

HIGH-PRECISION CALIBRATION OF THE RADIOCARBON TIME SCALE, 3930-3230 CAL BC

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This paper contains ^{14}C results obtained by the special high-precision proportional gas counter, designed by Tans and Mook (1978), on tree rings from the South German oak chronologies: Donau 7, 3, 10, and 12, originating from the Danube River basin (48° 24' N, 10° 5' E).

^{14}C and ^{13}C results were published earlier (De Jong, Mook & Becker, 1979; De Jong & Mook, 1980; De Jong, 1981). However, the historical time scale was then given as a floating series of tree-ring numbers, while an estimate of absolute scale was derived from wiggle-matching with the bristlecone curve of Suess (1978). Since the absolute Hohenheim master chronology could be extended to include this period (Linick, Suess & Becker, 1985) we can attach absolute values to the historical scale. Because the resulting curve of Figure 1 is to be used as a ^{14}C calibration curve, we presented this historical time scale in cal BC.

The tree-ring samples (ca 100g) were pretreated according to the AAA procedure, consisting of 1) extraction with 4% hydrochloric acid solution at 80°C for 24 hours to remove resinous material; 2) extraction with 4% sodium hydroxide solution at 80°C for 24 hours to remove tannic acids; 3)

treatment with 4% hydrochloric acid solution at 80°C for several hours to remove atmospheric carbon dioxide, possibly absorbed during step 2.

After each step, the samples were thoroughly washed with demineralized water to pH = 7. Further technical details were given by De Jong (1981).

The ^{14}C results, corrected for ^{13}C , are presented in Table 1 and Figure 1, where the thin lines refer to 1 σ values from counting statistics only, the other contributions being negligibly small.

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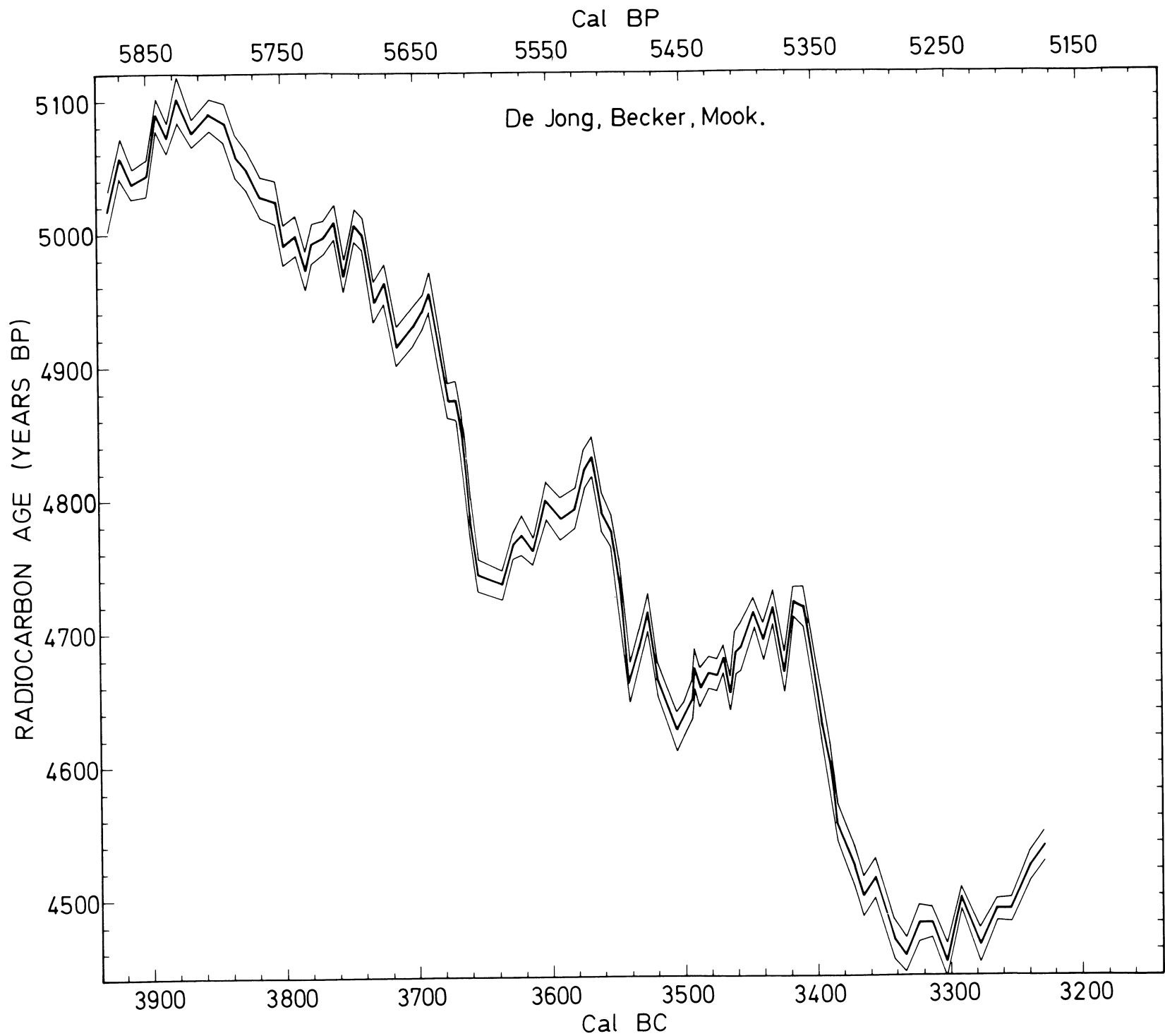


Fig 1. Radiocarbon calibration curve for the period 3930–3230 cal BC. The thin lines refer to 1σ errors from counting statistics.

TABLE 1

Results of ^{13}C (vs PDB) and ^{14}C analyses on tree rings from South German oak chronologies Donau 7, 3, 10, and 12. The absolute historical values are from the absolute master chronology (Becker & Kromer, 1986). The ^{14}C results are conventional ages (5568 yr half-life), corrected for ^{13}C .

GrN no.	Tree no.	Tree-ring no.	Dendro date BC	^{14}C age (BP)	$\delta^{13}\text{C}$ (‰)
9163	E1	136	3930	5017 ± 15	-26.18
9162	E1	145	3921	5057 ± 15	-25.90
9161	E1	154	3912	5037 ± 11	-26.01
9160	E1	165	3901	5043 ± 15	-25.42
9066	E1	173	3893	5090 ± 12	-25.51
9065	E1	181	3885	5072 ± 11	-25.54
9159	F1	189	3877	5101 ± 17	-24.50
9063	F1	200	3866	5076 ± 11	-25.17
9158	G1	213	3853	5090 ± 12	-26.16
9025	G1	224	3842	5083 ± 15	-25.21
9024	H1	232	3834	5058 ± 16	-25.05
9023	H1	241	3825	5047 ± 15	-25.46
9022	H1	251	3815	5027 ± 15	-25.36
9021	H1	262	3804	5023 ± 16	-25.54
9008	H1	268	3798	4991 ± 15	-25.55
9007	H1	277	3789	4998 ± 15	-25.30
9006	H1	284	3782	4973 ± 15	-25.37
9005	H1	289	3777	4992 ± 15	-24.93
9004	H1	298	3768	4997 ± 12	-25.06
9002	H1	306	3760	5008 ± 13	-24.30
9001	H1	313	3753	4968 ± 12	-24.65
8837	H1	321	3745	5006 ± 12	-24.40
8836	H1	327	3739	4999 ± 12	-24.54
8835	H1	335	3731	4948 ± 15	-25.37
8834	H1	343	3723	4962 ± 15	-24.53
8833	H1	352	3714	4915 ± 15	-24.79
8832	H1	358	3708	4922 ± 15	-24.73
8831	H1	365	3701	4930 ± 15	-24.68
8830	H1	372	3694	4941 ± 13	-24.53
8779	I1	377	3689	4955 ± 15	-24.54
8778	I1	384	3682	4907 ± 14	-24.82
8777	I1	390	3676	4874 ± 13	-24.90
8776	I1	396	3670	4874 ± 15	-24.59
8775	I1	400	3666	4853 ± 12	-25.09
8774	I1	406	3660	4785 ± 15	-24.84
8773	I1	412	3654	4743 ± 12	-25.26
8771	I1	430	3636	4736 ± 11	-25.27
8766	I1	438	3628	4765 ± 20	-25.27
8764	I1	445	3621	4773 ± 15	-24.81
8751	I1	453	3613	4761 ± 10	-24.37
8750	K1	463	3603	4799 ± 14	-24.49
8749	K1	474	3592	4785 ± 16	-24.69
8748	K1	485	3581	4793 ± 15	-24.68

TABLE 1 (continued)

GrN no.	Tree no.	Tree-ring no.	Dendro date BC	^{14}C age (BP)	$\delta^{13}\text{C}$ (‰)
8742	K1	492	3574	4822 ± 15	-24.76
8741	K1	498	3568	4831 ± 15	-24.65
8740	K1	505	3561	4790 ± 14	-25.06
8730	K1	512	3554	4775 ± 12	-24.90
8729	K1	518	3548	4739 ± 15	-24.60
8727	K1	525	3541	4662 ± 15	-24.43
8726	K1	532	3534	4688 ± 14	-25.31
8725	K1	539	3527	4714 ± 14	-25.21
8724	L1	546	3520	4664 ± 11	-25.02
8570	M1	553	3513	4644 ± 13	-25.54
8569	M1	560	3506	4625 ± 14	-24.71
8568	M1	566	3500	4635 ± 12	-25.03
8549	M1	572	3494	4649 ± 15	-26.12
8728	N1	574	3492	4672 ± 15	-23.99
8548	O1	578	3488	4658 ± 15	-25.66
8547	O1	585	3481	4669 ± 12	-25.69
8546	O1	591	3475	4667 ± 12	-25.58
8532	O1	596	3470	4679 ± 11	-25.09
8531	O1	601	3465	4654 ± 13	-24.60
8530	P1	605	3461	4684 ± 16	-25.33
8529	P1	609	3457	4688 ± 17	-24.95
8528	Q1	614	3452	4702 ± 15	-24.98
8527	Q1	619	3447	4714 ± 11	-25.13
8524	Q1	626	3440	4693 ± 15	-25.77
8523	Q1	633	3433	4718 ± 13	-25.35
8522	R1	641	3425	4669 ± 15	-25.46
8521	R1	649	3417	4722 ± 11	-25.26
8520	R1	656	3410	4718 ± 15	-25.63
8475	R1	661	3405	4692 ± 13	-25.44
8474	S1	669	3397	4631 ± 13	-25.46
8473	S1	676	3390	4600 ± 12	-25.27
8472	S1	687	3385	4556 ± 14	-24.84
8366	S1	694	3372	4522 ± 15	-24.79
8365	T1	700	3366	4500 ± 15	-24.20
8346	T1	709	3357	4514 ± 15	-24.43
8345	T1	723	3343	4468 ± 15	-24.05
8299	T1	732	3334	4456 ± 13	-24.81
8298	U1	742	3324	4480 ± 14	-24.98
8273	V1	752	3314	4480 ± 11	-24.53
8272	V1	763	3303	4451 ± 13	-25.37
8271	V1	774	3292	4499 ± 8	-24.57
8270	W1	788	3278	4463 ± 13	-24.67
8269	W1	801	3265	4490 ± 8	-24.41
8268	W1	812	3254	4490 ± 9	-25.28
8267	W1	826	3240	4523 ± 11	-25.03
8266	W1	837	3229	4538 ± 11	-25.28