Modul Regionale Geologie (600156)

WS 2015/16

TM1 – Regionale Geologie ausgewählter Gebiete der Erde

Kontinentale Extension: Das Beispiel des Oberrheingrabens

Hilmar von Eynatten

Abt. Sedimentologie/Umweltgeologie

Literatur

- (Walter, R., 2007. *Geologie von Mitteleuropa*, 7. Aufl., Schweizerbart)
- Eisbacher, G.H., Fielitz, W., 2010. Karlsruhe und seine Region. Sammlung geologischer Führer, 103, Gebr. Bornträger (Stuttgart), 342 S.
- Behrmann, JH, et al. (2005, Eds.) *EUCOR-URGENT – Upper Rhine Graben Evolution and Neotectonics*. Special Issue, International Journal of Earth Sciences, 94(4), 505-778.
- www.oberrheingraben.de (Dr. Christian Röhr)
- *EUCOR-URGENT* – http://comp1.geol.unibas.ch

Geländeübung (TM2)

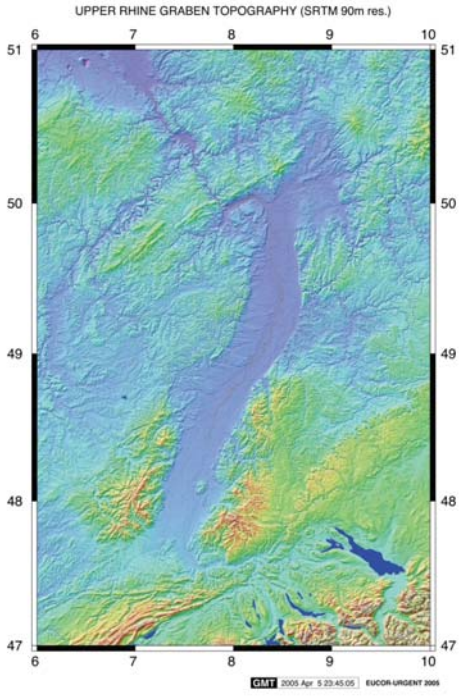
Oberrheingraben und Kaiserstuhl: **8 Tage, 05.-12.9.2016**

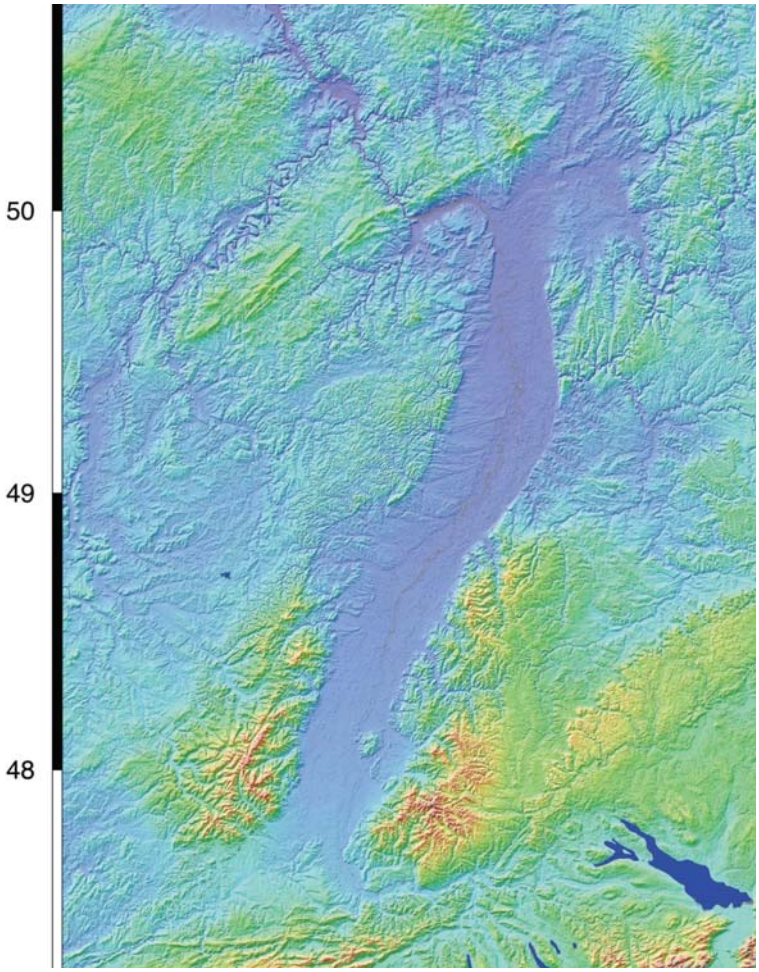
Inhalt:

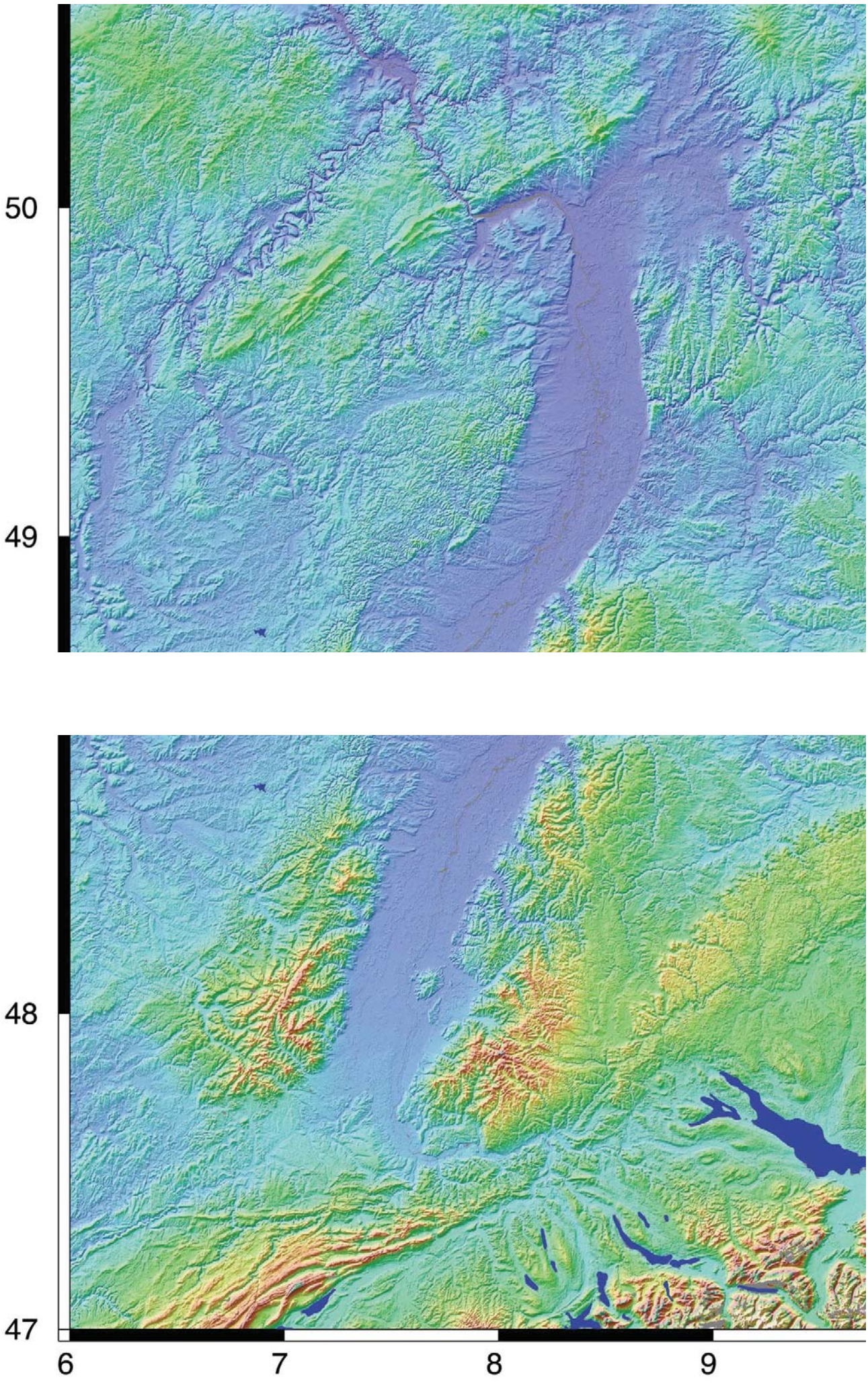
- Einführung, Geographie und Morphologie des ORG
- grösserer Rahmen: ECRIS, Krustenstruktur (Moho), Seismizität
- struktureller Überblick, Subsidenzgeschichte, Quer- und Längsprofile durch den ORG, Vulkanismus
- Stratigraphie der sedimentären Grabenfüllung und paläogeographische Rekonstruktion
- Tektonik, seismische Profile, Entwicklungsmodelle
- Bezug zum Schweizer Molassebecken: Stratigraphie - Paleogeographie

EUCOR URGENT UPPER RHINE GRABEN EVOLUTION & NEOTECTONICS

http://comp1.geol.unibas.ch



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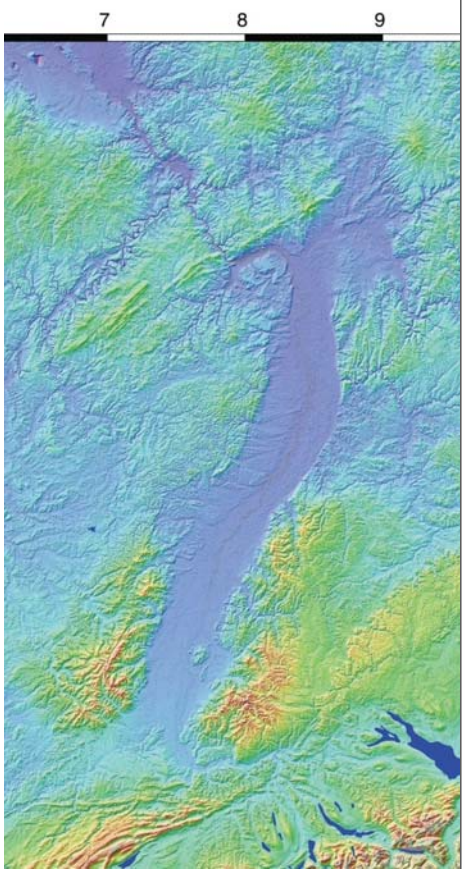
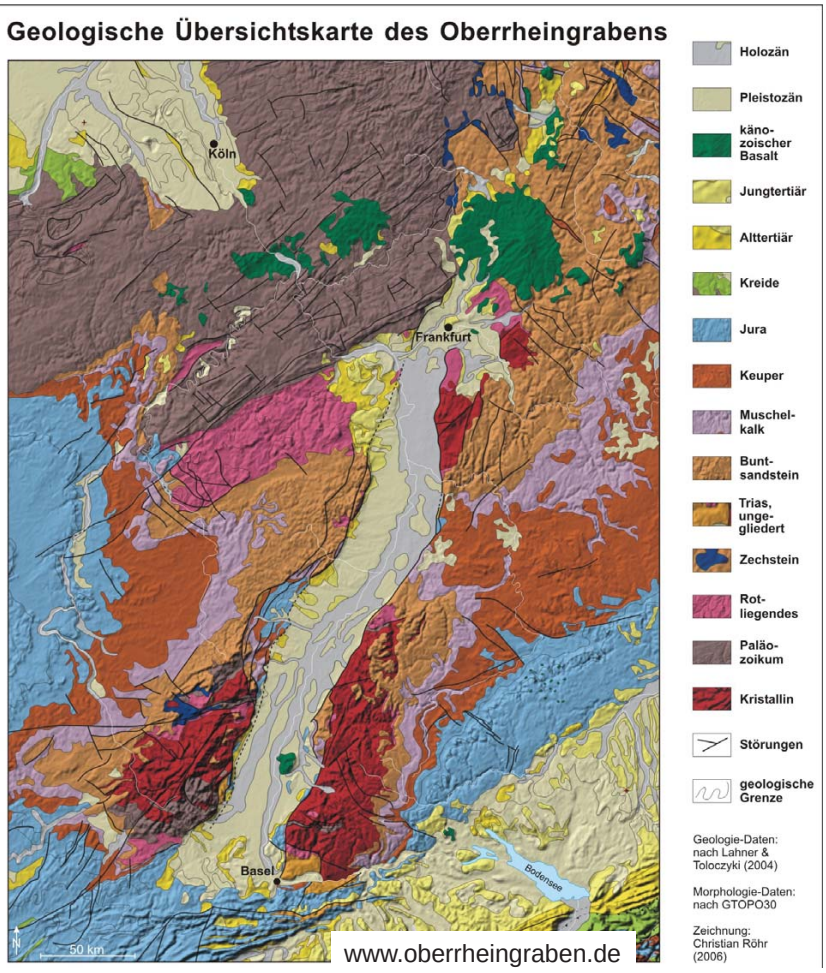
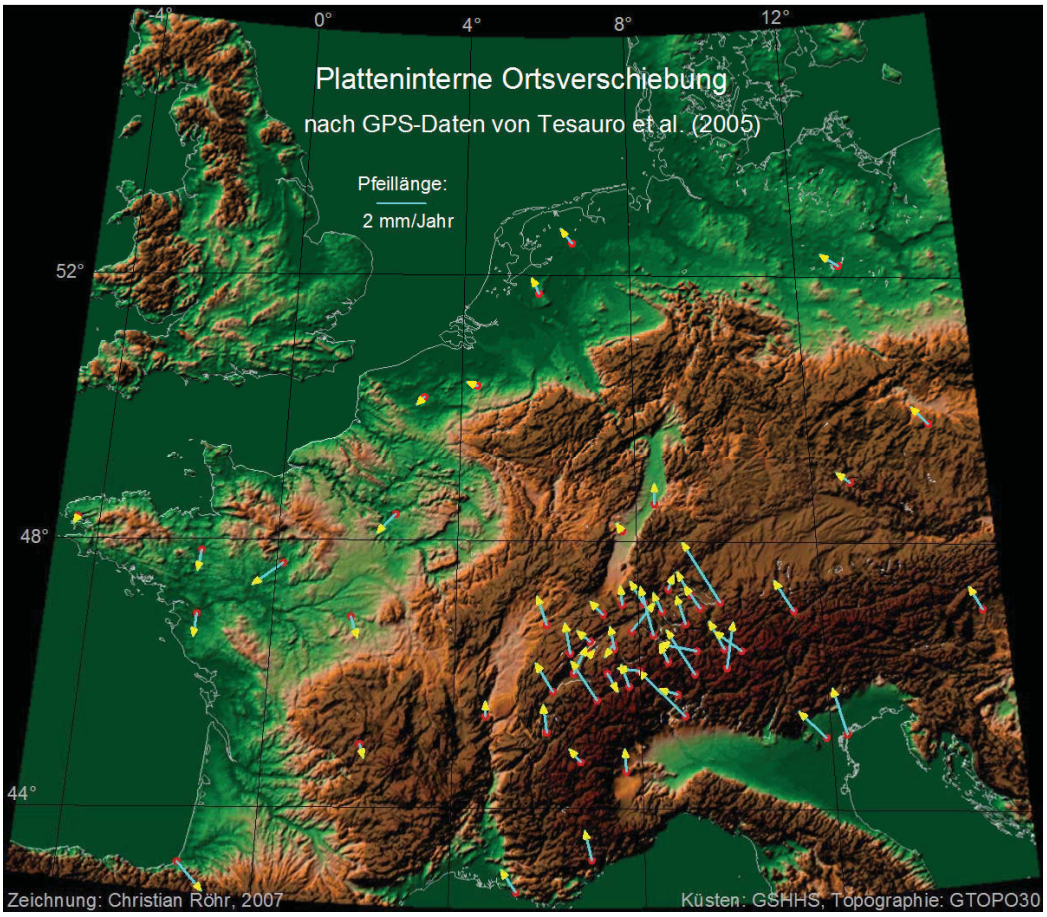
morphology vs. geology





Historical woodcut of the catastrophic 1356 earthquake in Basel. Location of epicenter was approx. 10 km south of the city (Munster, 1588; cit. in Illies & Greiner 1978)

„The earthquake that occurred on October 18, 1356, in the region of Basel is the strongest historically documented earthquake in central Europe“ (ETH Zürich)



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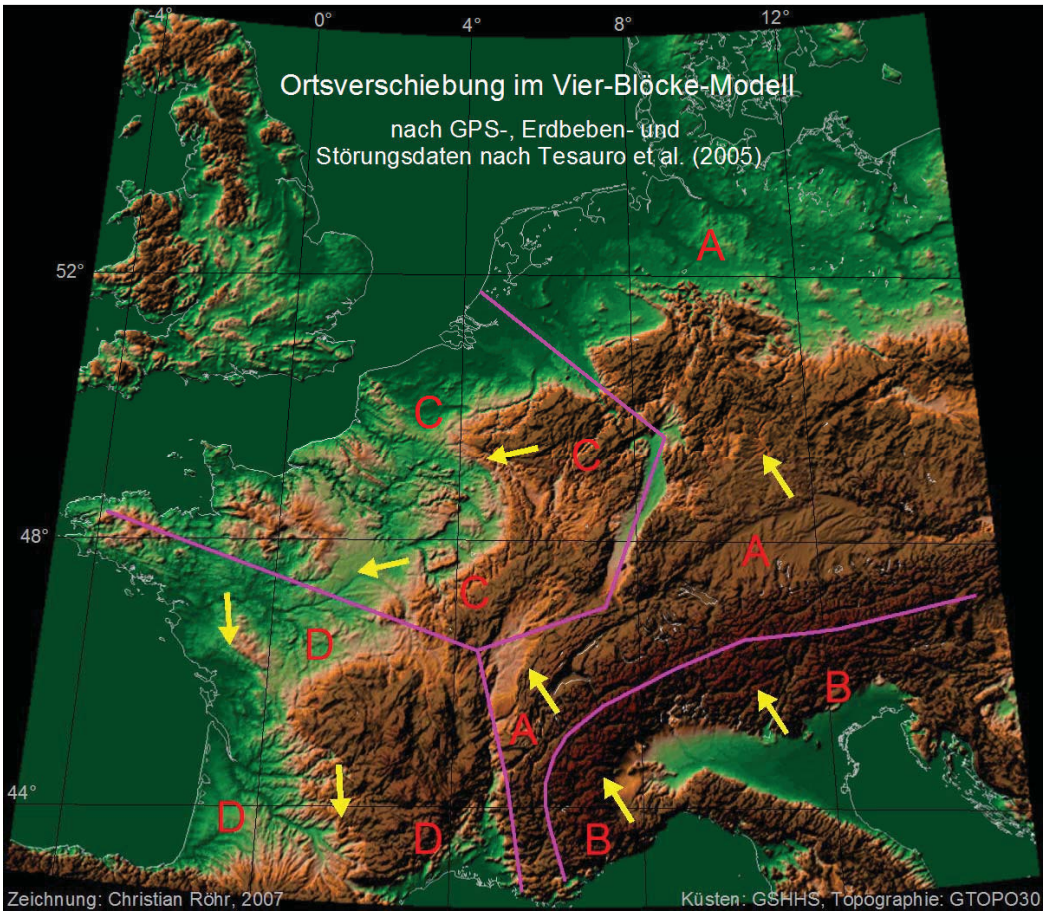

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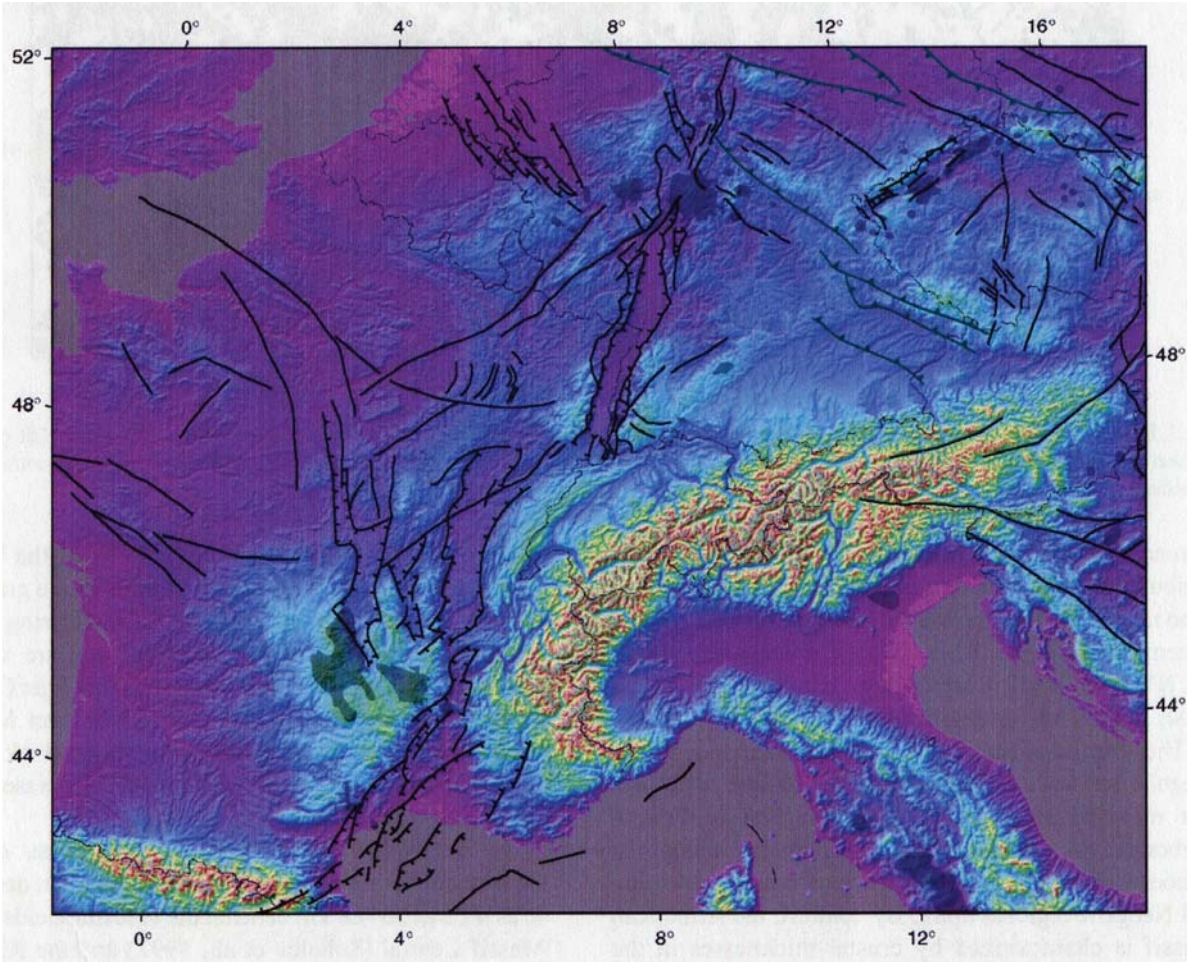
DEM of European Continetal Rift System (ECRIS)
(from Ziegler and Dezes, 2007, GPS)



HvE

EUCOR URGENT UPPER RHINE GRABEN EVOLUTION & NEOTECTONICS

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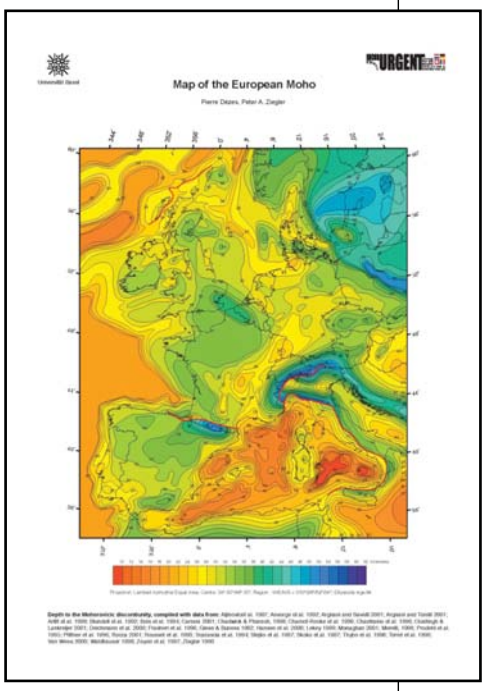

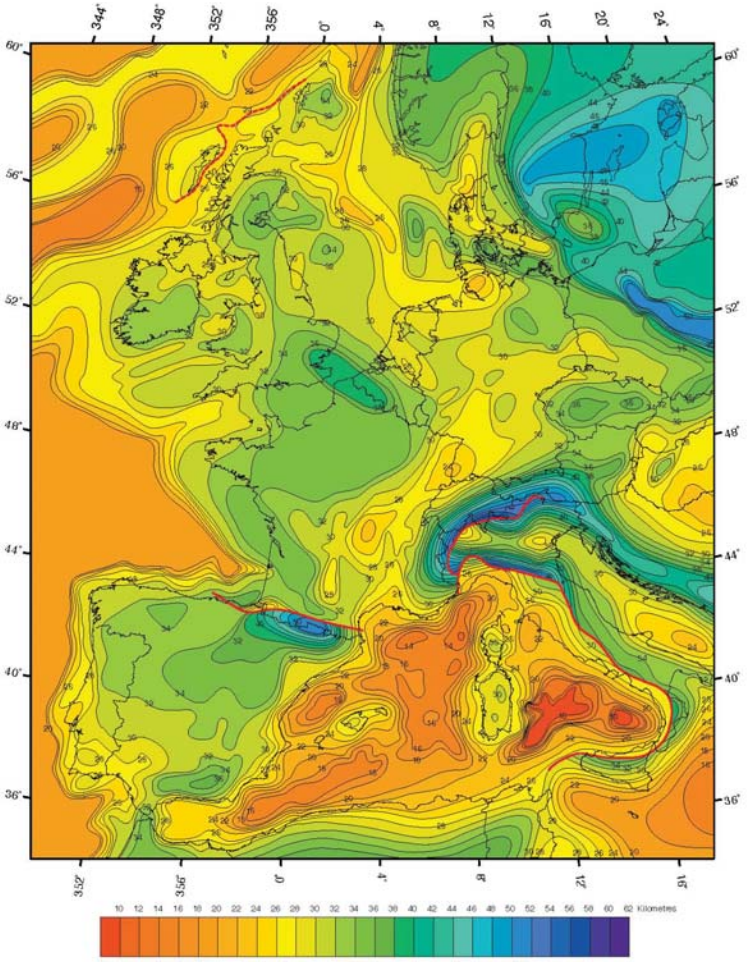

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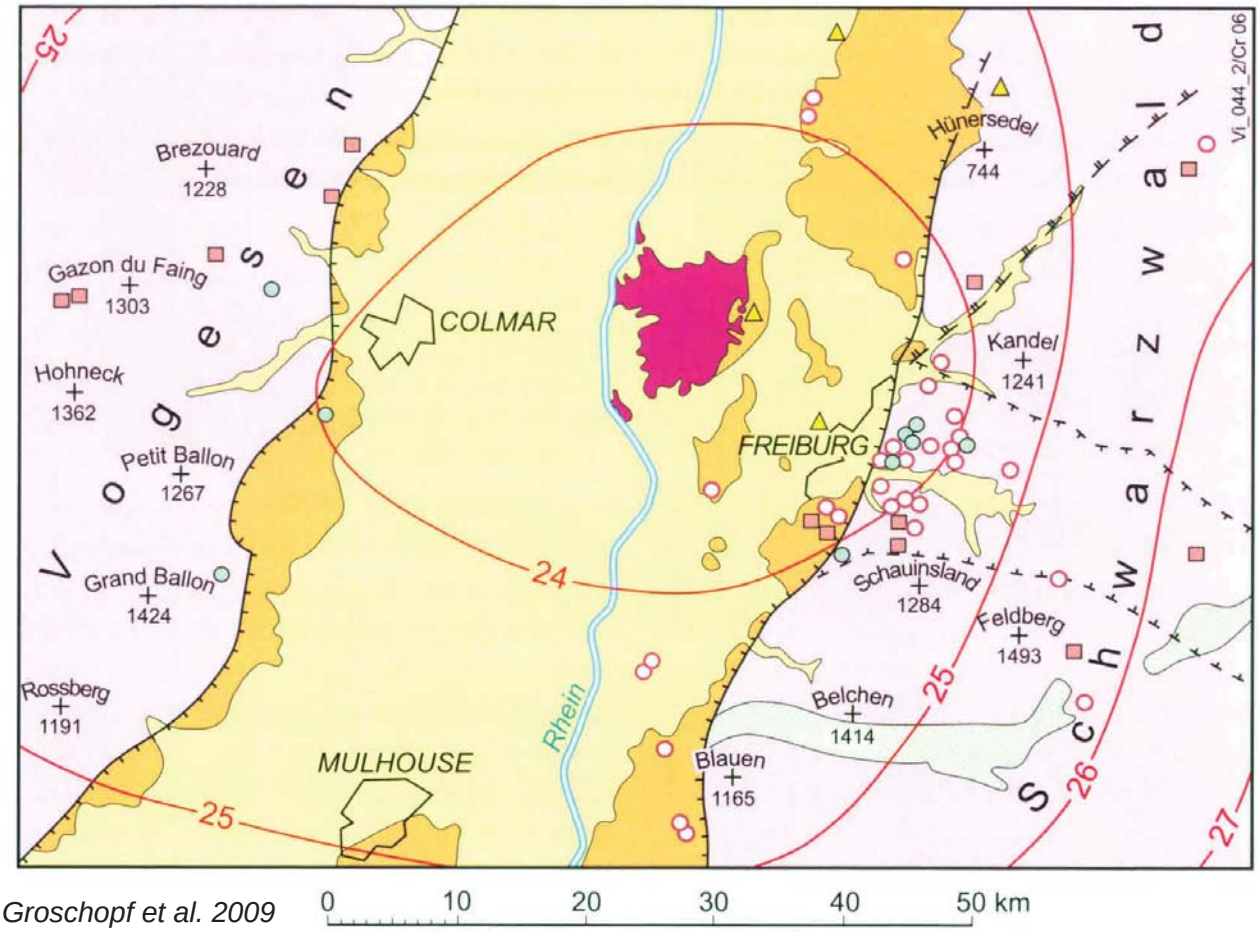
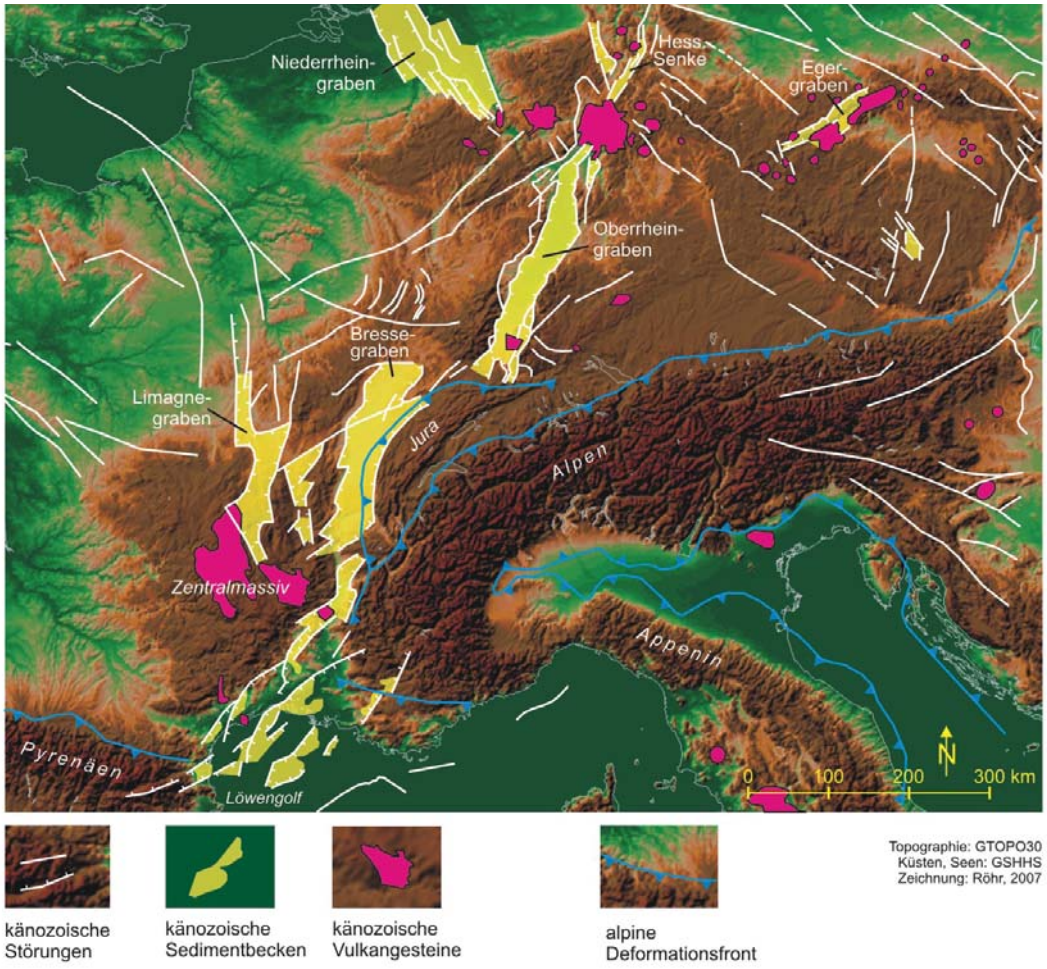


Groschopf et al. 2009



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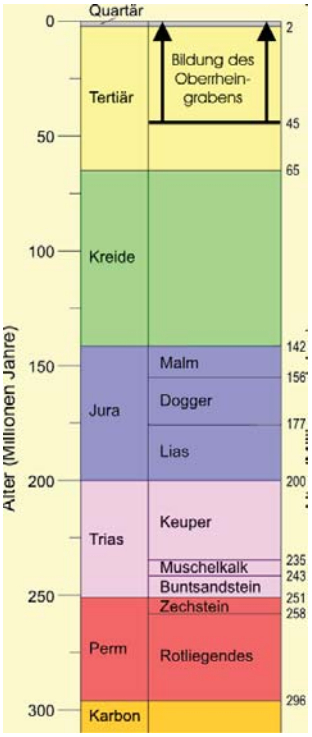
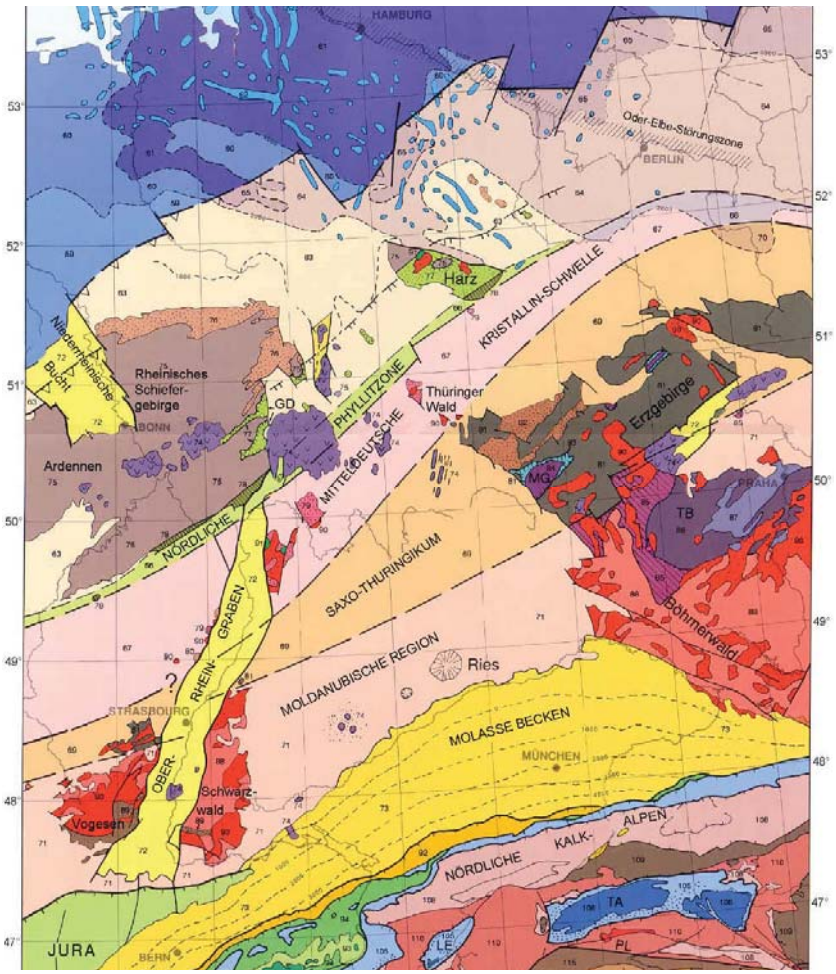
Structural Overview





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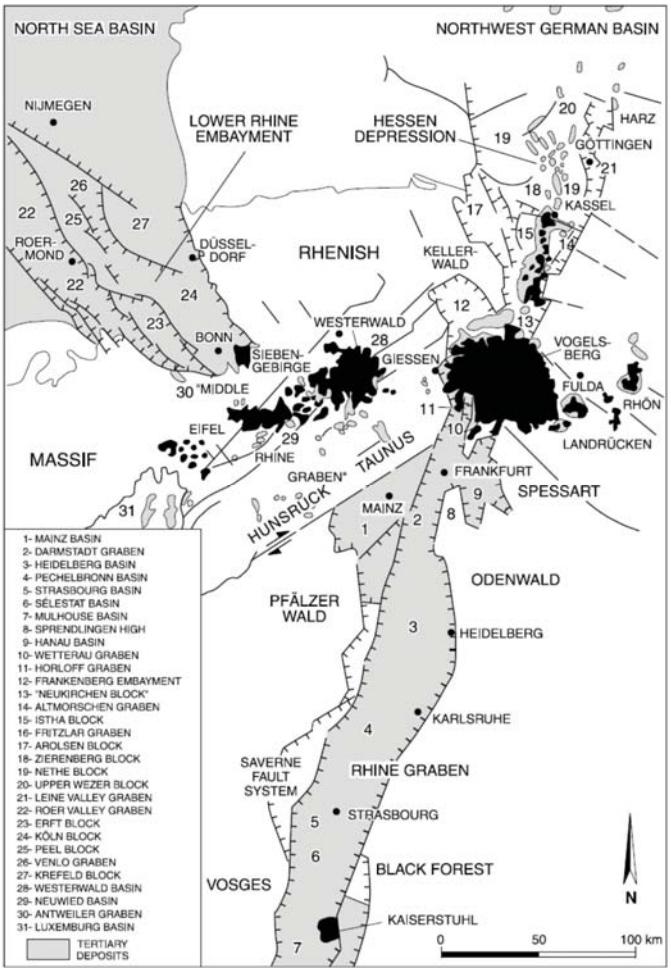

Structural summary map for the area
of the Rhenish Triple Junction.
(Sissingh 2003; PPP 196, 229-263)

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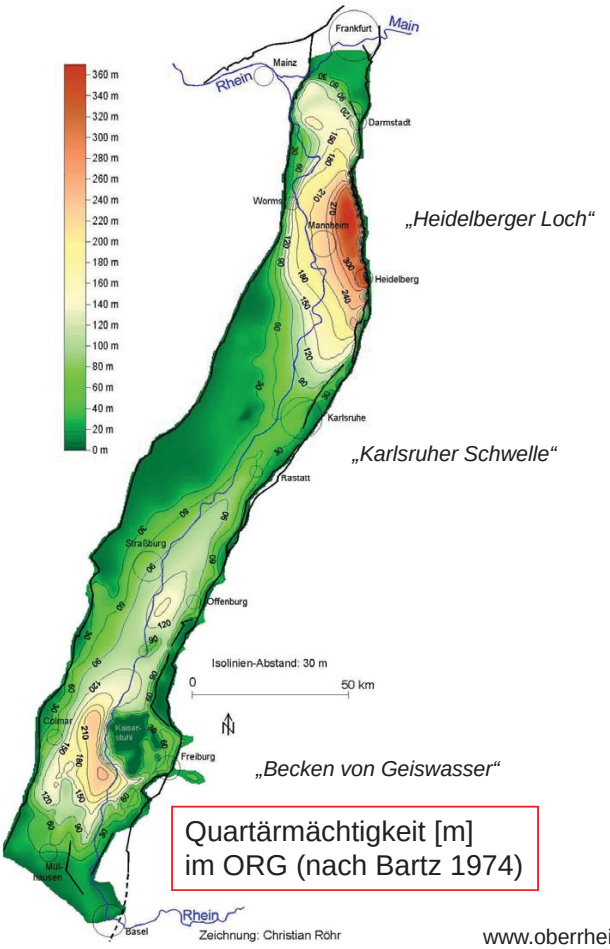
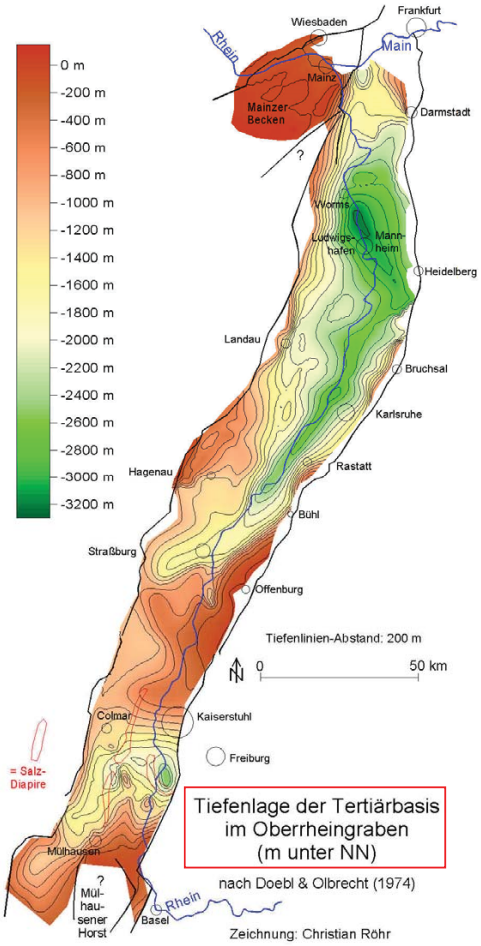


„Heidelberger Loch“

„Karlsruher Schwelle“

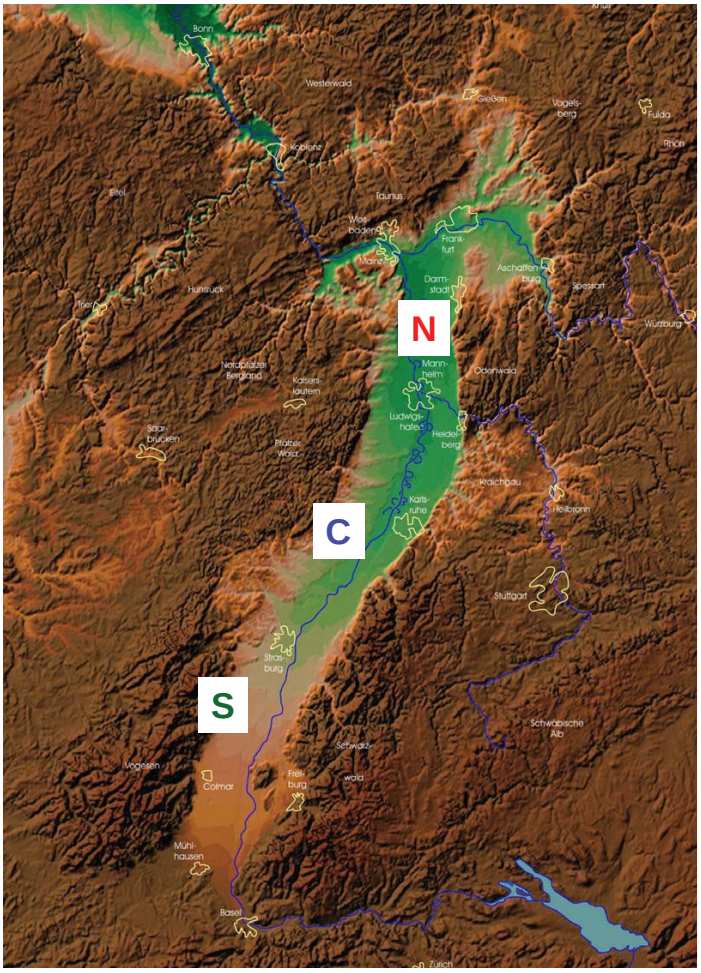
„Becken von Geiswasser“

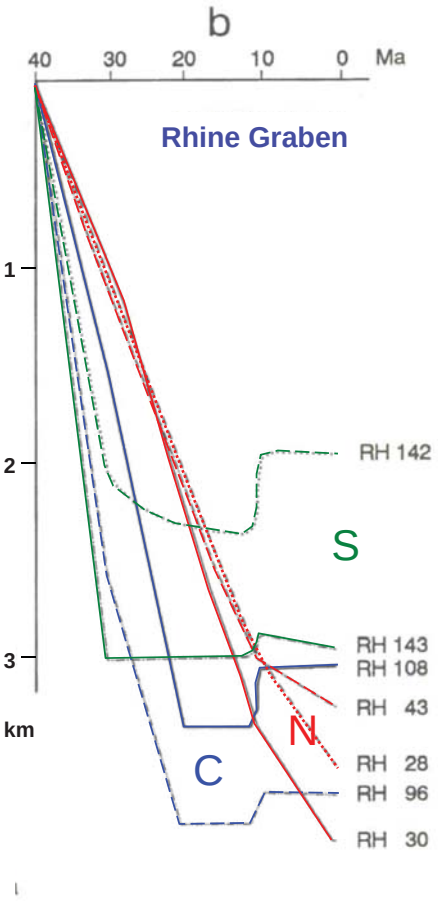
Quartärmächtigkeit [m]
im ORG (nach Bartz 1974)



Tiefenlage der Tertiärbasis
im Oberrheingraben
(m unter NN)

nach Doebl & Olbrecht (1974)





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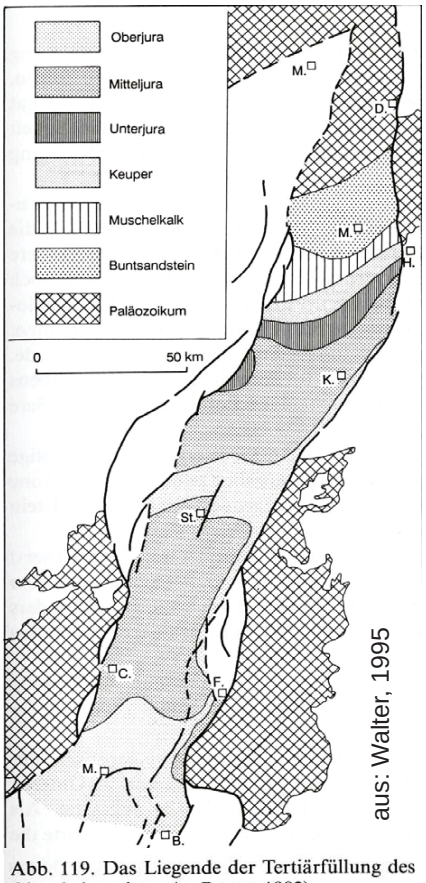
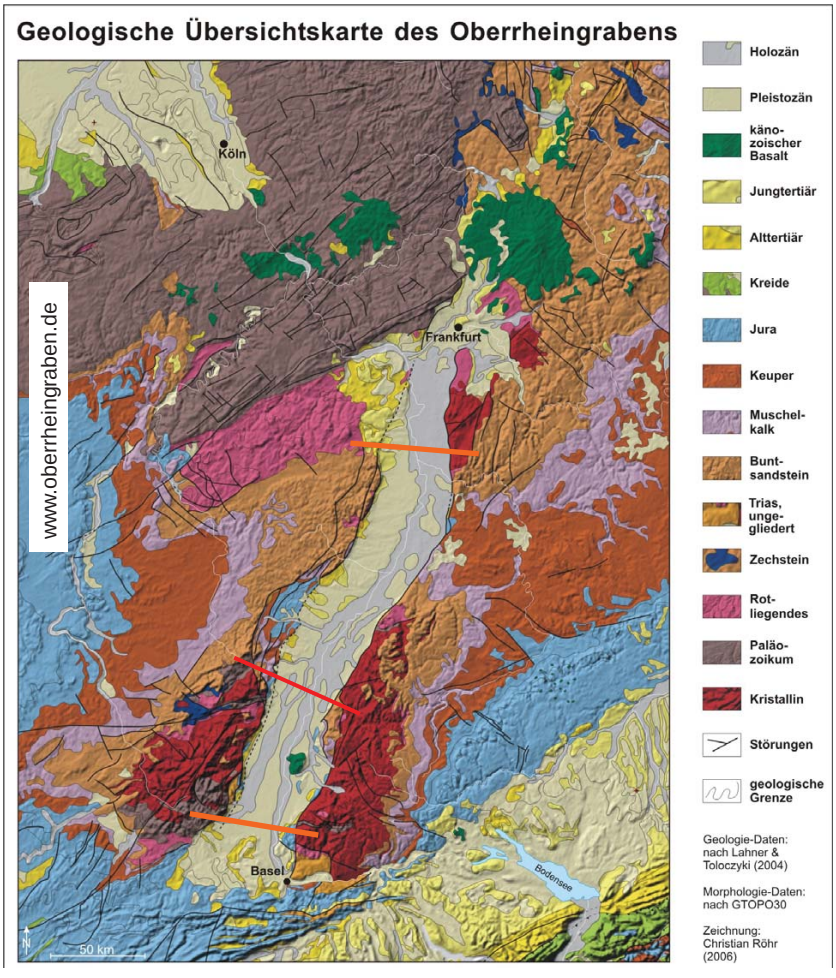


aus: Walter, 1995

Abb. 119. Das Liegende der Tertiärfüllung des Oberrheingrabens (n. PFLUG 1982).



Behrmann et al. 2005

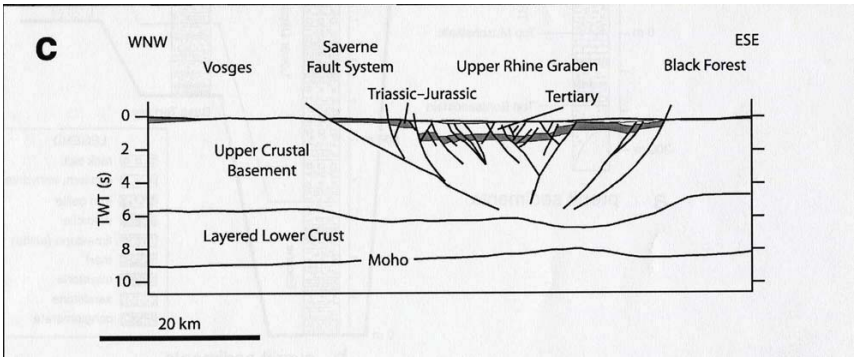


Figure 1. (a) The European Cenozoic rift system (modified from Ziegler, 1992). (b) Geological-tectonic sketch of the Upper Rhine graben rift and its major structural and physiographic features. (c) Crustal-scale cross section, interpreted from DEKORP–ECORS reflection seismic profiling. Modified after Brun et al. (1992).

Ziegler & Dezes 2007

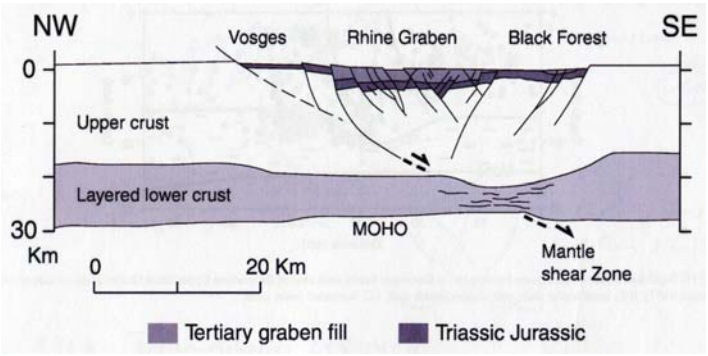


Fig. 15. Crustal-scale cross-sections through the southern part of Upper Rhine Graben at the latitude of c.48°22′N (Brun et al., 1992).

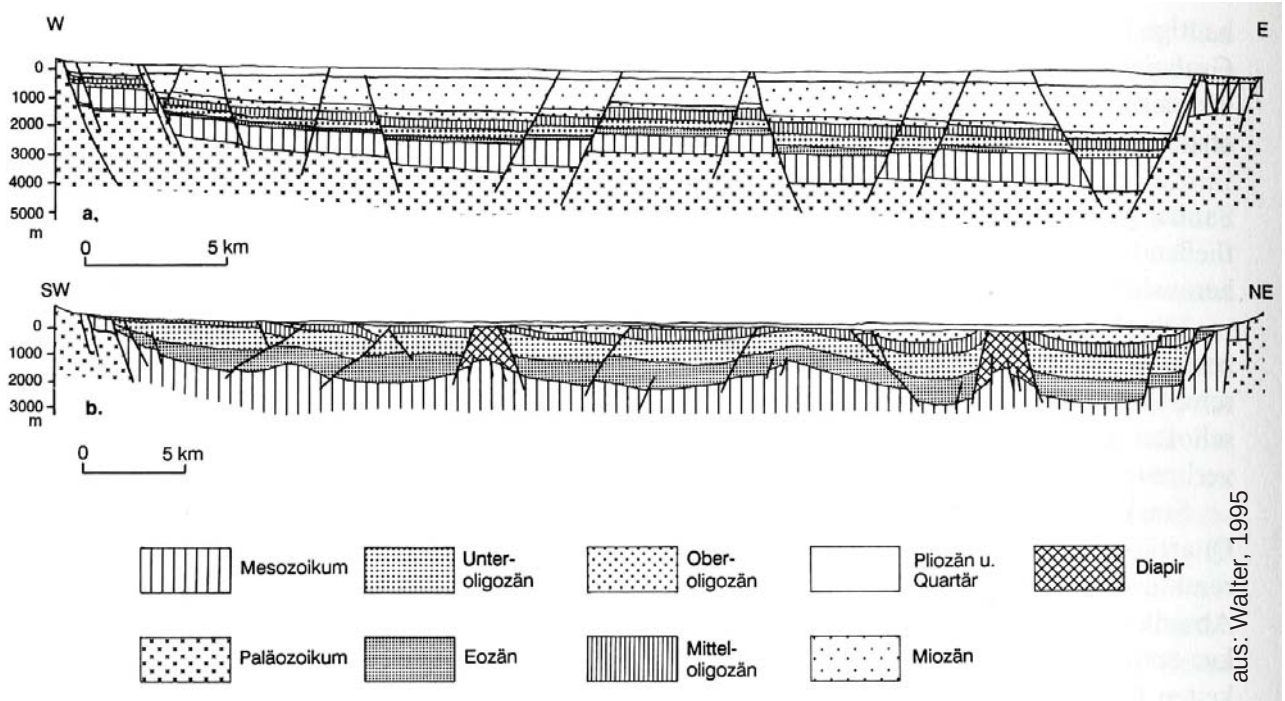


Abb. 123. Geologische Profile durch den Oberrheingraben südlich Speyer (a) und nördlich Mülhausen (b) (n. PFLUG 1982).

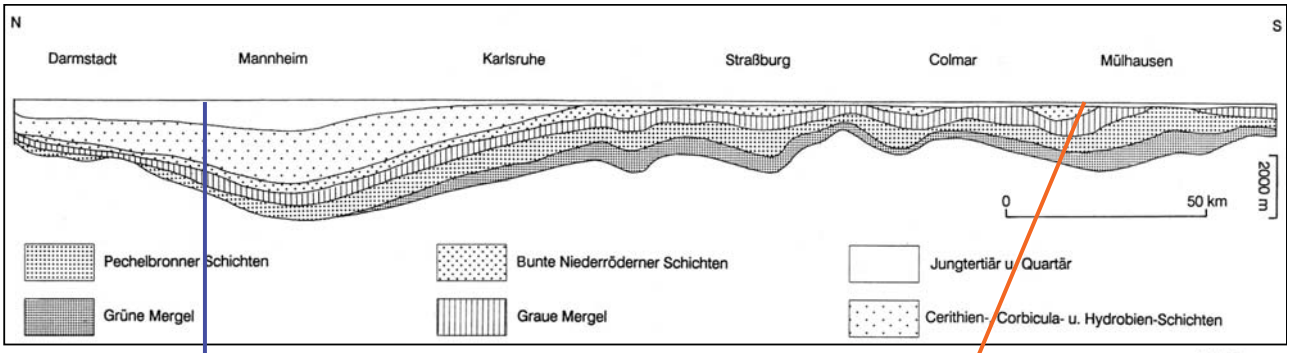
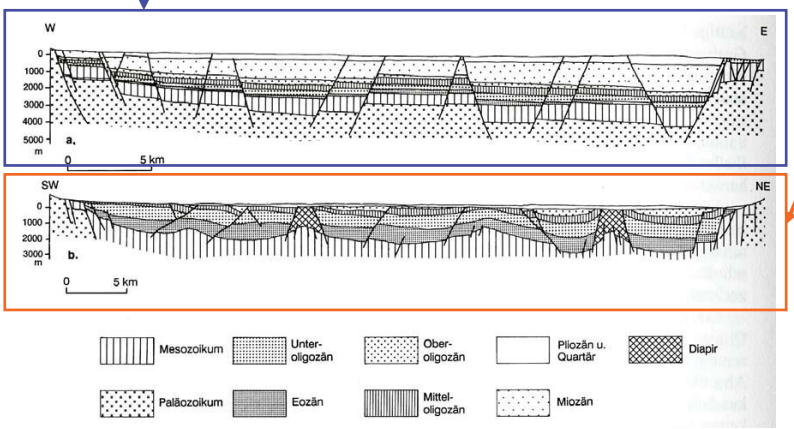
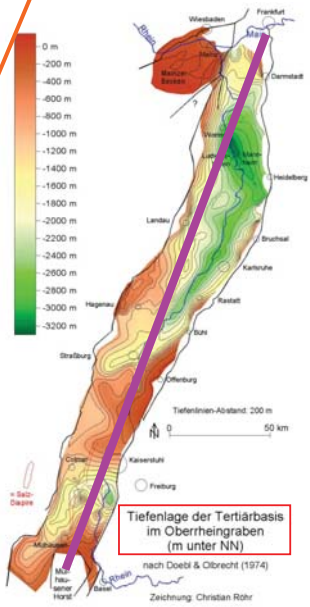


Abb. 121. Längsprofil durch die tertiäre Füllung des Oberrheingrabens (n. PFLUG 1982).





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Volcanism

Table 1. Information on size, rock species and age of the volcanic areas investigated in this publication

	Size of volcanic area in km²	Abundant types of alkali basalts	Differentiates (see also Table 4)	Age of volcanism[a]	References for chemical data and geological information
Hegau	300	Olivine nephelinite (melilite bearing)	Phonolite etc.	15–7 Ma	This paper; Keller (1984)
Kaiserstuhl	90	Nepheline tephrite (80%), olivine nephelinite	Phonolite	18–14 Ma	This paper, Keller (1984)
Vogelsberg	2500[b]	Alkali olivine basalt, nepheline basanite	Trachyte	24–9 Ma	Wittenbecher (1992); this paper; Ehrenberg (1986)
Rhön, Heldburg	1300	Nepheline basanite, olivine nephelinite, alkali olivine basalt	Phonolite, trachyte, benmoreite etc.	42–11 Ma	Freerk-Parpatt (1990); Ehrenberg et al. (1992); this paper; Huckenholz und Werner (1990)
Hessian Depression	5200[c]	Alkali olivine basalt (73%), nepheline basanite (12%), olivine nephelinite (9%)	–	20–8 Ma	Wedepohl (1985)
Westerwald	1200[b]	Alkali olivine basalt, nepheline basanite, olivine nephelinite	Trachyte, phonolite etc.	30–17 Ma 10–5 Ma 1–0.3 Ma	This paper; Vellmer (1989)
Siebengebirge	900	Nepheline basanite (65%), alkali olivine basalt (35%)	Trachyte, latite benmoreite etc.	28–18 Ma 6 Ma	This paper; Vieten et al. (1988)
Eifel (Tertiary)	1800	Nepheline basanite (64%), alkali olivine basalt (~10%), olivine nephelinite (10%)	Trachyte, benmoreite etc.	45–24 Ma	Huckenholz und Büchel (1988); this paper
E Eifel (Quaternary)	400	Nepheline leucite basanite, nepheline leucite tephrite, olivine nephelinite	Phonolite	0.7–0.01 Ma	This paper; Schmincke et al. (1983)

[a] Lippolt (1983), Baranyi et al. (1976), Wedepohl (1982), Huckenholz und Büchel (1988), Müller-Sohnius et al. (1989), Fuhrmann and Lippolt (1986) and this paper
[b] Highly covered by basaltic flows
[c] Coverage by basaltic flows and necks about 2.5% of this area

Wedepohl et al. 1994; CMP, 115, 253-278

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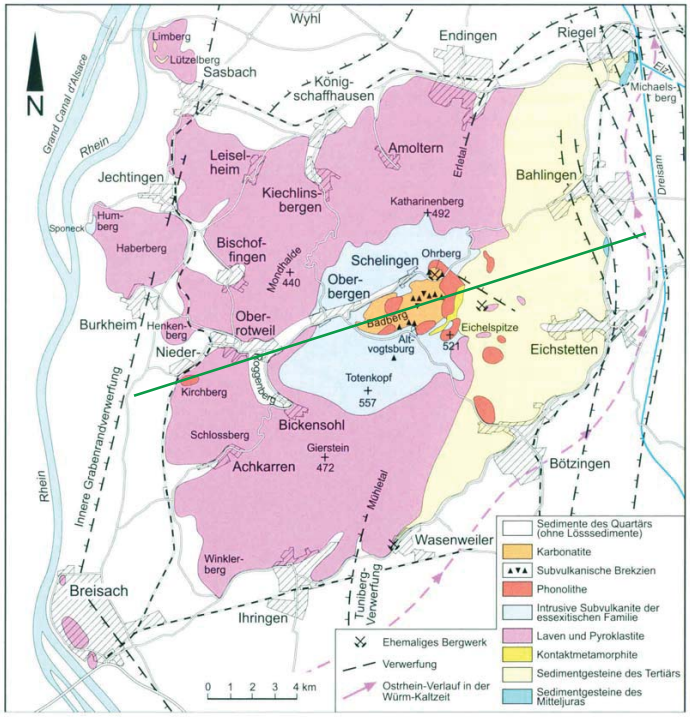
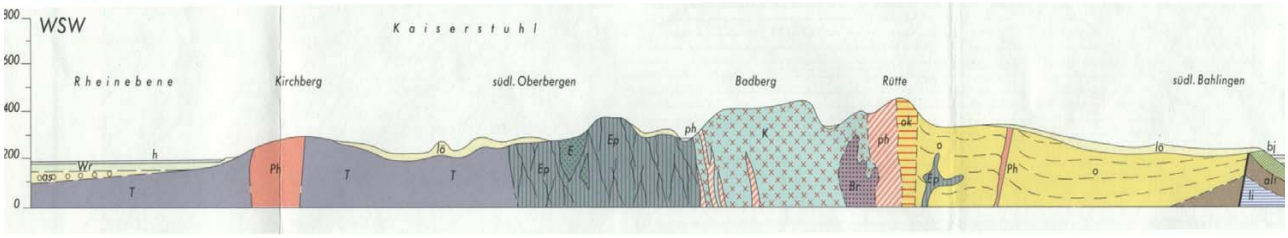
Kaiserstuhl

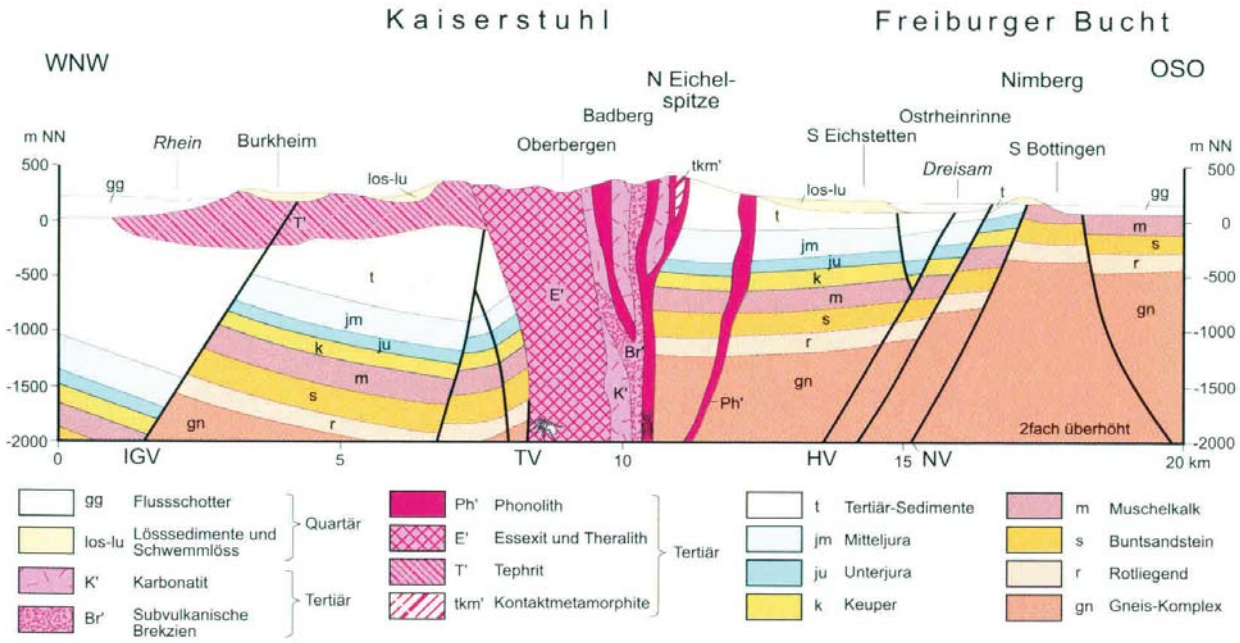


Groschopf et al. 2009

Wimmenauer et al. 2003
(GK25 Kaiserstuhl)



Kaiserstuhl



Groschopf et al. 2009

Tab. 7: Altersbestimmungen an Gesteinen und Mineralen des Kaiserstuhls.
Abkürzungen: BLT = BARANYI et al. (1976), LGW = LIPPOLT et al. (1963), K = KANZLER (1985), SCH = SCHLEICHER (1986), K01 = KELLER (2001), W = WAGNER (1976), KKH = KRAML et al. (1995, 1999), Ma = Million Jahre

Alter (Ma)	Methode	Gestein bzw. Mineral	Autoren
19,0 ± 1,6	K–Ar	Olivinnephelinit, Eichstetter Vulkan	BLT
18,0 ± 0,8	Spaltsp.	Titanit aus Tinguait, Bohrung Nr. 28, Badberg	W
17,8	K–Ar	Biotit im Tephrit, zwischen Burkheim und Sponeck	LGW
17,5 ± 0,1	K/Ar	Diatrembrekzie, Schelingen, Gesamtgestein	KKH
17,4 ± 0,8	Ar/Ar	Phlogopit in Diatrembrekzie	KKH
17,4 ± 1,1	Rb/Sr	Diatrembrekzie, Alt-Vogtsburg	SCH
17,4	K–Ar	Tephrit, Kirchberg bei Niederrotweil	LGW
17,3	K–Ar	Sanidin in Gangphonolith, Horberig bei Oberbergen	LGW
17,3 ± 0,1	K/Ar	Phlogopit im Karbonatit, Bohrung Nr. 27 Steinreiße	KKH
17,2 ± 0,1	Ar/Ar	Sanidin in Gangphonolith, Horberig	KKH
17,3 ± 0,2	Ar/Ar	Amphibol und Phlogopit in Diatrembrekzie, Schelingen	KKH
17,2 ± 0,1	Ar/Ar	Sanidin in phonolithischem Tuff, Bluttes Bückele bei Niederrotweil	K01
16,6	K–Ar	Essexit, Schelingen	LGW
16,6 ± 0,2	Ar/Ar	Amphibol in Mondhaldeit, Föhrenberg	KKH
16,2	K/Ar	Sanidin in phonolithischem Tuff t_3, Limberg Stbr. VI	LGW
16,2	K–Ar	Sanidin in Gangphonolith Seubertsbuck bei Bischoffingen	LGW
16,2	K–Ar	Phonolith (Gesamtgestein) in Tuff t_3, Limberg Stbr. VI	LGW
16,2 ± 0,2	K–Ar	Sanidin in Gangphonolith Seubertsbuck bei Bischoffingen	KKH
16,2	K–Ar	Essexit, Frohntal bei Oberrotweil	LGW
16,1	K–Ar	Biotit in Tephrit, zwischen Burkheim und Sponeck	LGW
16,1	K–Ar	Biotit in Shonkinitporphyr, Horberig	LGW
15,8 ± 0,5	Spaltsp.	Apatit in Karbonatit, Bohrung Nr. 28 am Badberg	W
15,7 ± 0,2	Ar/Ar	Biotit in Shonkinitporphyr, Horberig	K
15,6	K–Ar	Phonolith, Oberschaffhausen	LGW
15,1	K–Ar	Phonolith, Kirchberg bei Niederrotweil LGW	LGW

Wimmenauer et al. 2003
(GK25 Kaiserstuhl , Erl.)

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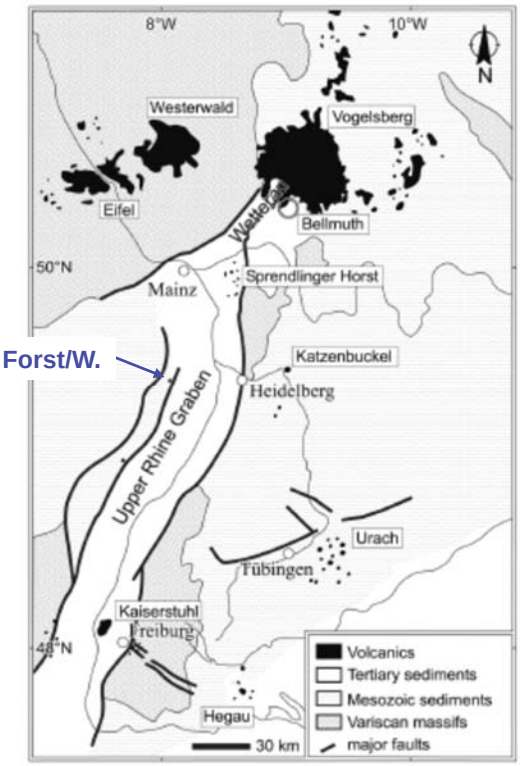

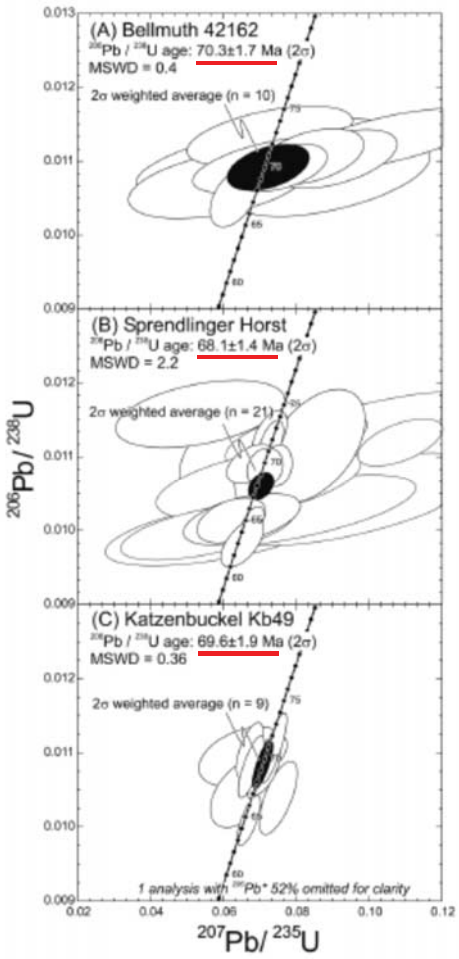

Map of the volcanic rocks within the URG and adjacent areas. Concordia diagrams with results for individual zircon spot analyses (Schmitt et al. 2007; EJM, 19, 849-857).

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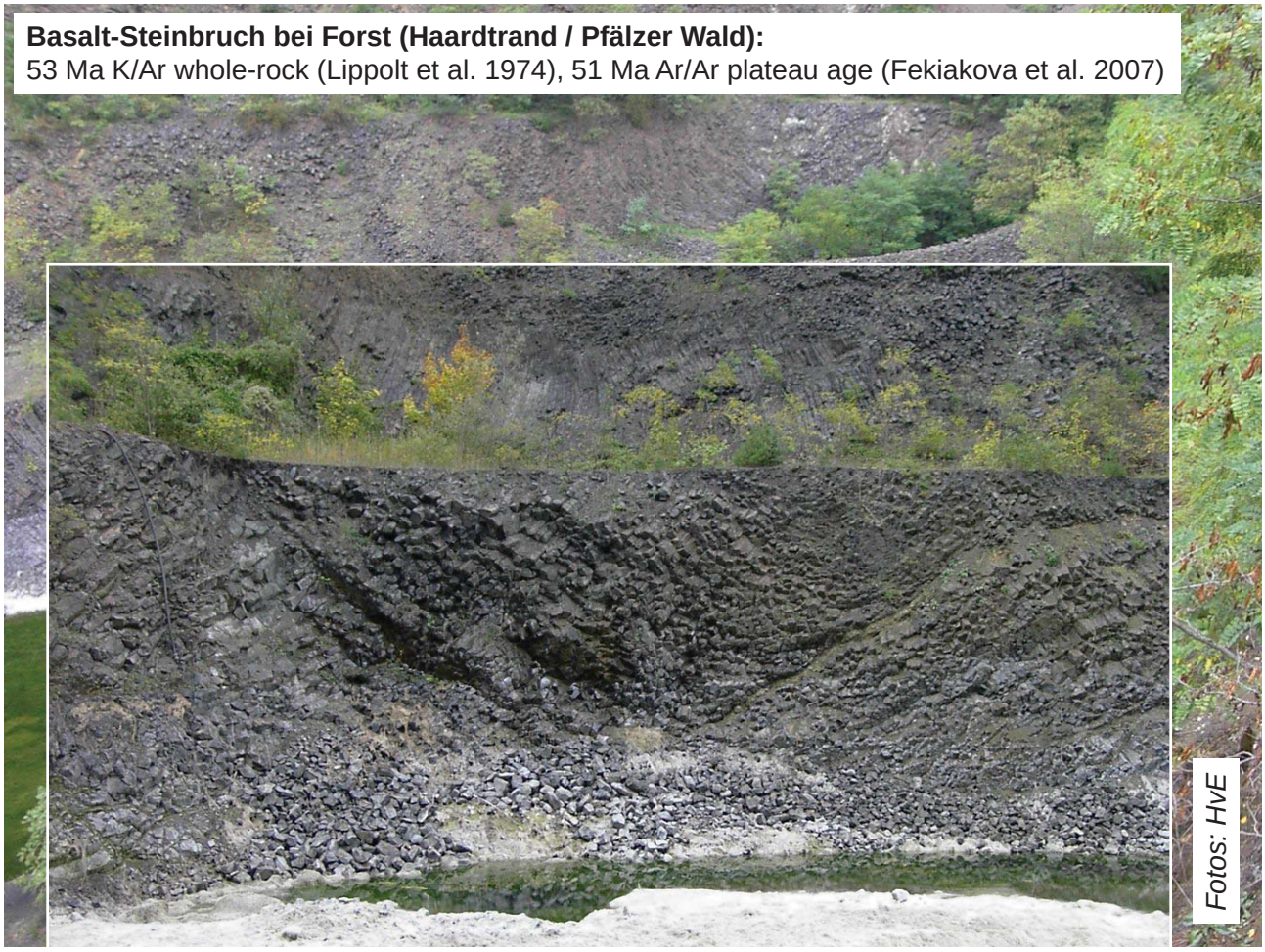
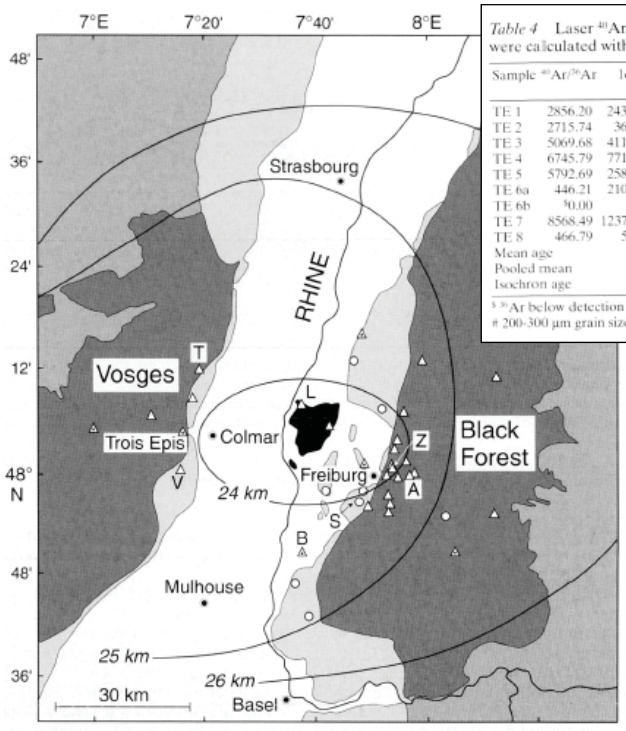
Basalt-Steinbruch bei Forst (Haardtrand / Pfälzer Wald):
53 Ma K/Ar whole-rock (Lippolt et al. 1974), 51 Ma Ar/Ar plateau age (Fekiakova et al. 2007)



Fotos: HvE



A = Attental, B = Buggingen, L = Limberg/Lützelberg, S = Schönberg,
T = Tannenbach, V = Vordermarbach, Z = Zähringen Reutebach/Uhlberg

Table 4 Laser $^{40}Ar/^{39}Ar$ analyses of Trois Epis amphibole (single crystals of 500 µm grain size except noted). Ages were calculated with a standard age of 24.29 Ma for HD-B1 biotite.

Sample	$^{40}Ar/^{36}Ar$	1σ	$^{39}Ar/^{36}Ar$	1σ	$^{37}Ar/^{39}Ar$	1σ	Ca/K	$^{40}Ar/^{39}Ar$	1σ	$^{40}Ar^*/^{39}Ar$	1σ	$^{40}Ar^*$ [%]	Date [Ma]	1σ	Note
TE 1	2856.20	243.52	106.90	9.16	2.32	0.04	4.64	26.72	0.39	23.95	0.43	89.7	61.2	1.1	4 grains#
TE 2	2715.74	36.39	101.87	1.59	4.10	0.06	8.20	26.66	0.38	23.76	0.36	89.1	60.7	0.9	12 grains#
TE 3	5069.68	411.51	203.36	16.59	2.33	0.04	4.66	24.93	0.36	23.48	0.36	94.2	60.0	0.9	
TE 4	6745.79	771.39	269.24	30.86	2.76	0.04	5.53	25.05	0.36	23.96	0.37	95.6	61.2	1.0	
TE 5	5792.69	258.85	230.57	10.47	2.26	0.03	4.51	25.12	0.36	23.84	0.35	94.9	60.9	0.9	2 grains
TE 6a	446.21	210.14	9.53	4.56	3.97	0.33	7.93	46.80	3.84	15.81	14.66	33.8	40.6	37.2	preheating
TE 6b	§0.00		§0.00		2.32	0.04	4.63	23.89	0.35	23.89	0.39	§100.0	61.0	1.0	fusion
TE 7	8568.49	1237.66	345.59	50.00	2.23	0.03	4.46	24.79	0.36	23.94	0.37	96.6	61.2	1.0	
TE 8	466.79	5.72	5.73	0.09	2.67	0.04	5.33	81.44	1.20	29.88	1.00	36.7	76.0	2.5	preheating multigrain#
Mean age													61.2	0.5	weighted mean all
Pooled mean													60.9	0.5	without 6a+8
Isochron age													60.9	0.6	without 6a,b+8

§ ^{39}Ar below detection limit.
# 200-300 µm grain size.

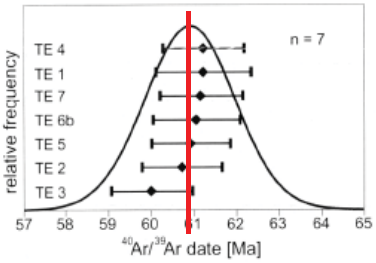
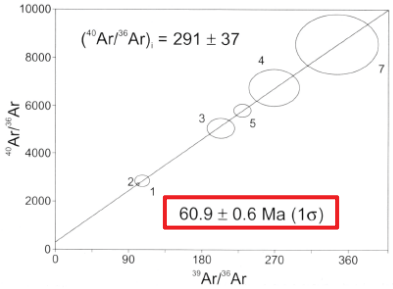


Fig. 4 Individual total-fusion analyses of Trois Epis amphibole (±1σ) with cumulative probability density function.



Keller et al. 2002, SMPM 82