Tatort Plattengrenze 2015 - Themen

1 *5. November*
Trailer
Einführung
Entstehung der Erde

2 *12. November* *
Geologische Zeiträume
Plattentektonik
Platten und Plattengrenzen

3 *19. November*
konstruktive Plattengrenzen
destruktive Plattengrenzen
konservative Plattengrenzen

4 *26. November*
Plattenrundgang
Tatort: Nepal 2015

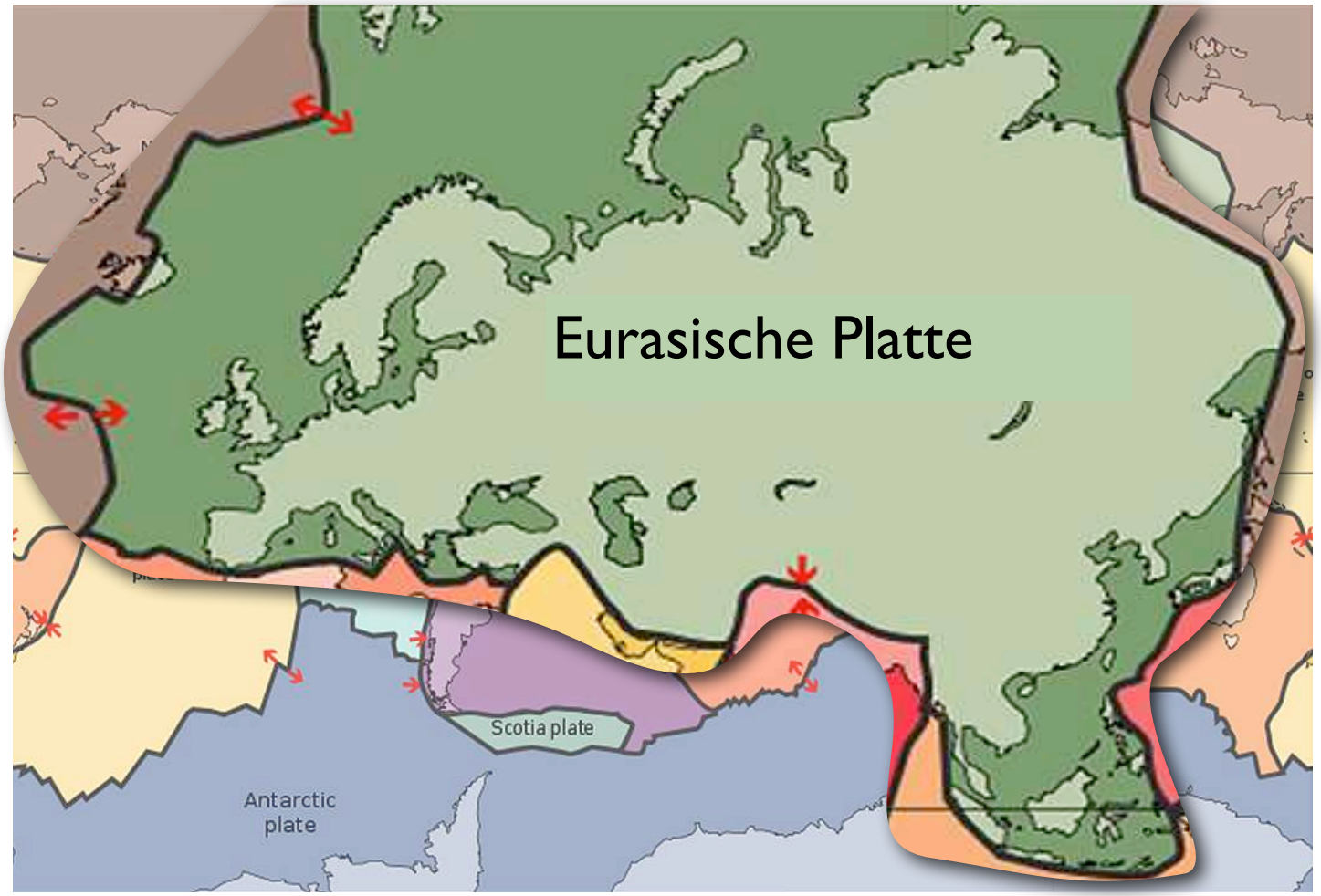
5 *3. Dezember*
Alles über Erdbeben
Magnitude
Intensitäten

6 *10. Dezember*
Berühmte Fälle
San Francisco
Tohoku

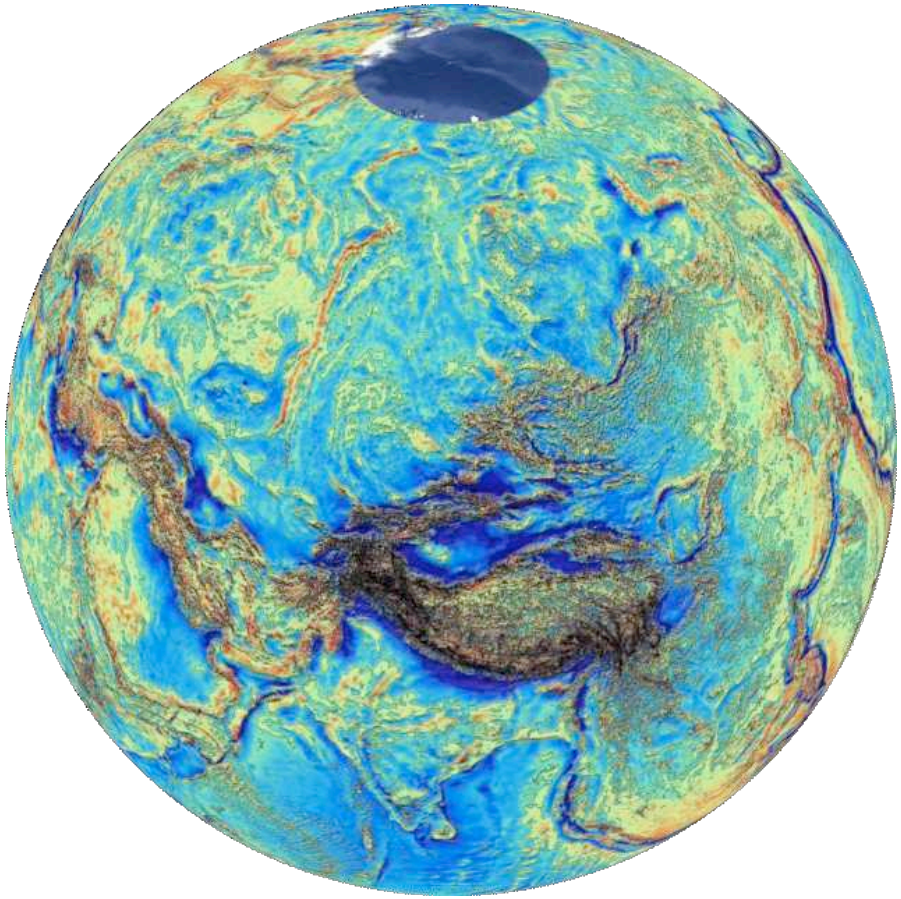
* *im Bernoullianum Hörsaal 223*

Eurasia - "unsere Platte"

Eurasische Platte



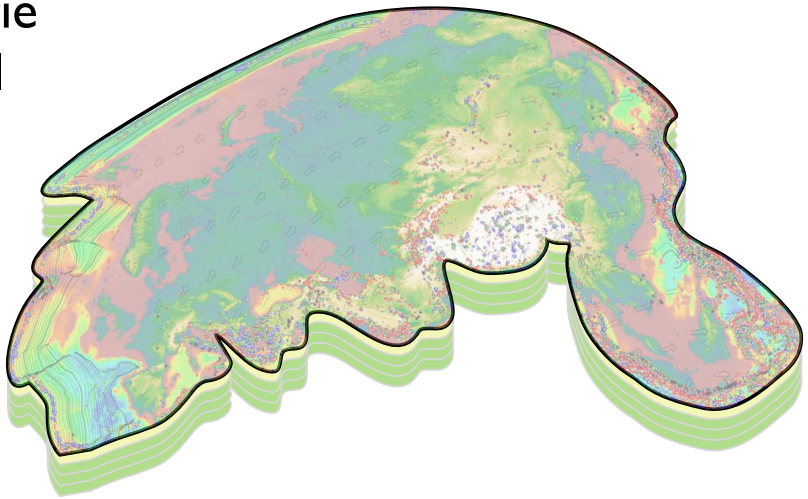
unsere Eurasische Platte

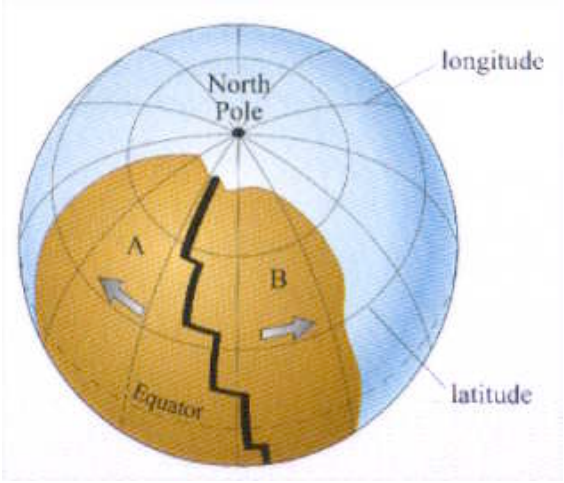


Freiluft - Anomalie

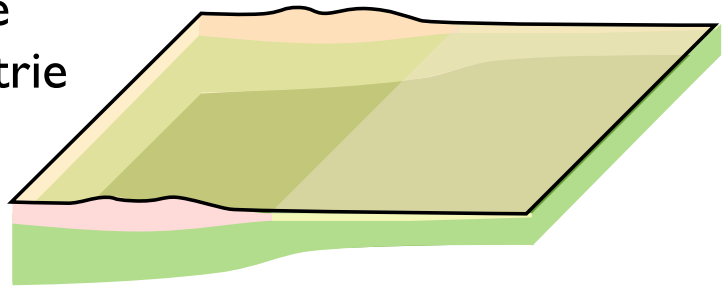
pro memoria: Tektonische Platten in 3D und 2D

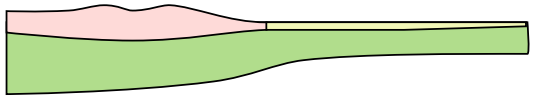
3D Geometrie
auf der Kugel



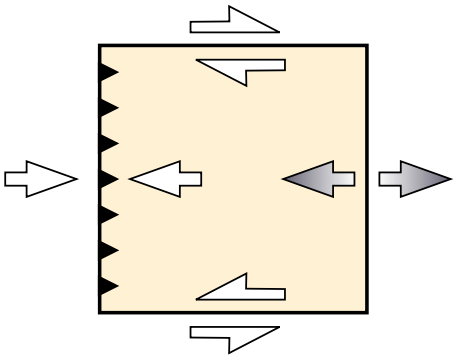


vereinfachte
3D Geometrie
orthogonal



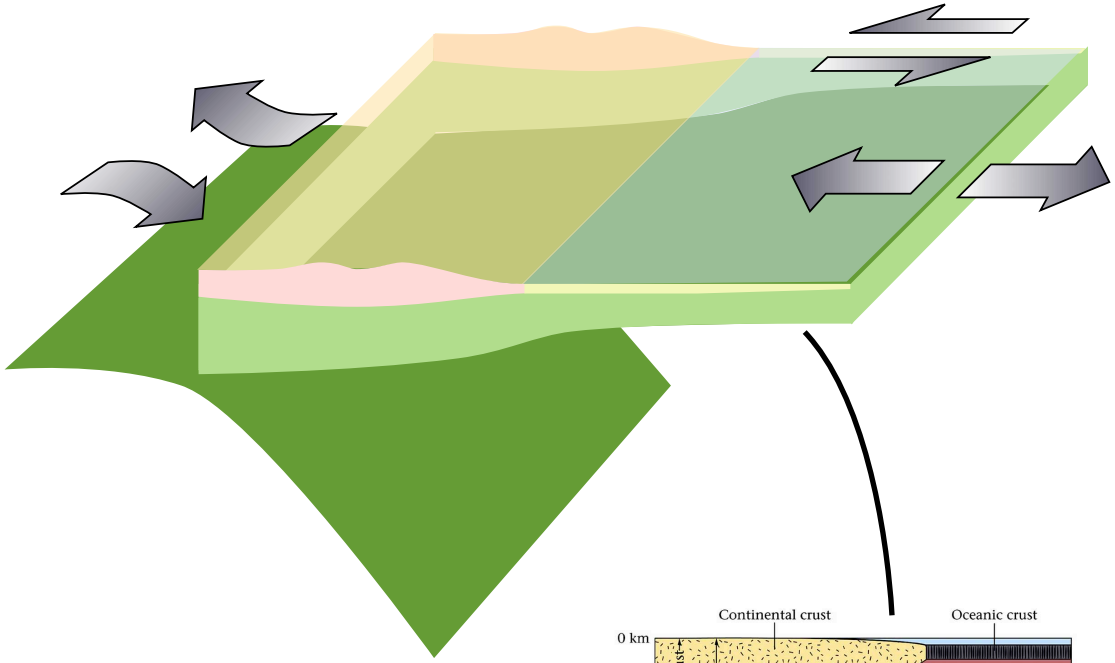


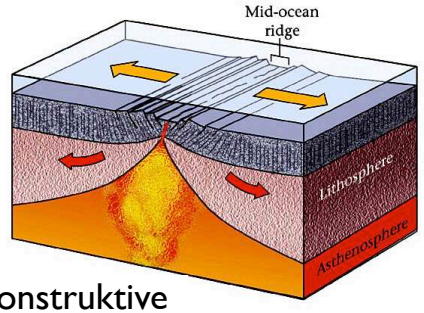
Profilansicht



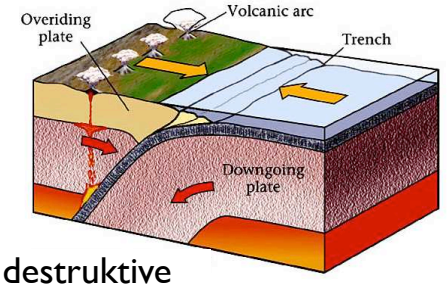
Kartenansicht

Tektonische Platten und ihre Grenzen

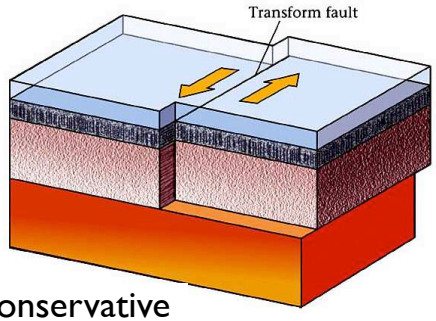




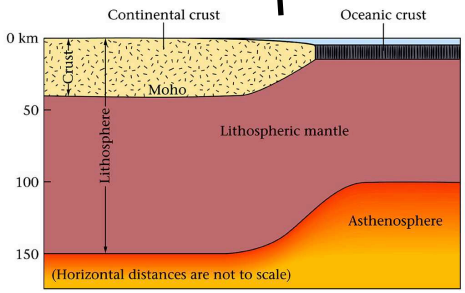
1 konstruktive Plattengrenze



2 destruktive Plattengrenze

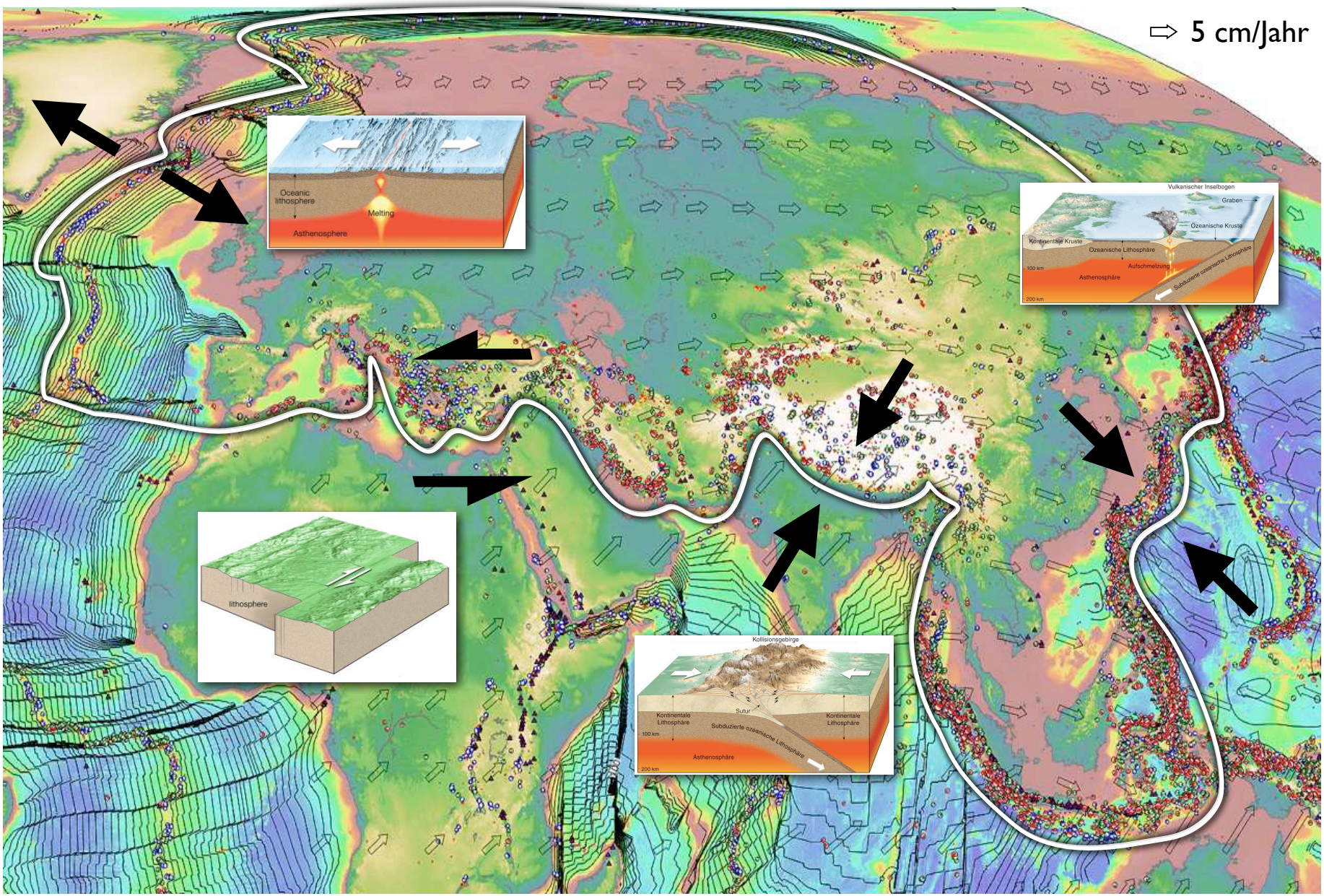


3 konservative Plattengrenze



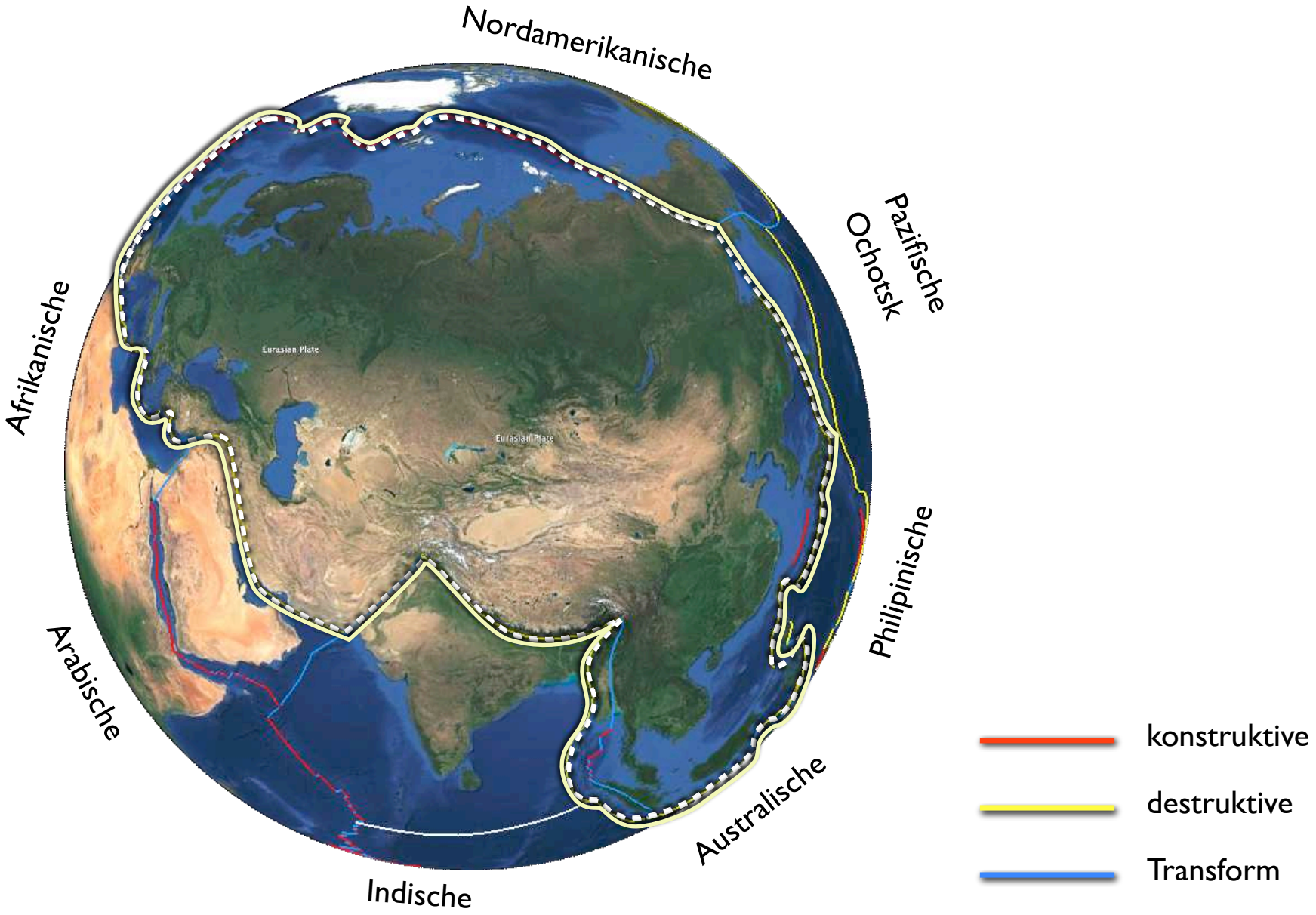
4 Platten-Untergrenze: Asthenosphäre

Plattengrenzen

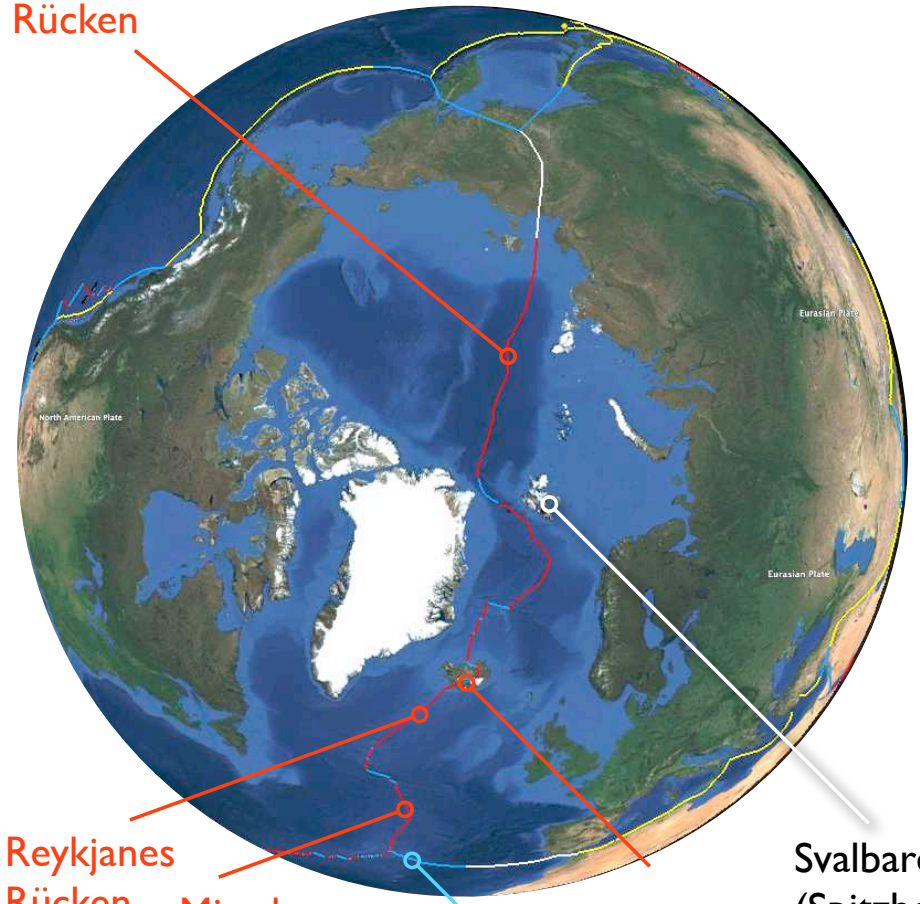


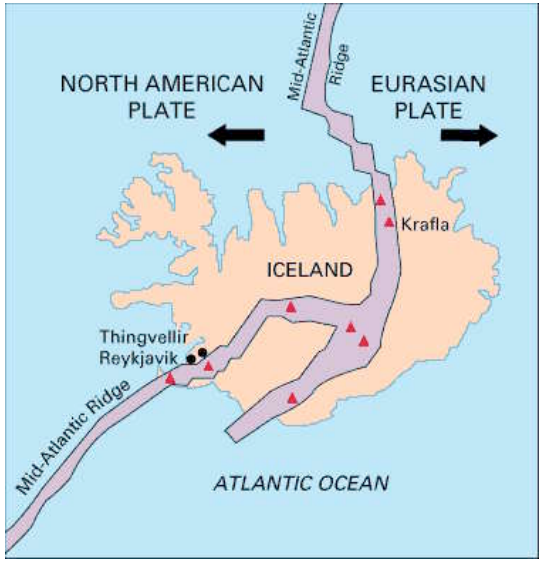
Plattenrundgang

Die Eurasische Platte und ihre 7 Nachbarinnen



West- und Nordgrenze



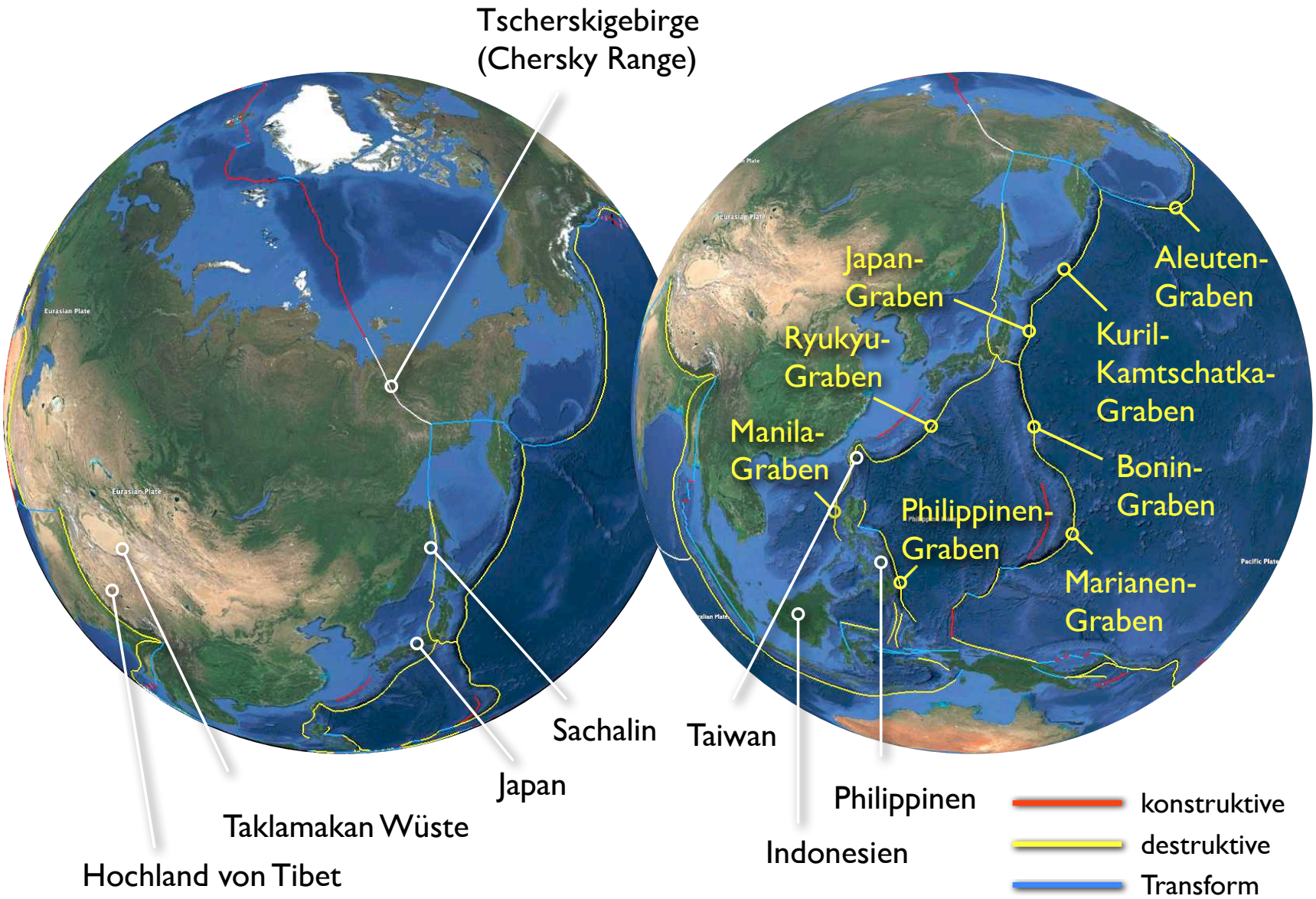


konstruktive

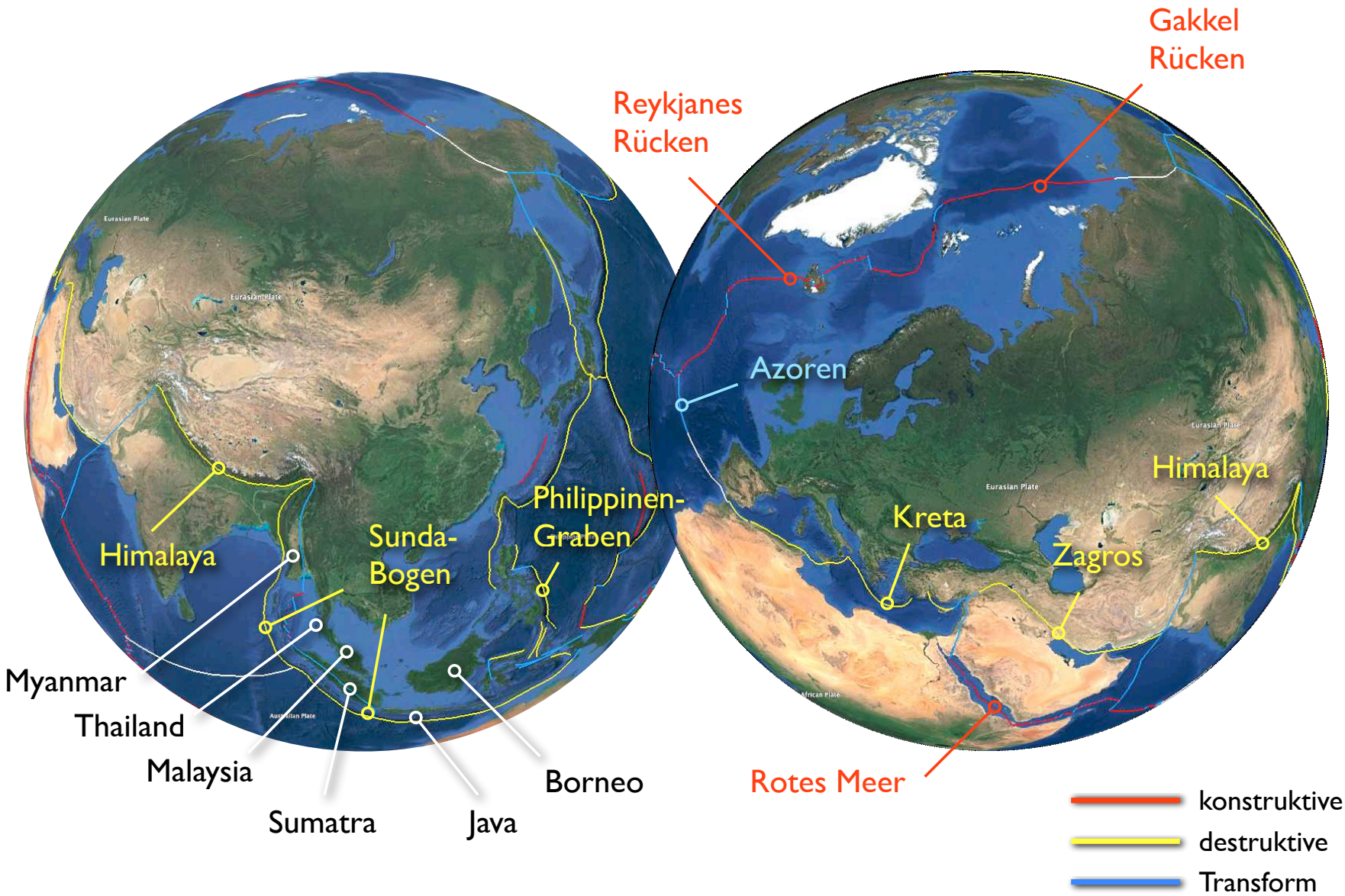
destruktive

Transform

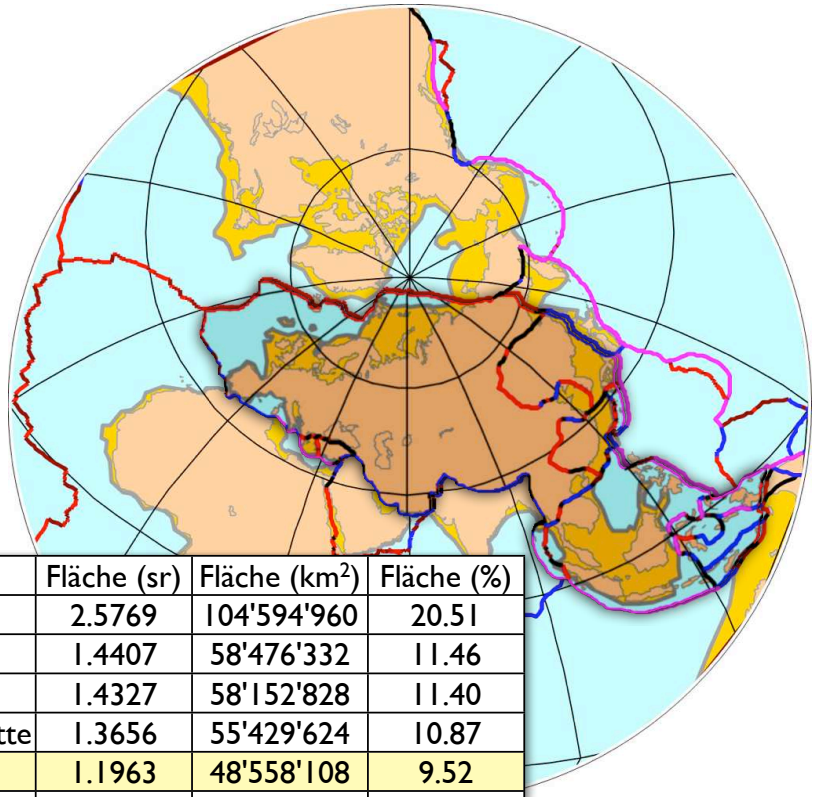
Nordost- und Ostgrenze



Südost- und Südwestgrenze



Die Eurasische Platte ...



		Fläche (sr)	Fläche (km^2)	Fläche (%)
1	Pazifische Platte	2.5769	104'594'960	20.51
2	Afrikanische Platte	1.4407	58'476'332	11.46
3	Antarktische Platte	1.4327	58'152'828	11.40
4	Nordamerikanische Platte	1.3656	55'429'624	10.87
5	Eurasische Platte	1.1963	48'558'108	9.52
6	Australische Platte	1.1329	45'986'312	9.02
7	Südamerikanische Platte	1.0305	41'826'216	8.20
8	Somaliaplatte	0.4719	19'155'346	3.76
9	Nazcaplatte	0.3967	16'101'743	3.16
10	Indische Platte	0.3064	12'435'632	2.44
11	Sundaplatte	0.2197	8'916'458	1.75
12	Philippinenseeplatte	0.1341	5'442'745	1.07
13	Amurplatte	0.1307	5'303'521	1.04
14	Arabische Platte	0.1208	4'904'112	0.96
15	Ochotskplatte	0.0748	3'036'962	0.60

Kontinentale Anteile

Europa und Asien
ohne:
- Indischen Subkontinent
- Arabischen Subkontinent
- Ost-Sibirien (östlich von Chersky-Kette)

Ozeanische Anteile

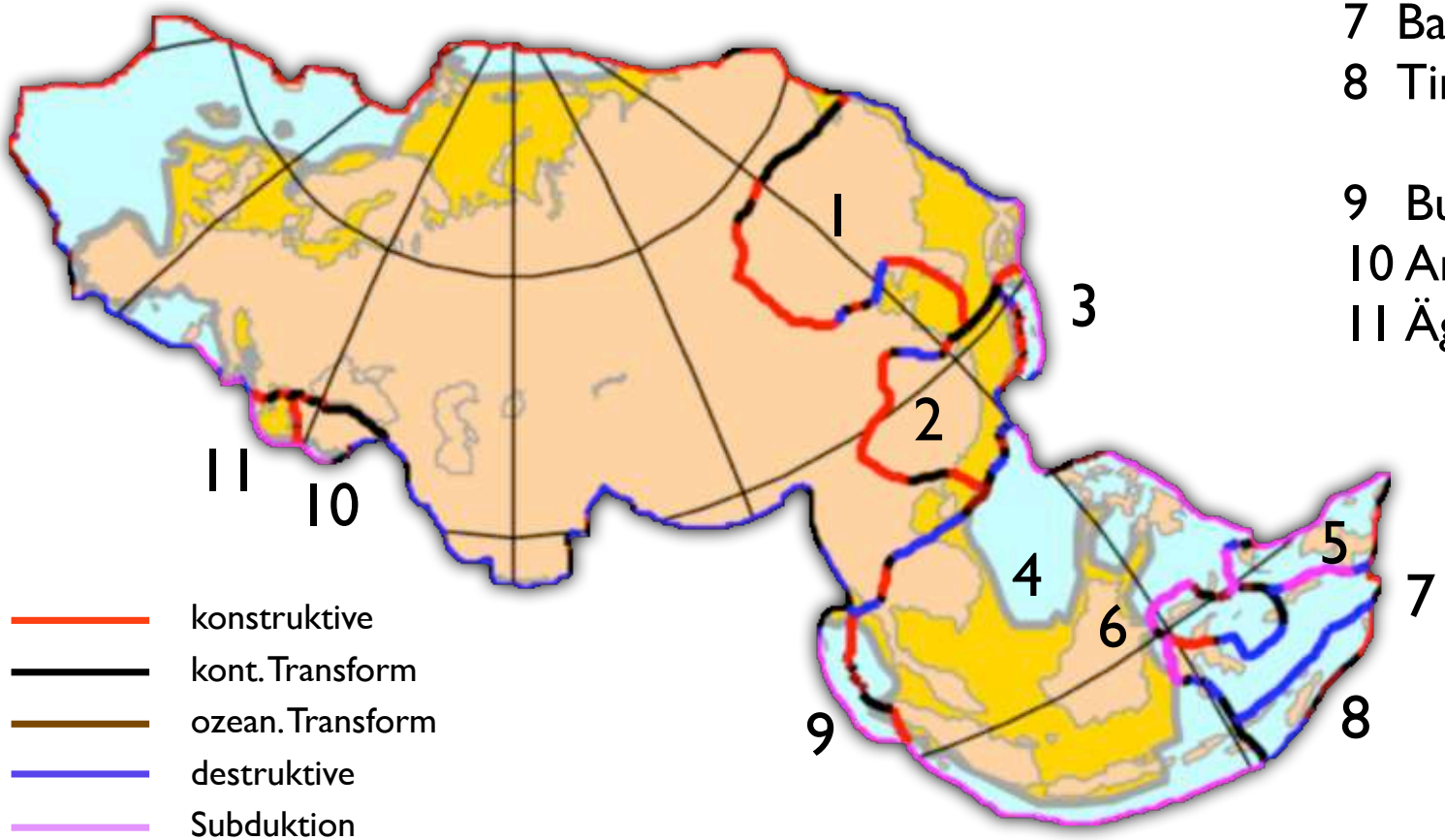
im Westen: bis zum Mittelatlantischen Rücken inklusive Island
im Norden: bis zum Gakkel-Rücken

Plattengrenzen-Typen

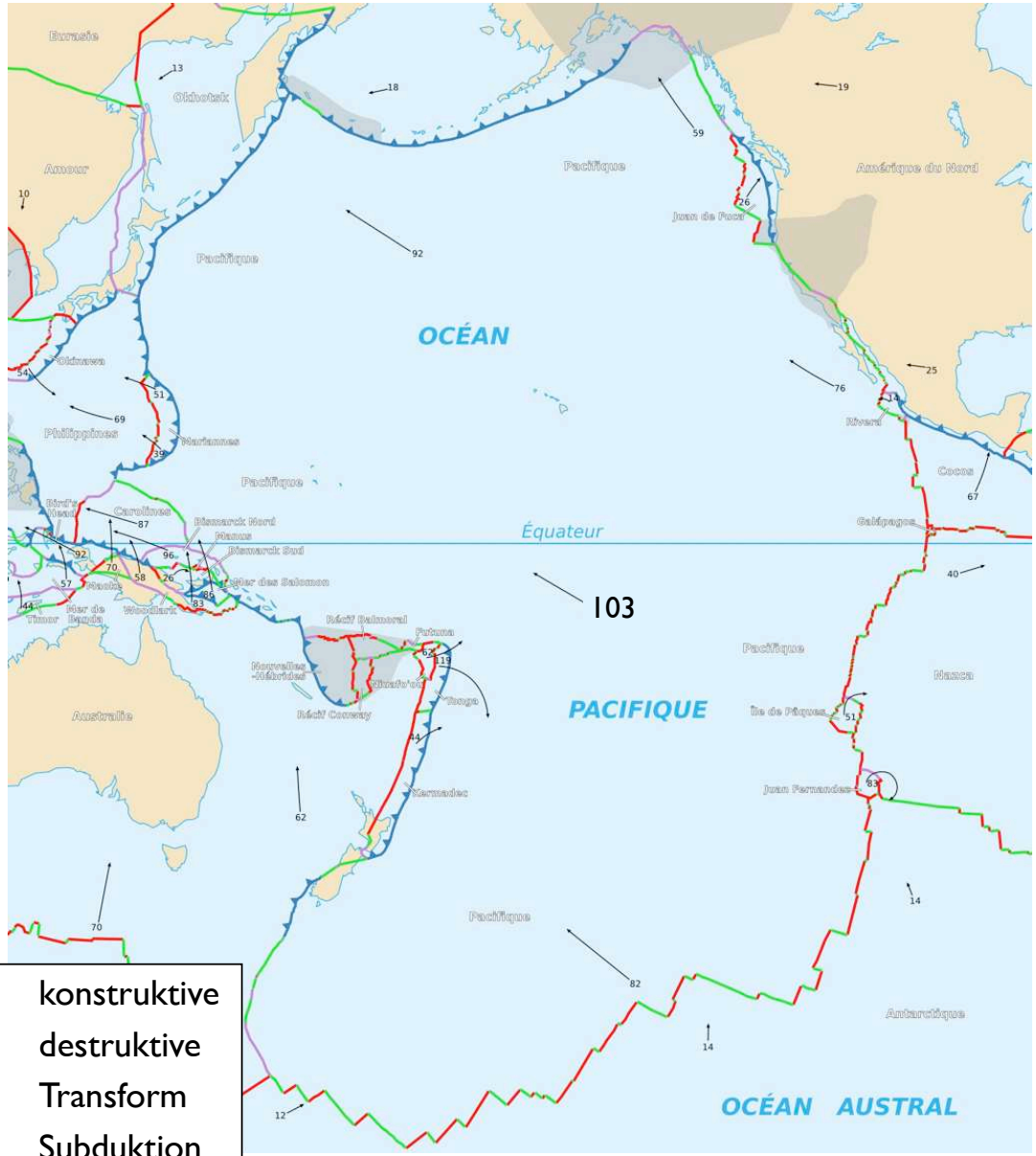
- konstruktive
- kont. Transform
- ozean. Transform
- destruktive
- Subduktion

... und ihre vielen Teil- und Mikroplatten

1 Amur
2 Yangtse
3 Okinawa
4 Sunda
5 Bird's Head
6 Molukkensee
7 Bandasee
8 Timor
9 Burma
10 Anatolia
11 Ägäis



Östlicher (Beinahe-)Nachbar: Pazifische Platte



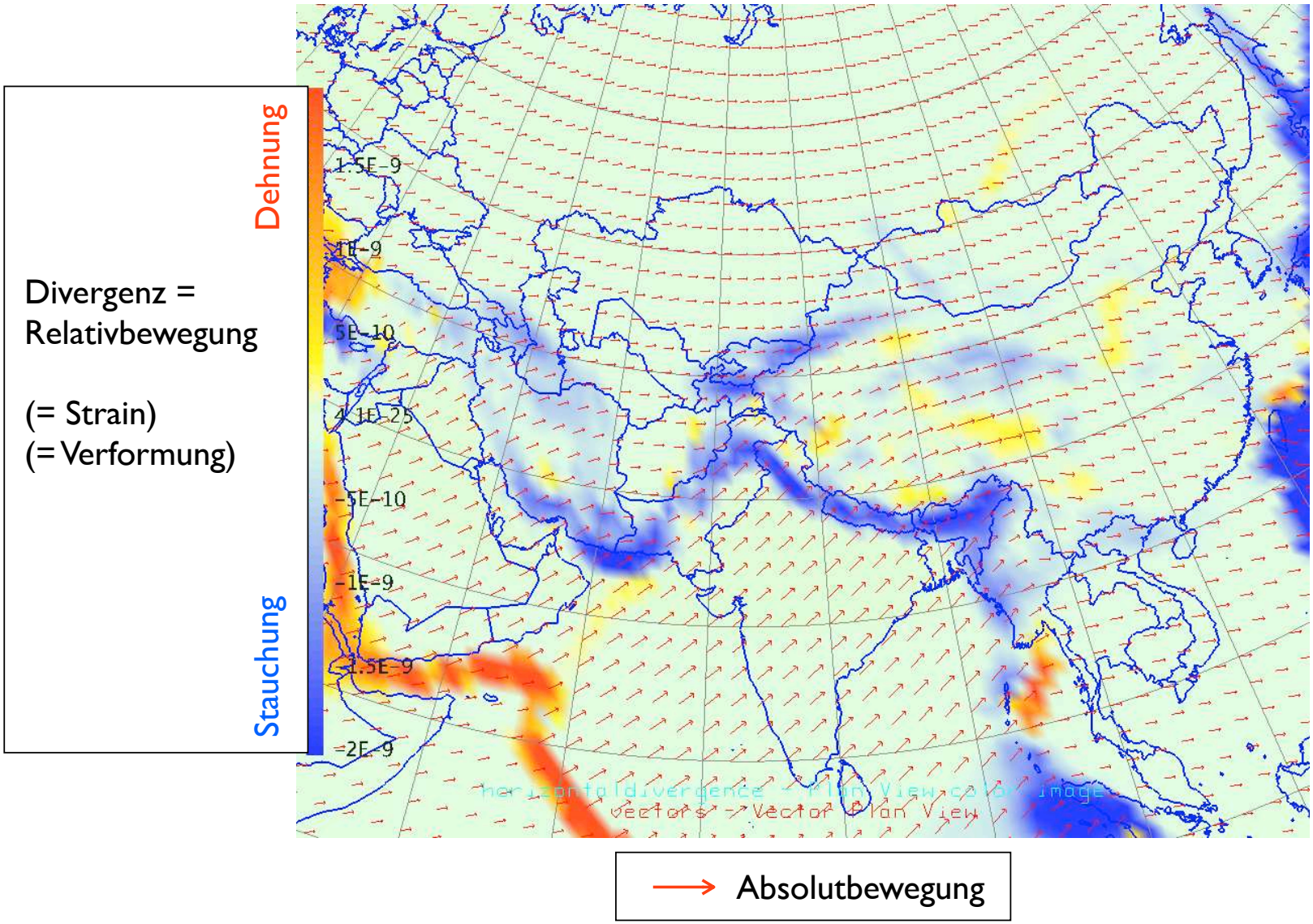
1	Pazifische Platte
2	Afrikanische Platte
3	Antarktische Platte
4	Nordamerikanische Platte
5	Eurasische Platte
6	Australische Platte
7	Südamerikanische Platte

konstruktive
destruktive
Transform
Subduktion

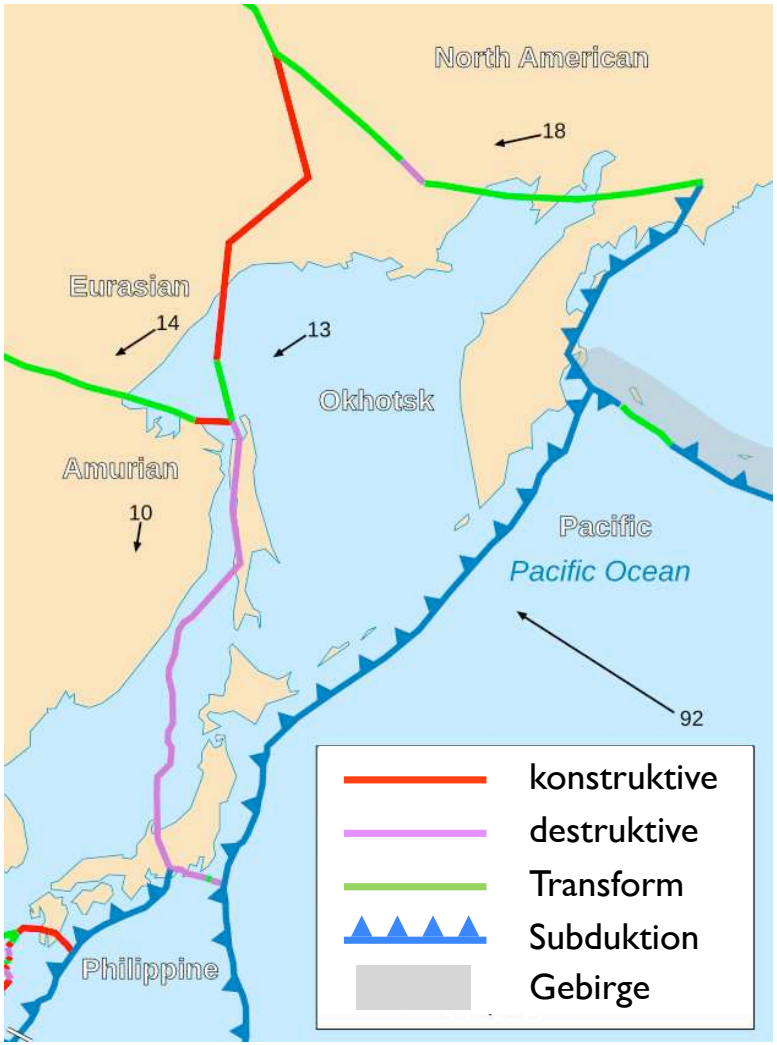
Gebirge

Plattenbewegung (mm/Jahr) bezüglich Afrika

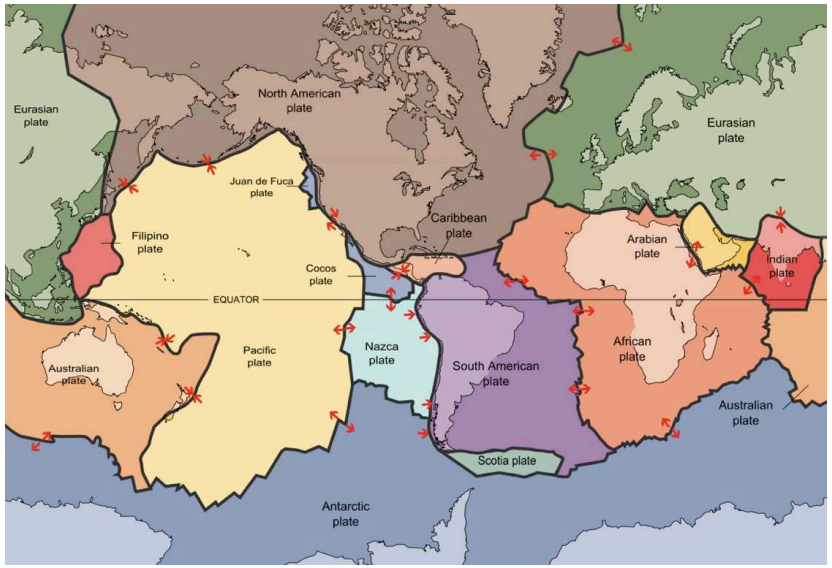
Plattenbewegungen aus GPS Messungen



Ochotskische Platte (Okhotsk Plate)

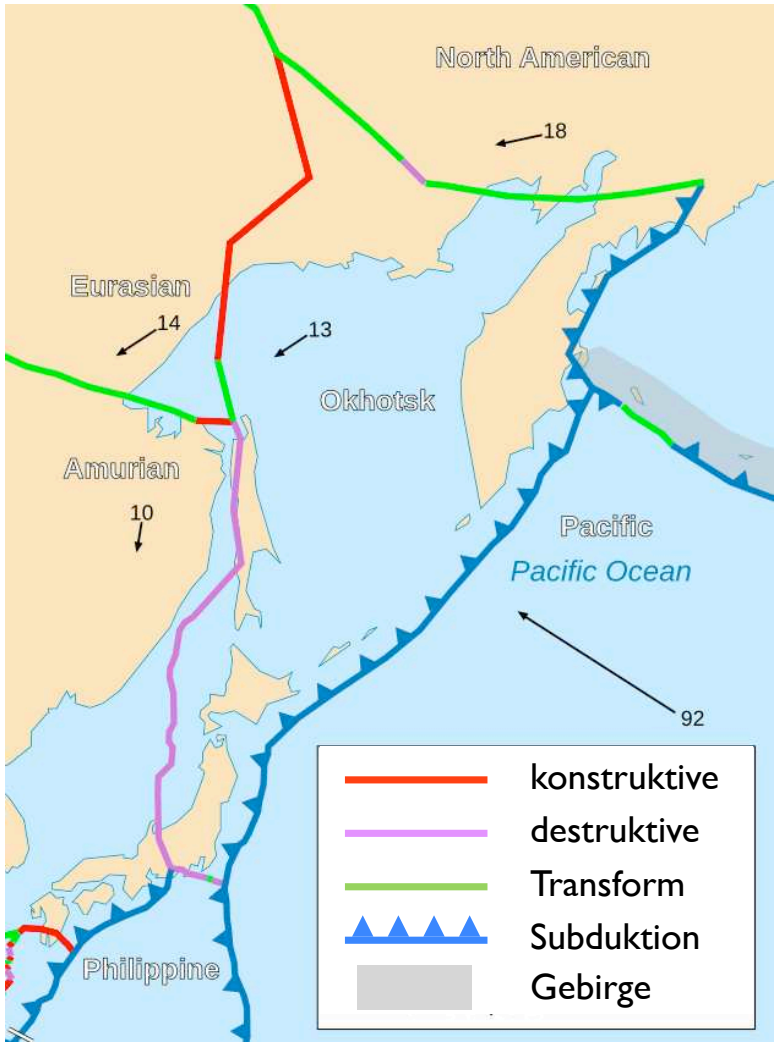


= mm/Jahr bezüglich Afrika



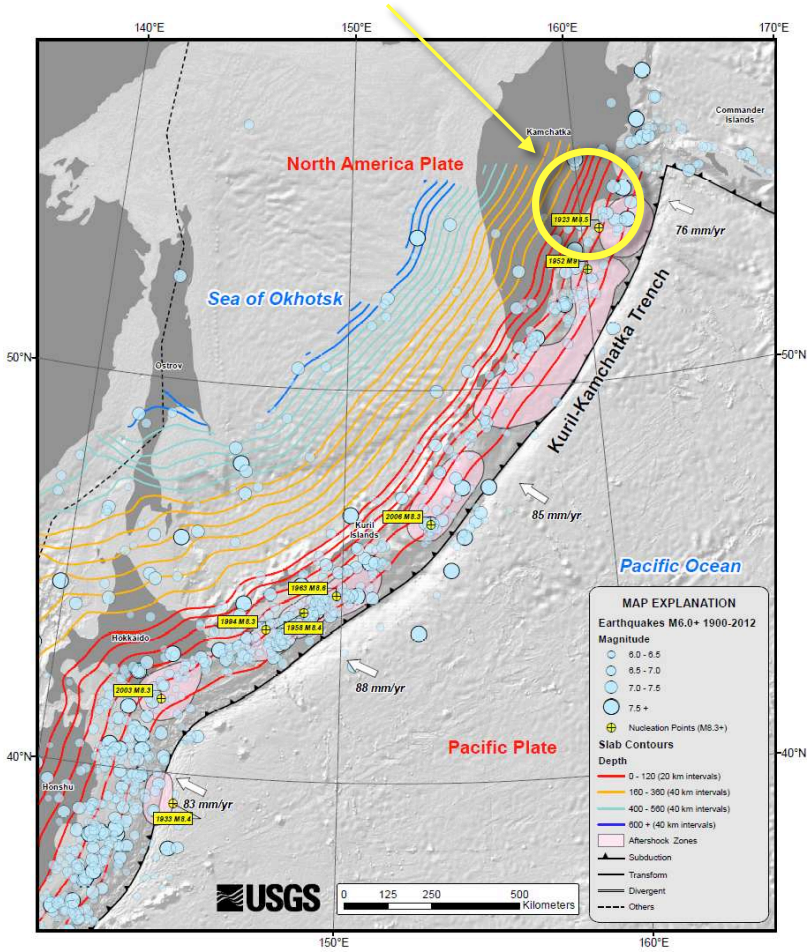
früher = Nordamerika

Ochotskische Platte (Okhotsk Plate)



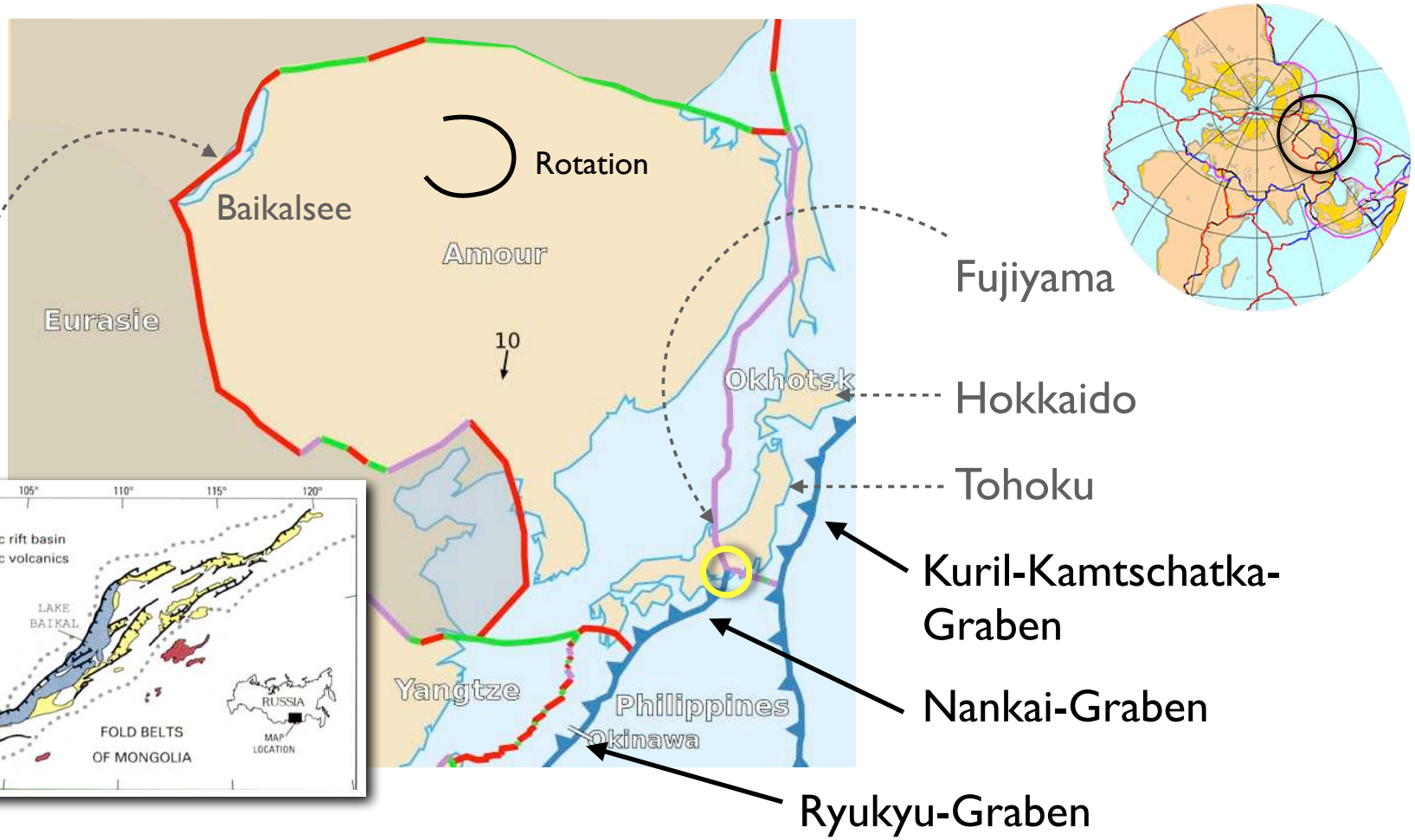
= mm/Jahr bezüglich Afrika

Kamchatka Erdbeben 4. 11. 1952 m=9.0

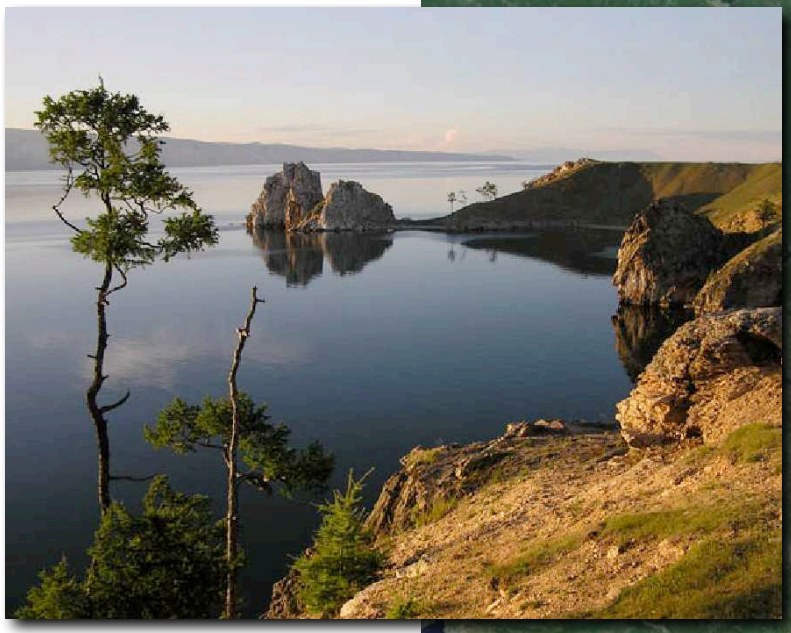


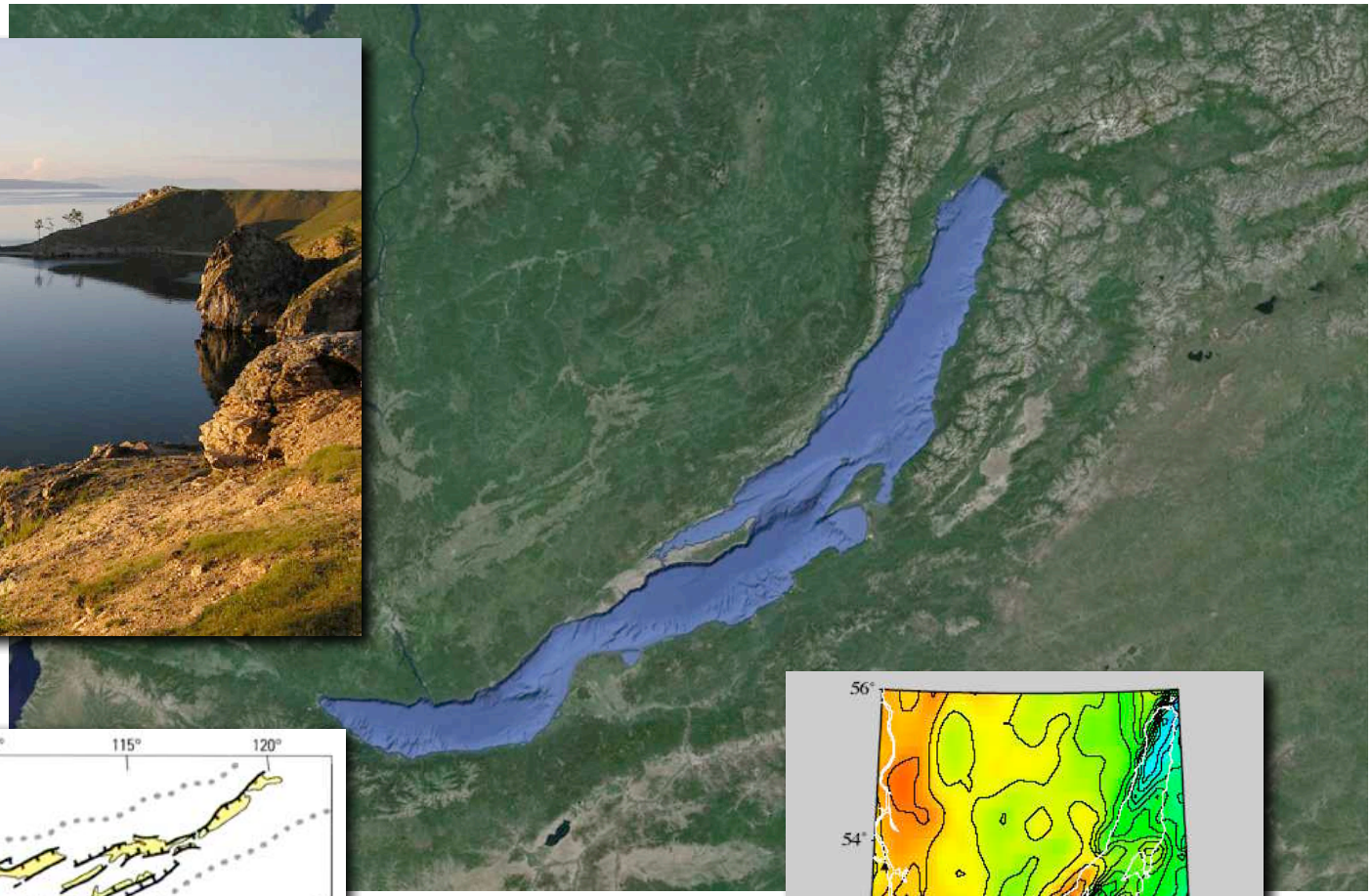
Kuril-Kamtschatka - Graben

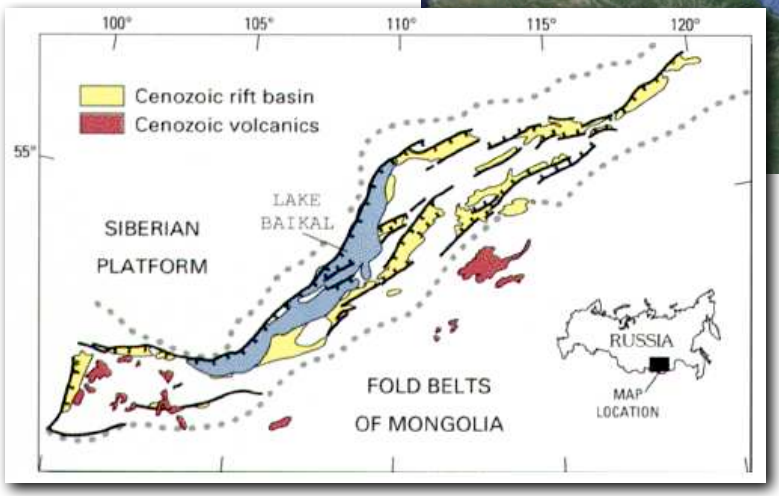
Amur- Platte (Chinesische Platte) (Amurian Plate)

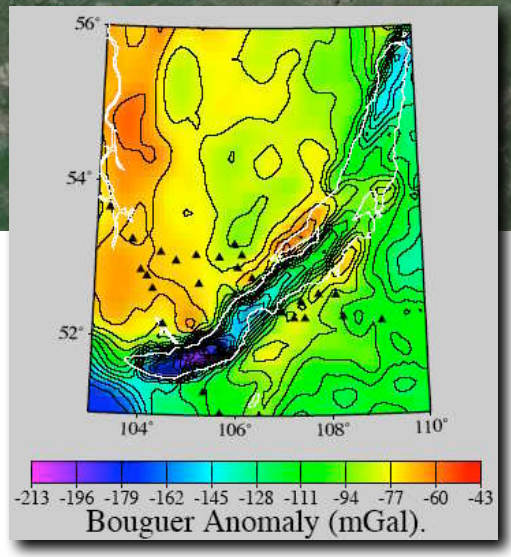


Baikalsee

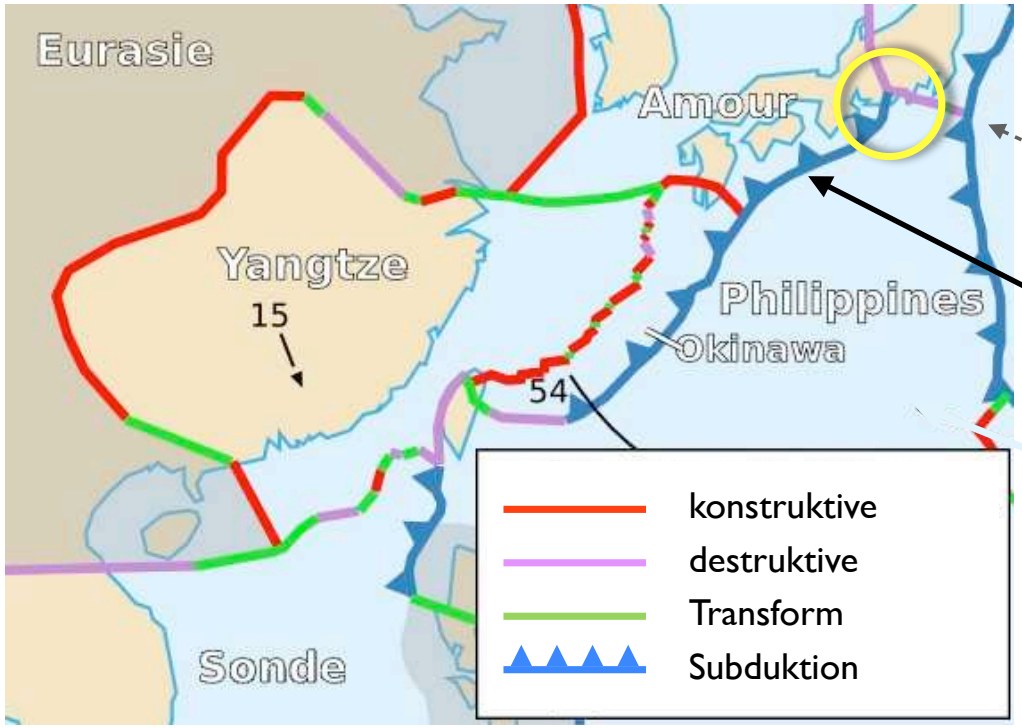





100°
105°
110°
115°
120°
55°
Cenozoic rift basin
Cenozoic volcanics
LAKE
BAIKAL
SIBERIAN
PLATFORM
FOLD BELTS
OF MONGOLIA
RUSSIA
MAP
LOCATION


56°
54°
52°
104°
106°
108°
110°
-213 -196 -179 -162 -145 -128 -111 -94 -77 -60 -43
Bouguer Anomaly (mGal).

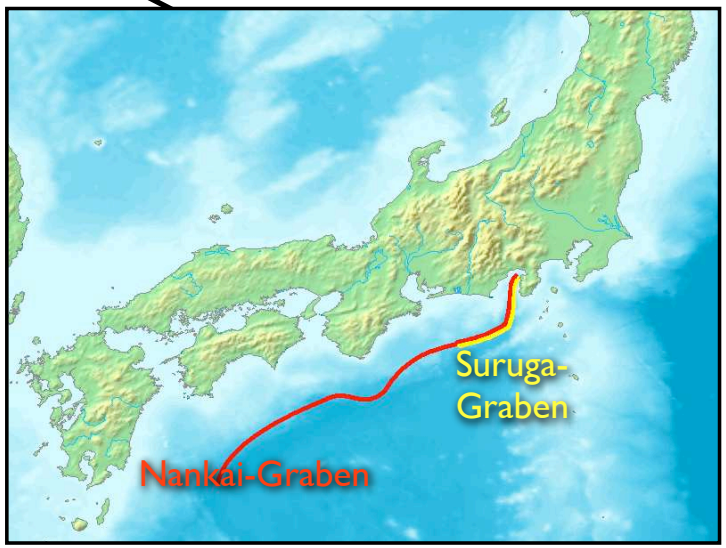
Yangtze- Platte



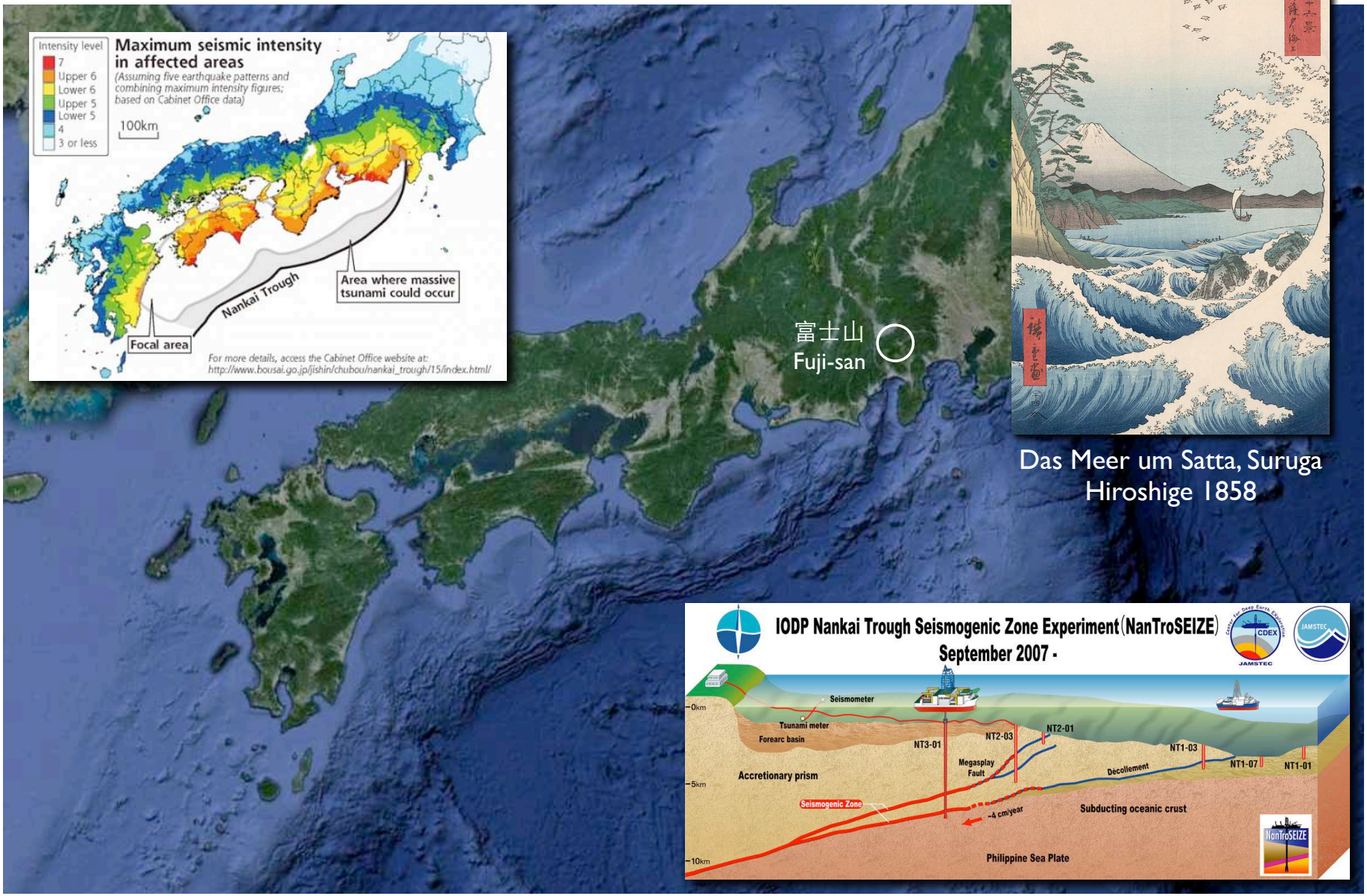
Gebirge

Plattenbewegung (mm/Jahr) bezüglich Afrika

Fujiyama

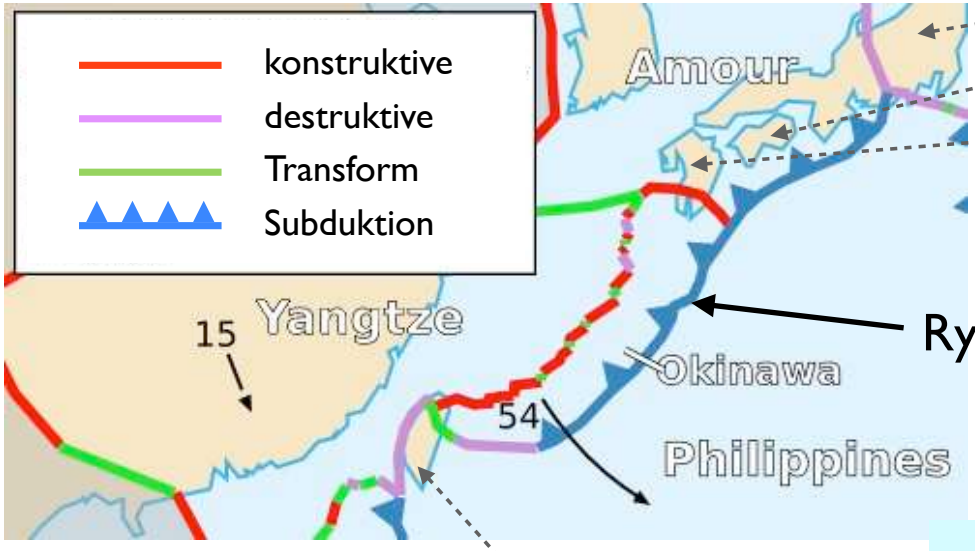


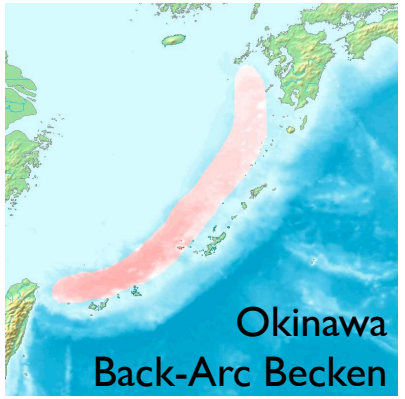
Nankai - Graben



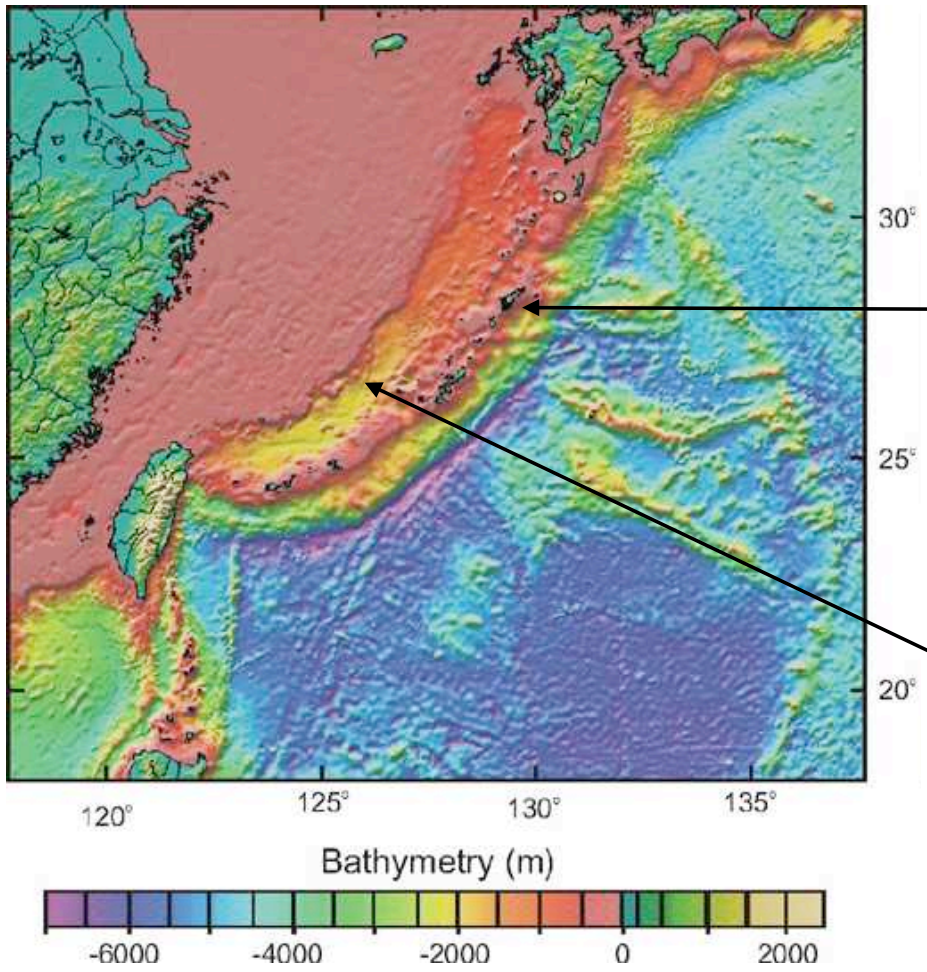
Das Meer um Satta, Suruga
Hiroshige 1858

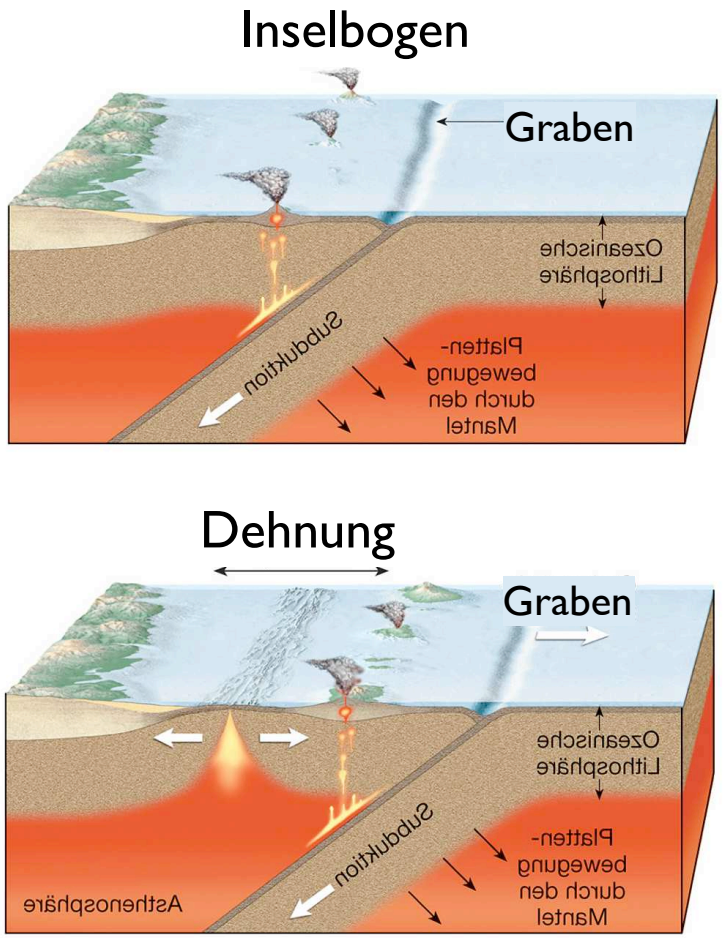
Okinawa- Platte und Okinawa Back-Arc Becken



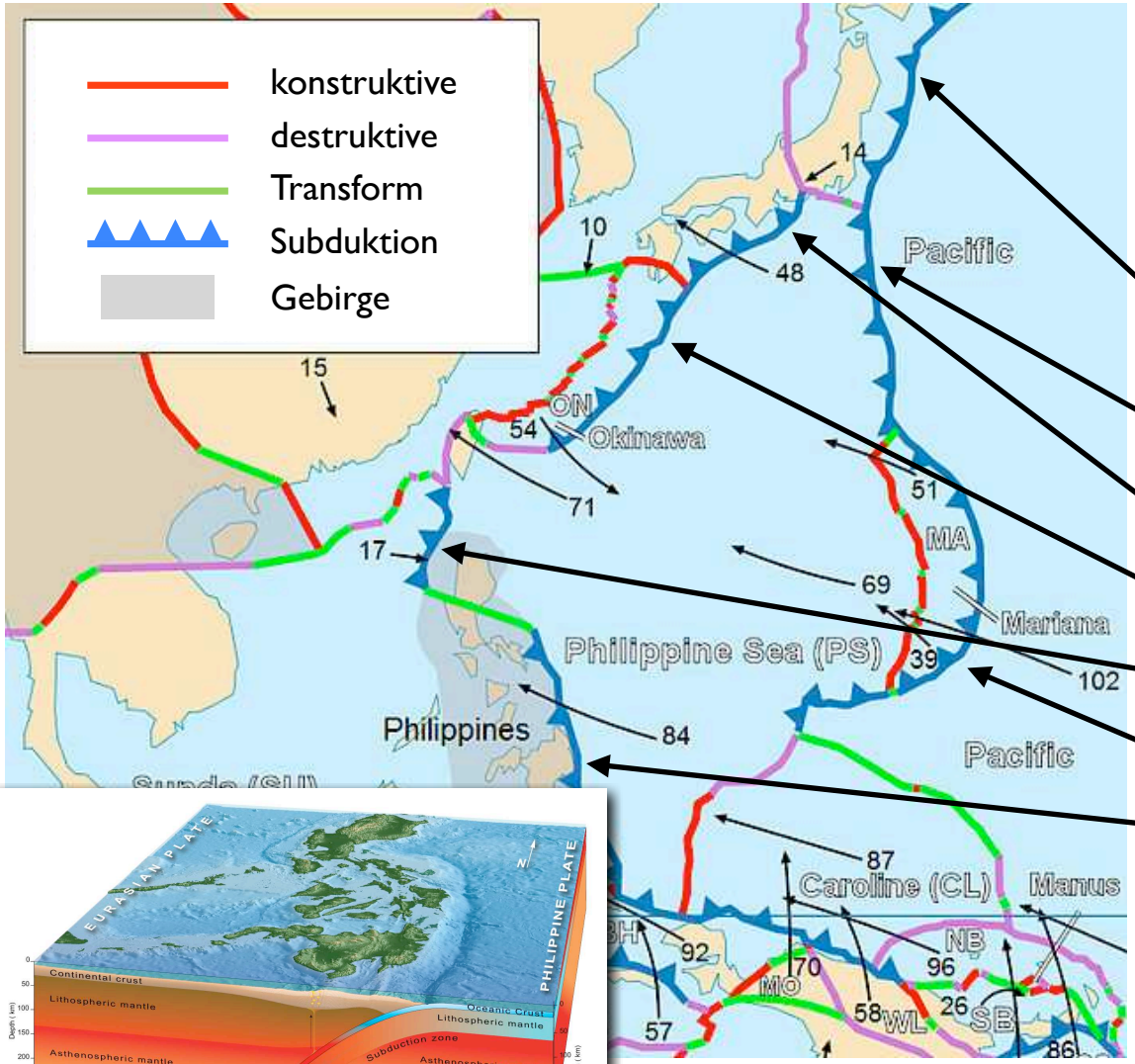


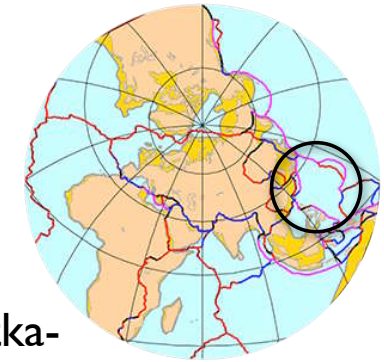
Back arc spreading (Okinawa)





Philippinische Platte (Philippine Sea Plate)





Kuril-Kamtschatka-Graben

Izu-Ogasawara-Graben

Nankai-Graben

Ryukyu-Graben

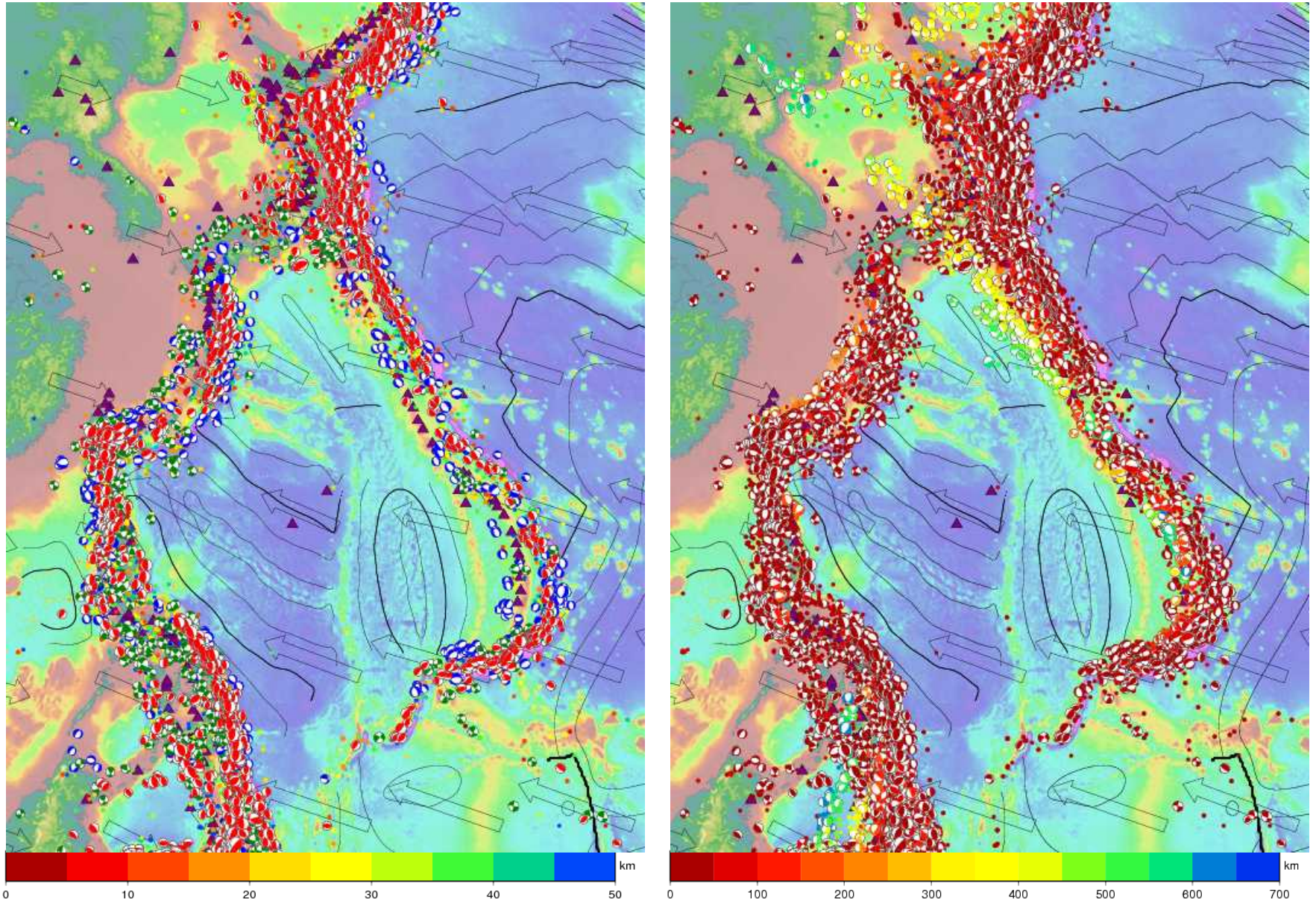
Manila-Graben

Marianen-Graben

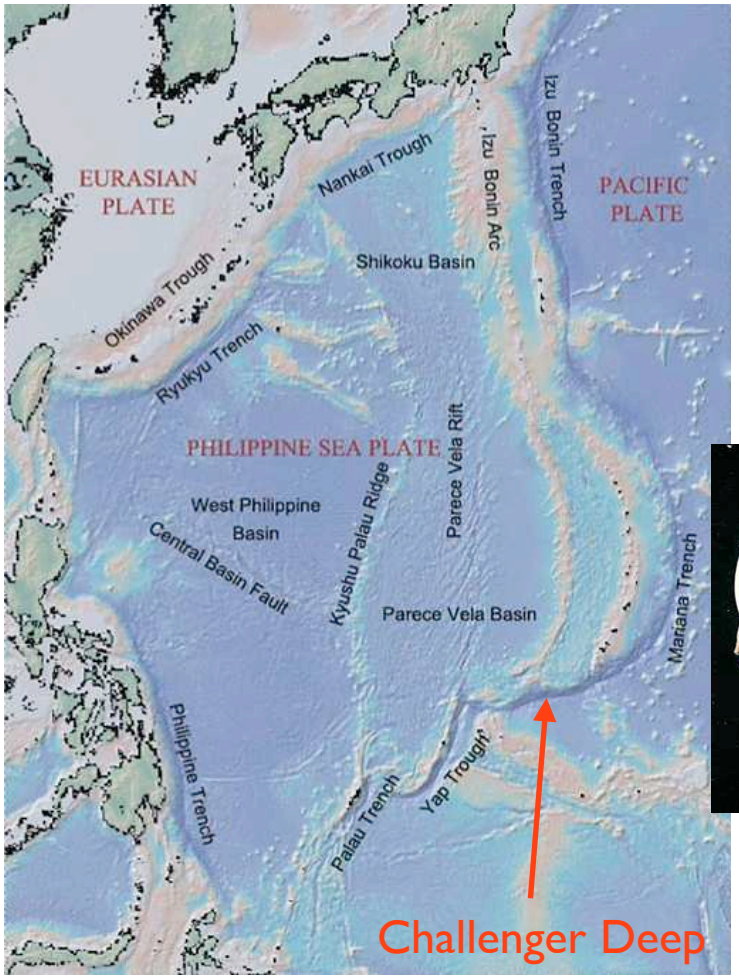
Philippinen-Graben

Plattenbewegung (mm/Jahr) bezüglich Afrika

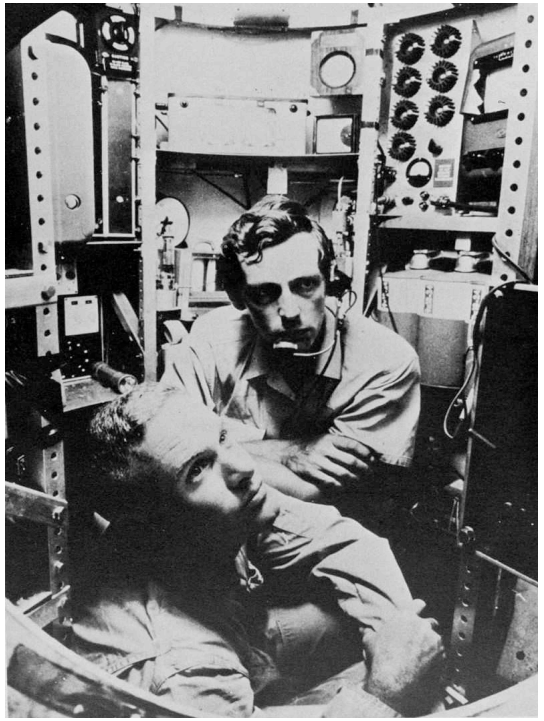
Philippinische Platte - seismisch aktiv



Challenger Deep



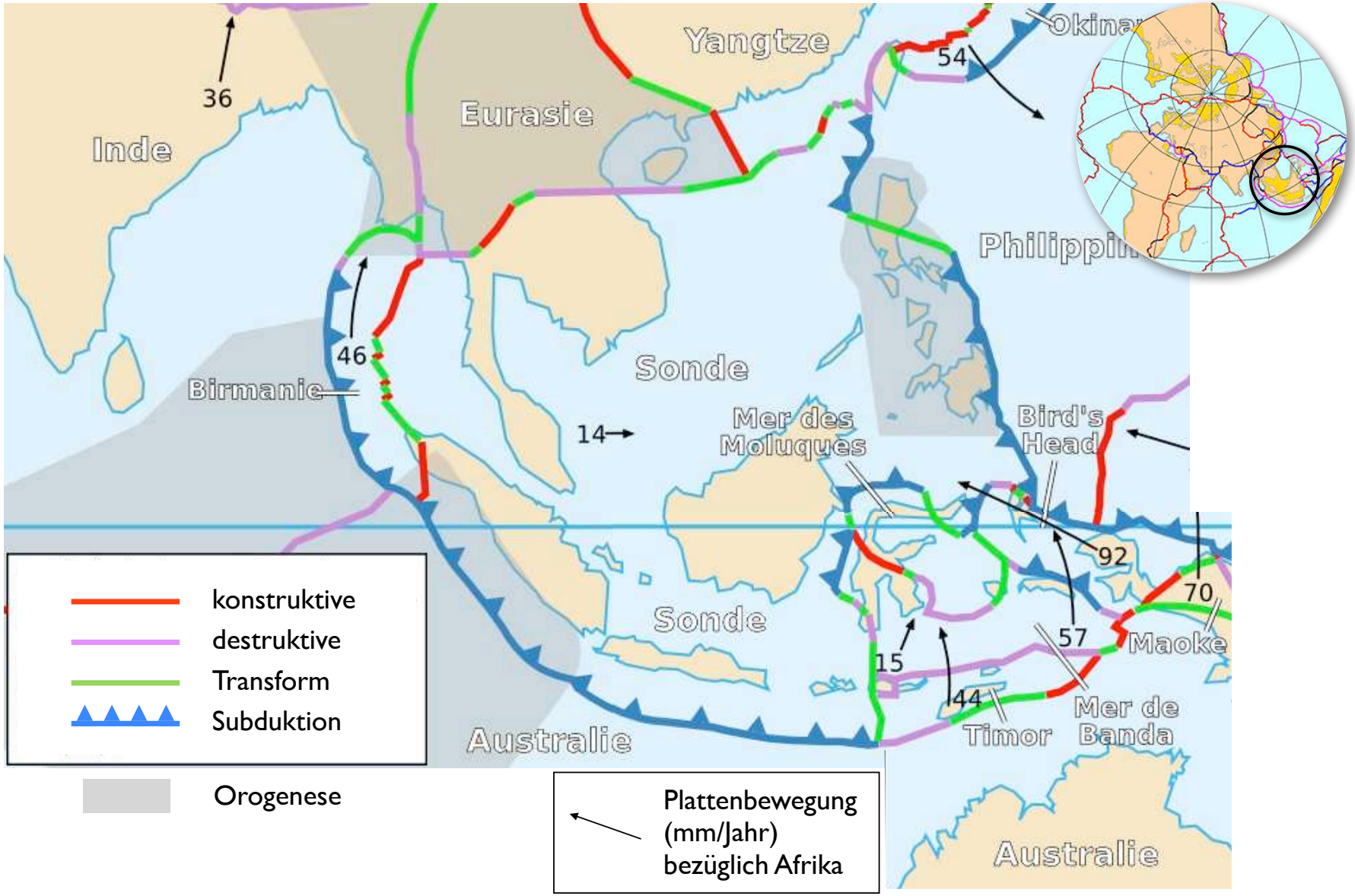
Grösste Tiefe weltweit: - 10,916 m ±5 m



Don Walsh, USN (vorn)
Jacques Piccard (Mitte)
im Bathyscaph Trieste
23. Januar 1960

http://www.deepseachallenge.com/the-science/biology/
https://www.youtube.com/watch?v=YeVp8MyXWFM

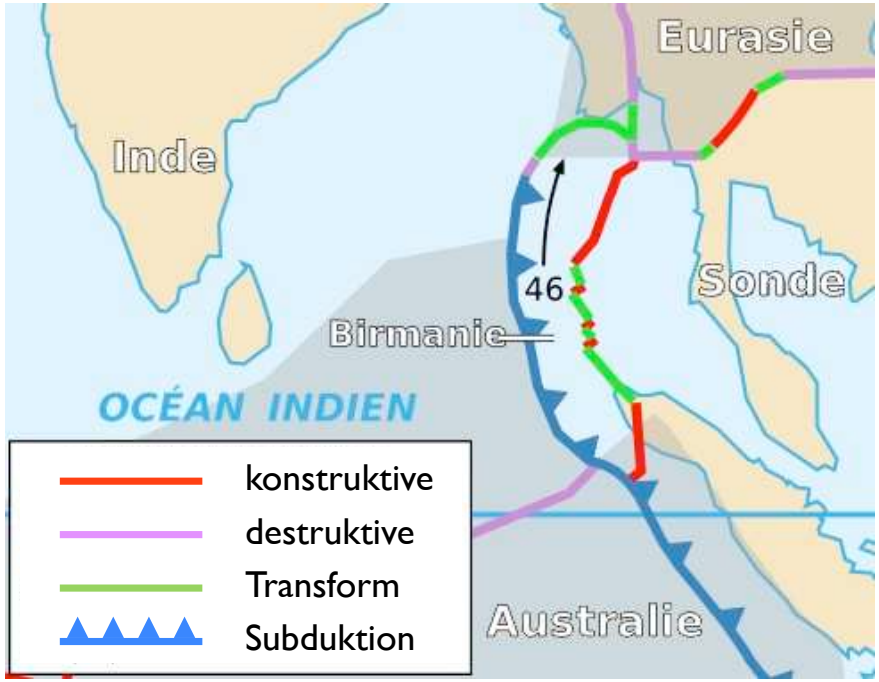
Sunda - Platte Bird's Head-, Molukkensee-, Bandasee-, Timorplatte



Sumatra-Andamanen - Beben 26. 12. 2004

https://walrus.wr.usgs.gov/tsunami/sumatraEQ/images/sum2TNWb.mov

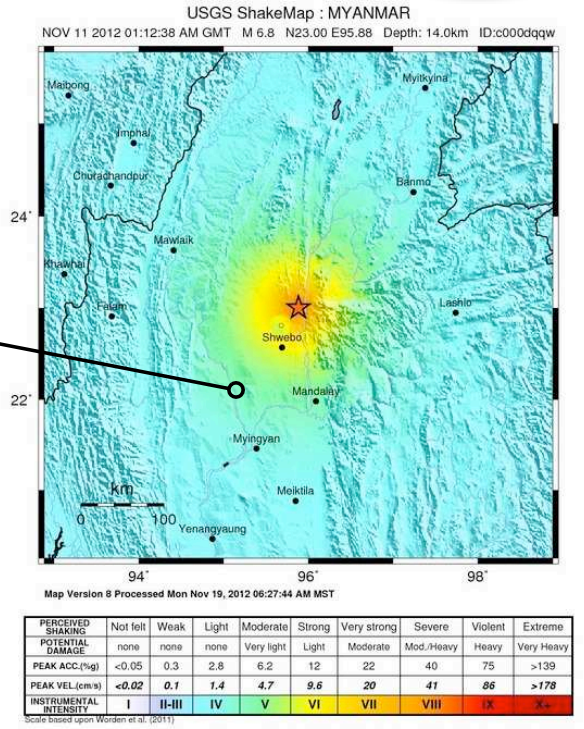
Burma Platte



Gebirge

= mm/Jahr
bezüglich Afrika

Bagan

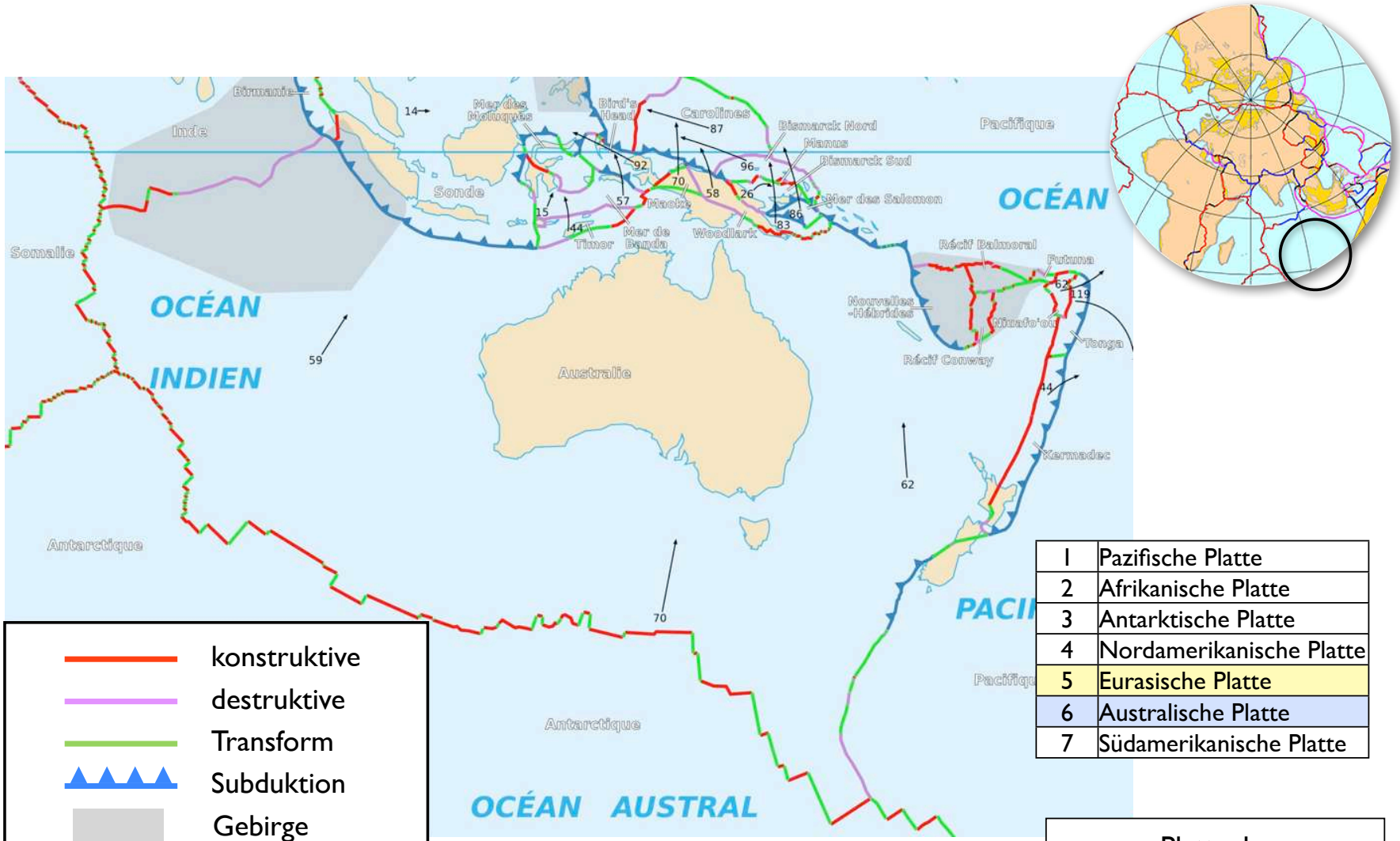


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	*<0.02*	*0.1*	*1.4*	*4.7*	*9.6*	*20*	*41*	*86*	*>178*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2011)

Shwebo 11. Nov. 2012

Südöstlicher Nachbar: Australische Platte

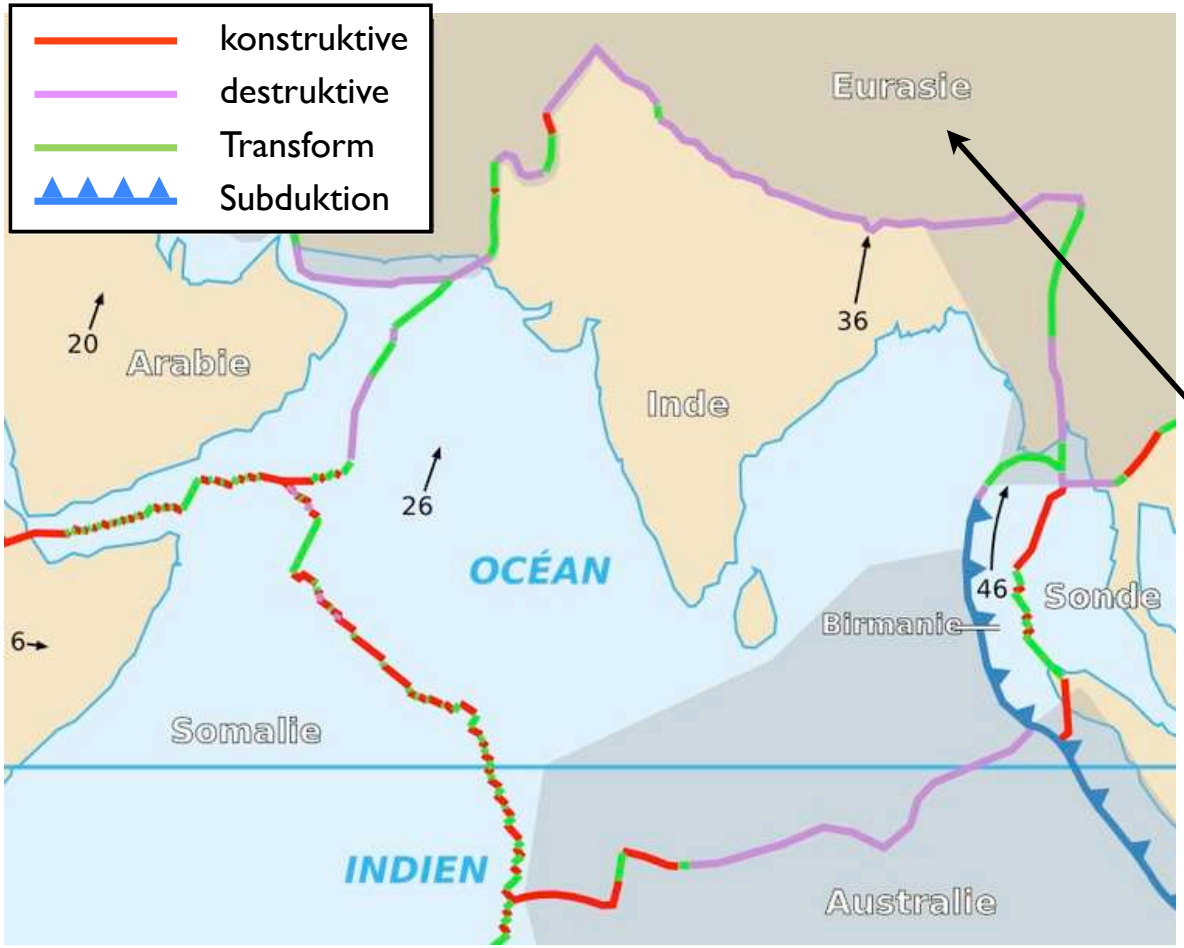


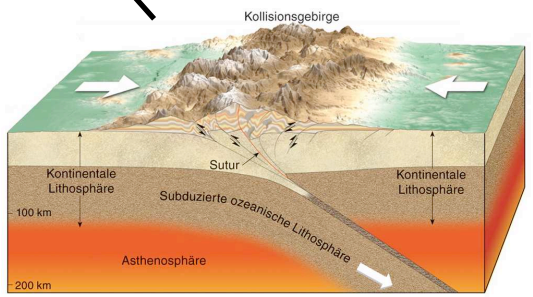
konstruktive
destruktive
Transform
Subduktion
Gebirge

1	Pazifische Platte
2	Afrikanische Platte
3	Antarktische Platte
4	Nordamerikanische Platte
5	Eurasische Platte
6	Australische Platte
7	Südamerikanische Platte

Plattenbewegung (mm/Jahr) bezüglich Afrika

Südlicher Nachbar: Indische Platte



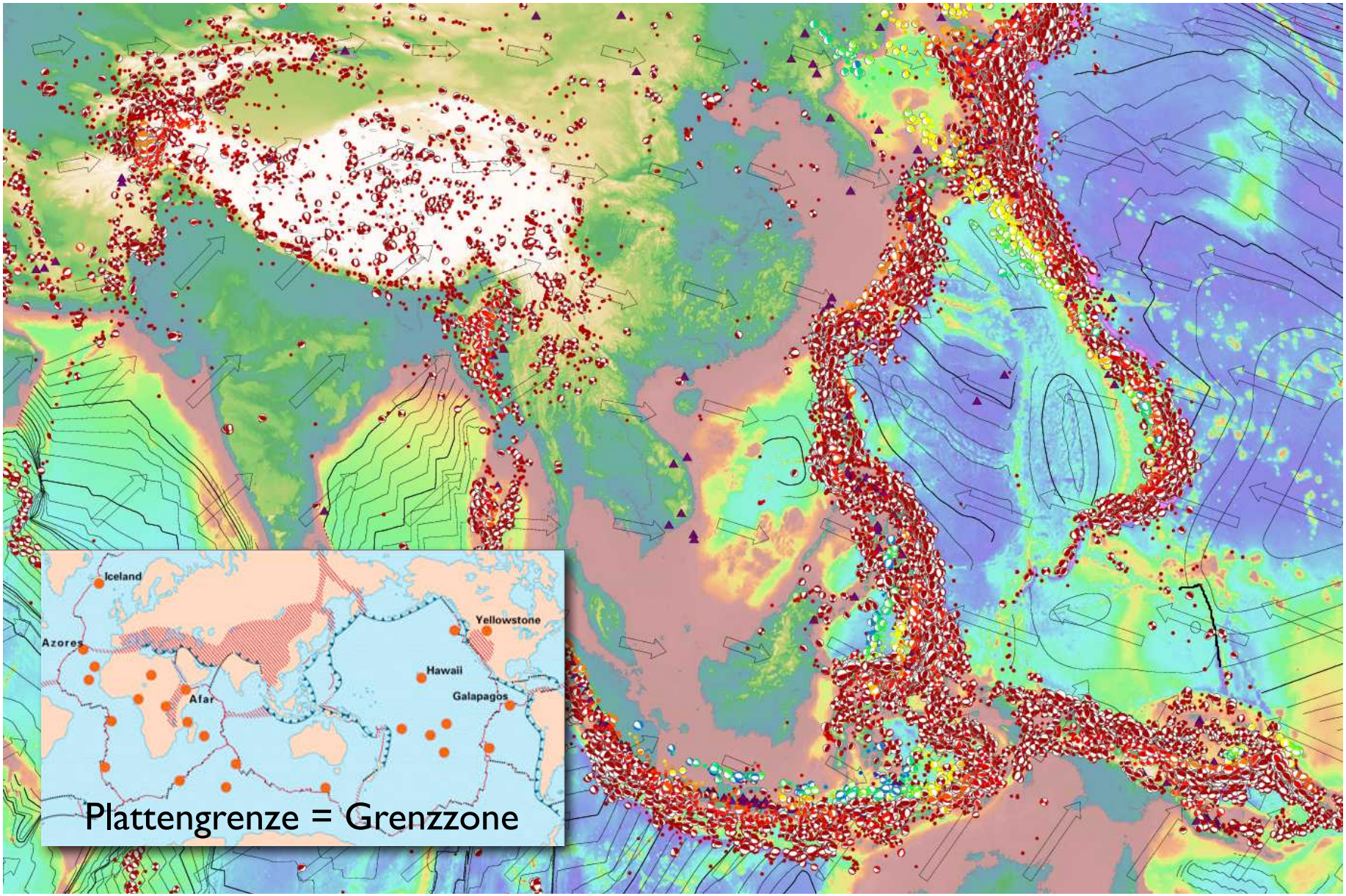


Indien - Eurasien:
Kontinent - Kontinent Kollision

Plattenbewegung (mm/Jahr) bezüglich Afrika

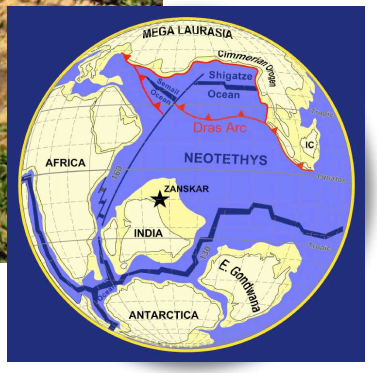
Gebirge

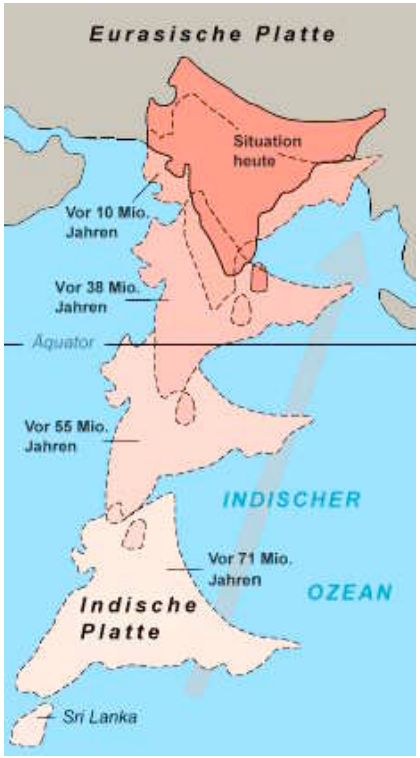
Himalaya - Tibet



Dekkan Trapp

Flutbasalte (= Trapp)





heute

10 Ma

38 Ma

55 Ma

71 Ma

Artensterben ?

~125Ma Trennung von Gondwana: (Indien/Seychellen/Madagaskar) ↔ (Australia/Antarctica)

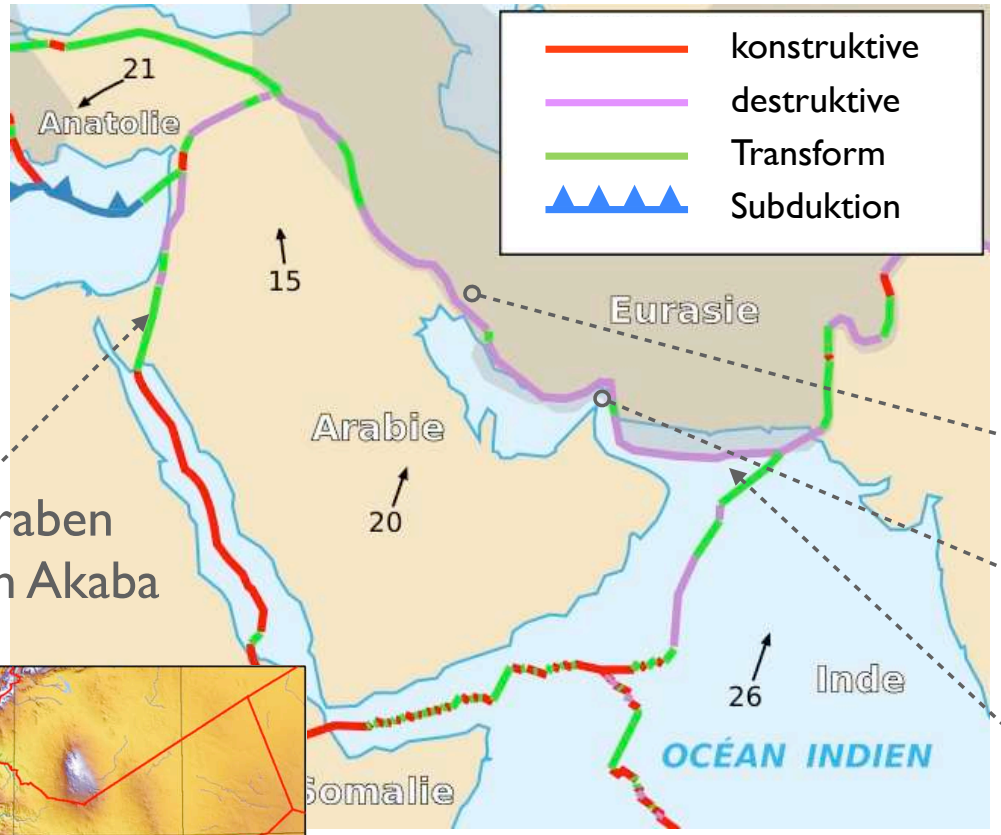
90 Ma Trennung von Madagaskar → Indien mit 20 cm/a (!!) nach N

65 Ma Trennung von Seychellen (N von Madagaskar), Naht = Carlsbergrücken

→Hotspot überfahren: →Dekkan Trapps (West-Indien, 2 km dick, 500 000 km^2)

40 Ma Kollision: Indien unter Eurasia (→Tibet Hochland: 60 km Kruste)

Südlicher Nachbar: Arabische Platte

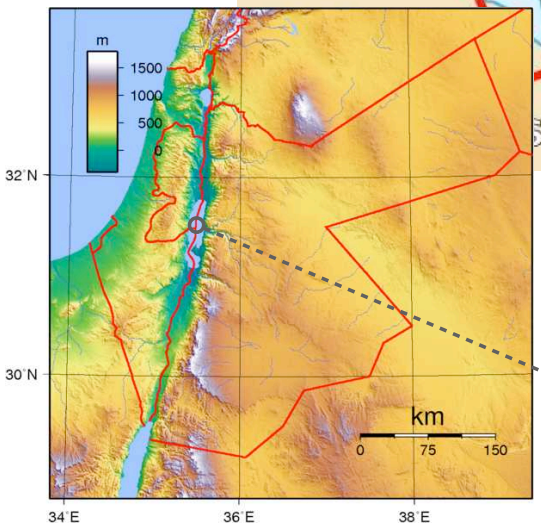


Jordangraben
Golf von Akaba

Zagros Gebirge

Strasse von
Hormus

Makran-Küste



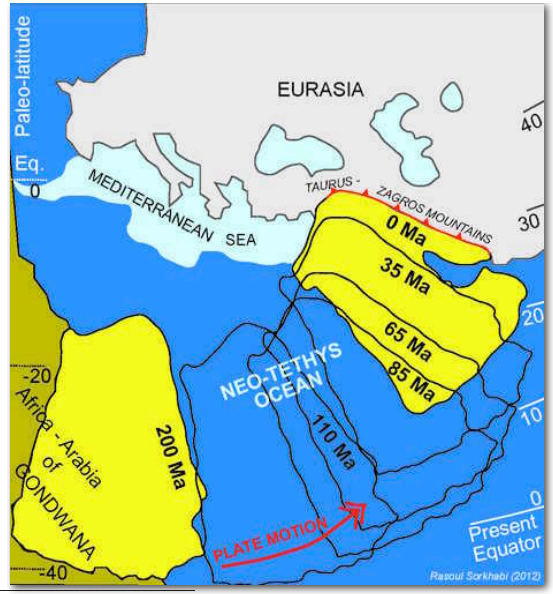
Totes Meer
- 420 m.ü.M.

Gebirge

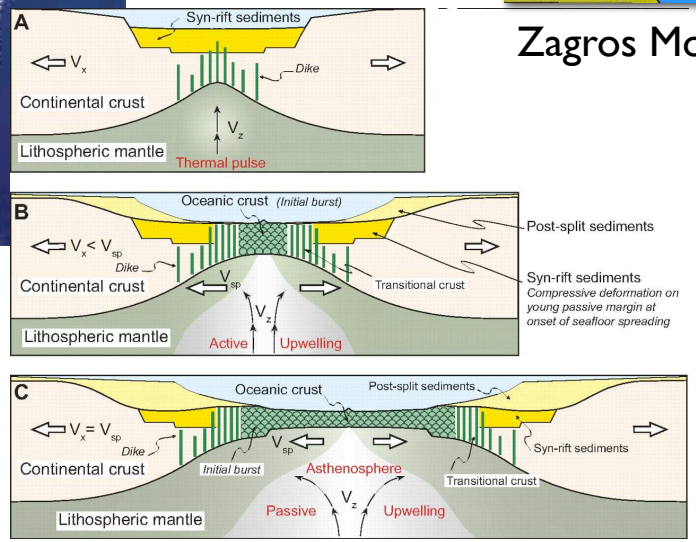
Plattenbewegung
(mm/Jahr)
bezüglich Afrika

Iranische Platte - Zagros-Gebirge

Pakistan EQ
24. 9. 2013

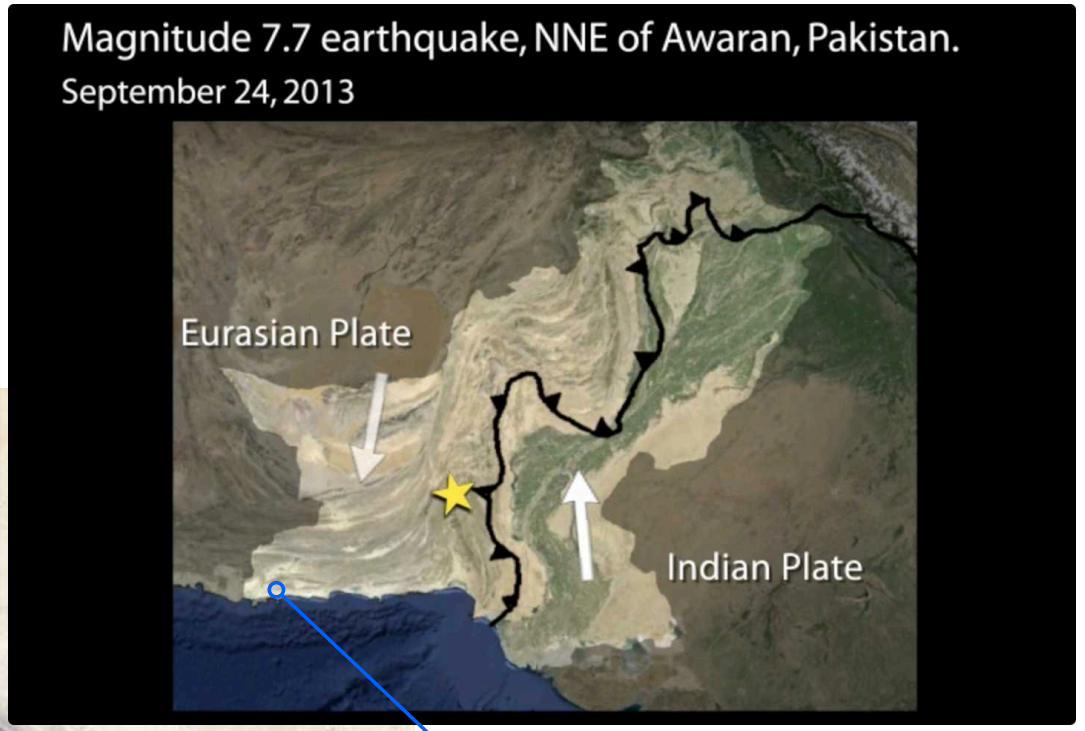


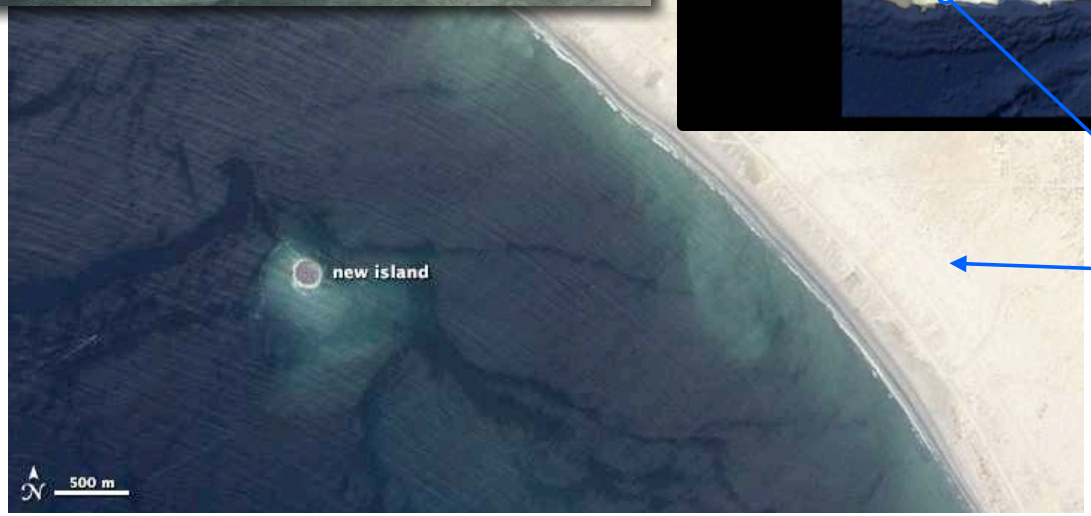
Zagros Mountains



Red Sea Rift

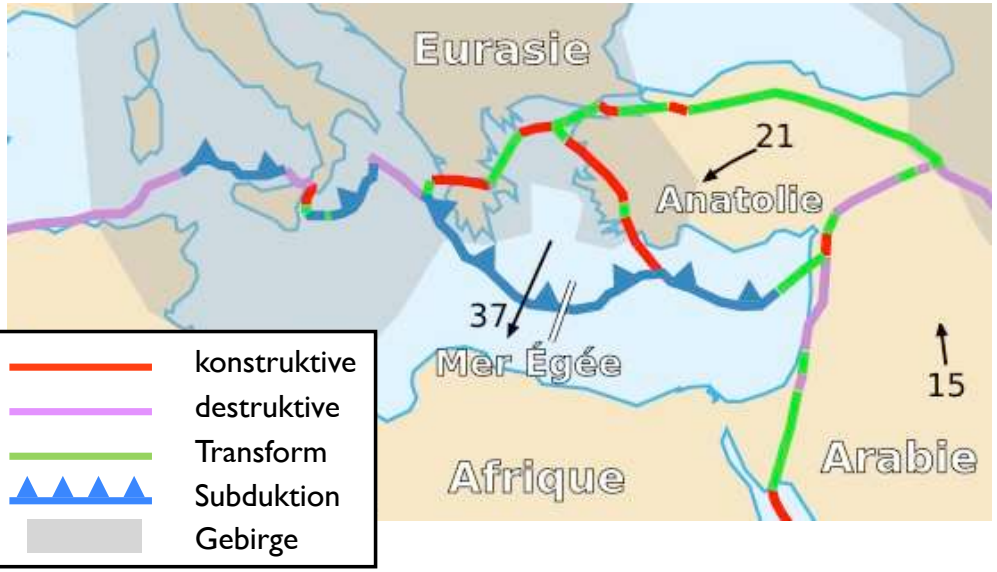
Strike slip earth quake Pakistan 24. Sept. 2013



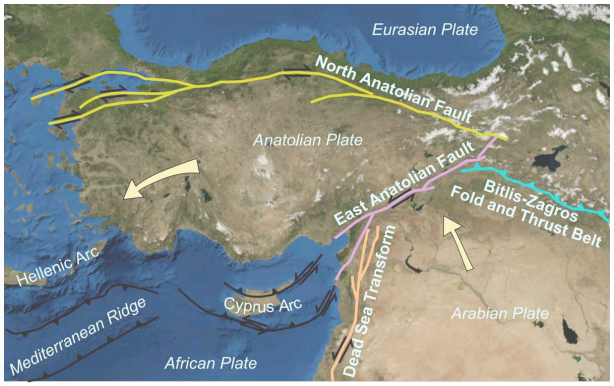


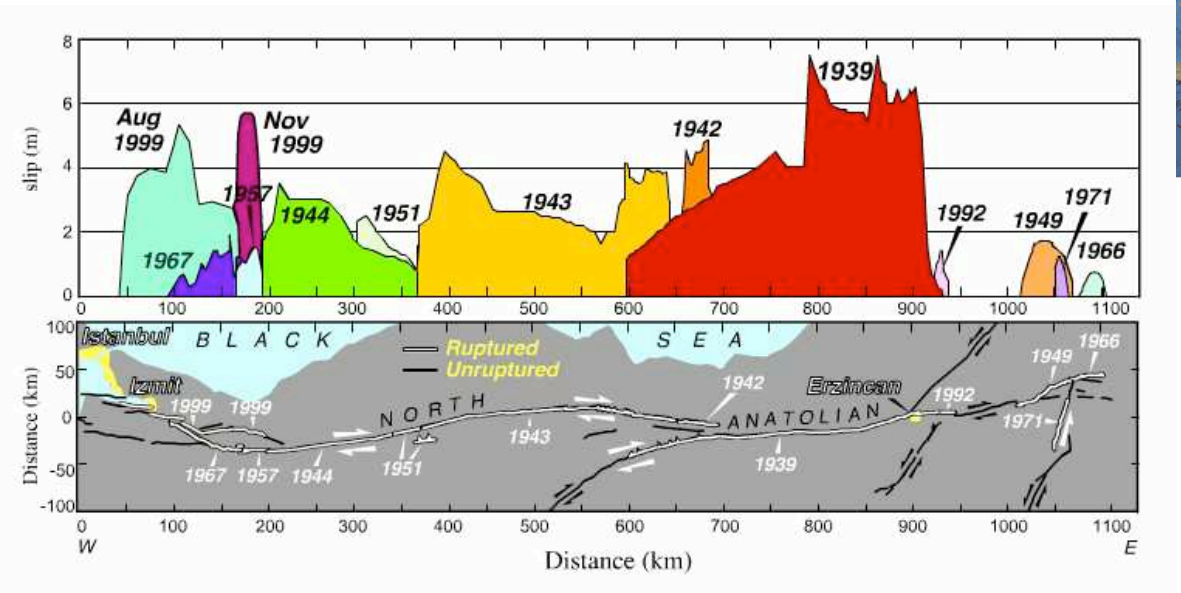
Gwadar
Schlammvulkan

Anatolische Platte



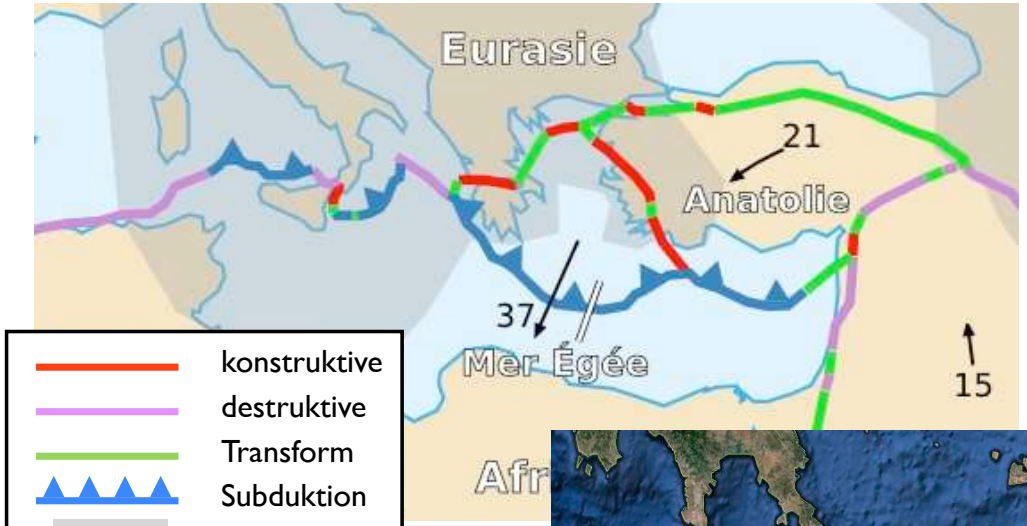
Blattverschiebung
(mm/Jahr)
bezüglich Afrika



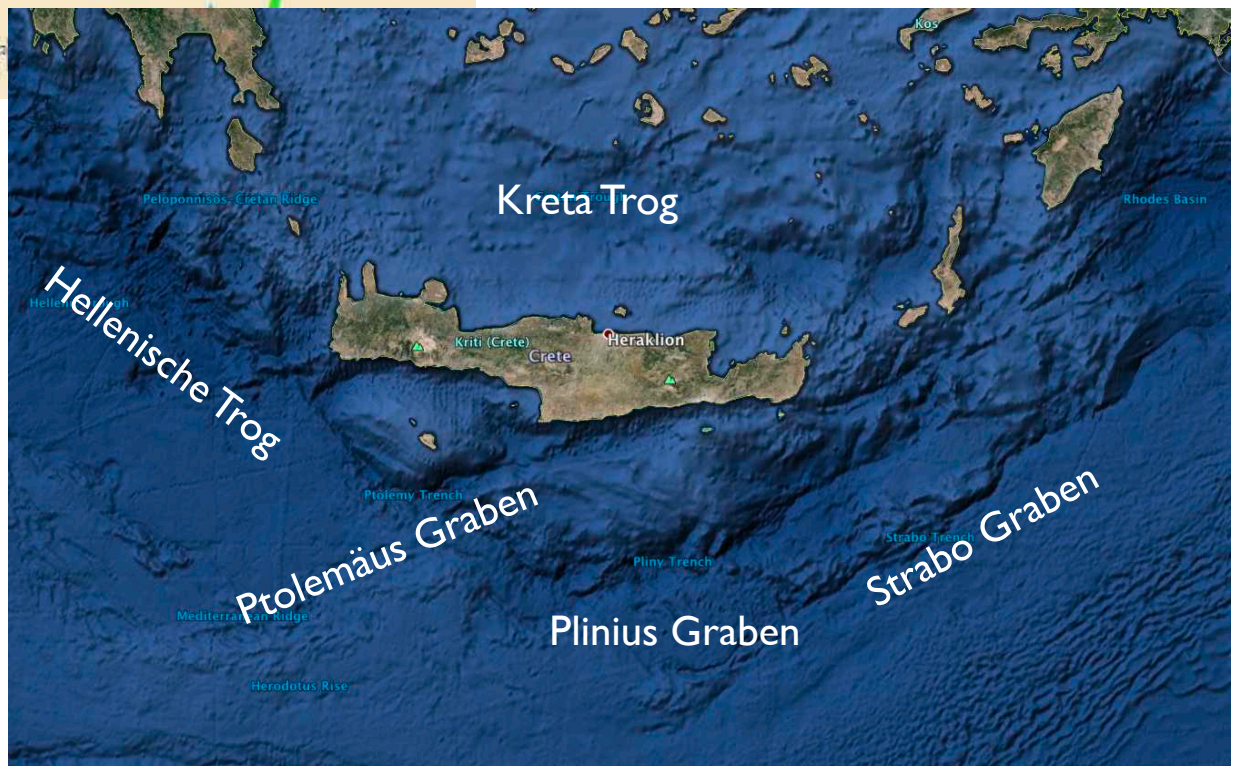


Nordanatolische Verwerfung
(dextraler Versatz)

Ägäische (Hellenische) Mikroplatte

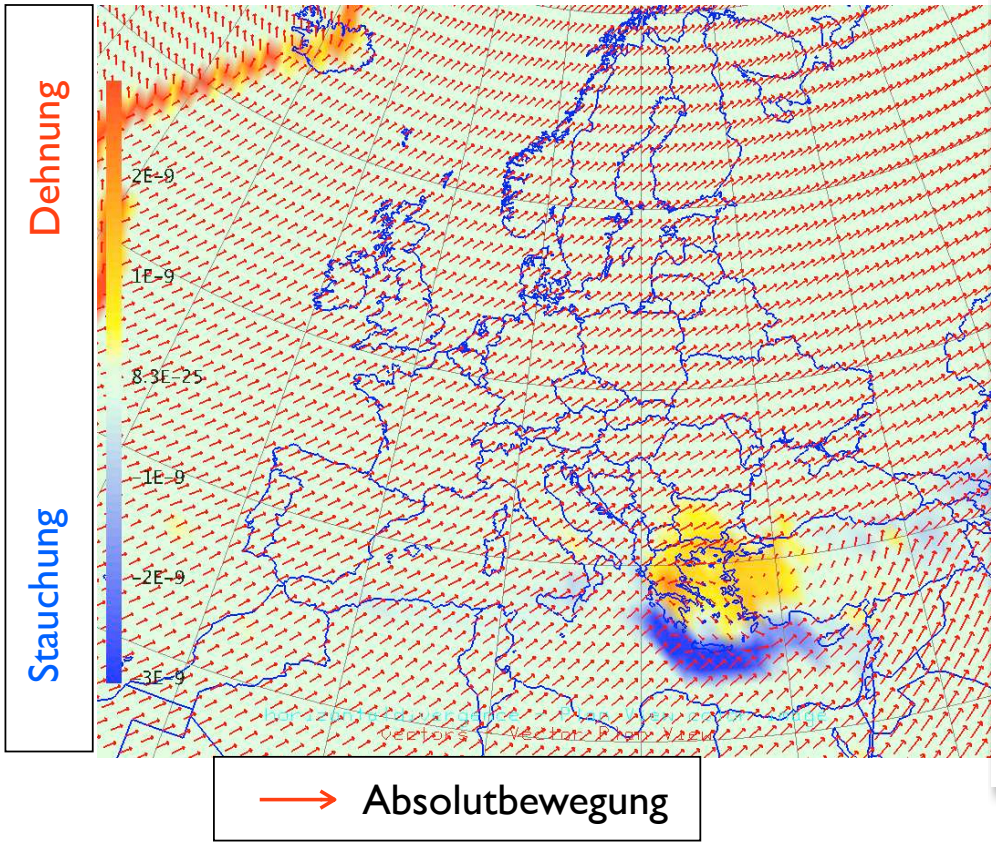


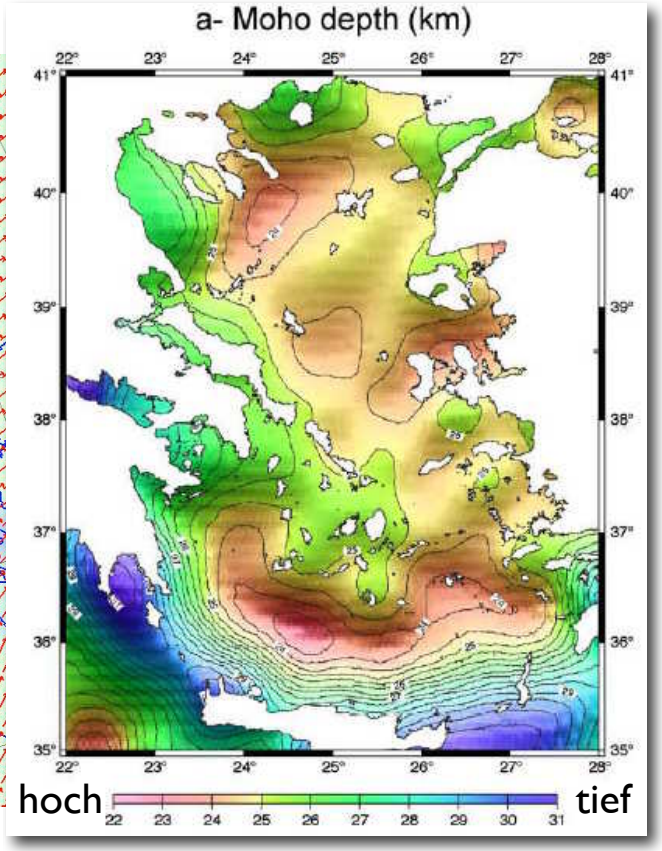
Blattverschiebung
(mm/Jahr)
bezüglich Afrika



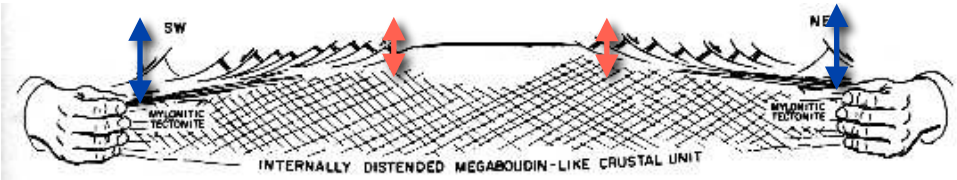
Ägäis

GPS Plattengeschwindigkeiten und -Strain

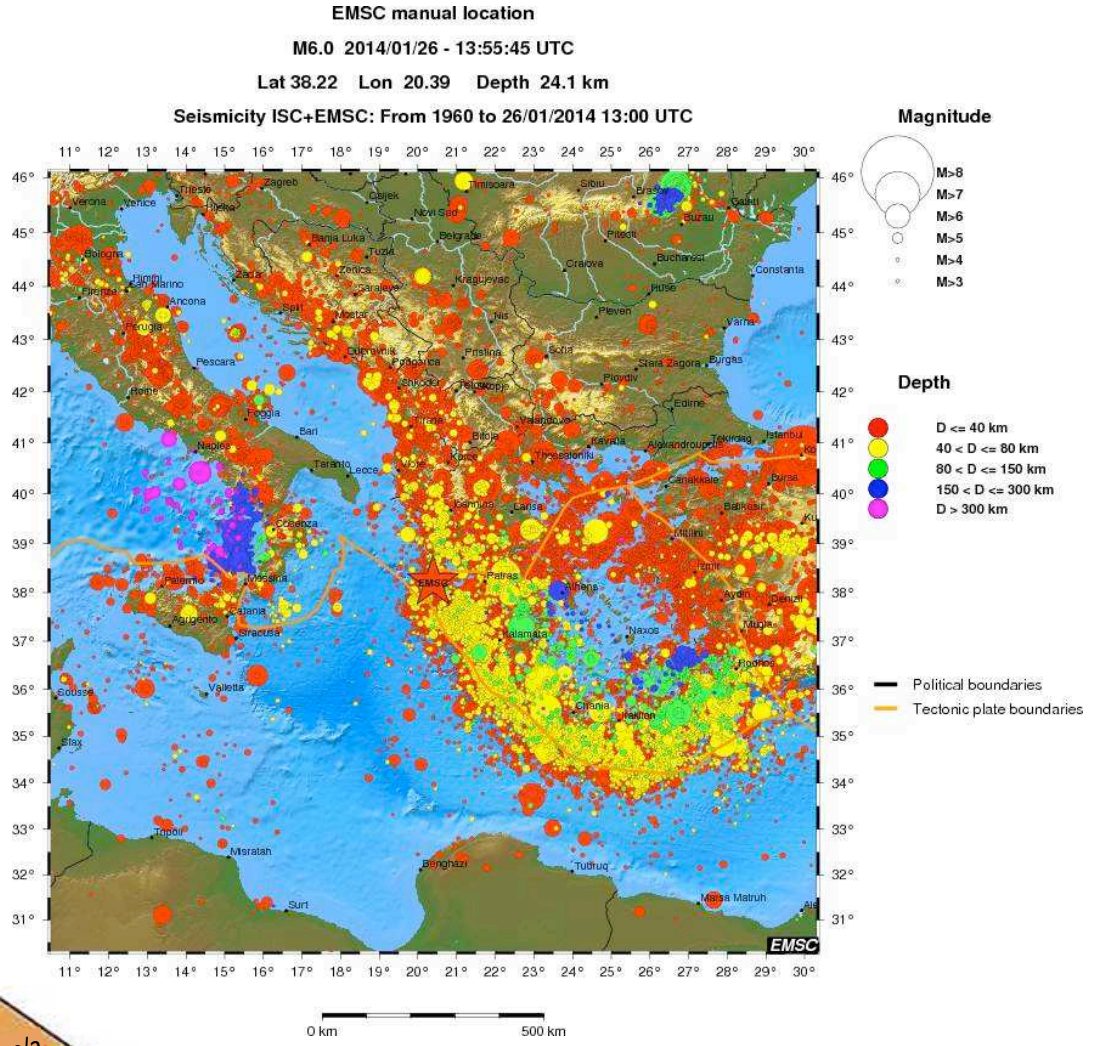


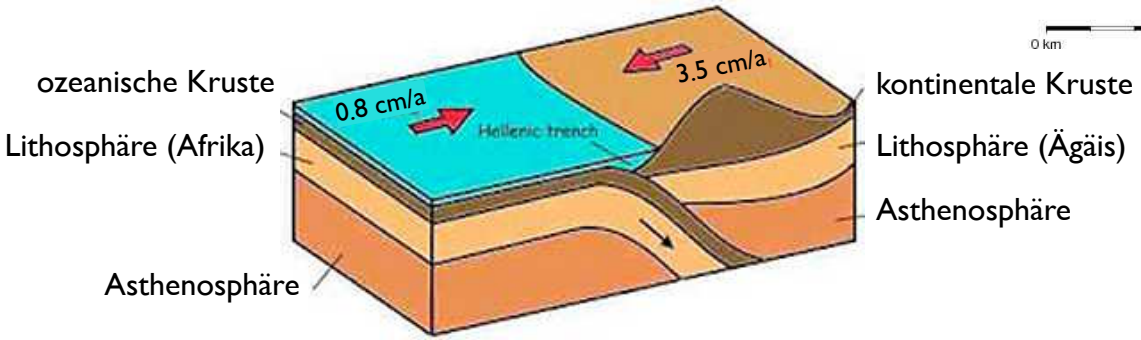


Metamorpher Kernkomplex
(metamorphic core complex MCC)

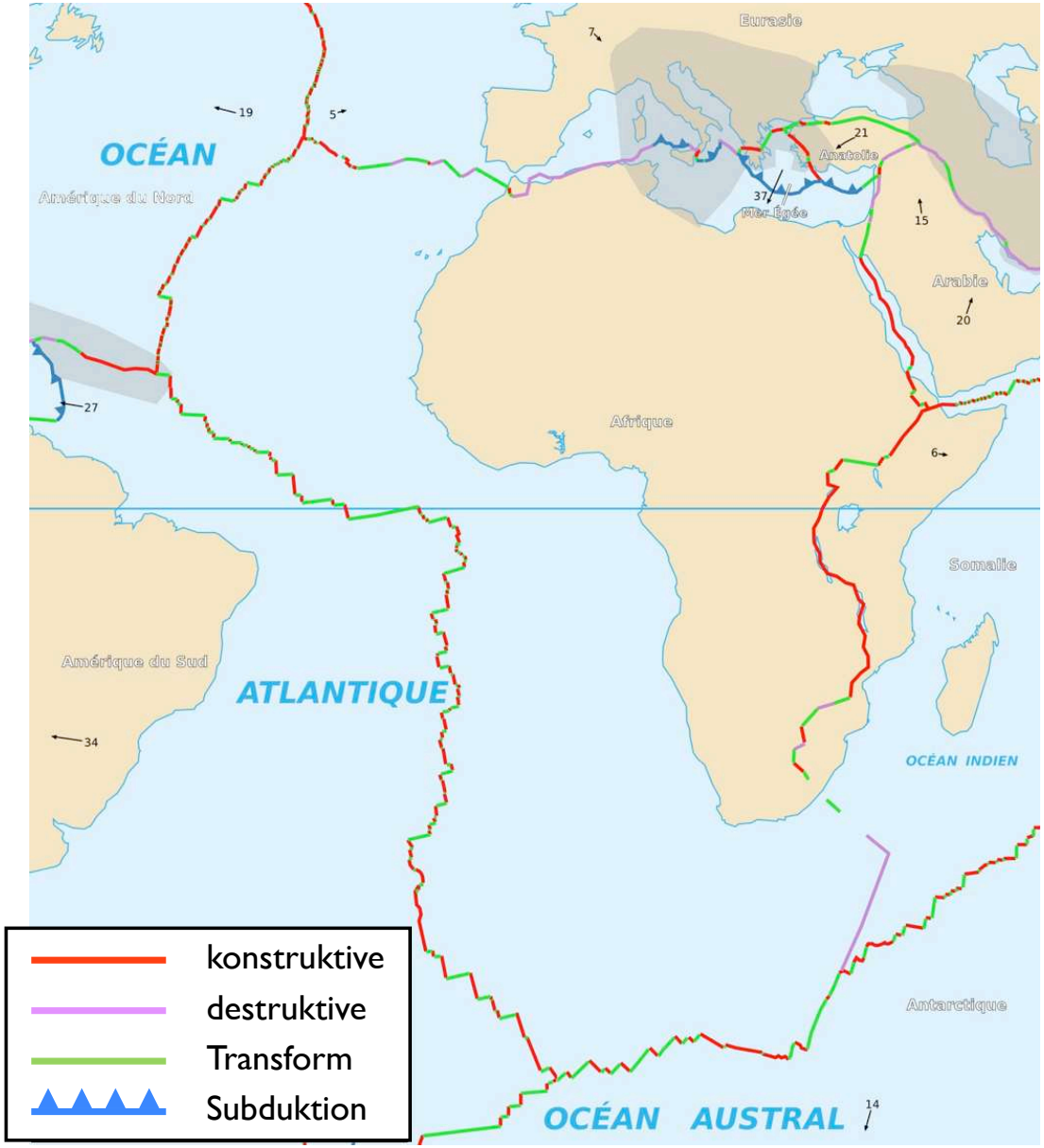


Kreta


EMSC manual location
M6.0 2014/01/26 - 13:55:45 UTC
Lat 38.22 Lon 20.39 Depth 24.1 km
Seismicity ISC+EMSC: From 1960 to 26/01/2014 13:00 UTC
Magnitude
M>8
M>7
M>6
M>5
M>4
M>3
Depth
D <= 40 km
40 < D <= 80 km
80 < D <= 150 km
150 < D <= 300 km
D > 300 km
Political boundaries
Tectonic plate boundaries
0 km
500 km
EMSC


ozeanische Kruste
Lithosphäre (Afrika)
Asthenosphäre
0.8 cm/a
3.5 cm/a
Hellenic trench
kontinentale Kruste
Lithosphäre (Ägäis)
Asthenosphäre

Südwestlicher Nachbar: Afrikanische Platte

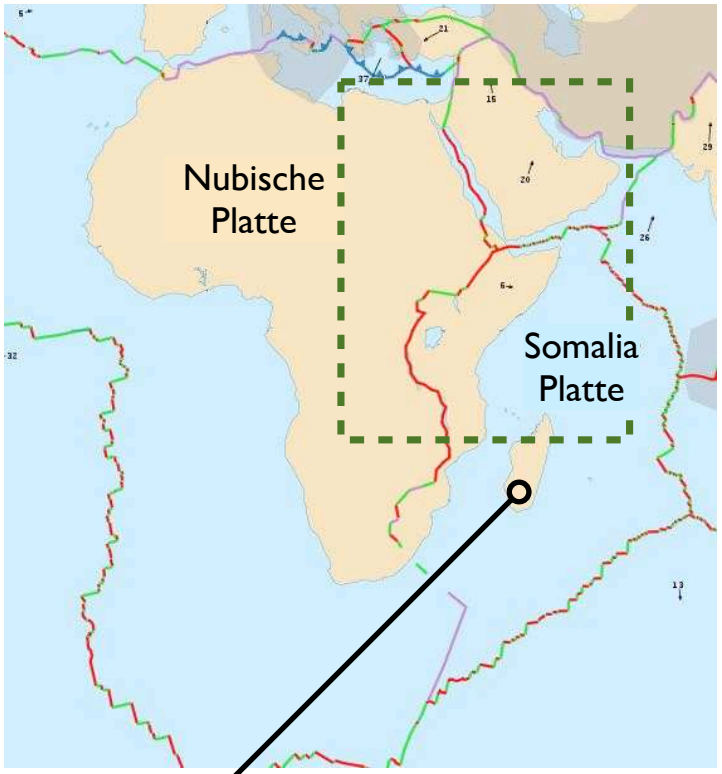


1	Pazifische Platte
2	Afrikanische Platte
3	Antarktische Platte
4	Nordamerikanische Platte
5	Eurasische Platte
6	Australische Platte
7	Südamerikanische Platte

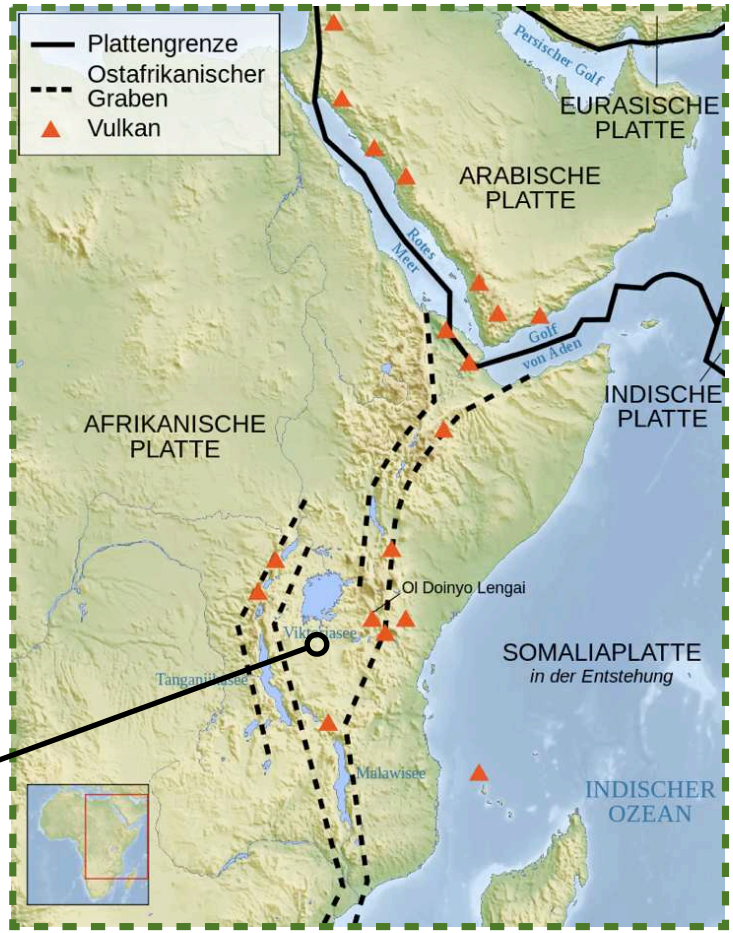
Gebirge

Plattenbewegung (mm/Jahr) bezüglich Afrika

Neue Platten am Ostafrikanischen Rift

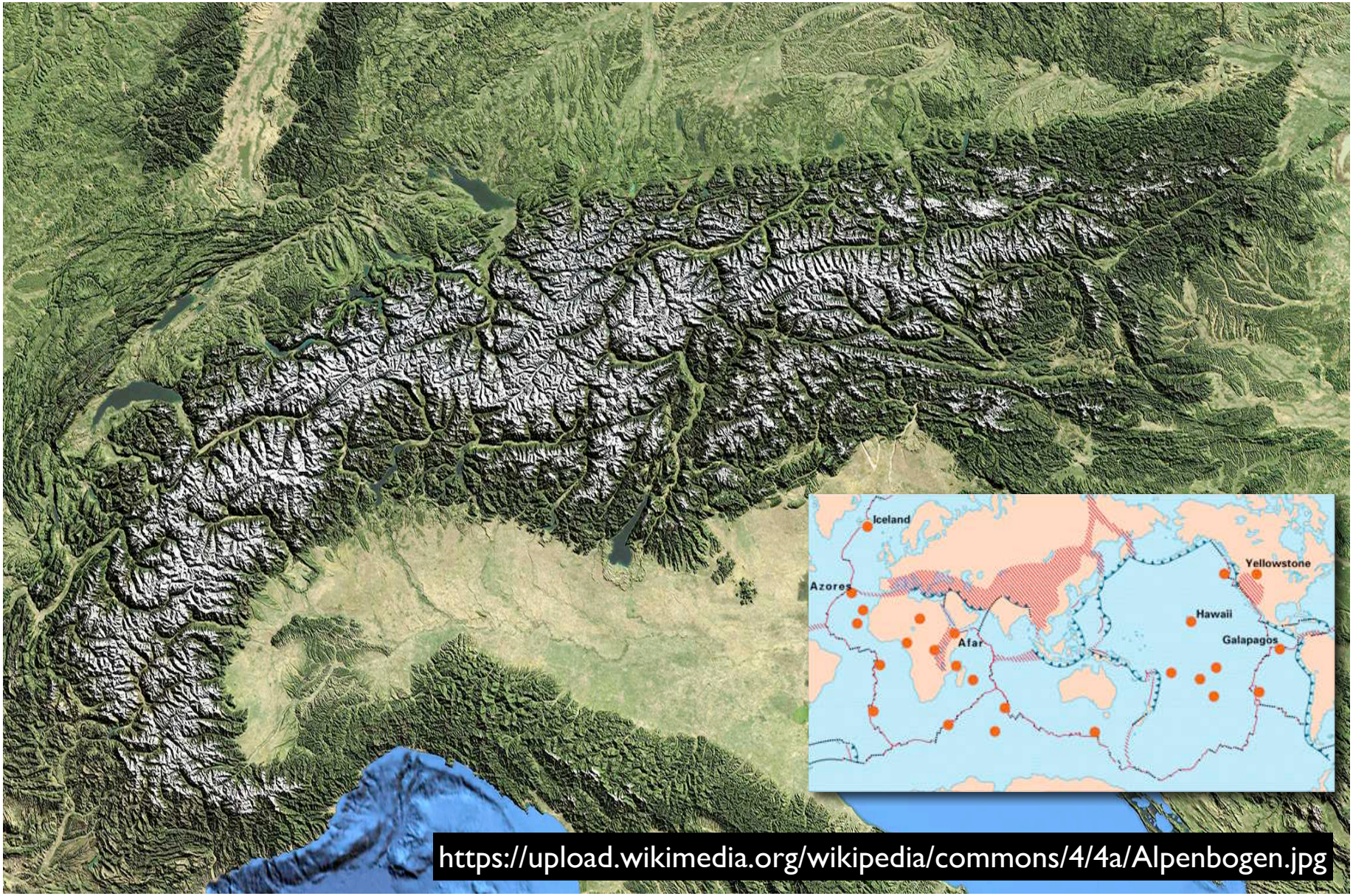


Süd-Madagaskar: Lwandleplatte

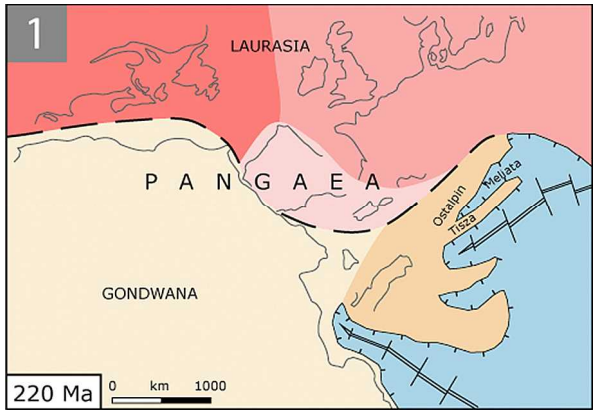


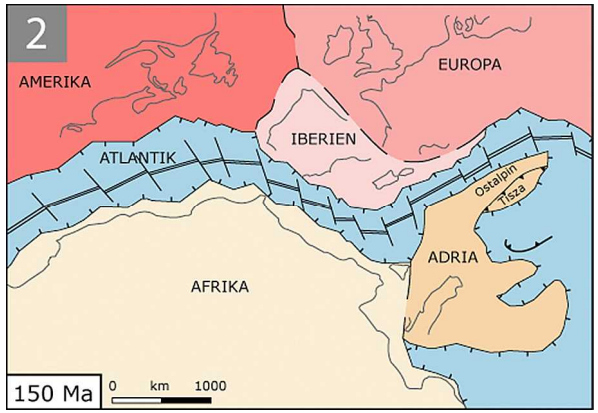
zwischen Grabenbrüchen
Nord: Viktoriaplatte
Süd: Rowumaplatte

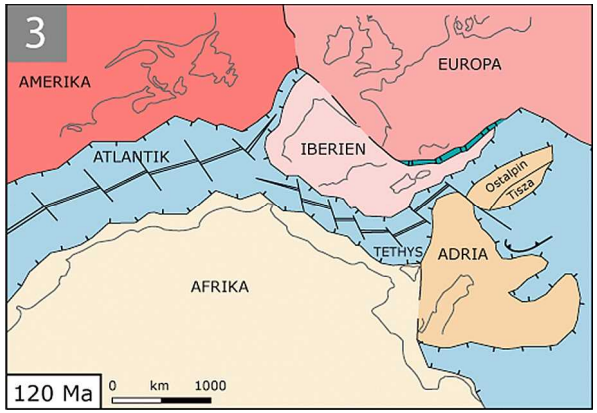
Alpen

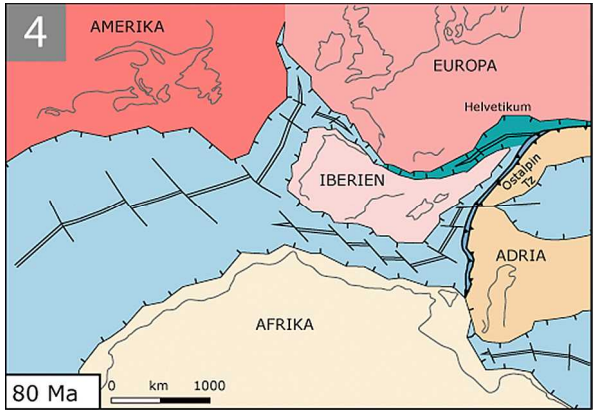

Iceland
Azores
Afar
Yellowstone
Hawaii
Galapagos
https://upload.wikimedia.org/wikipedia/commons/4/4a/Alpenbogen.jpg

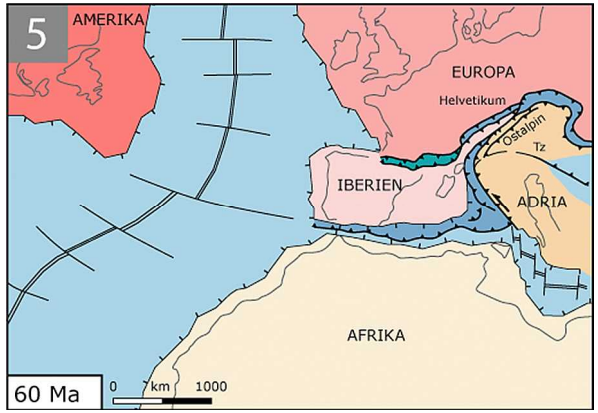
'The Alps - in five easy steps'

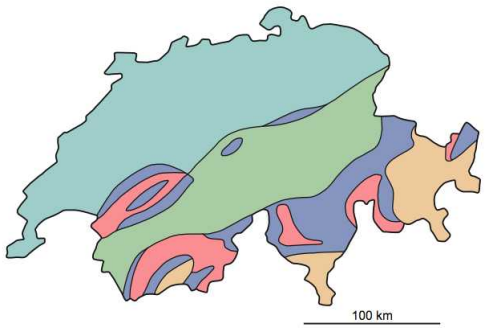


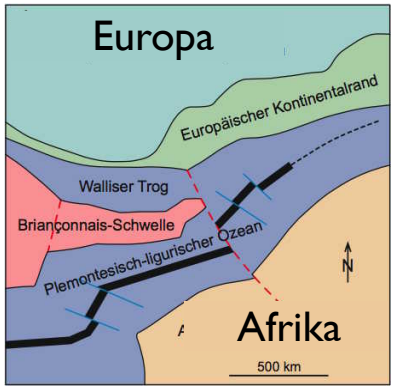




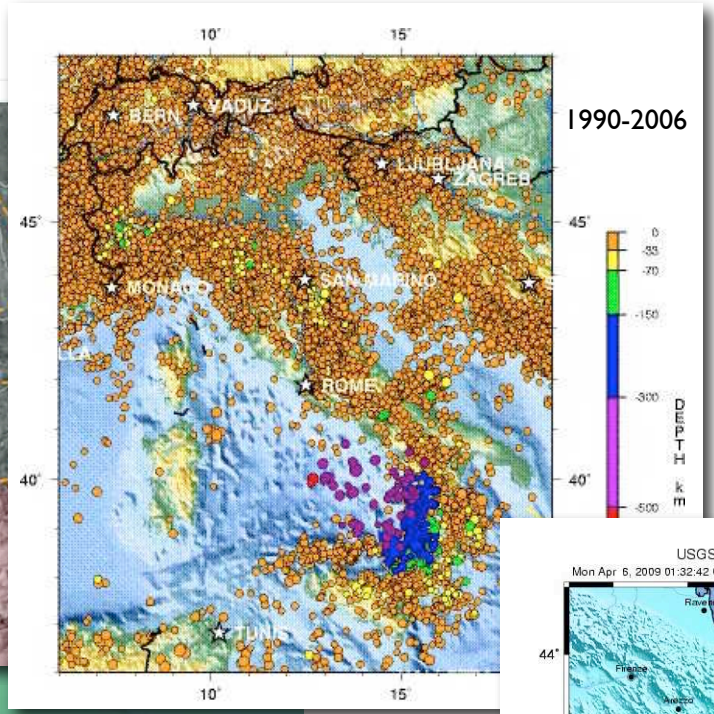


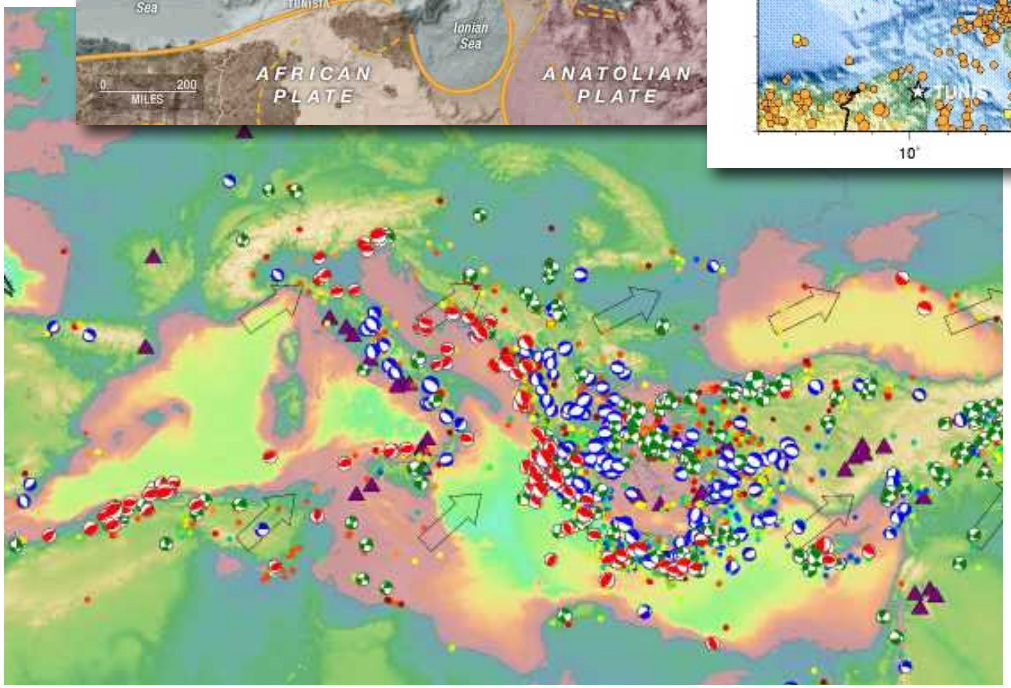


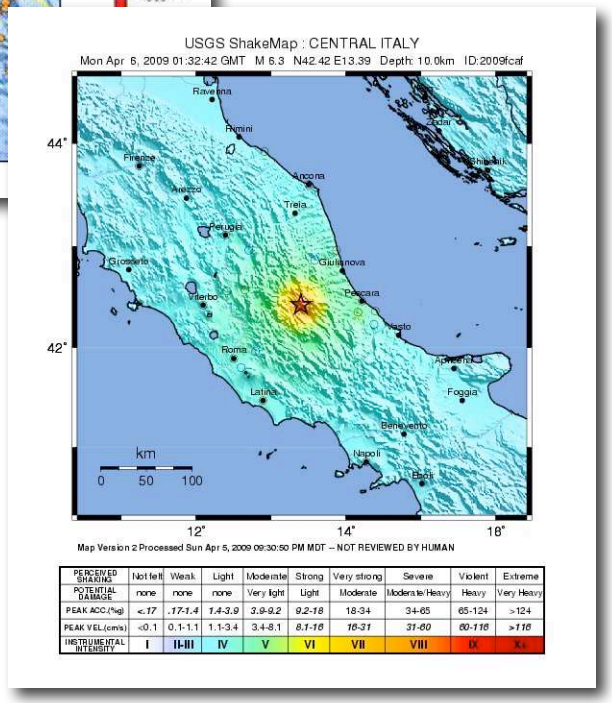




Italien L'Aquila 6. April 2009 M6.3







PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Neue Zürcher Zeitung

Erdbeben in L'Aquila

Seismologen letztinstanzlich freigesprochen

Sechs italienische Wissenschafter, die 2012 für schuldig erklärt worden waren, weil sie die Bevölkerung der Stadt L'Aquila 2009 nicht hinreichend vor einem Erdbeben gewarnt haben sollen, sind in letzter Instanz freigesprochen worden.

(sda/apa)
Das Oberste Gericht in Rom bestätigte am Freitagabend den Freispruch eines Berufungsgerichts von L'Aquila. Erstinstanzlich waren die Experten zu sechs Jahren verurteilt worden.

Das 2012 gefällte Urteil hatte in der internationalen wissenschaftlichen Gemeinschaft für einen Eklat gesorgt. Die Anklage hatte den Experten vorgeworfen, die Risiken des Bebens unterschätzt zu haben, bei dem im April 2009 mehr als 300 Menschen umkamen.

Im November 2014 waren die Verurteilten dann freigesprochen worden, doch die Staatsanwaltschaft legte dagegen Berufung ein. Das Kassationsgericht bestätigte jetzt letztinstanzlich den Freispruch.

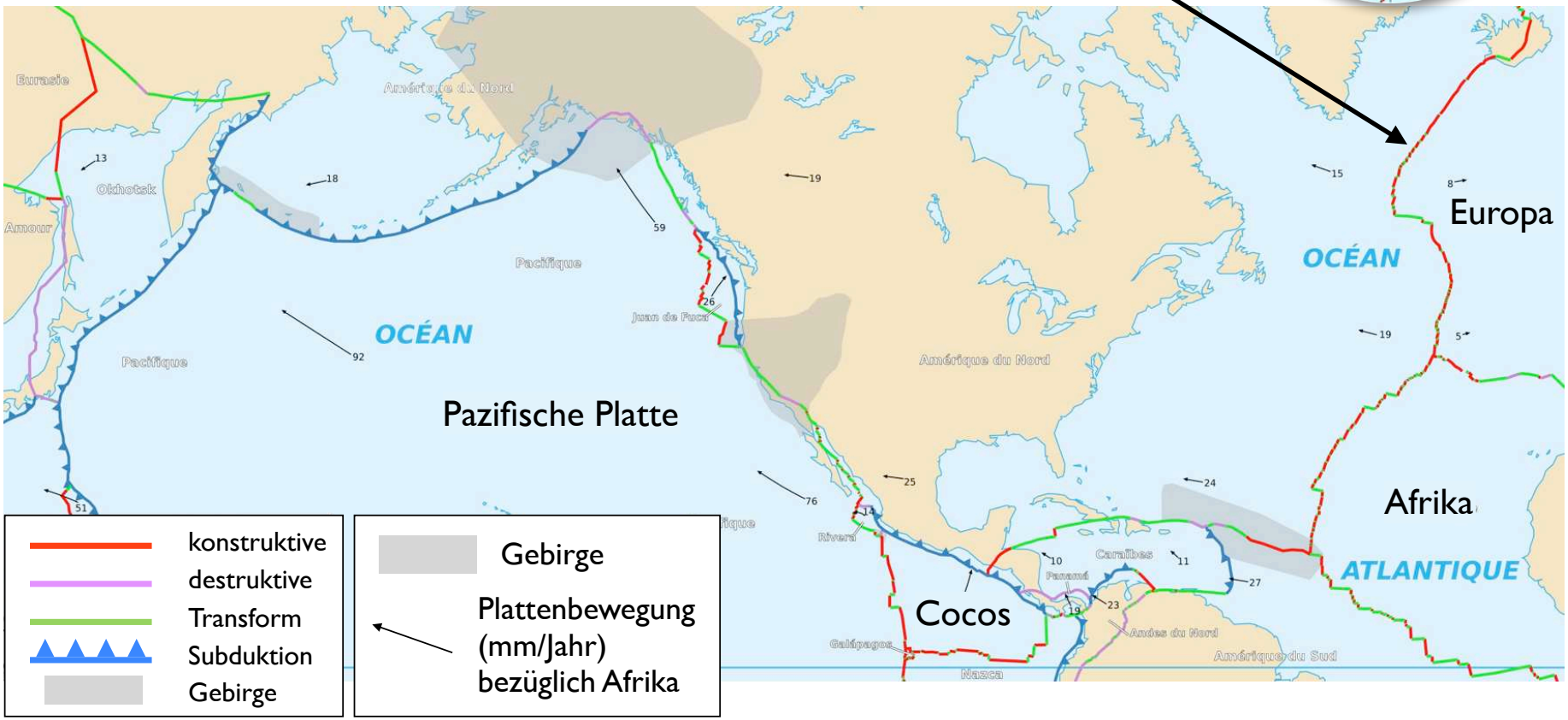
Zu den freigesprochenen Angeklagten zählen führende Wissenschafter Italiens, wie etwa der ehemalige Leiter des Instituts für Geophysik und Vulkanologie, Enzo Boschi, und Ex-Zivilschutzchef Franco Barberi. Sie waren vor dem Beben zum Schluss gekommen, dass eine Reihe von vorangegangenen Erdstössen in der Region auf kein erhöhtes Erdbebenrisiko hinweise. Ihre Empfehlungen dienten den Behörden als Entscheidungshilfe.

Die Angeklagten hätten die lange Serie kleiner Beben ohne Schäden ignoriert, die in der Region Wochen vor dem Erdbeben registriert worden waren, und die wachsende Sorge in der Bevölkerung heruntergespielt, meinten die Staatsanwälte. Die Verteidiger erwiderten, dass Erdbeben unvorhersehbar seien. Diese Ansichten teilten offenkundig auch die Berufungsrichter.

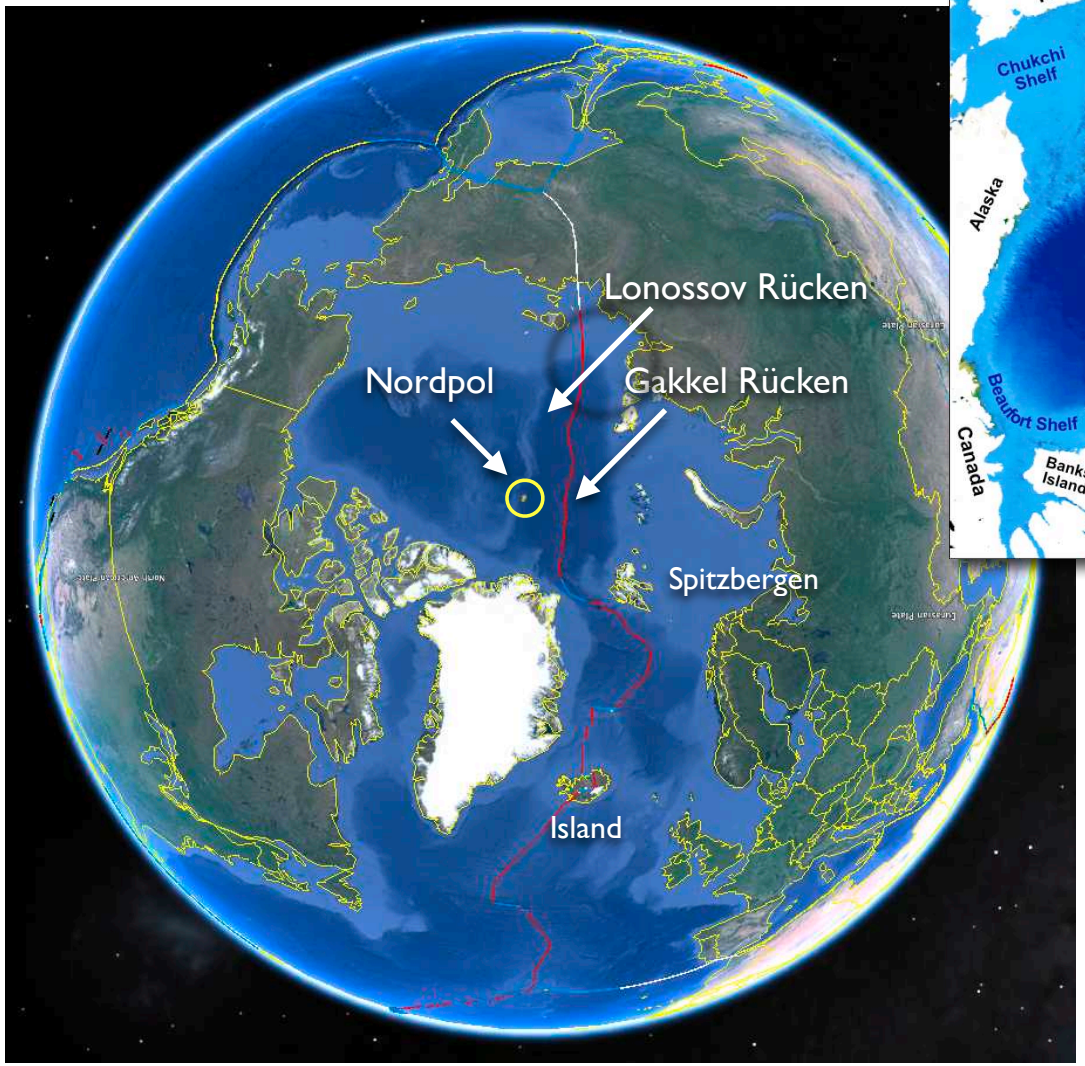
Westlicher Nachbar: Nordamerikanische Platte

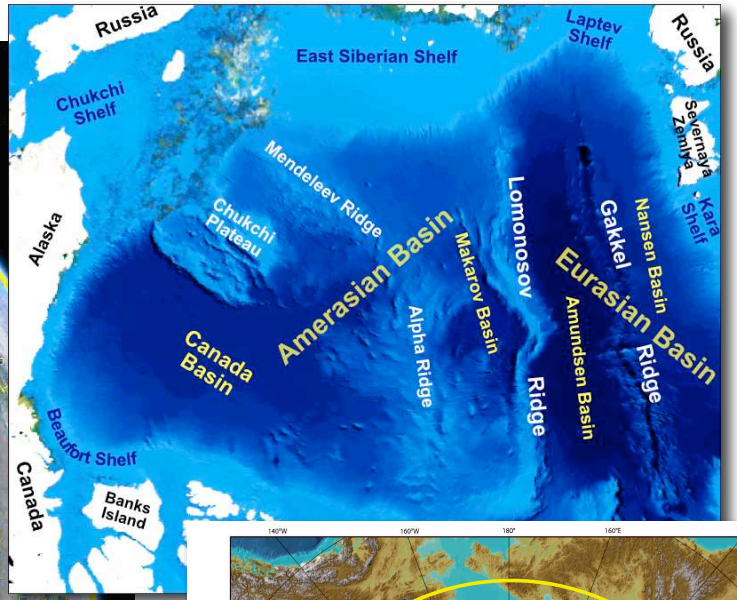
1	Pazifische Platte
2	Afrikanische Platte
3	Antarktische Platte
4	Nordamerikanische Platte
5	Eurasische Platte
6	Australische Platte
7	Südamerikanische Platte

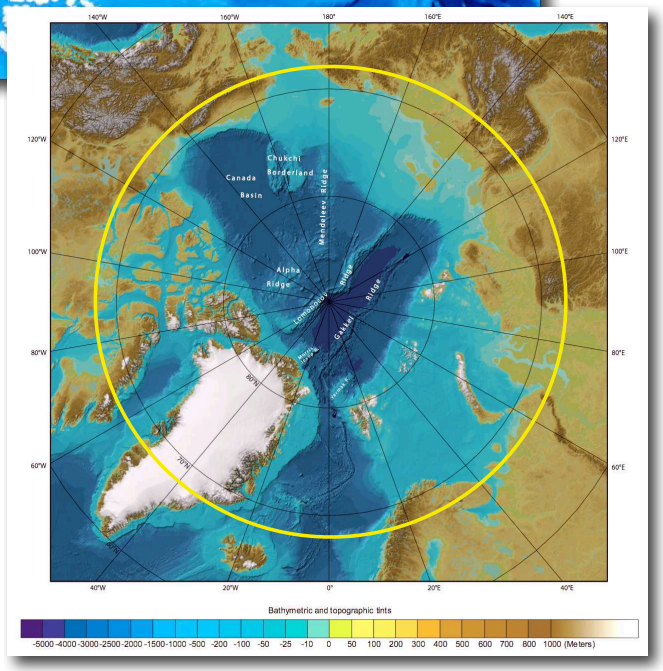
Mittelatlantischer Rücken



oder nördlicher Nachbar ...?







Tatort
Nepal 25. April 2015

www.iris.edu/hq/retm/event/3363

1

2

IRIS Teachable Moments

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

A magnitude 7.8 earthquake occurred with an epicenter 77 km (48 miles) northwest of Kathmandu, the capital city of Nepal that is home to nearly 1.5 million inhabitants. The earthquake flattened homes, buildings and temples, causing widespread damage across the region and killing more than 2,300 and injuring more than 5,000.

Rescue workers remove debris as they search for victims of earthquake in Bhaktapur near Kathmandu, Nepal. A major earthquake shook Nepal's capital and the densely populated Kathmandu Valley before noon Saturday, causing extensive damage with toppled walls and collapsed buildings, officials said.

(AP Photo/Niranjan Shrestha)

Schaden an Unesco World Heritage Site

3

IRIS Teachable Moments

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

The earthquake centered outside Kathmandu, the capital, was the worst to hit Nepal in over 80 years. It destroyed swaths of the oldest neighborhoods of Kathmandu and severely damaged three Unesco World Heritage sites. The earthquake was strong enough to be felt all across parts of India, Bangladesh, China's region of Tibet and Pakistan.

Image courtesy of the BBC

Reports of damage and injuries are still being confirmed. The situation is unclear in remote areas which remain cut off or hard to access. Many mountain roads are damaged or blocked by landslides.

Lawine am Mt. Everest

3

IRIS Teachable Moments

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

The earthquake triggered a major avalanche on the south slopes of Mt. Everest, located approximately 160 km east-northeast of the epicenter. The avalanche destroyed the base camp, where climbers were waiting for a break in the weather to ascend the mountain. According to reports, the avalanche killed at least 17 people and injured 61 others.

People approach the scene after an avalanche triggered by a massive earthquake swept across Everest Base Camp, Nepal on Saturday, April 25, 2015.

(AP Photo/ Azim Afif)

Intensität: Modifizierte Mercalli Intensität (MMI)

4

Mercalli Skala	
XII	grosse Katastrophe
XI	Katastrophe
X	vernichtend
IX	verwüstend
VIII	zerstörend
VII	sehr stark
VI	stark
V	ziemlich stark
IV	mässig
III	leicht
II	sehr leicht
I	unmerklich

IRIS Teachable Moments

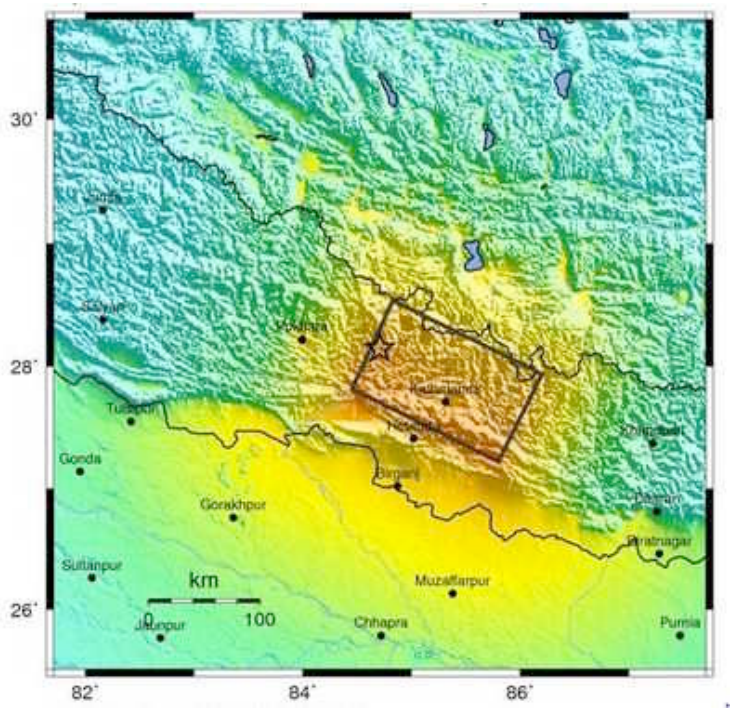
Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

Shaking Intensity

The Modified Mercalli Intensity (MMI) scale depicts shaking severity. The area nearest Katmandu experienced very strong to severe shaking.

Modified Mercalli Intensity	Perceived Shaking
X	Extreme
IX	Violent
VIII	Severe
VII	Very Strong
VI	Strong
V	Moderate
IV	Light
II-III	Weak
I	Not Felt

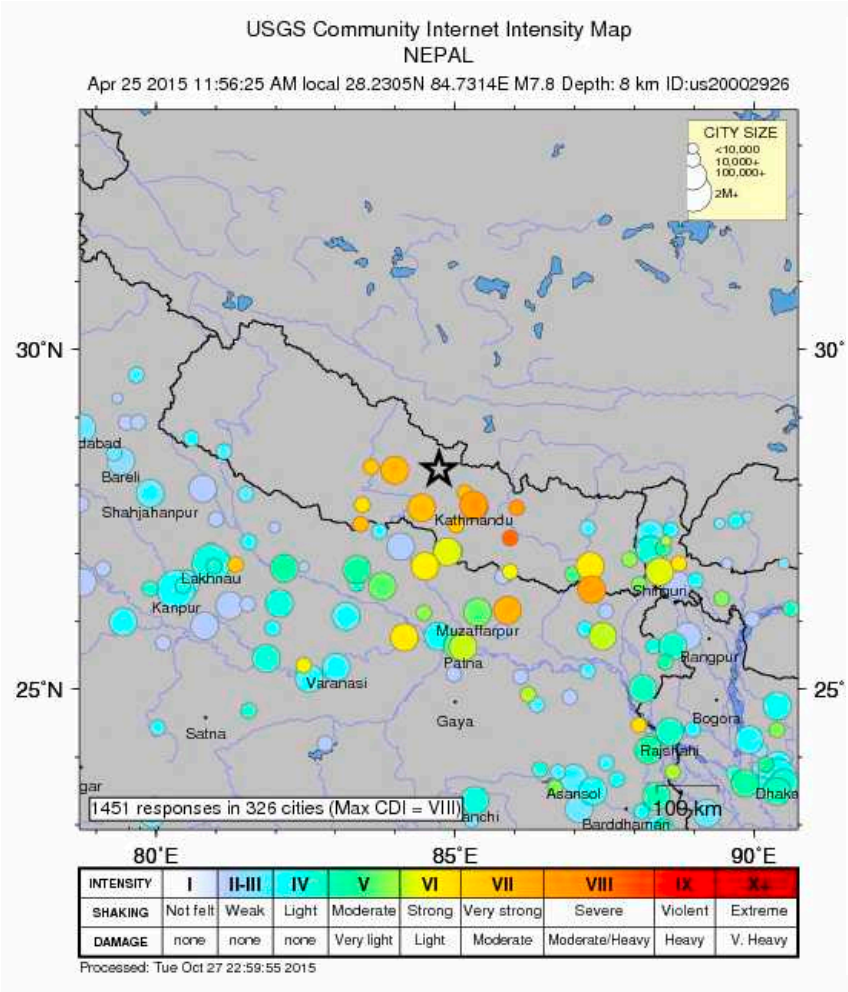
Image courtesy of the US Geological Survey



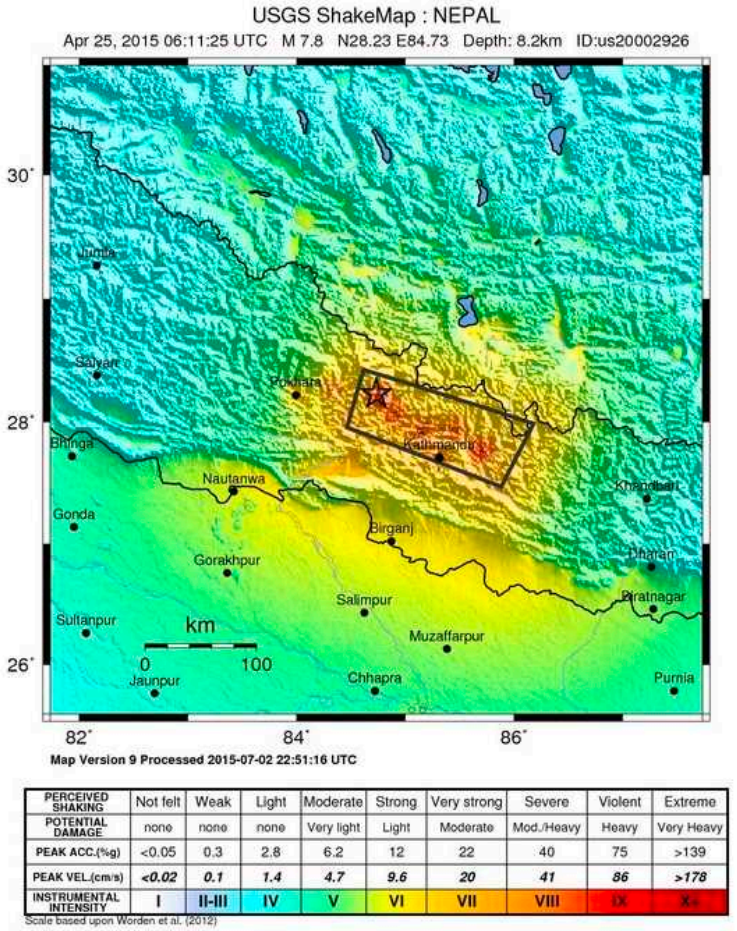
USGS Estimated shaking Intensity from M 7.8 Earthquake

earthquake.usgs.gov/earthquakes/eventpage/us20002926

27. Oktober 2015



2. Juli 2015



PAGER

Prompt Assessment of Global Earthquakes for Response

5

IRIS Teachable Moments

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

Nearly 5.3 million people experienced severe ground shaking during this earthquake.

MMI	Shaking	Pop.
I	Not Felt	--*
II-III	Weak	--*
IV	Light	5,616k*
V	Moderate	69,912k*
VI	Strong	61,669k
VII	Very Strong	9,288k
VIII	Severe	5,299k
IX	Violent	4k

USGS PAGER
Population Exposed to Earthquake Shaking

The color coded contour lines outline regions of MMI intensity. The total population exposure to a given MMI value is obtained by summing the population between the contour lines. The estimated population exposure to each MMI Intensity is shown in the table.

Image courtesy of the US Geological Survey

5 616 000 | 69 612 000 | 61 669 000 | 9 288 000 | 5 299 000 | 4 000

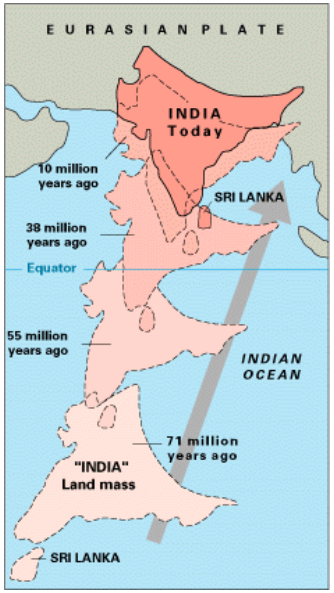
Kontinentale Kollision

6

IRIS Teachable Moments

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

The earthquake activity in Nepal is caused by the ongoing continent-continent collision between India and Asia. That collision has produced the Himalaya Mountains and the Tibetan Plateau. The collision zone wraps around the northwest promontory of the Indian continent in the Hindu Kush region of Tajikistan and Afghanistan then extends to the southeast through Nepal and Bhutan.



heute
10 Mio Jahre
38 Mio Jahre
55 Mio Jahre
71 Mio Jahre

The motion of India into Asia is essentially perpendicular to the Himalaya Mountains in Nepal. So thrust faulting earthquakes are the most common kind of earthquake in the central Himalayan region.

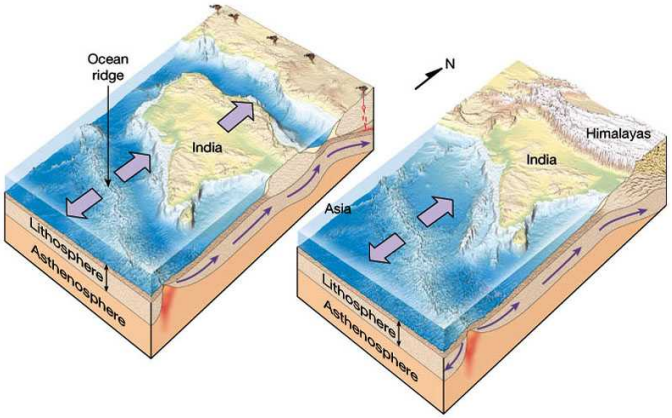
Herdflächenlösung Bewegungssinn

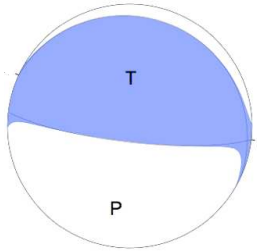
IRIS Teachable Moments

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

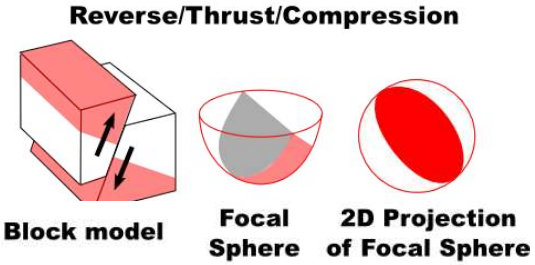
This earthquake occurred as the result of thrust faulting between the subducting Indian Plate and the overriding Eurasian Plate to the north.

At the location of this earthquake the Indian Plate is converging with Eurasia at a rate of 45 mm/yr towards the north-northeast, driving the uplift of the Himalayas and the Tibetan Plateau.





USGS Centroid Moment Tensor Solution



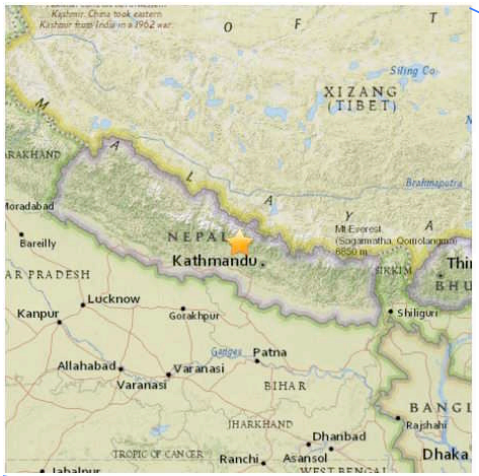
The tension axis (T) reflects the minimum compressive stress direction.
The pressure axis (P) reflects the maximum compressive stress direction.

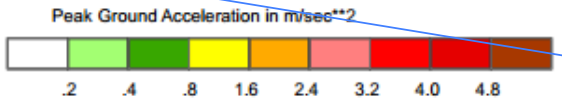
Seismische Gefährdung

8

IRIS Teachable Moments

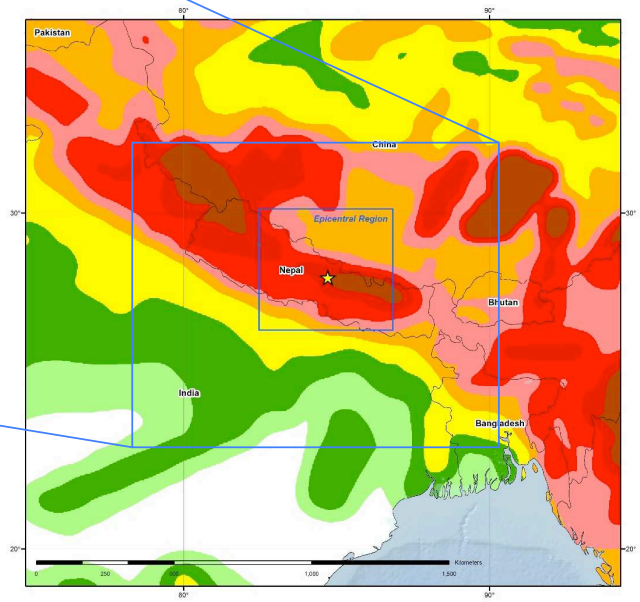
Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC





This earthquake hazard map illustrates the peak ground acceleration expected to be exceeded with 10% probability during a 50-year period. The dark red zones indicate accelerations of about 0.5g where g=acceleration of gravity.

Northward underthrusting of India beneath Eurasia generates numerous earthquakes and consequently makes this area one of the most seismically hazardous on Earth.



Seismic Hazard Image courtesy of the US Geological Survey

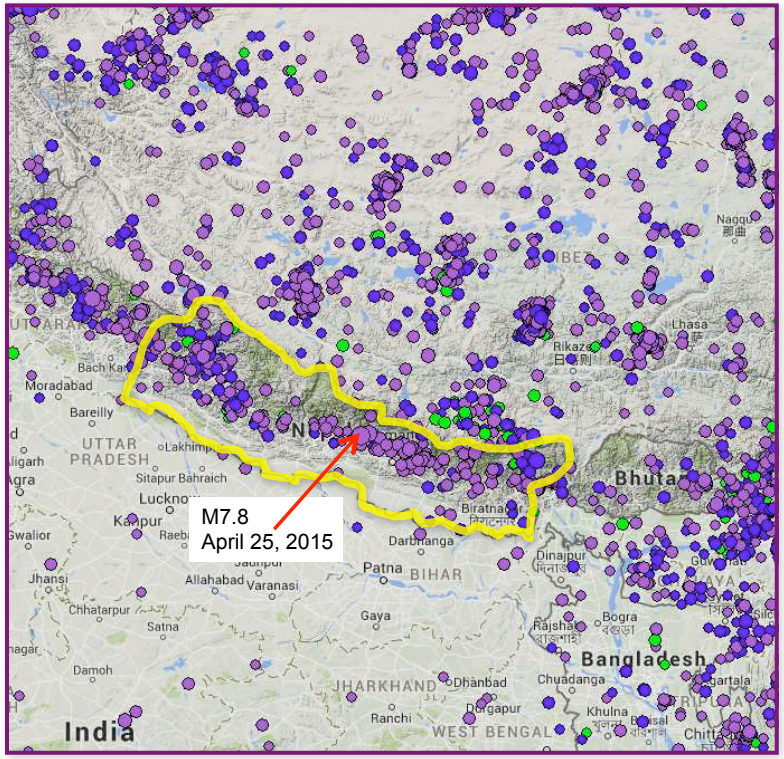
Erbeben seit 1990 Herdtiefe (Hypozentrum)

IRIS Teachable Moments

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

This map shows epicenters of earthquakes since 1990 (>M4) within the India – Asia collision zone. Note the belt of earthquakes along and south of the Himalaya Mountains sweeping through Nepal (yellow outline).

Four earthquakes ≥M6 have occurred within 250 km of the April 25 earthquake over the past century. The largest included a M6.9 in August 1988 and a M8.0 in 1934 which severely damaged Kathmandu. The 1934 earthquake is thought to have caused around 10,600 fatalities.



Map created using the IRIS Earthquake Browser: *www.iris.edu/ieb*

Haupbeben - Nachbeben

10

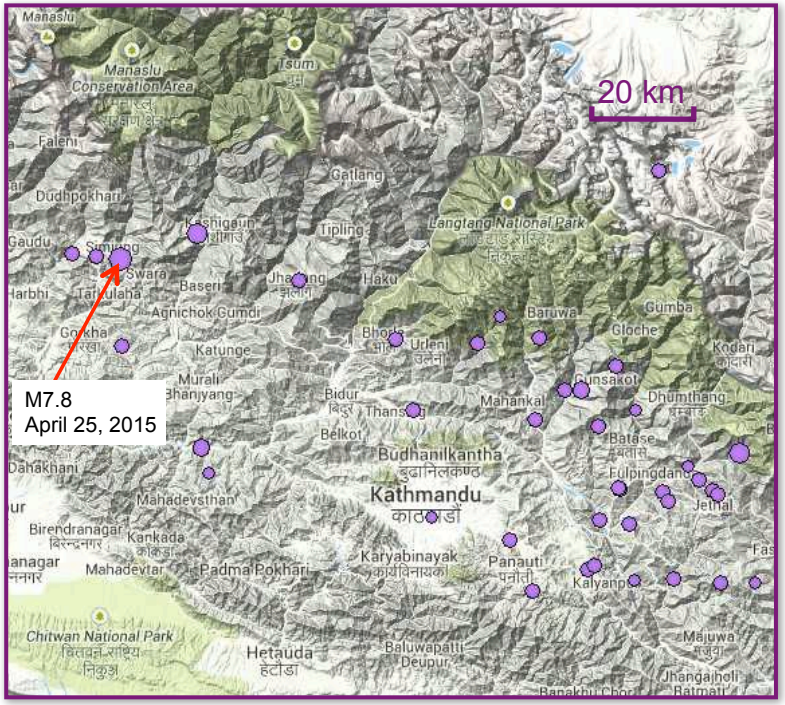
IRIS Teachable Moments

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

This map shows the magnitude 7.8 earthquake (mainshock) and the distribution of 40 aftershocks of magnitude 4 or larger that occurred over the following 27 hours.

The aftershock distribution outlines the rupture zone of the mainshock. The rupture during the mainshock initiated beneath the epicenter and propagated toward the southeast.

On the next slide, a map of fault displacement during the earthquake is superimposed on this same map.



Map created using the IRIS Earthquake Browser: *www.iris.edu/ieb*

Nachbeben

10

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

A magnitude 6.7 aftershock was felt on Sunday in Nepal, India and Bangladesh, and more avalanches were reported near Mt. Everest. Aftershocks following the magnitude 7.8 mainshock have resulted in additional damage and have been a major disruption to recovery efforts.

Aftershock sequences follow predictable patterns as a group, although the individual earthquakes are themselves not predictable. The graph shows how the number of aftershocks and the magnitude of aftershocks decay with increasing time since the main shock. The number of aftershocks also decreases with distance from the main shock.

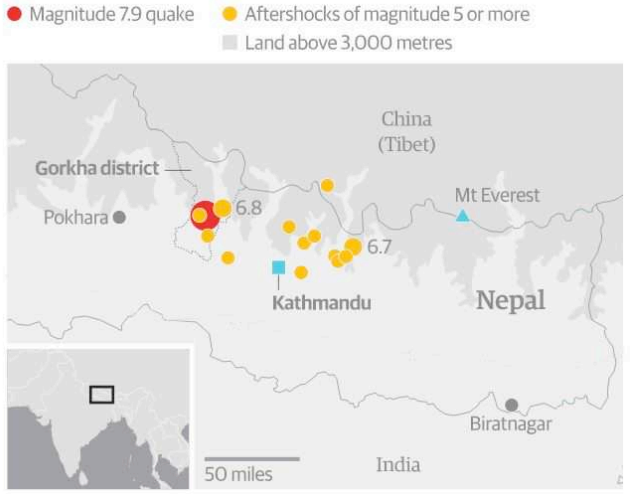


Image modified from the Guardian

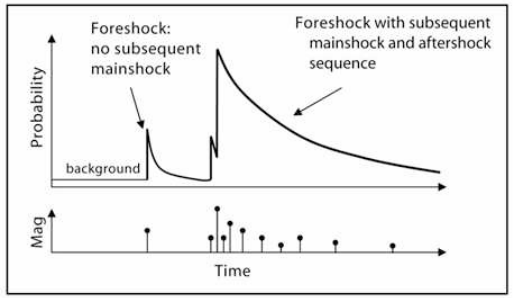


Image and text courtesy of the US Geological Survey

Magnitude 7.3 NEPAL
Tuesday, May 12, 2015 at 07:05:19 UTC

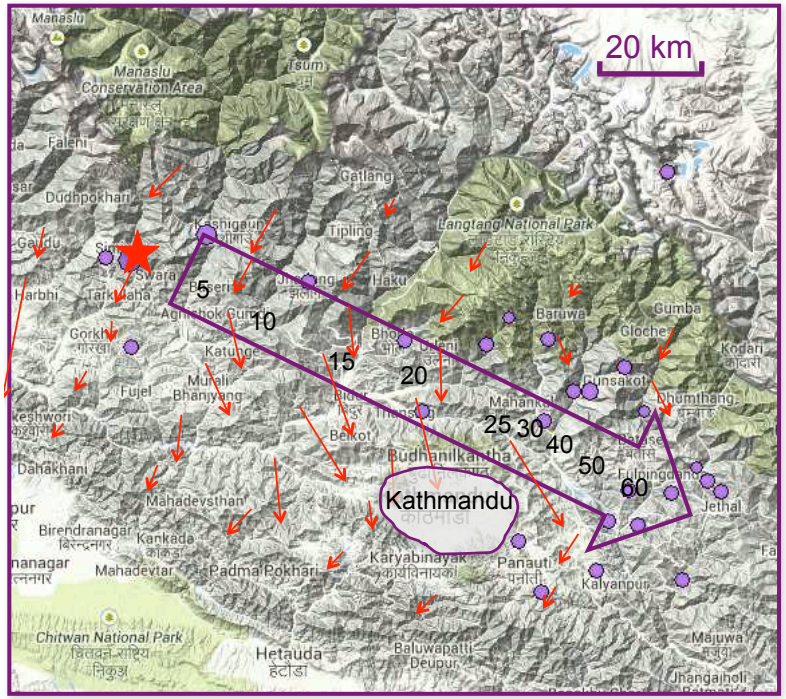
Bruchfläche · Versatz = Grösse des Erdbebens

11

IRIS Teachable Moments

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

This map shows fault displacement during this earthquake. The red star is the epicenter while the purple arrow shows the direction of rupture propagation towards the southeast. Contours show the rupture front in 5 second increments after rupture initiation. Small red arrows show the direction and amount of motion of the rocks above the fault with respect to the rocks below the fault. The amount of slip is shown by color of shading. Maximum fault displacement of about 3 meters occurred in the rupture zone about 20 km north of Kathmandu.



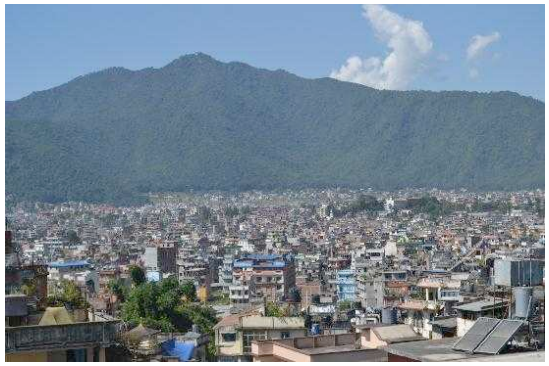
Vulnerabilität

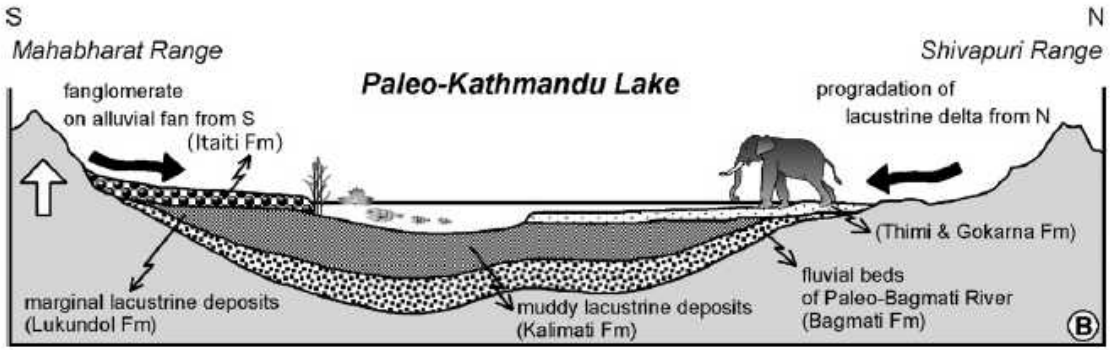
12

IRIS Teachable Moments

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

Because it is built in a basin underlain by lake sediment, Kathmandu was particularly vulnerable during this earthquake. The city is located in a broad valley surrounded by the Himalayas. This valley was formerly the site of a lake within which river delta and lake sediment accumulated to thickness of about 100 meters.





Simplified geologic cross-section of the Kathmandu Valley showing basin-fill sediments. Lakebed deposits are labeled “lacustrine” whereas sediments deposited by rivers are labeled “fluvial”. After Sakai et al. Pleistocene rapid uplift of the Himalayan frontal ranges recorded in the Kathmandu and Siwalik basins, Palaeogeography, Palaeoclimatology, Palaeoecology, v. 241, p.1 6–27, 2006.

Amplifikation

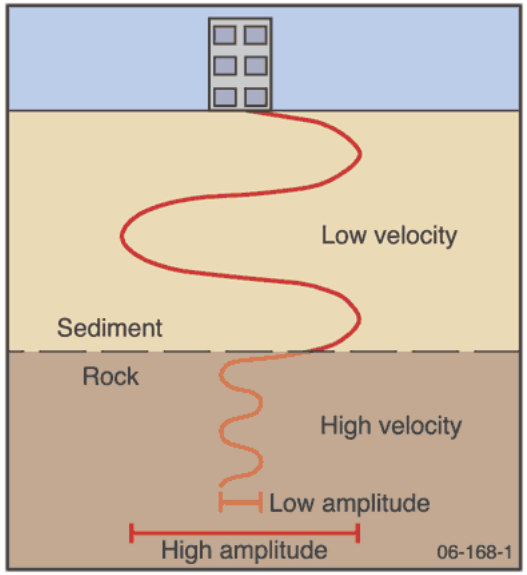
13

IRIS Teachable Moments

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

This earthquake was destructive due to both the shallow depth (15 km), and the fact that Kathmandu lies in a basin filled with about 2000 feet of soft sediment.

Sedimentary basins can have a large effect on ground motion above them. Earthquake waves travel at high velocity through the stiff, crystalline rock of the crust but slow dramatically when entering the basin. This increases the amplitude of the earthquake waves within the basin fill. In addition, the sharp density contrast of the soft basin rocks with surrounding material can cause waves to reflect, trapping energy in the basin for a period of time. This extends the duration of shaking.



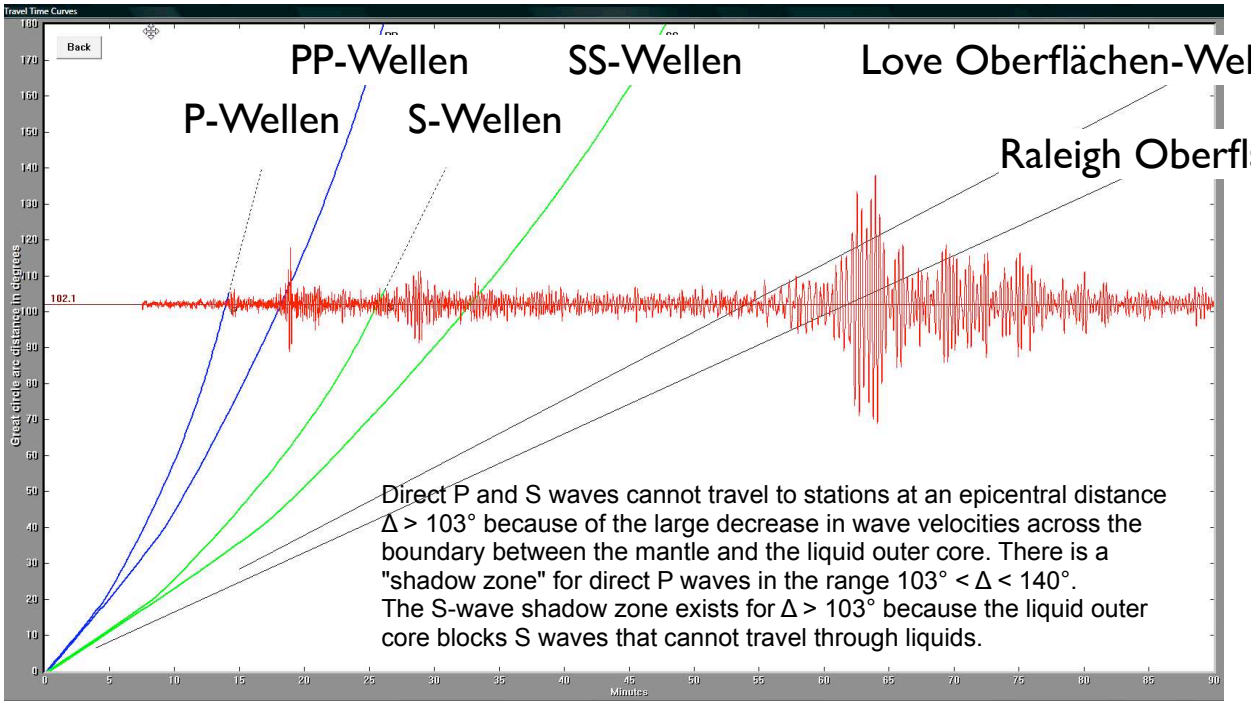
Seismogramm der Universität Portland

14

IRIS Teachable Moments

Magnitude 7.8 NEPAL
Saturday, April 25, 2015 at 06:11:26 UTC

The record of the earthquake on the Mt Tabor Middle School seismometer (MTOR) is illustrated below. Portland is about 11,355 km (~7055 miles, 102.3 degrees) from the location of this earthquake.



Zusammenfassung der Stichworte

1. Magnitude (Absolutmass, Energie)
2. Epizentrum
3. Human Interest
4. Intensität ("gefühlte Magnitude")
5. PAGER: Exposure (Bevölkerung, Sachwerte)
6. Tektonische Interpretation
7. Seismologische Interpretation: Herdflächenlösung
8. Gefährdung - Risiko
9. Historische Seismizität - Herdtiefe (Hypozentrum)
10. Haupt- und Nachbeben
11. Seismic slip: Bewegung an Bruchfläche
12. Vulnerabilität
13. Amplifikation - Erdbebenrisiko-Karte
14. Erdbebenwellen - Aufzeichnung