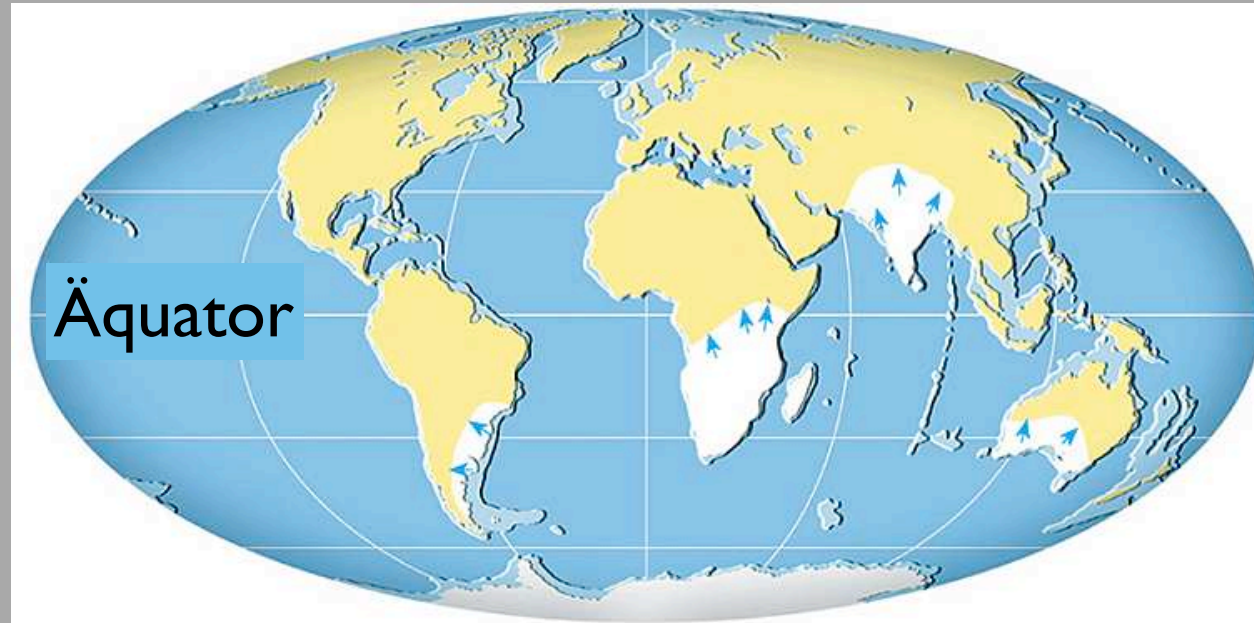
Gebirge (~300 Ma)
gebildet bei der
Kollision ⇒ Pangäa

Evidenz für die Existenz von Pangäa



Fossile Überreste von Mesosaurus (~Paläozoikum)

Weiterer Hinweis



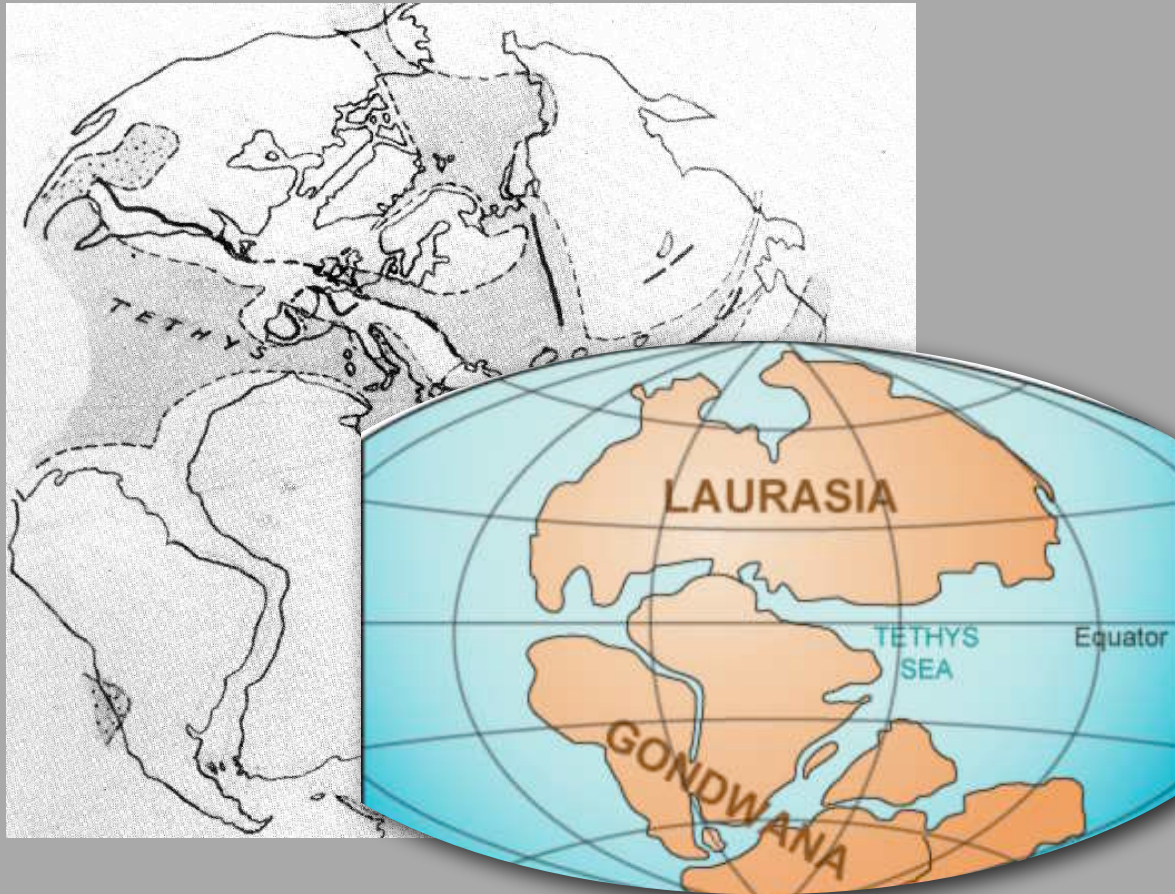
Vereisung 300 Ma

Fließrichtung
des Eises →

Heutige Position
der Kontinente

Kontinente in
ursprünglicher
Position

Unterstützung für Kontinentaldrift

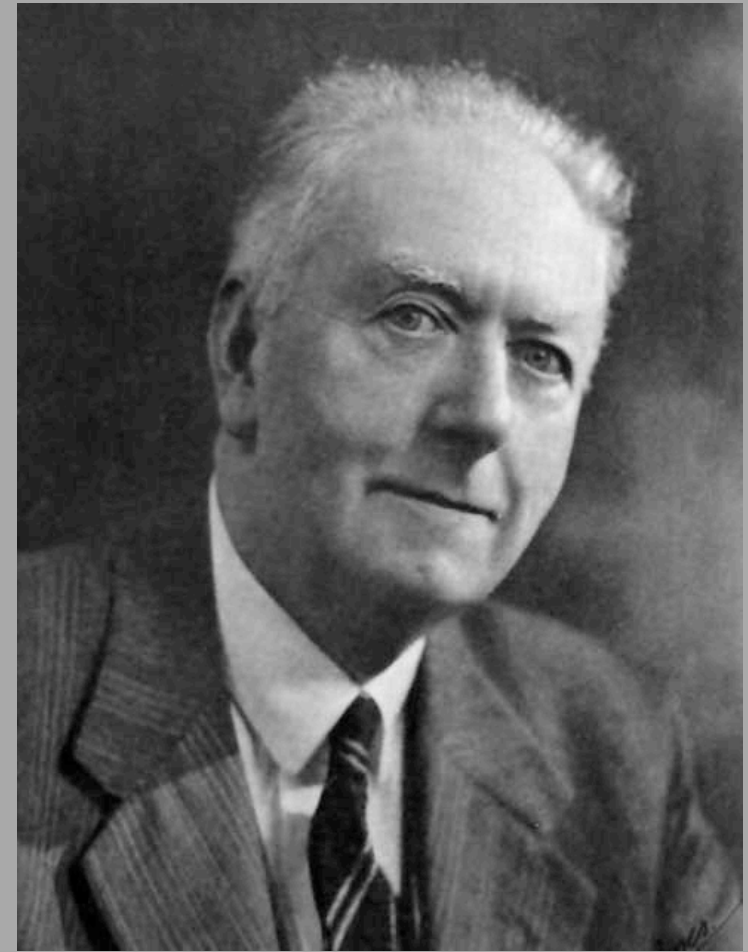
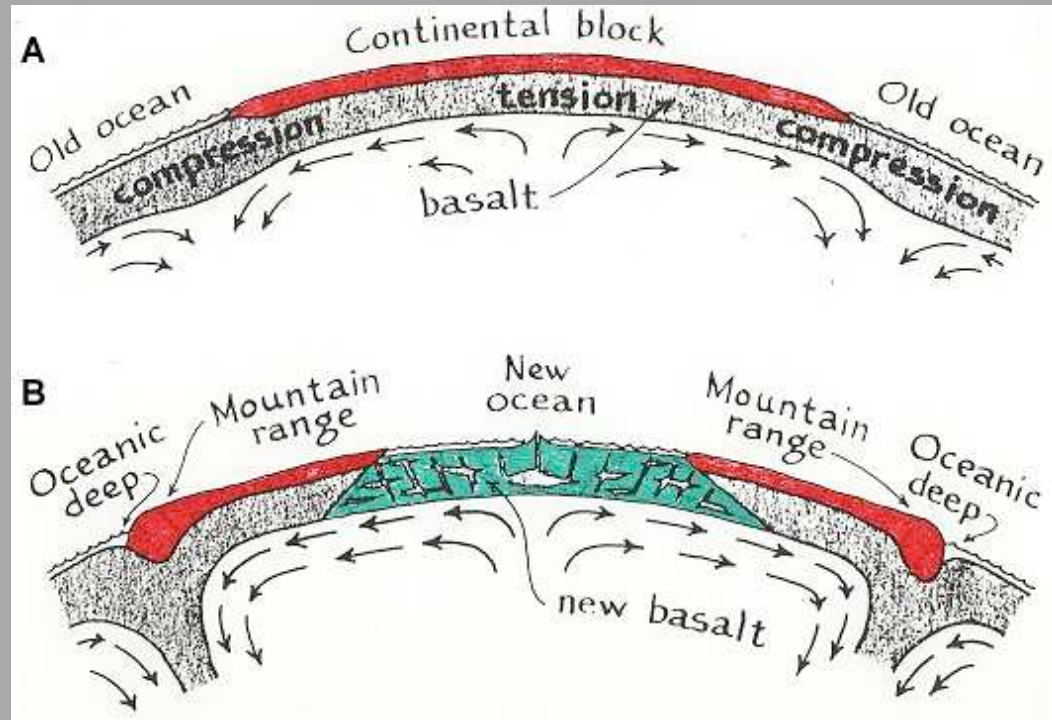


Alexander Logie du Toit
(1878 - 1948)

"Our wandering Continents" (1937)
Pangäa → Laurasia* + Gondwana

* Nordamerika Grönland Europa Asien

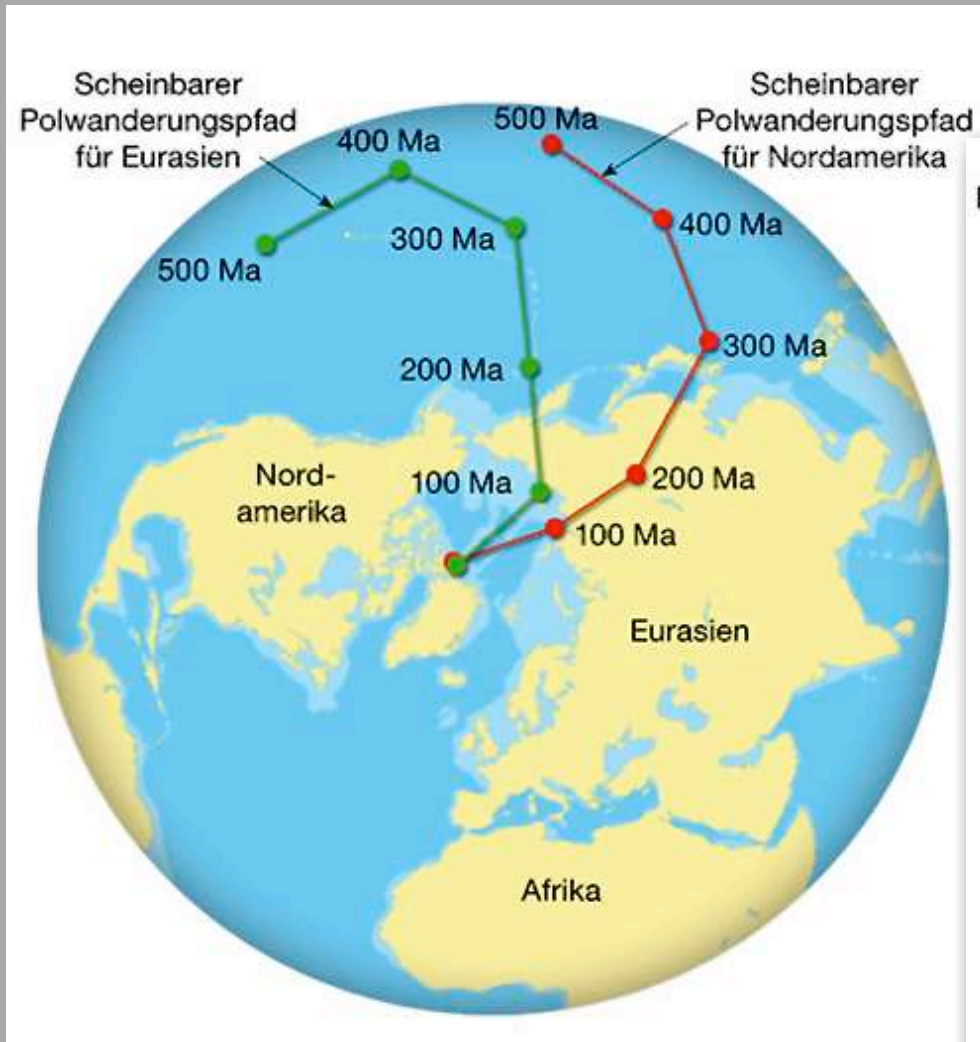
Modell für Kontinentaldrift



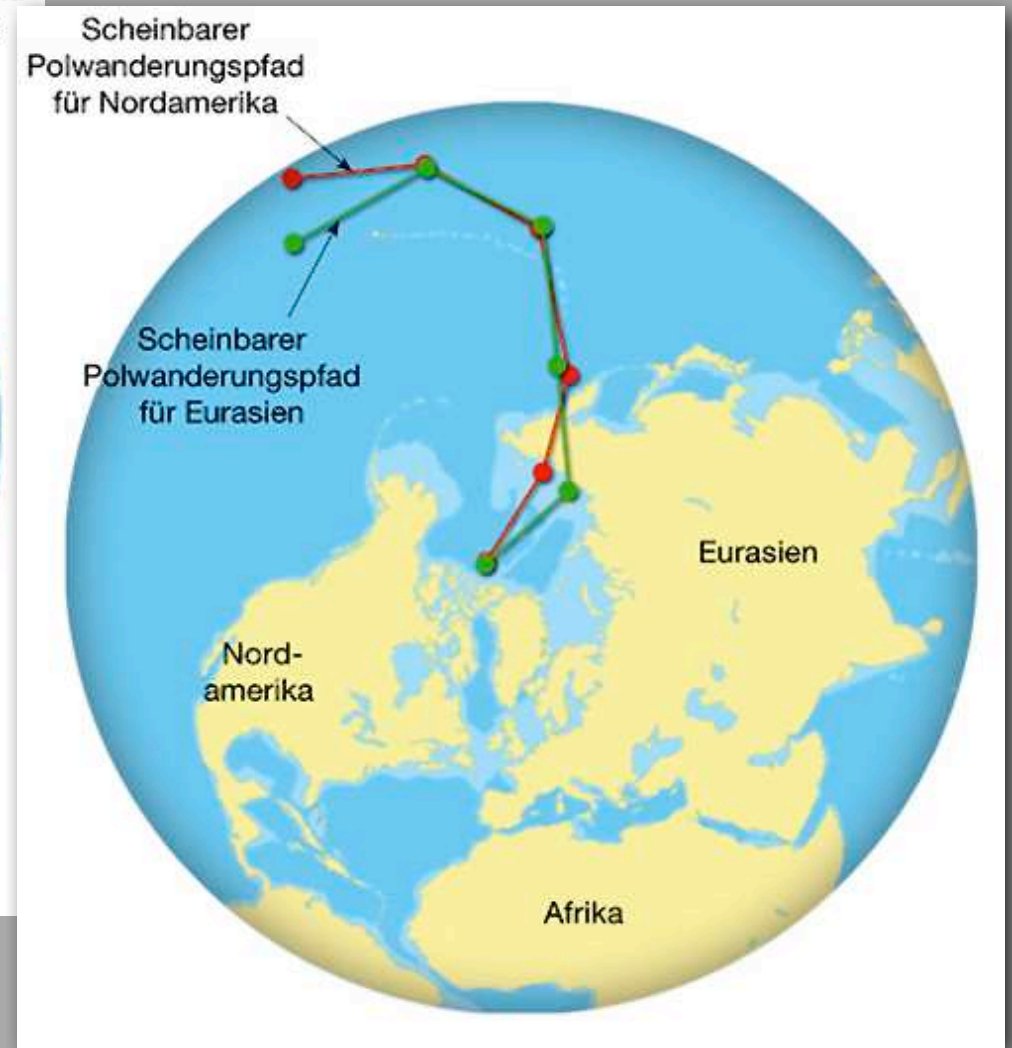
Arthur Holmes
(1890 - 1965)

"Principles of Physical Geology"
(1944)
mit Kapitel über Kontinentaldrift

Scheinbare Polwanderung



aus heutiger Sicht



Kontinente zurückrotiert

Kartierung des Ozeanbodens



Marie Tharpe
(1920 - 2006)

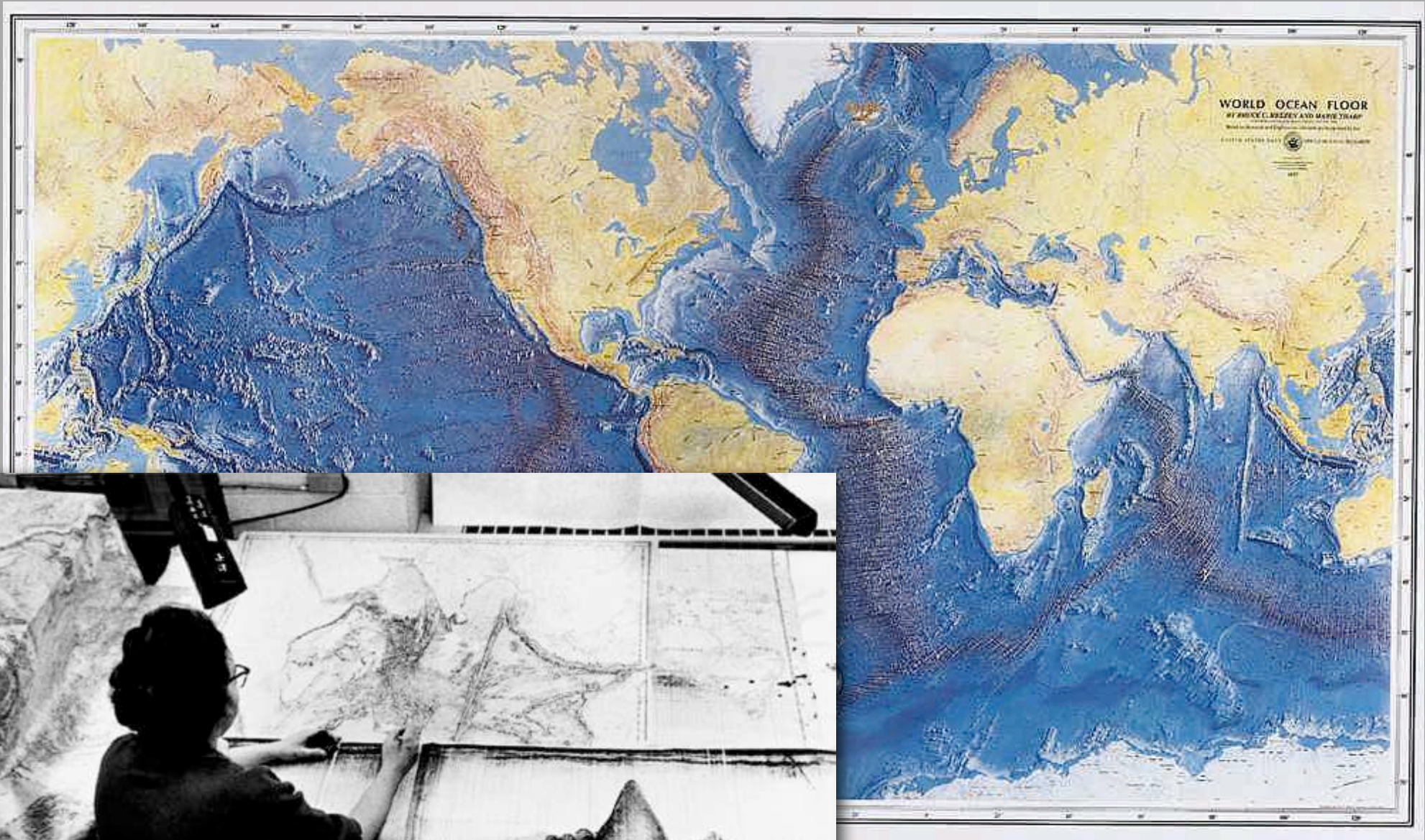
Bruce Heezen
(1924 - 1977)



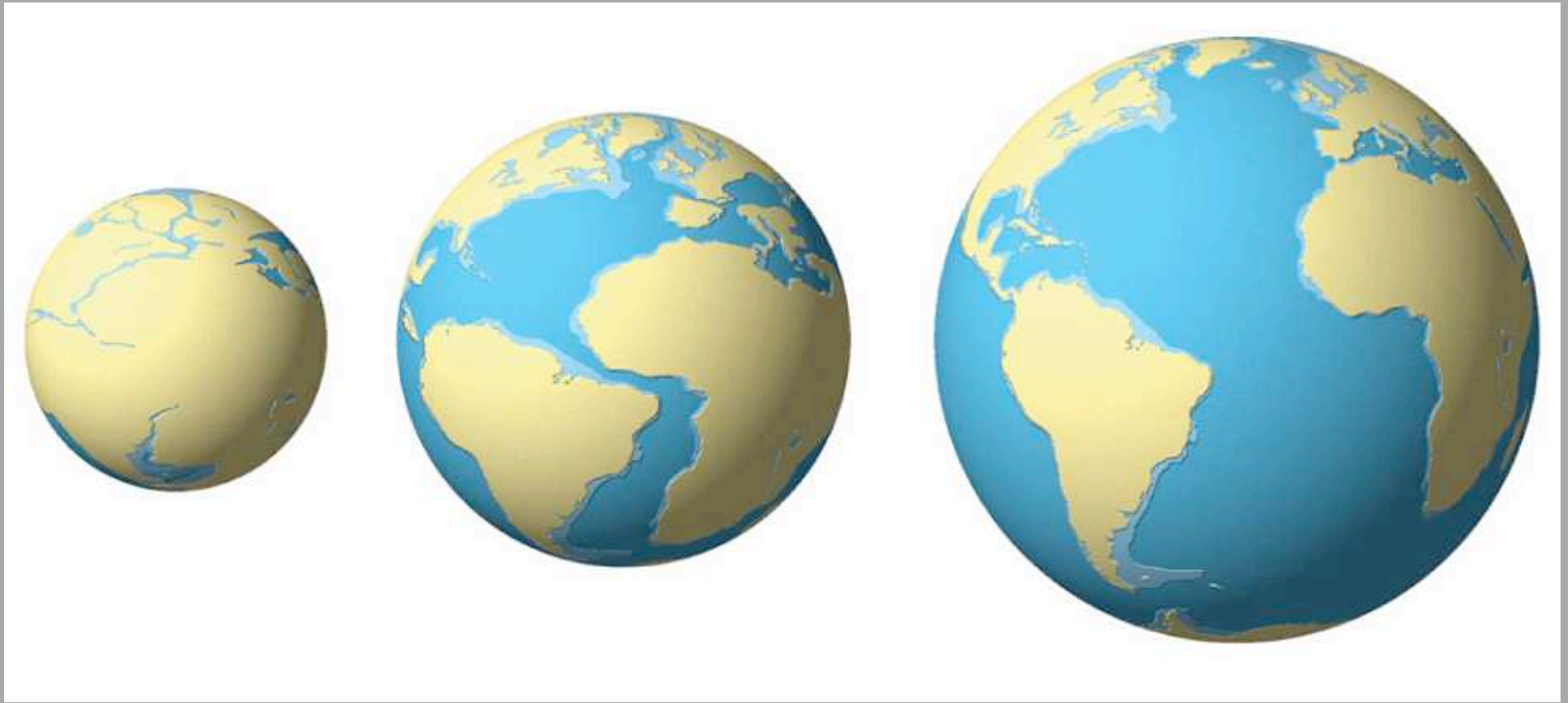
Harry Hammond Hess
(1906 - 1969)

Robert Dietz
(1914 - 1995)

grossartige Karten !



noch immer kein Mechanismus



Expandierende Erde ?

weitere Hypothesen

FLÖSSEREI



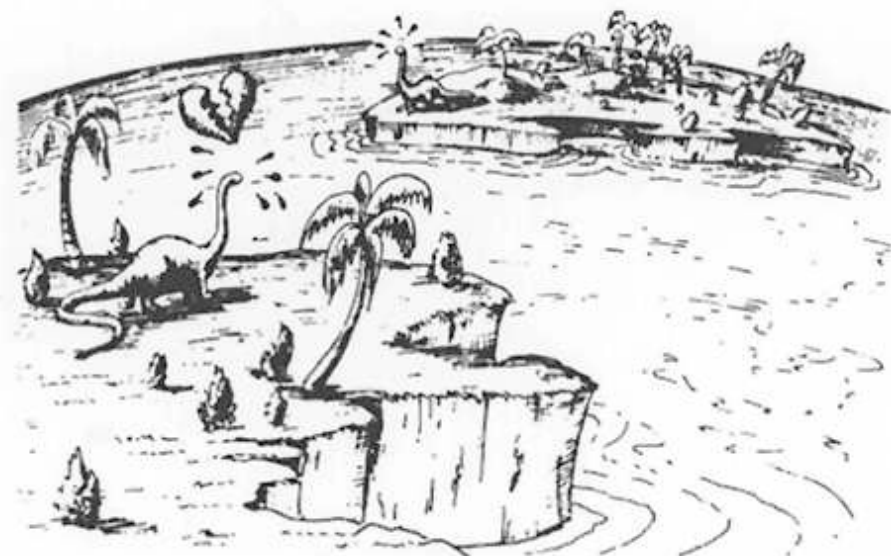
LANDBRÜCKEN



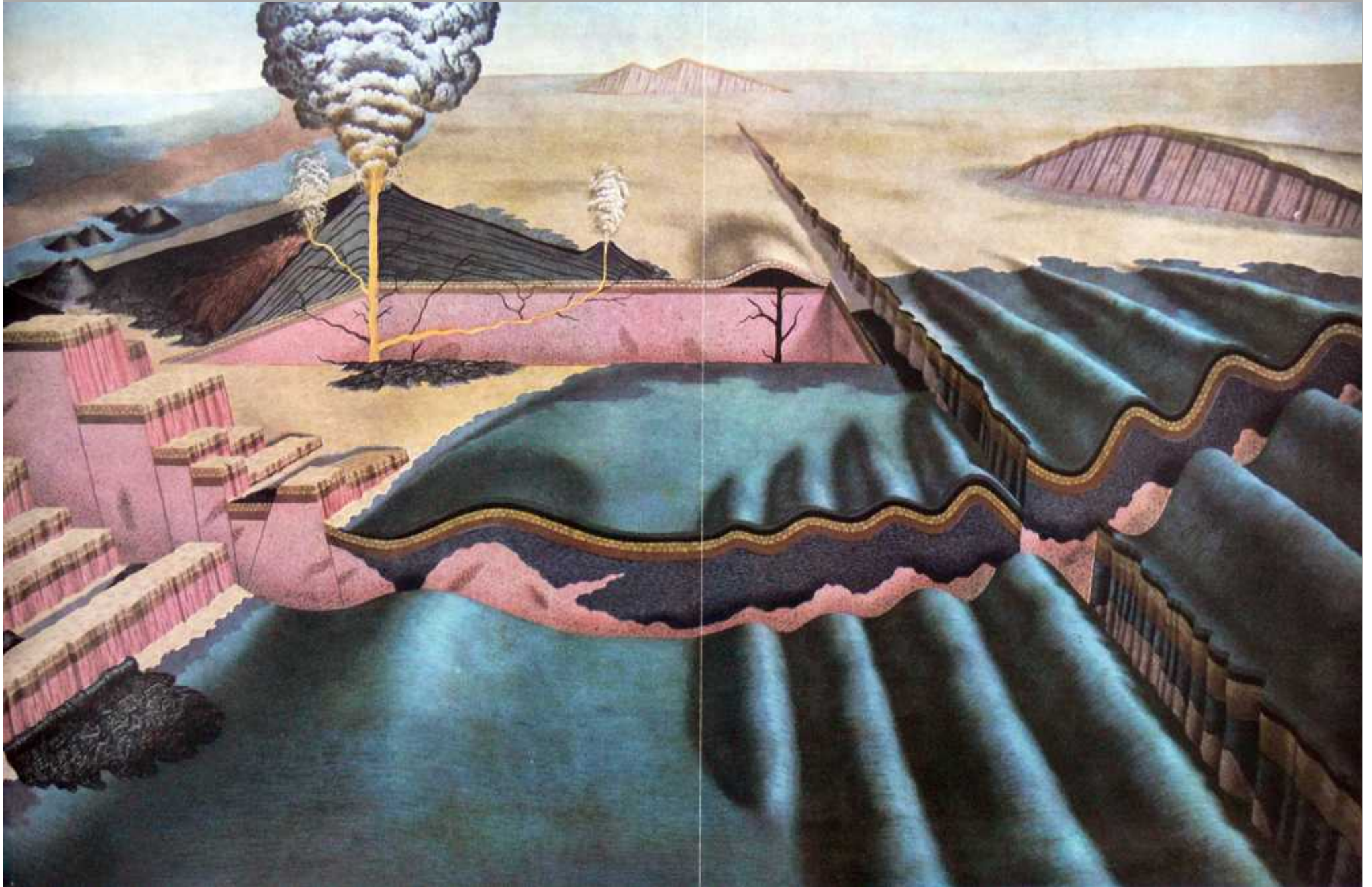
FURT



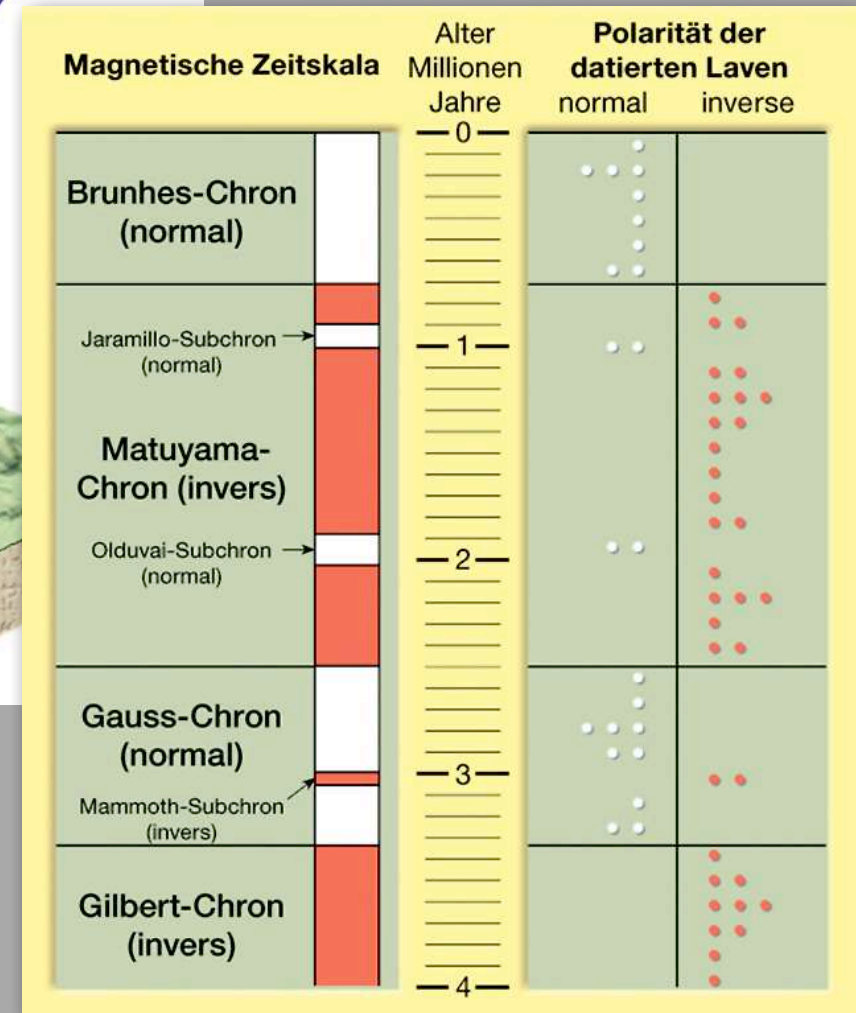
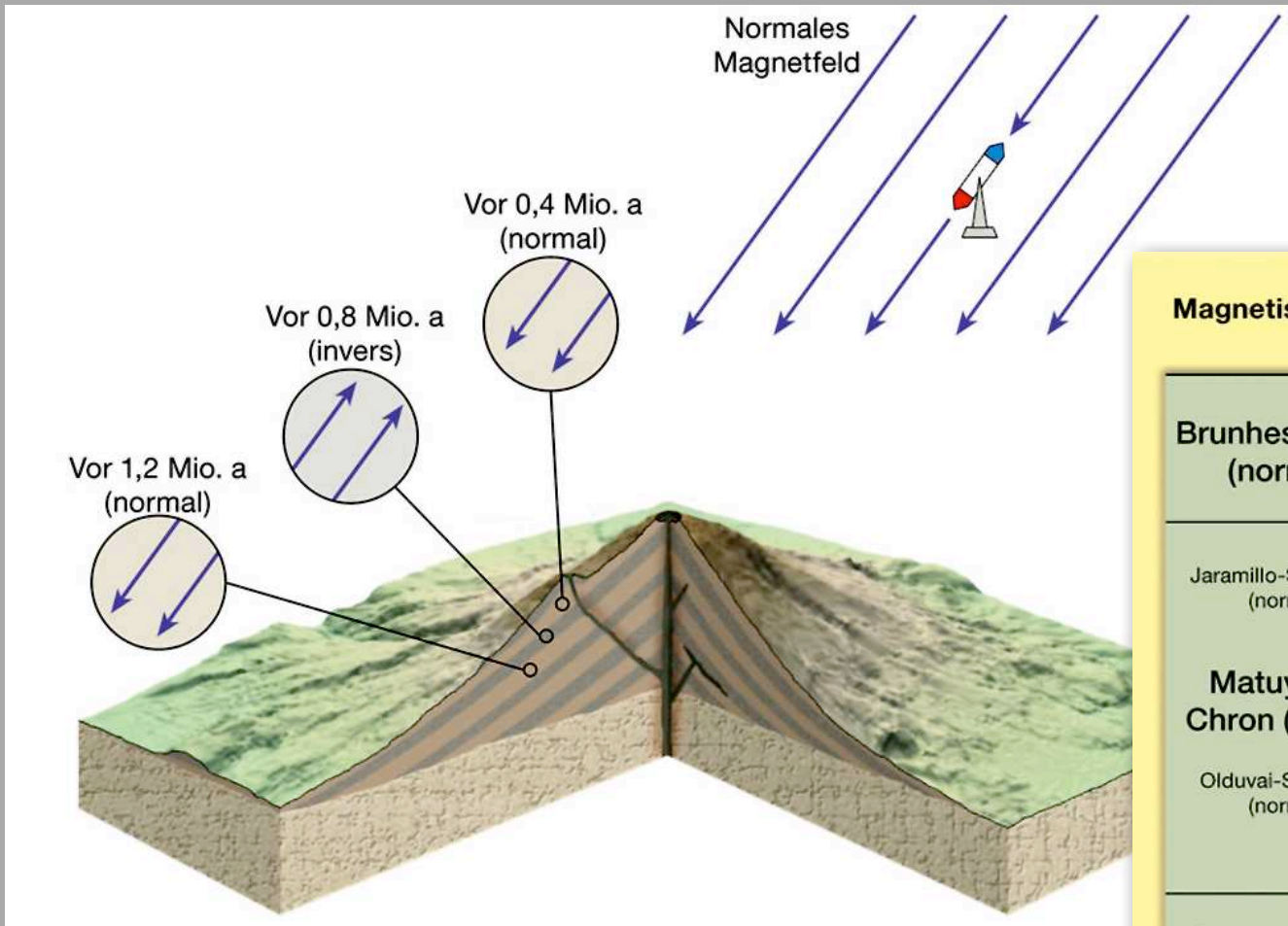
KONTINENTALDRIFT



noch immer keine gute Theorie ...



Fossiler Magnetismus



Polumkehrungen

⇒ Magnetostratigraphie

der Durchbruch !

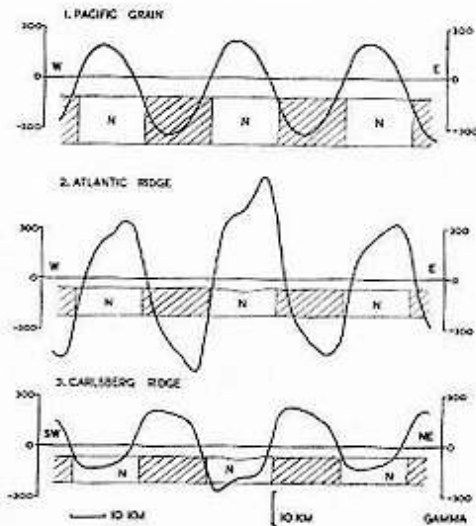
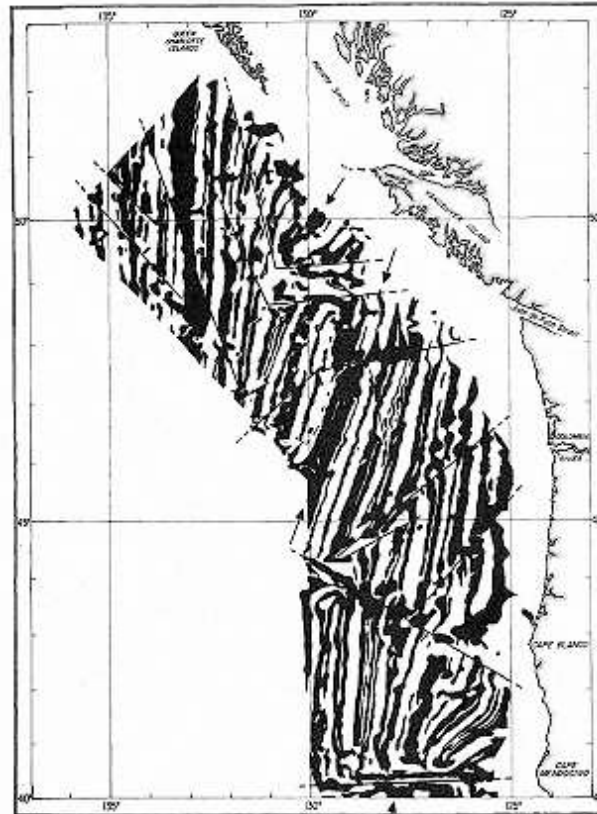


Fig. 4. Magnetic profiles computed for various crustal models. Crustal blocks marked *N*, normally magnetized; diagonally shaded blocks, reversely magnetized. Effective susceptibility of blocks, 0.0027, except for the block under the median valley in profiles 2 and 3, 0.0053. (1) Pacific Grain. Total field strength, $T = 0.5$ oersted; inclination, $I = 60^\circ$; magnetic bearing of profile, $\theta = 073^\circ$. (2) Mid-Atlantic Ridge, $T = 0.48$ oersted; $I = 65^\circ$; $\theta = 120^\circ$. (3) Carlsberg Ridge, $T = 0.376$ oersted; $I = -6^\circ$; $\theta = 044^\circ$.



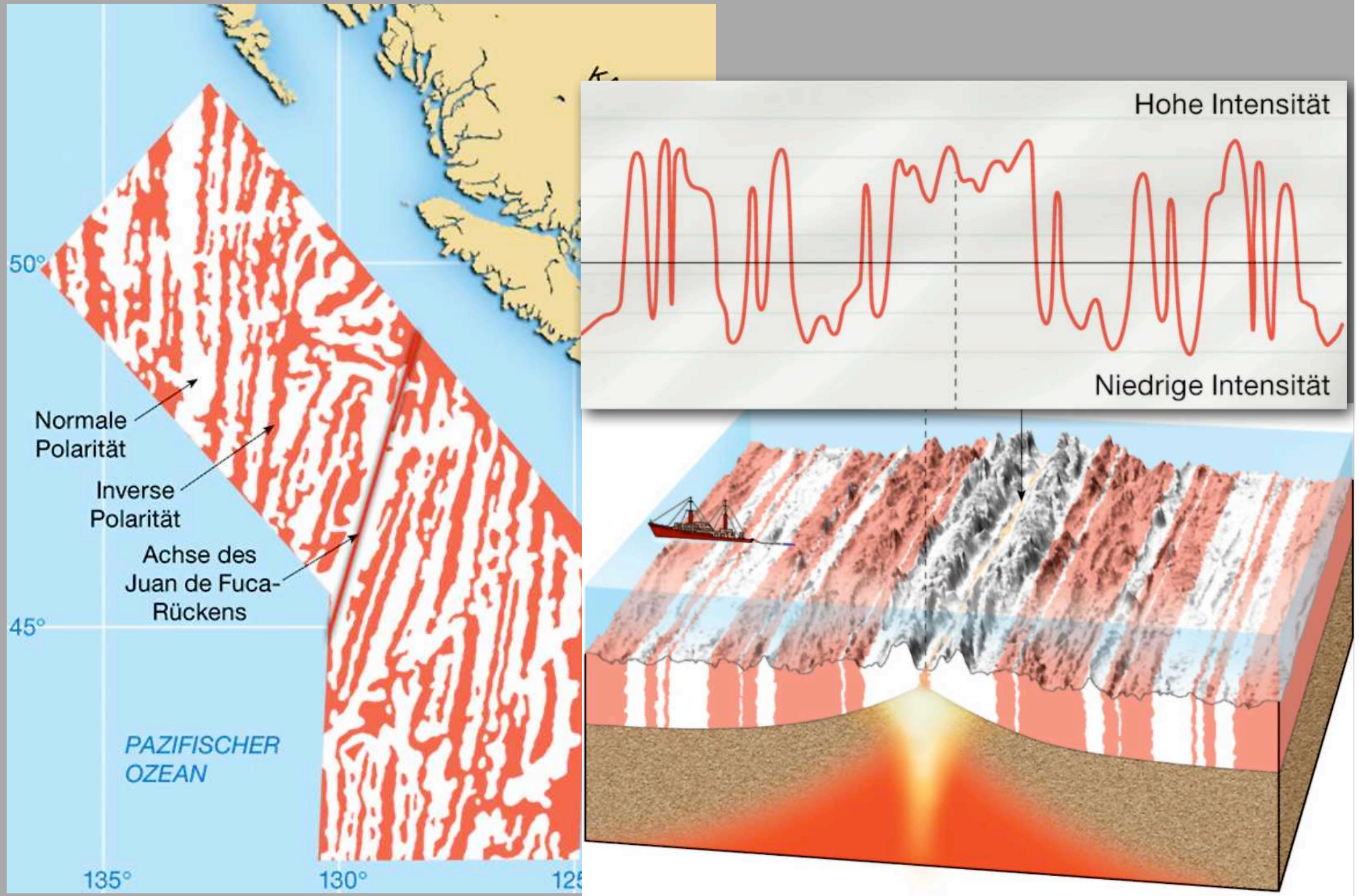
Summary of anomalies in the earth's magnetic field measured at sea level off British Columbia, Washington, and Oregon. Areas of anomalously high field strength are shown in black. Straight lines indicate faults offsetting the anomaly pattern; arrows, the axes of three short ridge lengths in the area - from north to south, the Explorer, Juan de Fuca, and Gorda Ridges. Reproduced courtesy of the Geological Society of America. (Raff and Mason, 1961, note 11.)



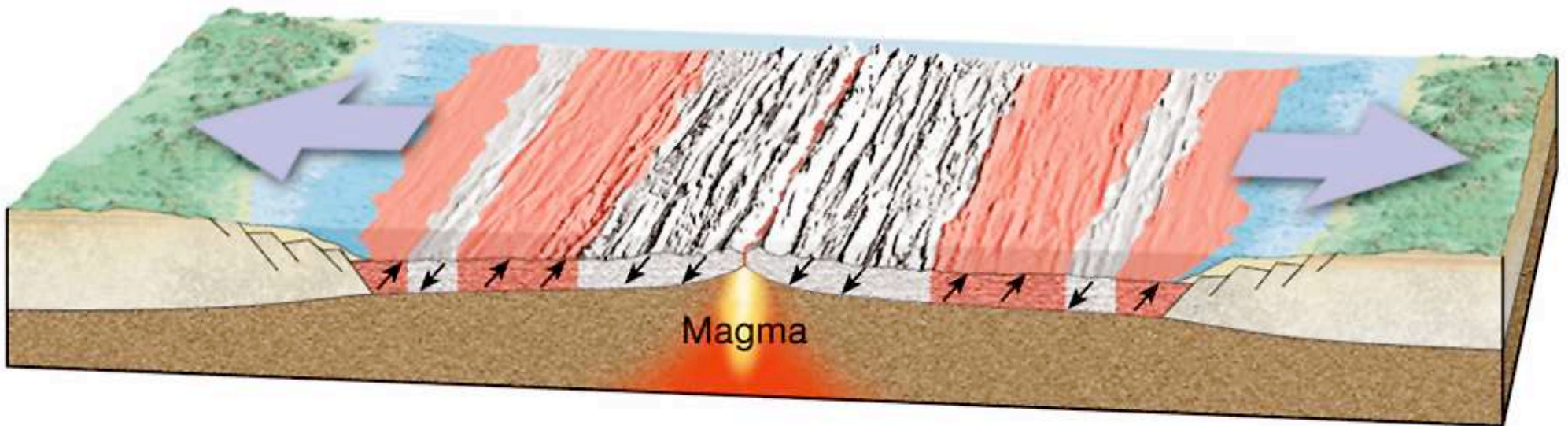
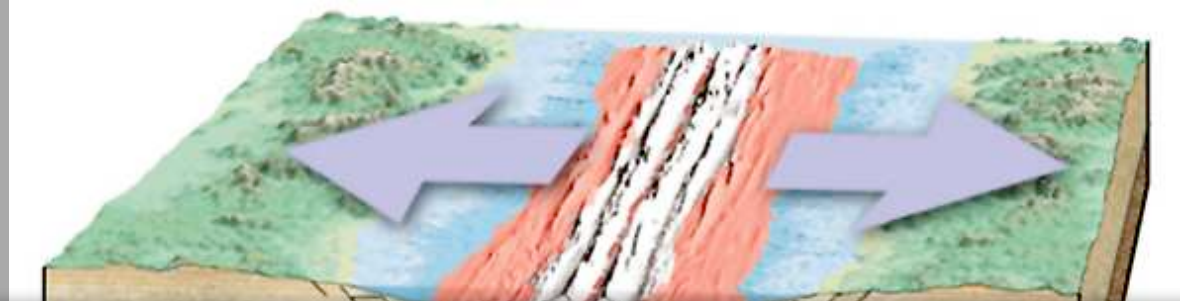
Frederick Vine
(* 1939)

Drummond Hoyle
Matthews (1931 - 1997)

magnetische Lineationen

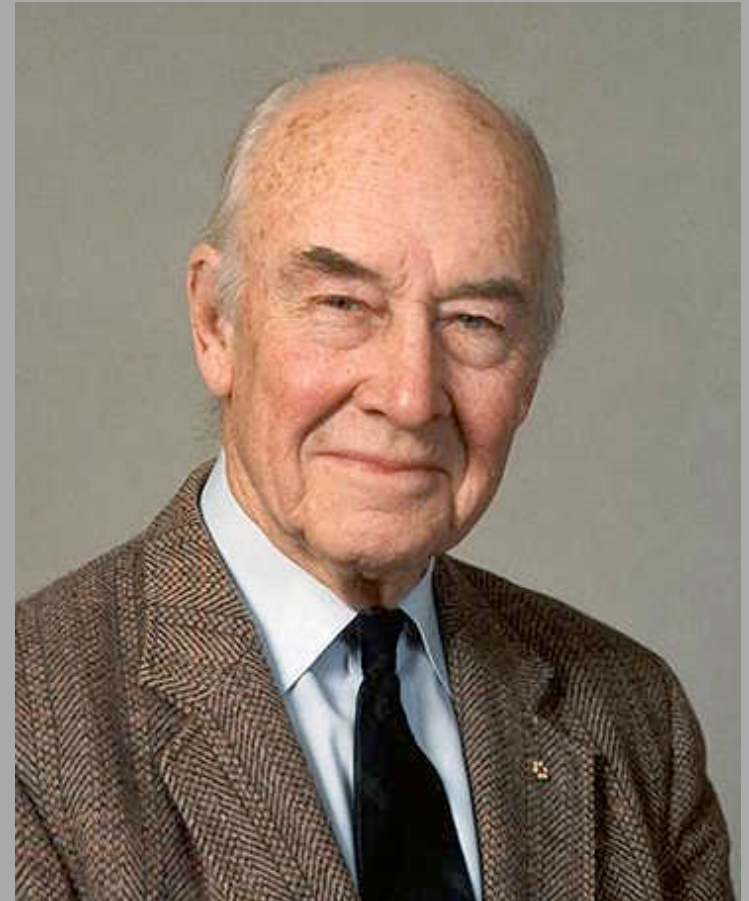


Sea Floor Spreading !



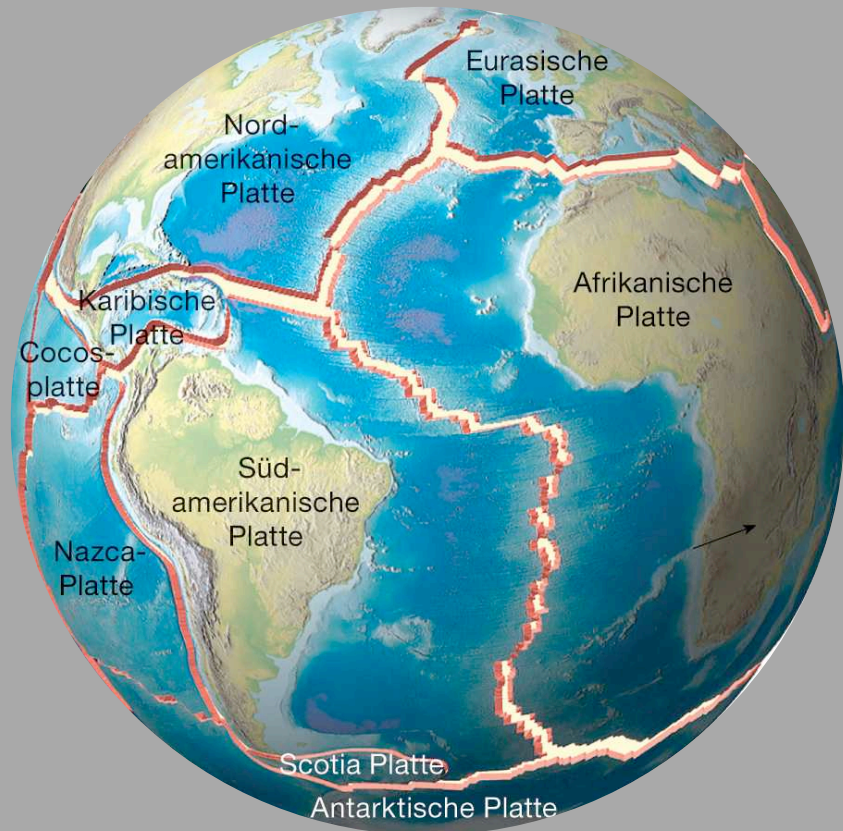
"Platten" !

1.
Neues Material an konstruktiven Plattengrenzen (sea floor spreading)
2.
Erdoberfläche = konstant: Subduktion an destruktiven Plattengrenzen
3.
Platten sind steif, können Spannungen übertragen



John Tuzo Wilson
(1908 - 1993)

"Plattentektonik" !



John Tuzo Wilson
(1908 - 1993)

Wilson Zyklus = 500 Ma

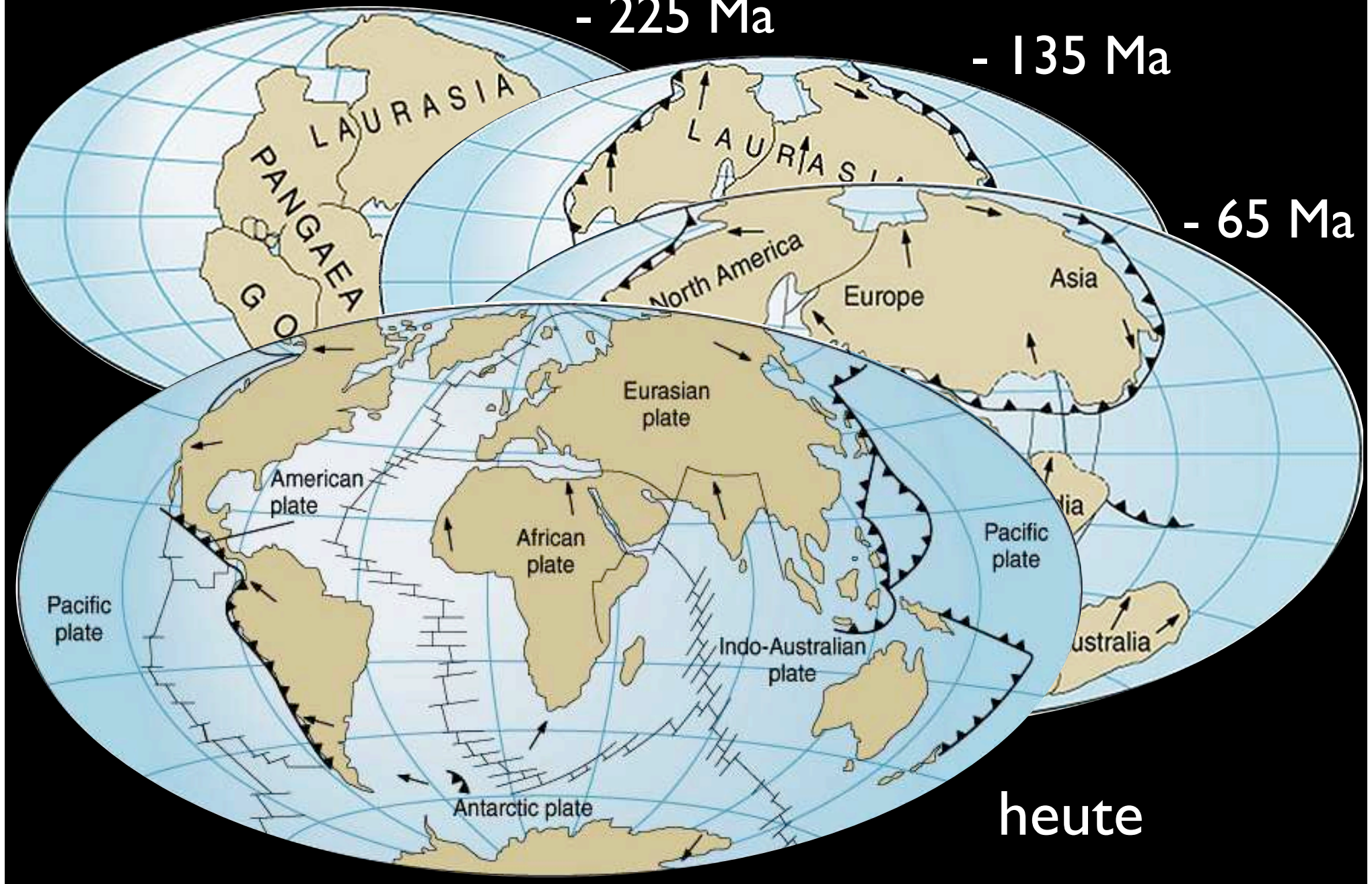
Pangäa ⇨ Kontinente ⇨ Pangäa

Wilson Cycle

- 225 Ma

- 135 Ma

- 65 Ma



Wilson Zyklus zu Ende geführt ...

