

U-SERIES DATING OF MIDDLE EUROPEAN TRAVERTINES

by

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Nearly all accessible travertines from Middle Europe have been dated by means of the Th/U method, in order to answer a temporal and regional orientated paleoclimatical questioning. These travertines are of warm climatic origin as proved by flora and fauna. Corresponding speleothems in Europe (about 600 samples) and correlative beach terraces are not mentioned here. The discussed Th/U results were produced by G.J. Hennig, R. Grün and R. Hausmann.

There seems to be a bipartition of the last interglacial according to the deep sea record into 5e ("Eemian") and 5c (R/W interglacial) with corresponding U-series ages of about 125 ka and 105 ka, respectively. An intercalated, eventually more cooler period has yet not been found.

The penultimate interglacial (stage 7) shows Th/U ages around 220 ka. These data were among others confirmed by ESR results of a tooth of *Paleoloxodon Antiquus* of the Bad Cannstatt region (R. Grün). Unfortunately diagenetical processes led to a broad scattering of the Th/U data of samples of the penultimate interglacial. The previous interglacial (stage 9) is determined tentatively around 350 ka.

The Th/U dating method has been applied to travertine complexes from A: Germany (Stuttgart Bad Cannstatt), B: Thüringen, C: Czechoslovakia, and D: Hungary.

A. TRAVERTINES FROM STUTTGART BAD CANNSTATT

Two periods of travertine growth can be distinguished:

- 1) about 100 ka and older (R/W interglacial), and
- 2) about 200 ka and older for the penultimate interglacial (Holsteinian?).

The older travertines show a relatively large scattering in the age results which disturbances mentioned above might be responsible for.

B. TRAVERTINES FROM THÜRINGEN

The travertine profile of Bad Langensalza is of Holocene age. Travertines of Eemian age (stage 5) are located in Burgtonna, Taubach, Weimar-Ehringsdorf Parktravertin, as well as in a part of Weimar Ehringsdorf (Upper Travertine). They show Th/U ages of about 100 to 130 ka.

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The penultimate interglacial has been determined with ages at about 200 ka (180-220 ka) in the travertine profiles of Weimar-Ehringsdorf and Bilzingsleben. In Weimar-Ehringsdorf the so-called Lower Travertine has been determined around 200 ka. The hominid finding in Bilzingsleben is older than the "Decktravertin" (around > 260 ka).

C. TRAVERTINES FROM CZECHOSLOVAKIA

Beside Holocene data travertines had been dated at about 100 ka (R/W interglacial). The penultimate interglacial seems to be represented especially in the profile of Vysne Ruzbachy (around 200 ka). Furthermore, there seems to be another warmer period at about 260 ka according to the Th/U data. The age of the hominid bearing layer in the profile of Ganovce is in the range of 80-120 ka.

D. TRAVERTINES FROM HUNGARY

The Th/U age results of the travertines under investigation seem to establish three periods of travertine deposition:

- 1) ages of about 100 ka (R/W interglacial),
- 2) ages of about 200 ka and older (Holsteinian II?), and
- 3) ages of more than 300 ka (Holsteinian I?).

In the profile of Vertesszöllös it was possible to date the hominid bearing layer with the help of the U-series method on more than 350 ka.

REFERENCES

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- BRUNNACKER K., JÄGER K.-D., HENNIG G.J., PREUSS J. and GRÜN R., 1983. Radiometrische Untersuchungen zur Datierung mitteleuropäischer Travertinvorkommen. *EAZ* 24, 217-266.
- GRÜN R., BRUNNACKER K. and HENNIG G.J., 1982. $^{230}\text{Th}/^{234}\text{U}$ -Daten mittel- und jungpleistozäner Travertine in Raum Stuttgart. *Jber. Mitt. oberrhein. geol. Ver.*, N.F., 64, 201-211.
- HENNIG G.J., GRÜN R., BRUNNACKER K. and PECSI M., 1983. Th-230/U-234- sowie ESR-Altersbestimmungen einiger Travertine in Ungarn. *Eiszeitalter u. Gegenwart* 33, 9-19.

TRAVERTINE-PROFILES

A. Stuttgart Bad Cannstatt

- 1 = Steinbruch Lauster
- 2 = Steinbruch Haas
- 3 = Kursaal
- 4 = Katzensteigle
- 5 = Naturdenkmal, Heinrich Ebner Str.
- 6 = Steinbruch Biedermann

Daten: GRÜN *et al.* (1982)

B. Thüringen

- 1 = Bilzingsleben
- 2 = Weimar Ehringsdorf, Bruch Fischer
- 3 = Weimar Ehringsdorf
- 4 = Weimar, Parktravertin
- 5 = Taubach
- 6 = Burgtonna
- 7 = Bad Langensalza

Daten: BRUNNACKER *et al.* (1983)

C. Czechoslovakia

- 1 = Hradisté pod Vrátnam
- 2 = Bejnice-Jaskyna
- 3 = Bejnice Hrad
- 4 = Besenova Drienok
- 5 = Hranovnica
- 6 = Gánovce
- 7 = Sobotisteo
- 8 = Siva Bracia
- 9 = Vysne Ruzbachy

Daten: HAUSMANN (unpublished)

D. Hungary

- 1 = Kalvaria
- 2 = Varpalota
- 3 = Buda
- 4 = Dunaalmás
- 5 = Vertesszöllös
- 6 = Tata

Daten: HAUSMANN and ASSMANN
(unpublished)

Daten: HENNIG *et al.* (1983)

Aktendaten von Traverdina mittels Th/U-Datierung

A: Germany, Stuttgart

Probe	Th230 U234	U234 U238	Th230 Th232	U-Gehalt ppm	Alter ka	Alter korr. ka
TR01	0.7820e-02	2.1910e-21	318.461e-08		137 ± 22 - 19	133 ± 21 - 17
TR02	0.6450e-02	1.7730e-05	504.6752e-90		107 ± 6 - 5	104 ± 4 - 6
TR03	0.6470e-03	1.7920e-08	328.9023e-52		107 ± 9 - 8	105 ± 9 - 7
TR04	0.6620e-02	1.8710e-04	599.7289e-19		106 ± 4 - 4	105 ± 4 - 4
TR11	0.6550e-02	2.1260e-05	430.6442e-99		103 ± 4 - 5	101 ± 5 - 4
TR12	0.6350e-02	1.9090e-08	178.810e-36		99 ± 6 - 6	95 ± 6 - 5
TR21	0.9570e-03	1.5670e-05	83.6023e-590		227 ± 25 - 21	197 ± 20 - 17
TR22	1.0030e-06	1.4870e-09	90.1024e-930		269 ± 93 - 41	255 ± 82 - 46
TR31	0.5480e-01	1.3030e-02	1.1000e-010		83 ± 3 - 3	41 ± 1 - 2
TR41	0.8410e-06	1.2150e-08	11.5021e-160		181 ± 40 - 29	174 ± 36 - 29
TR42	0.9730e-05	1.5920e-06	850 ± ---		235 ± 45 - 31	225 ± 45 - 31
TR43	0.7970e-13	1.1920e-23	46.0005e-620		136 ± 99 - 42	134 ± 96 - 41
TR45	1.0090e-03	1.4670e-04	74.1021e-37		286 ± 50 - 34	285 ± 50 - 34
TR46	0.9580e-01	1.3310e-03	19.0021e-400		247 ± 35 - 27	243 ± 34 - 27
TR48	1.2020e-13	1.6120e-57	9.00 ± 20e-380		350	>350
TR49	0.8420e-11	1.4280e-05	15.7020e-820		171 ± 67 - 42	166 ± 62 - 40
TR49A	0.9170e-05	1.3940e-04	27.3024e-870		212 ± 42 - 31	209 ± 41 - 31
TR49B	1.0010e-03	1.6960e-02	11.6020e-370		199 ± 65 - 38	192 ± 59 - 35
TR51	0.8930e-07	1.3630e-13	11.3020e-390		199 ± 65 - 38	192 ± 59 - 35
TR52	0.9750e-06	1.4850e-09	328.9020e-32		245 ± 68 - 41	245 ± 68 - 41
TR53	0.8610e-06	1.5780e-10	70.6021e-95		174 ± 34 - 25	171 ± 31 - 24
TR54	0.9350e-05	1.2180e-07	1.80020e-190		241 ± 73 - 41	225 ± 58 - 36
TR55	0.9750e-05	1.2900e-06	37.4029e-210		268 ± 101 - 51	266 ± 98 - 50
TR56	0.8870e-08	1.5210e-07	10.4023e-900		189 ± 56 - 38	182 ± 52 - 36
TR57	1.0020e-03	1.4540e-01	18.5021e-680		272 ± 35 - 27	267 ± 35 - 27
TR58	0.9580e-08	1.5520e-08	4.50020e-460		228 ± 76 - 45	212 ± 64 - 41
TR59	0.9770e-03	1.4870e-04	108.251e-970		247 ± 31 - 25	227 ± 24 - 21
TR60	0.8950e-05	1.2120e-04	7.50020e-680		188 ± 38 - 24	176 ± 32 - 25
TR61	0.4770e-03	1.4480e-04	61.7020e-10		68 ± 6 - 7	67 ± 7 - 7
TR62	1.0740e-08	1.4700e-06	127.911e-830		370 ± 40 - 86	370 ± 40 - 86
TR63	0.9160e-04	1.4080e-04	66.4019e-210		222 ± 34 - 25	221 ± 33 - 24

B: DDR, Thüringen

Probe	Th230 U234	U234 U238	Th230 Th232	U-Gehalt ppm	Alter ka	Alter korr. ka
TR64	0.138	1.533	6.57	0.356	15.9 ± 1.8 - 1.7	13.7 ± 1.6 - 1.5
TR65	0.130	1.787	8.89	0.286	13.8 ± 1.6 - 1.7	13.8 ± 1.6 - 1.7
TR66	0.083	1.249	66.08	0.478	5.4 ± 0.7 - 0.9	5.2 ± 0.7 - 0.7
TR67	0.086	1.956	69.50	0.477	9.6 ± 0.7 - 0.7	9.5 ± 0.7 - 0.7
TR68	0.648	1.599	252.06	0.482	104 ± 8.0 - 7.6	104 ± 8.0 - 7.6
TR69	0.651	1.490	13.27	0.383	106 ± 10.0 - 9.1	101 ± 9.0 - 8.7
TR70	0.674	1.512	45.11	0.531	112 ± 7.0 - 7.0	111 ± 7.0 - 7.0
TR71	0.678	1.698	82.68	0.231	111 ± 13.0 - 11.7	111 ± 13.0 - 11.7
TR72	0.695	1.527	84.04	0.426	117 ± 19.0 - 16.0	116 ± 19.0 - 15.0
TR73	0.690	1.314	15.32	0.427	119 ± 22.0 - 18.0	115 ± 23.0 - 18.0
TR74	0.723	2.137	11.95	0.166	120 ± 13.0 - 12.0	118 ± 12.0 - 12.0
TR75	0.844	1.437	3.53	0.431	172 ± 22.0 - 19.0	151 ± 16.0 - 14.0
TR76	0.749	1.166	1.29	0.441	142 ± 17 - 16	131 ± 13 - 11
TR77	0.738	1.205	14.40	0.526	137 ± 18 - 15	132 ± 17 - 15
TR78	0.462	1.109	1.17	0.397	66.1 ± 6.0 - 5.7	30.7 ± 3.0 - 2.9
TR79	0.626	1.122	1.72	0.386	104 ± 11 - 9.4	71.3 ± 4.8 - 4.3
TR80	1.070	1.159	632.85	0.424	2400	2400
TR81	0.534	1.281	319.83	0.337	80 ± 13.3 - 11.7	79.8 ± 13.2 - 11.7
TR82	0.652	1.227	12.73	0.573	110 ± 18 - 15.4	105 ± 14.0 - 13.1
TR83	0.808	1.112	18.64	0.530	216 ± 16.8 - 15.7	211 ± 13.5 - 12.5
TR84	0.626	1.117	25.22	0.495	105 ± 24 - 19.5	102 ± 24 - 18.5
TR85	0.830	1.613	78.34	0.256	161 ± 25 - 21	159 ± 26 - 20
TR86	1.083	1.253	113.77	0.282	2400	2400
TR87	1.269	1.568	88.01	0.226	2400	2400
TR88	0.760	1.189	206.42	0.289	146 ± 17 - 15	145 ± 17 - 14
TR89	0.830	1.142	35.40	0.516	179 ± 20 - 16	177 ± 19 - 16
TR90	0.900	1.212	23.20	0.649	215 ± 32 - 24	212 ± 30 - 24
TR91	0.814	1.220	80.64	0.413	167 ± 27 - 21	167 ± 27 - 21
TR92	0.946	1.257	54.36	0.475	246 ± 51 - 33	244 ± 50 - 34
TR93	0.900	1.236	140.70	0.062	160 ± 16 - 14	150 ± 16 - 14
TR94	0.596	2.008	8.63	0.356	89.5 ± 6.0 - 4.7	83.1 ± 5.5 - 5.1
TR95	0.568	1.305	8.61	0.289	87.8 ± 4.8 - 4.2	80.8 ± 4.1 - 3.8
TR96	0.873	1.522	33.11	0.348	182 ± 32 - 18	179 ± 22 - 17
TR97	0.961	1.373	152.60	0.543	245 ± 54 - 36	244 ± 54 - 35
TR98	1.115	1.465	207.50	0.083	320	320
TR99	1.011	1.210	30.42	0.101	303 ± 40 - 37	301 ± 40 - 36
TR100	0.880	1.516	174.10	0.380	166 ± 20 - 18	165 ± 20 - 17
TR101	0.878	1.465	195.60	0.113	186 ± 14 - 11	186 ± 14 - 11
TR102	0.935	1.606	102.33	0.108	223 ± 40 - 30	222 ± 40 - 29
TR103	1.044	1.184	13.56	0.729	400 ± 40 - 80	400 ± 40 - 80

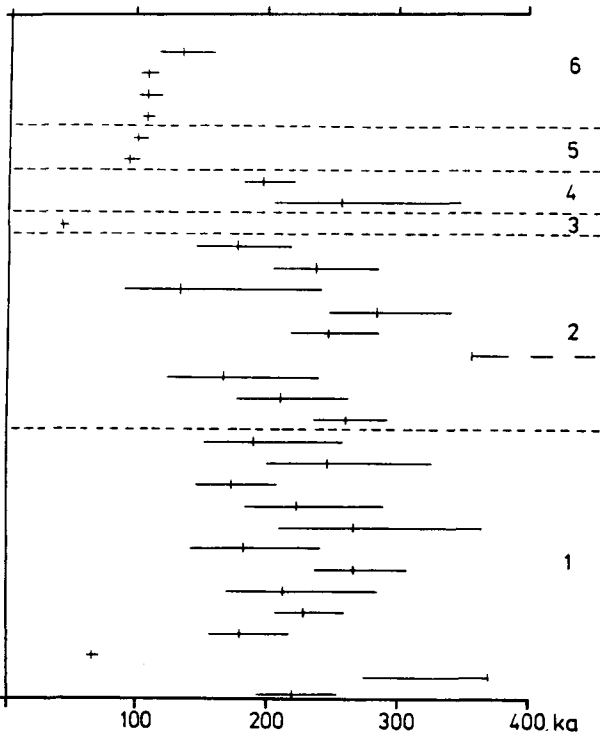
C: Czechoslovakia

Probe	Th230 U234	U234 U238	Th230 Th232	U-Gehalt ppm	Alter ka	Alter korr. ka
TR104	0.8170e-027	1.0560e-013	13.8901e-371	0.6620e-013	184.5 ± 18.1 - 15.3	172.1 ± 16.9 - 14.5
TR105	0.8450e-032	1.0600e-036	6.33020e-252	0.6780e-023	194 ± 27.6 - 21.0	179.9 ± 23.3 - 18.4
TR106	0.8990e-021	1.0510e-016	13.8921e-090	0.6620e-011	238.1 ± 25.7 - 20.3	231.1 ± 23.9 - 19.1
TR107	1.0410e-062	0.9720e-052	4.5119e-0318	0.5430e-028	204.5	204.9
TR108	0.6490e-008	1.2940e-052	6.0335e-204	0.4320e-015	107.8 ± 18.1 - 15.3	98.5 ± 16.4 - 14.2
TR109	1.1020e-001	1.1030e-013	79.0621e-398.8	1.1510e-016	12.6 ± 0.5 - 0.4	12.5 ± 0.5 - 0.4
TR110	0.1960e-053	0.9010e-091	1.2380e-389	0.0750e-004	23.7 ± 7.8 - 7.0	5.0 ± 6.3 - 5.0
TR111	0.9690e-072	1.1770e-097	7.0781e-419	0.0380e-006	206.9	206.9
TR112	0.5760e-015	2.1270e-019	12.911e-357	1.3450e-006	85.2 ± 3.3 - 3.2	83.5 ± 3.3 - 3.1
TR113	0.7610e-013	1.9970e-024	61.8271e-360	1.4680e-027	121.8 ± 4.1 - 3.9	130.8 ± 4.0 - 3.9
TR114	0.6730e-039	1.9360e-044	15.6227e-830	0.3320e-008	106.8 ± 10.5 - 9.7	104.5 ± 10.4 - 9.4
TR115	1.0050e-026	1.5420e-018	78.9371e-044	1.3420e-023	265.7 ± 28.0 - 22.8	264.7 ± 27.7 - 22.4
TR116	0.9270e-021	1.7030e-013	20.5670e-604	1.8250e-033	157.5 ± 8.4 - 8.0	153.0 ± 8.3 - 7.7
TR117	0.6340e-066	2.1300e-299	2.2030e-268	0.0870e-004	97.7 ± 7.8 - 14.8	67.7 ± 13.4 - 11.8
TR118	0.7590e-063	3.0970e-323	8.15021e-426	0.0640e-004	125.6 ± 19.6 - 16.7	114.5 ± 17.8 - 15.4
TR119	0.6460e-038	1.4430e-064	5.2950e-674	0.1240e-005	105.1 ± 11.1 - 9.9	92.4 ± 9.7 - 8.9
TR120	0.6270e-069	1.2850e-058	1.3190e-185	0.2080e-011	102.7 ± 10.6 - 17.1	36.3 ± 11.2 - 10.2
TR121	1.8320e-078	1.3490e-050	3.7430e-164	0.1890e-006	234.4	234.4
TR122	1.0520e-054	1.2880e-063	3.0890e-121	0.1640e-007	265.7	265.7
TR123	0.7810e-174	1.5610e-087	1.30520e-407	0.0020e-001	141.0 ± 87.8 - 49.8	59.0 ± 37.8 - 28.5

D: Hungary

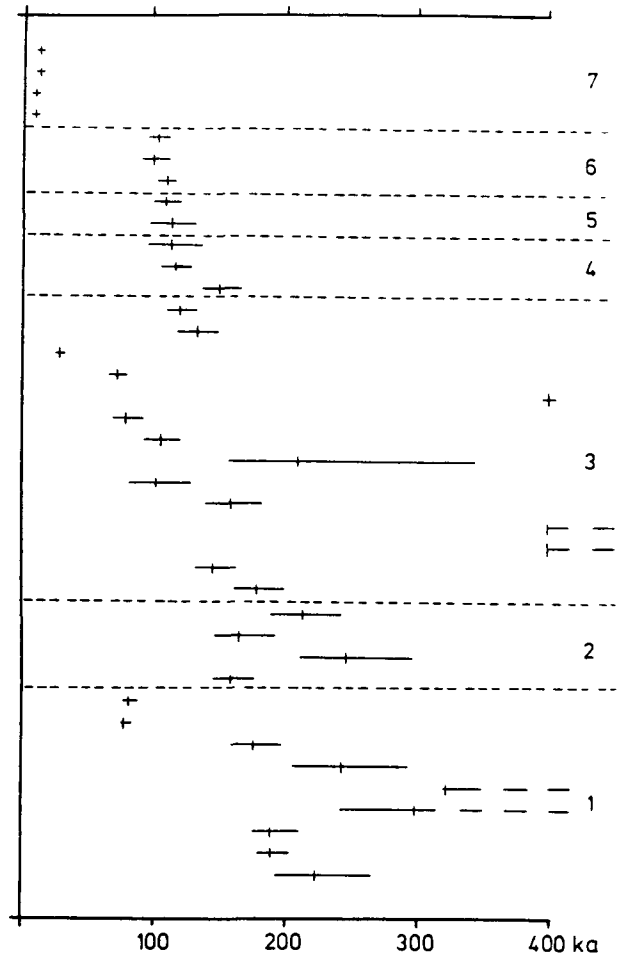
Probe	Th230 U234	U234 U238	Th230 Th232	U-Gehalt ppm	Alter ka	Alter korr. ka
TR124	0.5900e-031	0.8240e-021		0.6010e-015	101 ± 10	
TR125	0.5750e-026	0.7960e-017		0.6510e-014	98 ± 8	
TR126	0.7170e-053	1.2760e-051		0.1310e-008	128 ± 20 - 17	
TR127	0.8930e-037	1.5130e-052		0.1430e-006	217 ± 40 - 26	
TR128	1.0000e-030	1.1940e-031		0.1350e-004	325 ± 40 - 60	
TR129	1.1240e-077	1.1690e-044		0.1280e-004	250	
TR130	0.8170e-074	1.0070e-089		0.1850e-013	210 ± 151 - 51	
TR131	0.9210e-050	1.2500e-057		0.1690e-008	227 ± 56 - 37	
TR132	0.9010e-092	1.0120e-089		0.1100e-009	248 ± 40 - 67	
TR133	0.9490e-025	0.8750e-019		0.3910e-004	125 ± 12 - 11	
TR134	1.0020e-091	1.2020e-057		0.0900e-003	251 ± 40 - 32	
TR135	1.0020e-067	1.4480e-062		0.0960e-003	354 ± 40 - 94	
TR136	1.0310e-013	1.2620e-023		0.9680e-022	358 ± 40 - 60	
TR137	0.9170e-069	1.4310e-095		0.1040e-006	160 ± 38 - 27	
TR138	0.9670e-056	1.1380e-023	24.86 ± 5.214	1.1800e-028	1247.3	
TR139	1.0340e-033	1.1570e-031	6.8540e-295	0.7490e-020	206.5	
TR140	1.02521e-899	1.24120e-037	0.80321e-333	0.5260e-015	350	
TR141	0.9190e-074	1.0480e-027	17.48 ± 6.750	0.08520e-022	181.3 ± 57.9 - 16.7	176.3 ± 54.3 - 35.3

A
BRD, Stuttgart

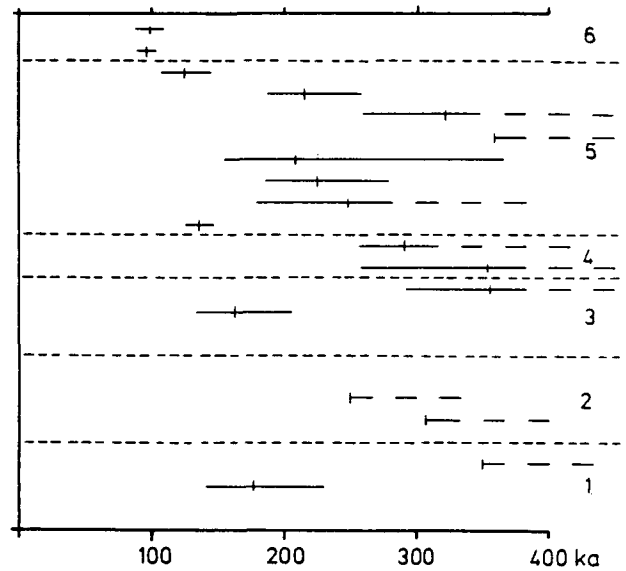


Thorium/Uran- Altersdaten von mitteleuropäischen Travertinen

B
DDR, Thüringen



D
UNGARN, Nordwesten



C
ČSSR, Slowakei

