RESEARCH DEPARTMENT REPORT SERIES no. 82-2009 ISSN 1749-8775

ALL SAINTS' CHURCH, SANCTON, NEAR MARKET WEIGHTON, EAST YORKSHIRE
TREE-RING ANALYSIS OF TIMBERS FROM THE BELFRY FLOOR AND BELLFRAME

SCIENTIFIC DATING REPORT

Martin Bridge

ARCHAEOLOGICAL SCIENCE

ENGLISH HERITAGE

Research Department Report Series 82-2009

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TREE-RING ANALYSIS OF TIMBERS FROM THE BELFRY FLOOR AND BELLFRAME

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NGR: SE 899 392

ISSN 1749-8775

SUMMARY

Fourteen timbers were sampled from the belfry floor and the bellframe. Six samples were found to have too few rings to be considered for further analysis. Six samples, representing timbers in both the belfry floor and the bellframe, matched each other and appear to form a group of timbers most likely felled at the same time. Their ring-width series were averaged to produce a site chronology, which was subsequently dated to the period AD 1620–1719. Three timbers retained complete sapwood; two were found to have been felled in winter AD 1719/20 and one in spring AD 1720. This dates the construction of the present belfry floor and bellframe to AD 1720, or within a year or two after this date. Two further samples failed to date.

CONTRIBUTOR

Dr M C Bridge

ACKNOWLEDGEMENTS

I would to thank the churchwarden, Mr Jim Reckitt, for arranging access and his assistance during the fieldwork. The work was commissioned by Isabelle Parsons (EH) and sketch drawings provided by Graham Pledger (EH). Cathy Tyers (Sheffield University) and John Meadows (EH) are thanked for their comments on an earlier draft of this report.

ARCHIVE LOCATION

Humber Sites and Monuments Record
The Old School
Northumberland Avenue
Hull HU2 0LN

DATE OF INVESTIGATION

2008-9

CONTACT DETAILS

Dr M C Bridge
UCL Institute of Archaeology, 31–34 Gordon Square, London WC1H 0PY
E-mail: martin.bridge@ucl.ac.uk

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INTRODUCTION

Sancton lies about 3km to the south-east of Market Weighton, and the church is at the north end of the village (Figs 1 and 2). The bellframe of this grade II* listed church sits in the fifteenth-century octagonal west tower, and had been previously surveyed by the EH Senior Conservation Engineer, Graham Pledger. The bellframe itself is supported by four north-south spanning beams, which overlie three east-west spanning belfry floor beams at the lowest level. The central of these three beams is clearly reused, but it was thought that the other beams and the bellframe were contemporary. Dating was requested by Dr Diane Green (EH Historic Buildings Inspector) in order to establish whether the belfry floor is indeed of the same age as the bellframe, and to inform decisions about lifting and so retaining the bellframe and its foundations, whilst accommodating a new ring of bells below it.

METHODOLOGY

The site was visited in December 2008. In the initial assessment, accessible oak timbers with more than 50 rings and where possible traces of sapwood were sought, although slightly shorter sequences are sometimes sampled if little other material is available. Those building timbers judged to be potentially useful were cored using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis. The cores removed were polished on a belt sander using 60 to 400 grit abrasive paper to allow the ring boundaries to be clearly distinguished. The samples had their tree-ring sequences measured to an accuracy of 0.01mm, using a specially constructed system utilising a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to a PC, which recorded the ring widths into a dataset. The software used in measuring and subsequent analysis was written by Ian Tyers (2004). Cross-matching was accomplished by a combination of visual matching and a process of qualified statistical comparison by computer. The ring-width series were compared for statistical cross-matching, using a variant of the Belfast CROS program (Baillie and Pilcher 1973). Ring sequences were plotted to allow visual comparisons to be made between sequences on a light table. This method provides a measure of quality control in identifying any potential errors in the measurements when the samples cross-match.

In comparing one sample or site master against other samples or chronologies, *t*-values over 3.5 are considered significant, although in reality it is common to find demonstrably spurious *t*-values of 4 and 5 because more than one matching position is indicated. For this reason, dendrochronologists prefer to see some *t*-value ranges of 5, 6, and higher, and for these to be well replicated from different, independent chronologies with both local and regional chronologies well represented, except where imported timbers are identified. Where two individual samples match together with a *t*-value of 10 or above, and visually exhibit exceptionally similar ring patterns, they may have originated from the same parent tree. Same-tree matches can also be identified through the external

characteristics of the timber itself, such as knots and shake patterns. Lower *t*-values however do not preclude same-tree derivation.

Ascribing felling dates and date ranges

Once a tree-ring sequence has been firmly dated in time, a felling date, or date range, is ascribed where possible. With samples which have sapwood complete to the underside of, or including bark, this process is relatively straightforward. Depending on the completeness of the final ring, ie if it has only the spring vessels or early wood formed, or the latewood or summer growth, a precise felling date and season can be given. If the sapwood is partially missing, or if only a heartwood/sapwood transition boundary survives, then an estimated felling date range can be given for each sample. The number of sapwood rings can be estimated by using an empirically derived sapwood estimate with a given confidence limit. If no sapwood or heartwood/sapwood boundary survives then the minimum number of sapwood rings from the appropriate sapwood estimate is added to the last measured ring to give a *terminus post quem* (*tpq*) or felled-after date.

A review of the geographical distribution of dated sapwood data from historic timbers has shown that a sapwood estimate relevant to the region of origin should be used in interpretation. For this region, the sapwood estimate used is 12–45 (Miles 1997). It must be emphasised that dendrochronology can only date when a tree has been felled, not when the timber was used to construct the structure or object under study.

RESULTS

Details of the samples taken are given in Table 1, and their approximate locations are illustrated in Figures 3–9. Six samples were found to have too few rings to be considered for further analysis. Of the eight measured samples, six were cross-matched, as is shown in Table 2, and were combined to produce a site master chronology of 100 years, SANCTON. Samples snc03 and snc08 are seen to match very well ($t = 10.7$) and might be considered to have come from the same tree. However, as they were from the two different structures under investigation, the floor and the bellframe, and there was no other evidence, such as matching grain and knot patterns, for them having come from the same tree, their series were not first combined into a single-tree sequence before making the site chronology. The 100-year-long site chronology, formed by combining the six matched individual series, SANCTON, was dated to the period AD 1620–1719, some of the strongest matches being shown in Table 3. The relative positions of overlap of the samples is shown, along with their actual or interpreted likely felling dates/date ranges, in Figure 10.

Two of the measured series, snc04 and snc12, did not match the other series, nor did they date independently.

DISCUSSION

The series SANCTON appears to match most strongly with reference material from the Midlands, although the geographical spread of the matches is quite wide. Fewer chronologies are available in this post-medieval period, and therefore not too much emphasis should be put on this finding, which may reflect the distribution of available data as much as the geographical origin of the timbers. It seems likely that the timber source was relatively local. The level of cross-matching, and the similarity in felling dates between the timbers suggests that they represent a single group of timbers felled within the short period winter AD 1719/20 to spring AD 1720 (Fig 10). Although the lower support beams were not dated, the study shows that the upper four beams are contemporaneous with the bellframe itself.

Figure 1. Map to show the location of the church (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

Figure 2. Map showing the location of the church (circled) within its immediate environs (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

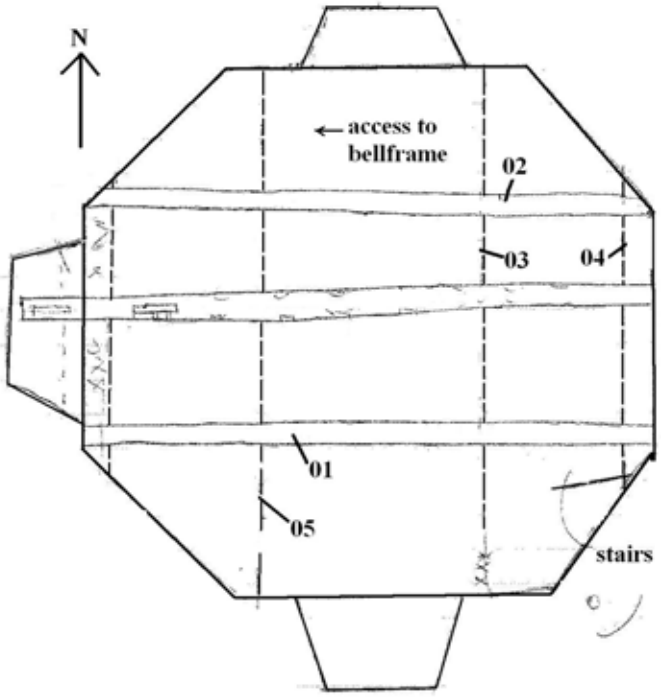

Figure 3. Sketch plan of the tower showing the locations of the three support beams and the four north-south beams supported by them, with the approximate locations of samples taken for dendrochronology added.

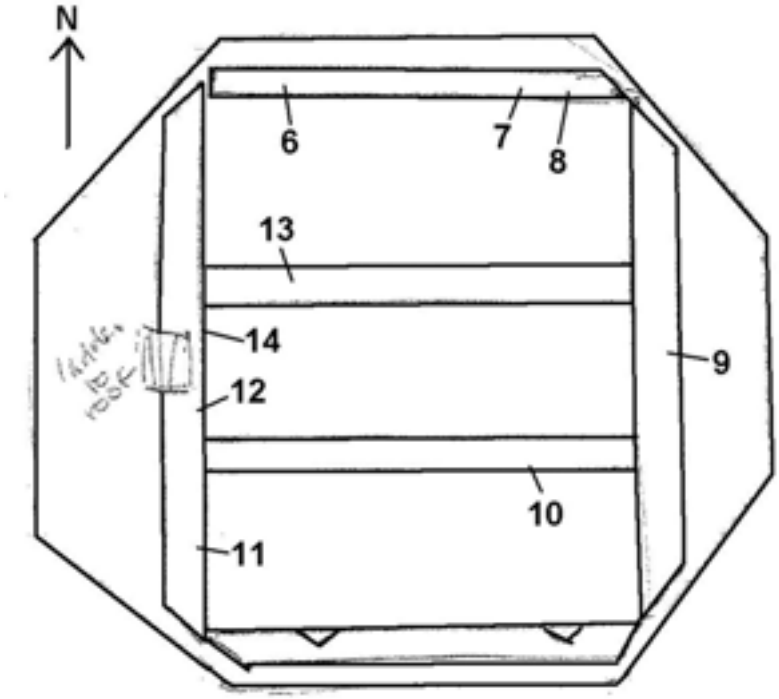

Figure 4. Sketch plan of the bellframe showing the approximate positions of the samples taken, and detailed in subsequent figures

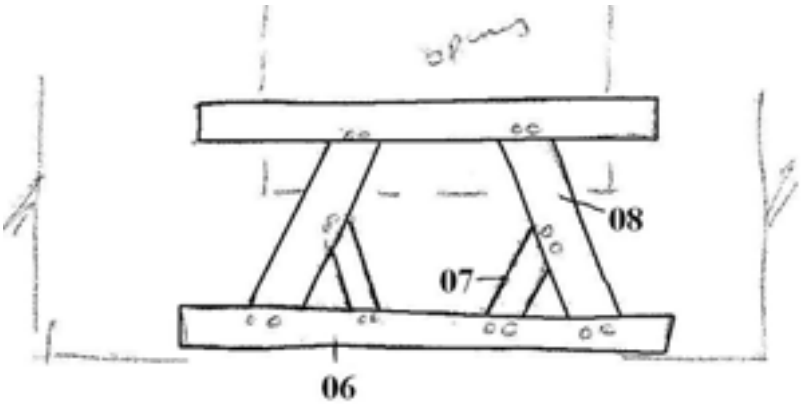

Figure 5. Sketch of the northern east-west frame, looking north, showing the timbers sampled for dendrochronology

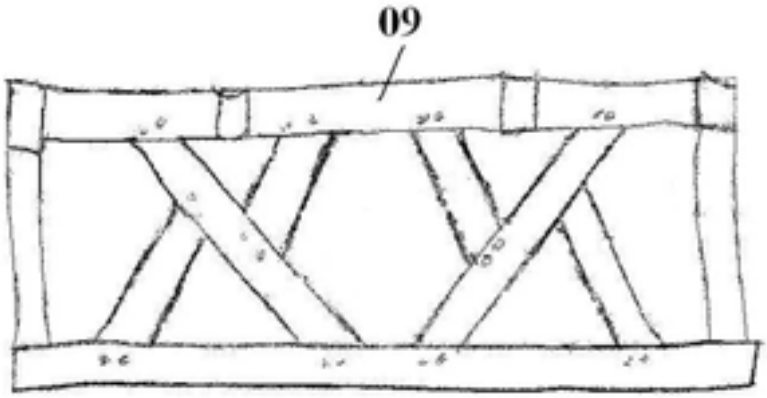

Figure 6. Sketch of the eastern north-south frame, looking east, showing the timber sampled for dendrochronology

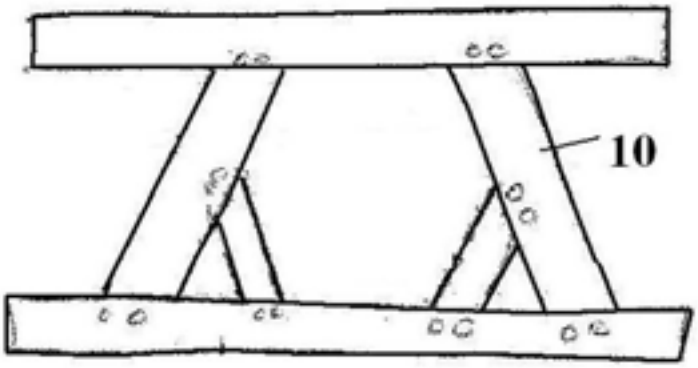

Figure 7. Sketch of the third east-west frame from the north end, looking north, showing the timber sampled for dendrochronology

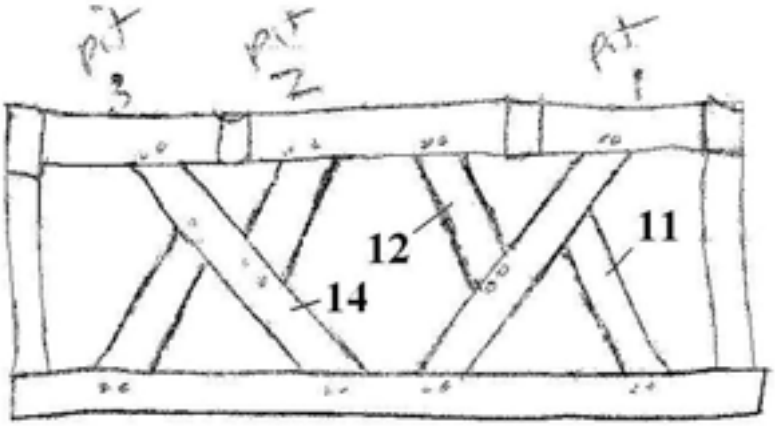

Figure 8. Sketch of the western north-south frame, looking east, showing the timbers sampled for dendrochronology

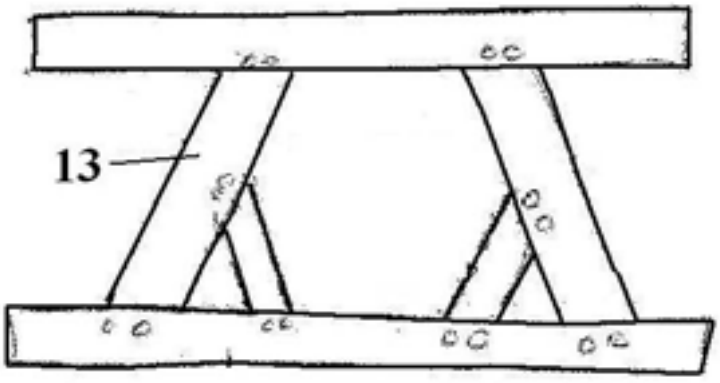

Figure 9. Sketch of the second east-west frame from the north end, looking north, showing the timber sampled for dendrochronology

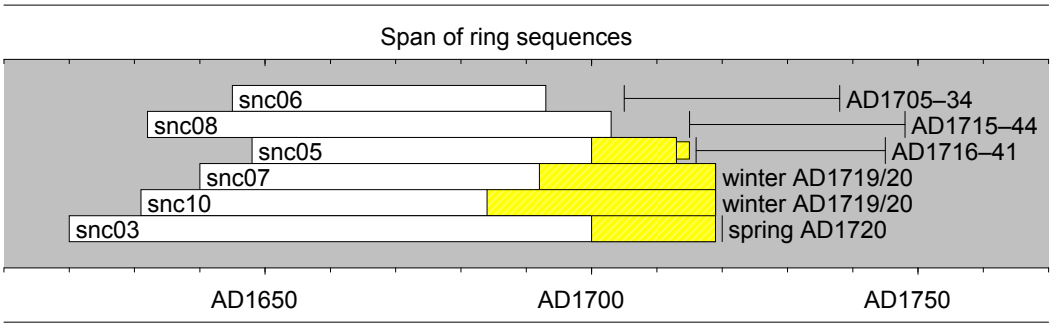

Figure 10. Bar diagram showing the relative positions of overlap of the dated samples, along with their actual or interpreted felling dates/date ranges

*Table 1: Details of oak (*Quercus *spp.) timbers sampled from All Saints' Church tower, Sancton*

Sample	Timber and position	No of rings	Mean width (mm)	Mean sens (mm)	Spanning Dates AD	H/S bdry AD	Sapwood	Felling seasons and dates/date ranges (AD)
Belfry support beams								
snc01	Southern east-west lower beam	<40	NM	-	undated	-	9	unknown
snc02	Northern east-west lower beam	<40	NM	-	undated	-	H/S	unknown
snc03	Upper beam, 3rd from west	100	1.14	0.20	1620–1719	1700	19¼C	spring 1720
snc04	Upper beam, 4th from west	72	1.71	0.19	undated	-	H/S	unknown
snc05	Upper beam, 2nd from west	66	1.40	0.23	1648–1713	1700	13+2NM	1716–41
Bellframe								
snc06	Sill beam, northernmost east-west frame	49	1.79	0.17	1645–93	1693	H/S	1705–34
snc07	East lower brace, northernmost east-west frame	80	1.80	0.21	1640–1719	1692	27C	winter 1719/20
snc08	East upper brace, northernmost east-west frame	72	1.18	0.25	1632–1703	1703	H/S	1715–44
snc09	Headbeam, east end of north-south frame	<40	NM	-	undated	-	-	unknown
snc10	East diagonal brace, third east-west frame from north	89	1.26	0.24	1631–1719	1684	35C	winter 1719/20
snc11	South lower brace, west end north-south frame	<40	NM	-	undated	-	H/S	unknown
snc12	Middle sloping brace, west end north-south frame	50	2.47	0.22	undated	-	18¼C	unknown
snc13	West brace, second east-west frame from north	<40	NM	-	undated	-	25½C	unknown
snc14	Long north brace, west end north-south frame	<40	NM	-	undated	-	-	unknown

Key: NM = not measured; C = complete sapwood, winter felled; ¼C = complete sapwood felled the following spring; ½C = complete sapwood, felled the following summer. Uses sapwood estimate 12–45 from Miles (1997)

Table 2: Cross-matching between the dated timbers from All Saints' Church, Sancton

	t-values				
Sample No	snc05	snc06	snc07	snc08	snc10
snc03	5.7	3.9	6.7	10.7	5.1
snc05		4.9	4.2	5.6	-
snc06			4.3	3.8	4.3
snc07				7.4	9.3
snc08					4.4

- = *t* value is less than 3.5

*Table 3: Dating evidence for the series SANCTON, AD 1620–1719, file names in **BOLD** represent regional chronologies*

County/ region:	Chronology name:	Short publication reference:	File name:	Spanning: (yrs AD)	Overlap (yrs)	*t*-value
Shropshire	Llan Farmhouse, Clunbury	(Miles *et al* 2006)	LLANFMHS	1544–1740	100	5.9
East Midlands	East Midlands Master	(Laxton and Litton 1988)	EASTMID	882–1981	100	5.5
Leicestershire	Church Farm, Bringhurst	(Groves *et al* 2004)	BRNGHST1	1664–1781	56	5.4
Nottinghamshire	Manor Farm barn, Askham	(Howard *et al* 2003)	ASKASQ02	1629–1724	91	5.4
Oxfordshire	Old Clarendon Building, Oxford	(Worthington and Miles 2006)	CLRNDNOX	1539–1711	92	5.3
Bedfordshire	Chicksands Priory	(Howard *et al* 1998)	CHKSAND2	1611–1814	100	5.1
Warwickshire	Middleton Hall	(Arnold *et al* 2006)	MIDHSQ01	1593–1718	99	5.0
Kent	Wheelwrights' Shop, Chatham	(Bridge 1998)	CHATHAM2	1615–1780	100	4.9
Buckinghamshire	Claydon House	(Tyers 1995)	CLAYDON	1613–1756	100	4.9
Essex	Doddinghurst Church	(Tyers 2002)	DODNG_XY	1637–1735	83	4.8
Berkshire	Maidenhead Bridge	(Miles *et al* 2003)	MDNHEAD2	1605–1750	100	4.8
Derbyshire	Bolsover Castle	(Arnold *et al* 2003)	BLSBSQ01	1532–1749	100	4.8

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APPENDIX

Ring width values (units of 0.01mm)

snc03

237	305	432	256	146	186	235	172	168	158
142	177	189	166	112	95	83	144	146	216
174	223	169	147	121	152	164	147	139	114
104	108	116	164	179	174	165	118	118	97
104	94	110	140	86	82	78	91	70	121
99	93	108	123	127	73	112	124	117	101
77	69	110	90	57	53	65	75	104	82
58	58	68	82	80	57	50	60	70	52
39	56	34	59	84	85	86	83	70	58
43	64	62	63	71	71	71	56	50	66

snc04

290	304	205	212	180	142	281	185	247	165
169	183	176	195	192	196	153	195	173	201
227	287	270	264	201	154	160	212	236	264
263	166	195	156	212	186	178	184	194	199
178	142	126	131	158	107	100	260	250	274
157	122	139	98	75	112	131	135	112	104
65	95	83	145	131	116	125	83	74	64
75	90								

snc05

244	161	134	171	117	175	210	216	180	111
154	183	192	123	236	270	231	166	116	168
139	245	233	188	221	203	186	116	130	177
185	152	120	141	190	149	112	102	104	128
149	135	85	62	82	75	95	73	63	69
56	49	66	72	61	163	131	138	164	109
77	90	86	81	128	114				

snc06

205	318	247	272	230	166	174	170	198	375
399	263	277	260	206	218	194	202	231	195
131	113	166	154	174	164	177	158	163	117
99	118	182	162	131	135	132	161	136	120
132	117	169	135	143	87	94	100	89	

snc07

320	311	227	210	203	310	235	194	207	134
107	116	95	113	191	219	236	145	160	167
179	173	181	331	147	188	164	177	181	252
227	251	268	246	164	136	158	235	271	234
197	127	224	135	85	126	119	133	175	197
125	159	145	157	234	136	132	141	226	159
166	185	144	150	150	226	184	177	181	173
107	146	158	192	143	106	129	146	170	159

snc08

146	115	84	61	113	170	110	249	153	229
167	216	179	208	220	194	220	165	131	116
104	120	125	164	148	136	133	126	146	103
167	169	124	107	106	114	67	101	72	74
109	97	78	48	62	89	102	103	68	68
134	101	64	55	78	98	124	108	73	75
78	97	105	86	74	75	121	88	72	110
72	130								

snc10

208	169	124	119	141	115	160	160	205	227
179	137	103	93	171	166	123	137	102	83
73	70	95	168	276	209	179	136	113	122
168	165	216	126	112	90	92	67	128	131
235	236	238	117	108	118	215	177	198	175
113	178	131	77	116	120	92	134	93	73
130	95	96	125	86	58	62	60	53	53
61	63	60	85	98	98	150	158	136	72
92	113	113	76	73	93	76	61	132	

snc12

264	362	468	485	453	442	269	282	407	339
147	150	199	326	224	234	138	194	236	178
182	212	172	196	312	259	242	196	185	285
186	227	303	315	214	295	244	231	263	222
179	146	241	222	161	181	157	166	155	187






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