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Supplementary Information for

Securing time-lines in the ancient Mediterranean using multi-proxy annual tree-ring data

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Table S1. 186 Annual ^{14}C measurements from the Gordion tree-ring chronology with relative year identifiers and in calendar years BP according to the dating provided in this study.

Lab number	Tree number	14C Age (BP)	+/-	Calendar year (BP)	Gordion relative year
AA111568	GOR-161	3403	28	3624	834
AA111567	GOR-161	3418	23	3623	835
AA111566	GOR-161	3388	22	3622	836
AA111565	GOR-161	3392	22	3621	837
AA111564	GOR-161	3409	26	3620	838
AA111563	GOR-161	3401	22	3619	839
AA110982	GOR-161	3389	21	3618	840
AA110981	GOR-161	3416	21	3617	841
AA110980	GOR-161	3396	22	3616	842
AA110979	GOR-161	3398	23	3615	843
AA110978	GOR-76	3406	21	3614	844
AA110977	GOR-76	3389	21	3613	845
AA109766	GOR-76	3367	30	3612	846
AA108803	GOR-76	3364	24	3611	847
AA108800	GOR-76	3402	24	3610	848
AA108804	GOR-76	3403	21	3609	849
AA108801	GOR-76	3399	21	3608	850
AA108805	GOR-76	3429	21	3607	851
AA108766	GOR-76	3416	23	3606	852
AA109070	GOR-76	3365	26	3605	853
AA108802	GOR-76	3405	21	3604	854
AA109021	GOR-76	3370	21	3603	855
AA109022	GOR-76	3382	23	3602	856
AA108767	GOR-76	3427	23	3601	857
AA109023	GOR-76	3409	20	3600	858
AA109071	GOR-76	3367	23	3599	859
AA109072	GOR-76	3388	23	3598	860
AA109073	GOR-76	3370	24	3597	861
AA108768	GOR-76	3436	23	3596	862
AA109767	GOR-76	3400	29	3595	863
AA109768	GOR-76	3380	22	3594	864
AA109769	GOR-76	3441	23	3593	865
AA109770	GOR-76	3367	22	3592	866
AA108769	GOR-76	3405	23	3591	867
AA109771	GOR-76	3356	22	3590	868
AA109772	GOR-76	3380	25	3589	869
AA109773	GOR-76	3395	23	3588	870
AA109774	GOR-76	3394	37	3587	871
AA108770	GOR-76	3394	23	3586	872
AA109775	GOR-76	3372	31	3585	873
AA109776	GOR-76	3411	27	3584	874
AA109777	GOR-76	3397	39	3583	875
AA108707	GOR-76	3380	25	3582	876
AA108708	GOR-76	3374	27	3581	877
AA108709	GOR-76	3395	25	3580	878
AA108710	GOR-76	3380	26	3579	879
AA108711	GOR-76	3326	28	3578	880
AA109074	GOR-76	3372	24	3577	881
AA108763	GOR-76	3370	28	3576	882
AA111069	GOR-76	3395	21	3575	883
AA111548	GOR-76	3450	22	3574	884
AA111070	GOR-76	3294	20	3573	885
AA111071	GOR-76	3373	20	3572	886
AA108780	GOR-76	3372	21	3571	887
AA111072	GOR-76	3381	20	3570	888
AA111073	GOR-76	3404	21	3569	889
AA111074	GOR-76	3349	24	3568	890
AA111075	GOR-76	3317	20	3567	891

Lab number	Tree number	14C Age (BP)	+/-	Calendar year (BP)	Gordion relative year
AA108781	GOR-76	3302	24	3566	892
AA111076	GOR-76	3303	20	3565	893
AA111077	GOR-76	3333	20	3564	894
AA111078	GOR-76	3346	24	3563	895
AA111079	GOR-76	3354	21	3562	896
AA111080	GOR-76	3346	25	3561	897
AA111081	GOR-76	3346	27	3560	898
AA111082	GOR-76	3363	24	3559	899
AA111083	GOR-76	3358	24	3558	900
AA111084	GOR-76	3336	26	3557	901
AA111085	GOR-76	3350	29	3556	902
AA111086	GOR-76	3358	24	3555	903
AA111087	GOR-76	3309	24	3554	904
AA111088	GOR-76	3200	21	3553	905
AA111089	GOR-76	3302	24	3552	906
AA111090	GOR-76	3338	25	3551	907
AA111091	GOR-76	3285	28	3550	908
AA111092	GOR-76	3260	24	3549	909
AA111093	GOR-76	3293	24	3548	910
AA111094	GOR-76	3255	24	3547	911
AA111095	GOR-76	3328	22	3546	912
AA111096	GOR-76	3324	21	3545	913
AA111097	GOR-76	3326	27	3544	914
AA111098	GOR-76	3317	25	3543	915
AA111099	GOR-76	3304	21	3542	916
AA111100	GOR-76	3339	20	3541	917
AA111549	GOR-76	3356	21	3540	918
AA111550	GOR-76	3352	21	3539	919
AA111551	GOR-76	3312	22	3538	920
AA111552	GOR-76	3390	21	3537	921
AA111553	GOR-76	3327	22	3536	922
AA111554	GOR-76	3359	24	3535	923
AA111555	GOR-76	3365	24	3534	924
AA110971	GOR-76	3282	21	3533	925
AA110970	GOR-76	3315	23	3532	926
AA110969	GOR-76	3322	21	3531	927
AA110968	GOR-76	3291	22	3530	928
AA110967	GOR-76	3324	19	3529	929
AA110722	GOR-76	3352	21	3528	930
AA110721	GOR-76	3341	21	3527	931
AA110720	GOR-76	3334	23	3526	932
AA110719	GOR-76	3310	21	3525	933
AA110718	GOR-76	3333	21	3524	934
AA110717	GOR-76	3329	22	3523	935
AA110716	GOR-76	3315	22	3522	936
AA110715	GOR-76	3333	22	3521	937
AA110714	GOR-76	3344	22	3520	938
AA110713	GOR-76	3230	22	3519	939
AA110712	GOR-76	3349	20	3518	940
AA110711	GOR-76	3322	22	3517	941
AA110710	GOR-76	3326	22	3516	942
AA110709	GOR-76	3337	22	3515	943
AA110708	GOR-76	3312	22	3514	944
AA110442	GOR-76	3334	24	3513	945
AA110441	GOR-76	3310	24	3512	946
AA110440	GOR-76	3342	25	3511	947
AA110439	GOR-76	3330	24	3510	948
AA110438	GOR-76	3336	23	3509	949
AA110437	GOR-76	3343	26	3508	950
AA110436	GOR-76	3377	26	3507	951

Lab number	Tree number	14C Age (BP)	+/-	Calendar year (BP)	Gordion relative year
AA110435	GOR-76	3324	30	3506	952
AA110434	GOR-76	3353	25	3505	953
AA110433	GOR-76	3309	25	3504	954
AA110432	GOR-76	3353	25	3503	955
AA110431	GOR-76	3303	25	3502	956
AA110430	GOR-76	3352	25	3501	957
AA110411	GOR-76	3360	24	3500	958
AA110412	GOR-76	3379	23	3499	959
AA110413	GOR-76	3399	23	3498	960
AA110414	GOR-76	3420	24	3497	961
AA110415	GOR-76	3297	23	3496	962
AA110416	GOR-76	3333	23	3495	963
AA110417	GOR-76	3319	24	3494	964
AA110418	GOR-76	3314	23	3493	965
AA110419	GOR-76	3306	24	3492	966
AA110420	GOR-76	3316	25	3491	967
AA110421	GOR-76	3301	25	3490	968
AA109778	GOR-76	3287	22	3489	969
AA109779	GOR-76	3310	22	3488	970
AA109780	GOR-76	3322	22	3487	971
AA109781	GOR-76	3320	22	3486	972
AA110322	GOR-76	3293	23	3485	973
AA110323	GOR-76	3266	23	3484	974
AA110324	GOR-76	3290	23	3483	975
AA110325	GOR-76	3318	24	3482	976
AA110326	GOR-76	3316	24	3481	977
AA110327	GOR-76	3307	29	3480	978
AA110328	GOR-76	3283	26	3479	979
AA110329	GOR-76	3284	23	3478	980
AA110330	GOR-76	3286	25	3477	981
AA110331	GOR-76	3263	23	3476	982
AA109853	GOR-76	3249	22	3475	983
AA109854	GOR-76	3304	24	3474	984
AA109855	GOR-76	3305	24	3473	985
AA109734	GOR-76	3282	22	3472	986
AA109735	GOR-76	3292	23	3471	987
AA109736	GOR-76	3271	26	3470	988
AA109737	GOR-76	3285	22	3469	989
AA109738	GOR-76	3292	32	3468	990
AA109739	GOR-76	3271	23	3467	991
AA109740	GOR-76	3279	22	3466	992
AA109974	GOR-76	3296	22	3465	993
AA109975	GOR-76	3303	24	3464	994
AA109976	GOR-76	3257	22	3463	995
AA109977	GOR-76	3243	22	3462	996
AA110406	GOR-76	3297	23	3461	997
AA110407	GOR-76	3298	23	3460	998
AA110408	GOR-76	3292	23	3459	999
AA110409	GOR-76	3365	23	3458	1000
AA110410	GOR-76	3358	24	3457	1001
AA110427	GOR-76	3269	32	3456	1002
AA110428	GOR-76	3239	27	3455	1003
AA110429	GOR-76	3253	25	3454	1004
AA110983	GOR-76	3260	20	3453	1005
AA110984	GOR-76	3254	35	3452	1006
AA110985	GOR-76	3260	20	3451	1007
AA110986	GOR-76	3241	20	3450	1008
AA110987	GOR-76	3257	20	3449	1009
AA110988	GOR-76	3235	25	3448	1010
AA110989	GOR-76	3234	22	3447	1011

Lab number	Tree number	14C Age (BP)	+/-	Calendar year (BP)	Gordion relative year
AA110990	GOR-76	3258	22	3446	1012
AA110991	GOR-76	3235	20	3445	1013
AA110993	GOR-76	3247	20	3444	1014
AA110994	GOR-76	3228	22	3443	1015
AA110995	GOR-76	3216	22	3442	1016
AA110996	GOR-76	3215	22	3441	1017
AA110997	GOR-76	3198	20	3440	1018
AA110998	GOR-76	3206	20	3438	1019

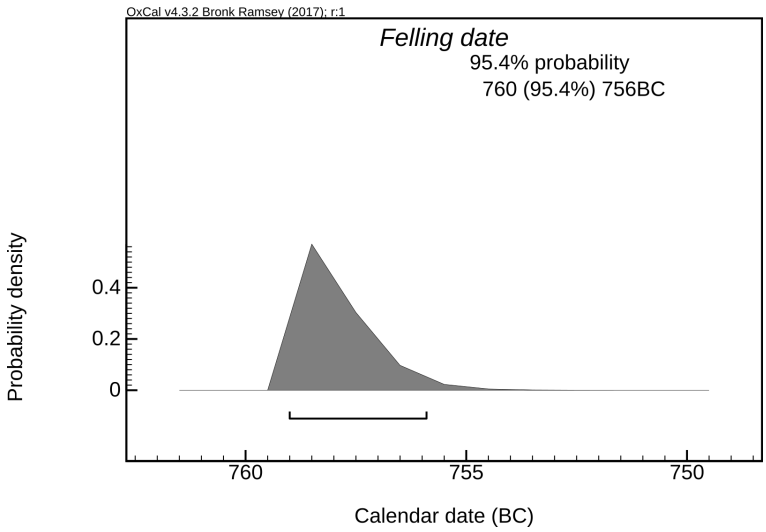

Fig. S1. OxCal plot (Ramsey, C.B., 2009. Bayesian analysis of radiocarbon dates. Radiocarbon, 51(1), pp.337-360.) generated using the IntCal13 (Reimer, P.J. et al., 2013. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon, 55(4), pp.1869-1887.) callibration curve to derive an end date for the wigglematched Gordion tree-ring sequence (Ramsey, C.B., van der Plicht, J. and Weninger, B., 2001. 'Wiggle matching' radiocarbon dates. Radiocarbon, 43(2A), pp.381-389.) using the single year radiocarbon data reported in this study. A gap of 97 years was added to the start of the single year sequence and 745 years were added at the end to represent the entire chronology. This replicates previous work. Relative to IntCal20, using OxCal4.3.2 the result for the same sequence is 750-747 BC, closely supporting our dating of within a year of 745 BC.

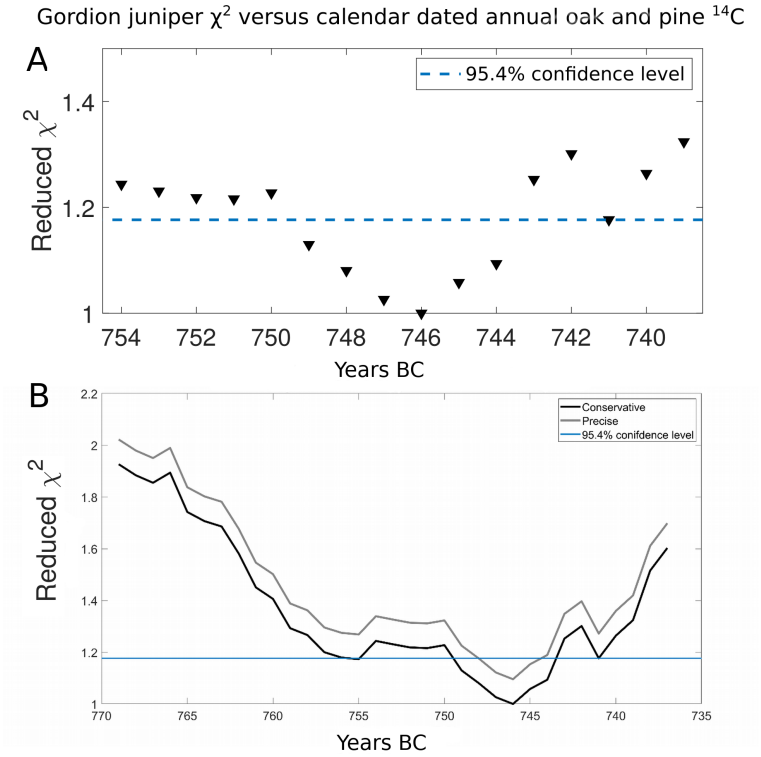

Fig. S2. A: Chi-squared test result (745±4 BC at a 95.4% confidence level) for the annual juniper radiocarbon data versus the calendar dated oak and pine values (published Pearson et al. 2018, 2020). To arrive at this result we used equations outlined by Ramsey, C.B., van der Plicht, J. and Weninger, B., 2001. 'Wiggle matching' radiocarbon dates. Radiocarbon, 43(2A), pp.381-389, removing data points from the Gordion record lying outside the three-sigma range with two scenarios: 1) Precise, and 2) Conservative. (B shows the conservative value in black and the precise value in grey. The 95.4% CI was determined to be 1.18.) For the precise scenario, the results were generated using unmodified equations. This provides a narrow two-sigma range, 746±2 BC. Whereas, the conservative scenario – the minimum chi-squared value is set to 1 - broadens the range to 745 ±4 BC and absolutely at 755 BC.The absolute placement at 755 BC, however shows a clear misalignment in ^{14}C structure when compared with the Pearson et al. 2018, 2020 data. This match is likely noise from our conservative scenario. Conversely, at 745 ±4 BC the alignment between the two patterns is clear. This produces a very similar result to that produced by OxCal (especially relative to IntCal20 which now includes the Pearson et al 2018, 2020 data), however this result is permanently fixed as it will not be subject to further changes with new iterations of the calibration curve or OxCal. SEA analysis was then used to test this placement and alternatives within the possible range. The result producing the best correlation via this alternate method was at 745 BC whether using the full Anatolian tree-ring sequence as shown in the text, or a truncated version (the statistically strongest portion of the chronology) from 1772 BC to 678 BC.

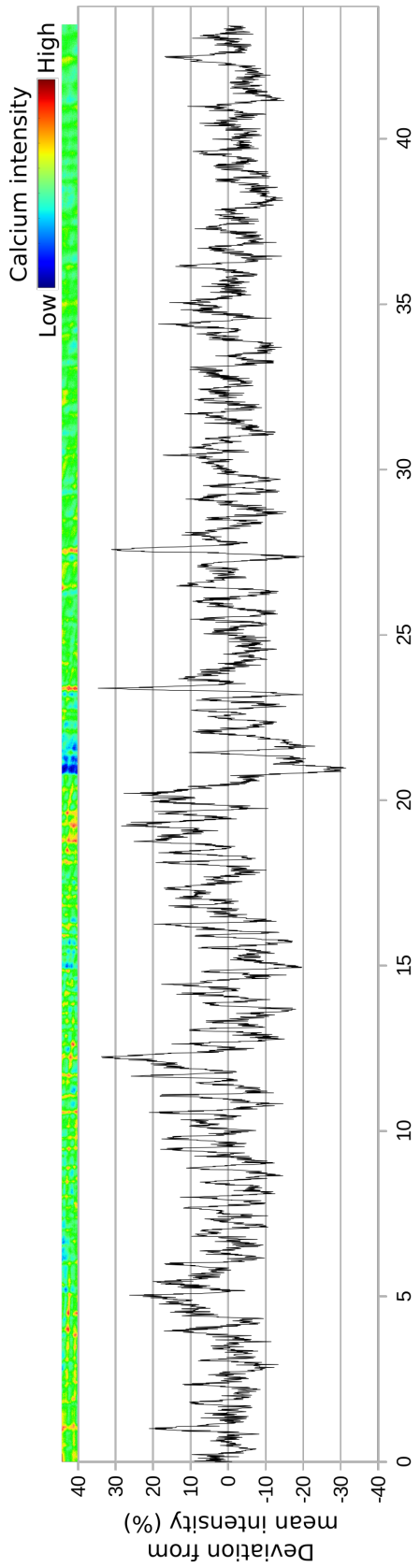

Fig. S3. A composite figure showing intensity of calcium (Ca) as determined by an XRF scan of Gordion juniper growth rings from 1600 BC to 1517 BC. An area scan (4096 × 47 resolution, pixel size 0.011mm) is shown (left). The blue area at 21 mm (c.1650 BC) emphasizes that a depletion of Ca (with a slight following increase) is anomalous within the time period covered.The other data presented represents a single transect across the same tree rings illustrating the percentage deviation from the mean Ca intensity for the sample (a qualitative measure of the amount of Ca in the sample).