The Tree-Ring Dating of the Old Clarendon Building, Oxford, Oxfordshire

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Summary

Thirteen timbers thought to be from the primary construction phase were sampled at the Old Clarendon Building, Oxford. Eleven samples were combined to form the 173-ring site master CLRNDNOX with a date span from AD 1539 to AD 1711. Eight of the samples retained complete sapwood and were felled during winter AD 1711/12 through to spring AD 1712. The other three dated samples were found to have felling date ranges consistent with these precise felling dates.

As the documented construction date for the building is AD 1711–13, these results clearly show that original timbers survive in the building. In addition it appears likely that the timbers were specifically felled for the construction of this building and were therefore not stockpiled.

Keywords

Dendrochronology
Standing Building

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Description of building

The Old Clarendon Building, a grade 1 listed building, is located towards the eastern end of Broad Street, Oxford (SP 51553 06473; Fig 1). It was built during AD 1711–13, partially from the profits of Lord Clarendon's book *The History of the Rebellion and Civil Wars in England*, in order to house the Oxford University Press. Lord Clarendon was the Chancellor of the University of Oxford in AD 1660–67. The building was designed by the architect Nicholas Hawksmoor, who trained under Sir Christopher Wren.

The building is rectangular in plan, on an east-west alignment. It is divided into two main floors with attics and cellars. Its walls are ashlar-faced and the roof structure consists of queen-post trusses supporting lead sheeting. It has a large portico in the centre of the north façade, supported by large Doric columns (Fig 2). The side bays have segmented-headed windows on the ground and first floors, and square-headed windows to the basement. The building has a barrel-vaulted central passageway, with doors leading off to the ground floor rooms. Twin staircases, running from the cellar to the attic, allow access to all the floors in the building.

Objectives of dating

The main objective of the dating was to confirm that the surviving timberwork is associated with the documented construction of the building in AD 1711–13, and hence to confirm the extent of the survival of the primary phase timber throughout the building.

Commissioners

The work to the building was commissioned by English Heritage and the University of Oxford. This analysis formed part of the dendrochronology training programme of the first author at Oxford University, funded by English Heritage and supervised by the second author. The study also formed part of the syllabus for the MSc in Archaeological Science at Oxford University.

Methodology

The samples from the timbers were taken using a 16mm hollow auger powered by an electric drill. The samples were sanded on a linisher using 60 to 1000 grit abrasive paper. These were then measured to an accuracy of 0.01mm using a travelling stage attached to a microcomputer-based measuring system (Reynolds pers comm 1998).

The samples were compared with each other using dendrochronological techniques as outlined in English Heritage (1998). This involved both visual comparisons using semi-logarithmic graphs and statistical cross-correlations using a computer. This utilised cross-correlation algorithms (Baillie and Pilcher 1973) which have been implemented using computer software written for Windows in Visual Basic by M R Allwright and P A Parker. In comparing two individual samples, a *t*-value of 3.5 or higher is usually indicative of a match, whilst *t*-values of 10 and above often suggest that samples have originated from the same parent tree. All individual samples showing a match with consistently high correlation during cross-matching are averaged together to form a mean site master. On comparing this site master with dated reference chronologies, *t*-values of 5 and above are normally expected for the correct dating position. A conclusive match should exhibit the highest matches with reference chronologies of local origin as well as with relevant well-replicated regional chronologies unless the timbers were imported. Matching positions suggested by computer are confirmed by satisfactory visual matching.

On some occasions duplicate samples are taken, to allow the spanning of any breaks within the first sample. These breaks are commonly in the sapwood of oak, which is soft and often insect-damaged, making it liable to fragment during coring. However breaks can also occur, though less frequently, in the heartwood of oak, which may have splits or shakes within it. These cannot always be seen from the outside when inspecting the timbers, so cannot be avoided when coring. Retention of complete sapwood is vital in determining a precise felling date. Occasionally, two cores are taken from a timber in order to maximise the ring sequence length, the first extending nearer the pith or centre of the tree, and the second extending nearer or to the bark edge. When these are combined, a longer sequence is produced, which is more likely to cross-match successfully. In instances where duplicate samples or same-tree sequences both have sapwood, the heartwood/sapwood boundary date for the mean sequence is calculated by taking an average of the individual samples heartwood/sapwood date. Where this is not a full year, the previous full year is used in this report.

Once a ring sequence has been dated chronologically, the date of felling needs to be ascertained. When the sapwood is complete on a sample, the determination of a felling date is relatively straightforward. Each growth ring has one or more rows of open spring vessels, or early wood, followed by a band of dense summer growth or late-wood. During the winter months the tree remains dormant. If both the spring and summer growth are present and thought to be complete, then the tree would have been felled during the winter period. If only the spring vessels are present beneath the bark, then the tree can be said to have died or been felled during the spring period. If only a few incomplete vessels are present, then it is possible to further refine the time of felling to *early spring*. If some dense wood or summer growth is present, then a *summer or autumn* felling period can be suggested. However, as it is not known how wide the summer growth band should be for that particular tree, it cannot be stated conclusively whether the tree was felled in early or late summer, or if indeed it was felled at some point in the winter. For instance, a severe May frost can suddenly arrest growth, which would produce a very narrow ring with little or no summer wood (Baillie 1982, plate 2c). Therefore, a certain degree of caution should be used in interpreting felling seasons between summer and autumn, or even winter seasons in some instances. Only apparently complete rings indicating felling during the winter months are measured. Samples exhibiting spring or summer growth therefore give a felling date during the year following the last measured ring.

If the outermost rings are missing but the heartwood/sapwood boundary survives, then the number of missing sapwood rings can be estimated using an empirically derived sapwood estimate. The sapwood estimate used in this report is 9 to 41 rings, the 95% confidence range calculated for the south of England. Samples only having heartwood but without any indication of a heartwood/sapwood transition are given a *terminus post quem* or felled after date which is calculated by adding a minimum of 9 years to the last ring present on the sample (Miles 1997).

It should be remembered that dendrochronology can only date when the tree died, not the date of construction for a building or artefact. The interpretation of a felling date relies on having a good number of precise felling dates rather than just one or two. Nevertheless, it was common practice to build timber-framed structures with green or unseasoned timber and construction usually took place within twelve months of felling (Miles 1997).

Assessment and Sampling Strategy

The building was assessed and sampled in November AD 2003 whilst it was empty for major renovation works, thus allowing relatively unrestricted access throughout. Work to the suspended floor structure of the ground floor fortuitously necessitated the removal of a number of floorboards, hence allowing access to the normally concealed joists and beams.

The basic criteria used for assessing the suitability of the phase or area under investigation for dendrochronological analysis were the presence of a minimum of eight to ten timbers containing at least fifty annual rings, preferably more. Samples with fewer than fifty annual rings are less likely to date reliably. Additionally samples with complete sapwood or bark were also sought, as these would allow precise felling dates to be assigned.

Large sections of the main east-west roof's timber trusses were exposed, allowing them to be inspected very closely. The trusses were numbered from the west to the east, from 0 to 16 (Fig 4). Nine timbers, all with ample rings and most with complete sapwood, were selected for analysis. Only one timber from the trusses in the portico was found to meet the criteria for analysis. The remaining timbers in the portico were either unsuitable or inaccessible.

In addition the two staircases and the suspended floor to the ground floor, all thought to be associated with the primary construction phase, were assessed. Most of the timbers used to construct the suspended floor were converted from very fast grown trees, with less than fifty rings. Only two joists were located that were suitable for sampling, both of which retained complete sapwood. Although of different character than the rest of the floor timbers there were no obvious signs of reuse on these two joists. The handrail to the top west staircase flight was also sampled.

Details of the samples and their locations can be seen in Table 1 and Figures 3–4.

Cross-matching and site chronology

During sampling, many of the initial cores fragmented so additional cores were taken from the same timber in order to maximise the dating potential. Mean individual timber sequences were produced for **cbo1**, **cbo2**, **cbo4**, **cbo5**, **cbo6**, **cbo7,** and **cbo12** by combining, where appropriate, the multiple series produced from fragmented and duplicate cores (Figs 5 and 6; Tables 2–8).

When all the timber sequences were compared against each other, two pairs cross-matched with *t*-values above 10 (Tables 9 and 10). This is usually taken to indicate that the timbers may come from the same tree. Such pairs are combined so that if they are incorporated in to a site master chronology, it is not weighted towards one tree. Samples **cbo9** and **cbo11** were therefore combined to form **cbo911**, whilst **cbo12** and **cbo13** were combined to form **cbo1213**. These mean sequences were used in the remaining analyses.

Sequences **cbo3**, **cbo4, cbo5, cbo6, cbo7, cbo8, cbo911, cbo10,** and **cbo1213** all cross-matched with good visual and statistical correlation and were combined to form the 173-year site master **CLRNDNOX** (Tables 11 and 12).

Absolute dating

The site master **CLRNDNOX** was then compared with over 1200 dated reference chronologies from the British Isles and was found to date, spanning the years AD 1539 to 1711 (Table 13). Calendar dates could then be assigned to the individual component sequences of **CLRNDNOX** (Fig 7; Table 1).

The two unmatched samples were also compared with the reference chronologies, and with the site master **CLRNDNOX**, but neither was found to match conclusively and these samples must remain undated.

Interpretation and discussion

Of the samples that made up the site master **CLRNDNOX**, eight retained complete sapwood and produced a series of precise felling dates ranging from winter AD 1711/12 through to the spring of AD 1712. The three samples without complete sapwood produced felling date ranges that were consistent with the precise felling dates produced (Table 1, Fig 7).

These results are clearly consistent with the documented construction period AD 1711–13 for the building (RCHME 1939) and thus confirm the survival of primary-phase timber. They also demonstrate that, as expected, the main roof, the portico roof, and the west staircase are likely to be coeval. Thus the precise felling dates obtained show that the timbers used appear to have been felled specifically for the construction of the Old Clarendon Building and were not stockpiled or seasoned for any length of time. The precise felling date of winter AD 1711/12 for the west staircase handrail is notable in that joinery elements are usually thought to have been constructed out of seasoned, or at least partially seasoned, timber. This handrail timber could have been seasoned for little more than a year before the completion of the building in AD 1713.

The felling dates indicated for **cbo12** and **cbo13** are slightly different, even though they cross-match with a very high *t*-value (Table 10) which would usually be taken to suggest that they may come from the same tree. Both samples have an outermost complete ring dating to AD 1710. The spring vessels of **cbo12** are just starting to form, whereas on **cbo13** there is a single row of fully formed spring vessels. This implies that **cbo12** was felled very early in spring AD 1711 and that **cbo13** was felled later in the same season. However, as indicated above, a certain degree of caution should be used in interpreting felling seasons. The variation in the initiation of growth around the circumference of a tree is such that these two timbers could still have been derived from the same tree. Alternatively, in this instance, this could indicate that the timbers actually come from different trees.

No dating evidence was produced for the suspended floor, so it has not been possible to prove whether this timber work is a survival from the original construction phase. One of the possible reasons for the failure to date **cbo1** and **cbo2** is the fact that they both have periodic sudden growth suppression, resulting in bands of very narrow rings, which will have reduced their dating potential by masking the general climatic signal needed for successful dating.

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References

Arnold , A J, Howard , R E, and Litton , C D, 2003 *Tree-Ring Analysis of Timbers from the Roof of the Keep or "Little Castle", Bolsover Castle, Bolsover, Derbyshire*, CfA Rep, **15/2003**

Baillie, M G L, and Pilcher, J R, 1973 A simple cross-dating program for tree-ring research, *Tree-Ring Bulletin*, **33**, 7–14

Baillie, M G L, 1982 *Tree-Ring Dating and Archaeology*, London, 64

English Heritage, 1998 *Dendrochronology: guidelines on producing and interpreting dendrochronological dates*, London

Haddon-Reece, D, and Miles, D H, 1993 *Working compilation of 190 British reference chronologies supplied by various researchers*, unpubl computer file *MASTERAL*, Oxford Dendrochronology Laboratory

Haddon-Reece, D, Miles, D H, Munby, J T, and the late Fletcher, J M, 1993 *Oxfordshire Mean Curve - a compilation of master chronologies from Oxfordshire*, unpubl computer file *OXON93*, Oxford Dendrochronology Laboratory

Laxton, R R, and Litton, C D, 1988 *An East Midlands Master Tree-Ring Chronology and its use for dating Vernacular Buildings,* Univ Nottingham, Dept of Classical and Archaeol Studies, Monograph Ser, **3**

Miles, D H, 1997 The interpretation, presentation, and use of tree-ring dates, *Vernacular Architect*, **28**, 40–56

Miles, D, 2003 Dating Buildings and Dendrochronology in Hampshire, in *Hampshire Houses 1250–1700: Their Dating and Development* (ed E Roberts), 220–6, Southampton (Hampshire County Council)

Miles, D H, and Haddon-Reece, D, 1994 List 56 - Tree-ring dates, *Vernacular Architect*, **25**, 28–36

Miles, D H, and Worthington, M J, 1998 Tree-ring dates, *Vernacular Architect* **29**, 111–29

Miles, D H, Worthington, M J, and Bridge, M C, 2003 Tree-ring dates, *Vernacular Architect* **34**, 109–21

RCHME, 1939 An Inventory of the Historical Monuments in the City of Oxford, London

Tyers, I, 1995 *Tree-ring analysis of Claydon House, Middle Claydon, Buckinghamshire,* Anc Mon Lab Rep, **13/95**

Table 1: Summary of tree-ring dating

OLD CLARENDON BUILDING, OXFORD, OXFORDSHIRE

Sample number & type		**Timber and position**	**Dates AD spanning**	**H/S bdry**	**Sapwood complement**	**No of rings**	**Mean width** mm	**Std devn** mm	**Mean sens**	**Felling seasons and dates/date ranges (AD)**
cbo1a	c	22nd floor joist from east in southeast ground-floor room			30	101	1.48	1.05	0.287	
cbo1b	c	ditto			32¼C	37	0.92	0.37	0.292	
cbo1		*Mean of **cbo1a** + **cbo1b***			*32¼C*	*102*	*1.47*	*1.05*	*0.283*	
cbo2a1	c	19th floor joist from east in southeast ground-floor room			h/w only	30	1.90	0.73	0.228	
cbo2a2	c	ditto			10	53	1.36	0.60	0.310	
cbo2a3	c	ditto			6	6	1.69	0.68	0.425	
cbo2b1	c	ditto			h/w only	15	2.23	1.02	0.288	
cbo2b2	c	ditto			h/w only	16	1.69	0.54	0.267	
cbo2b3	c	ditto			12	52	1.30	0.54	0.294	
cbo2c	c	ditto			21¼C	24	1.47	0.78	0.354	
cbo2		*Mean of **cbo2a2** + **cbo2b3** + **cbo2c***			*21¼C*	*64*	*1.39*	*0.62*	*0.313*	
* **cbo3**	c	North principal rafter T14	1542–1711	1686	25C	170	1.15	0.49	0.232	Winter 1711/12
cbo4a	c	Tiebeam T13	1539–1705	1692	13	167	1.23	0.38	0.240	
cbo4b	c	ditto	1679–1711	1691	20C	33	1.45	0.38	0.270	
* **cbo4**		*Mean of **cbo4a** + **cbo4b***	*1539–1711*	*1691*	*20C*	*173*	*1.24*	*0.38*	*0.242*	*Winter 1711/12*
cbo5a	c	South tiebeam T12	1615–1702	1694	8	88	1.30	0.39	0.264	
cbo5b	c	ditto	1599–1711	1694	17C	113	1.41	0.40	0.246	
* **cbo5**		*Mean of **cbo5a** + **cbo5b***	*1599–1711*	*1694*	*17C*	*113*	*1.37*	*0.37*	*0.251*	*Winter 1711/12*
cbo6a	c	Tiebeam T11	1563–1708	1695	13	146	1.09	0.32	0.208	
cbo6b	c	ditto	1660–1711	1694	17C	52	1.24	0.34	0.223	
* **cbo6**		*Mean of **cbo6a** + **cbo6b***	*1563–1711*	*1694*	*17C*	*149*	*1.14*	*0.30*	*0.203*	*Winter 1711/12*
cbo7a	c	North principal rafter T2	1628–1706	1682	24	79	1.75	0.54	0.253	
cbo7b	c	ditto	1624–1711	1684	27C	88	1.83	0.68	0.301	
* **cbo7**		*Mean of **cbo7a** + **cbo7b***	*1624–1711*	*1683*	*28C*	*88*	*1.76*	*0.60*	*0.252*	*Winter 1711/12*
* **cbo8**	c	Handrail 2nd from top W stairs	1641–1711	1687	24C	71	1.41	0.55	0.197	Winter 1711/12
cbo9	c	North brace T8	1603–91	1689	2	89	1.29	0.37	0.226	1698–1730
* **cbo10**	c	East principal rafter 2nd truss N of ridge to portico	1567–1702	1686	16	136	1.04	0.36	0.221	1702–27

	cbo11	c	North principal rafter T8	1560–1700	1688	12	141	1.52	0.49	0.199	1700–29
*	**cbo911**	m	*Mean of **cbo9** + **cbo11***	*1560–1700*	*1688*	*12*	*141*	*1.51*	*0.49*	*0.199*	
	cbo12a1	c	Collar T5	1636–90		h/w only	55	1.84	0.62	0.313	
	cbo12a2	c	ditto	1692–1711	sap only	20¼C	20	1.84	0.66	0.241	
	cbo12b	c	ditto	1641–1711	1686	25¼C	71	2.01	0.77	0.288	
	cbo12		*Mean of **cbo12a1** +**cbo12a2**+**cbo12b***	*1636–1711*	*1686*	*25¼C*	*76*	*1.93*	*0.66*	*0.287*	*Early spring 1712*
*	**cbo1213**	m	*Mean of **cbo12** + **cbo13***	*1636–1711*	*1684*	*27¼C*	*76*	*2.05*	*0.70*	*0.273*	
	cbo13	c	Collar T7	1646–1711	1683	28¼C	66	2.08	0.90	0.288	Spring 1712
*****	**= CLRNDNOX Site Master**			**1539–1711**			**173**	**1.37**	**0.29**	**0.183**	

Key: * = sample included in site master; ¼C,½C,C = bark edge present, partial or complete ring: ¼C = spring (ring not measured), ½C = summer/autumn (ring not measured), or C = winter felling (ring measured); H/S bdry = heartwood/sapwood boundary (last heartwood ring date); h/w only = heartwood only; std devn = standard deviation; mean sens = mean sensitivity. Sapwood estimate 9–41 rings (Miles 1997).

Table 2: Matrix of *t*-values and overlaps for components of ***cbo1***

Sample: *Last ring date relative:*	**cbo1b** 102
cbo1a 101	10.80 36

Table 3: Matrix of *t*-values and overlaps for components of ***cbo2***

Sample: *Last ring date relative:*	**cbo2b3** 53	**cbo2c** 64
cbo2a2 53	18.01 52	5.05 13
	cbo2b3	5.39 13

Table 4: Matrix of *t*-values and overlaps for components of ***cbo4***

Sample: *Last ring date AD:*	**cbo4b** 1711
cbo4a 1705	16.77 27

Table 5: Matrix of *t*-values and overlaps for components of ***cbo5***

Sample: *Last ring date AD:*	**cbo5b** 1711
cbo5a 1702	14.43 88

Table 6: Matrix of *t*-values and overlaps for components of ***cbo6***

Sample: *Last ring date AD:*	**cbo6b** 1711
cbo6a 1708	7.28 49

Table 7: Matrix of *t*-values and overlaps for components of ***cbo7***

Sample: *Last ring date AD:*	**cbo7b** 1711
cbo7a 1706	8.43 79

Table 8: Matrix of *t*-values and overlaps for components of ***cbo12***

Sample: *Last ring date AD:*	**cbo12a2** 1711	**cbo12b** 1711
cbo12a1 1690	00.00 0	13.08 50
	cbo12a2	6.30 20

Table 9: Matrix of *t*-values and overlaps for components of ***cbo911***

Sample: *Last ring date AD:*	**cbo11** 1700
cbo9 1691	12.40 89

Table 10: Matrix of *t*-values and overlaps for components of ***cbo1213***

Sample: *Last ring date AD:*	**cbo13** 1711
cbo12 1711	14.11 66

Table 11: Matrix of *t*-values and overlaps for components of the site master ***CLRNDNOX***

Sample:	**cbo4**	**cbo5**	**cbo6**	**cbo7**	**cbo8**	**cbo911**	**cbo10**	**cbo1213**
Last ring date AD:	1711	1711	1711	1711	1711	1700	1702	1711
cbo3	8.95	6.64	6.67	5.35	3.64	7.38	5.51	3.65
1711	170	113	149	88	71	141	136	76
	cbo4	7.58	9.21	5.87	2.92	7.65	5.76	8.52
		113	149	88	71	141	136	76
		cbo5	6.85	5.09	4.05	6.64	5.74	9.40
			113	88	71	102	104	76
			cbo6	6.07	3.31	5.45	3.99	7.76
				88	71	138	136	76
				cbo7	4.87	5.24	1.66	4.63
					71	77	76	76
					cbo8	3.02	2.41	3.84
						60	62	71
						cbo911	5.22	5.51
							134	65
							cbo10	8.10
								67

Table 12: Ring-width data for site master curve, **CLRNDNOX**, AD 1539–1711

ring widths (0.01mm)	***number of samples in master***
142 099 140 163 176 166 201 144 171 215	1 1 1 2 2 2 2 2 2 2
212 145 175 120 192 186 246 103 080 088	2 2 2 2 2 2 2 2 2 2
120 164 153 227 139 107 111 114 123 156	2 3 3 3 4 4 4 4 5 5
175 176 151 145 169 166 144 130 140 101	5 5 5 5 5 5 5 5 5 5
131 194 159 116 116 129 159 152 104 118	5 5 5 5 5 5 5 5 5 5
169 119 121 130 127 132 140 145 161 185	5 5 5 5 5 5 5 5 5 5
143 112 096 103 114 160 122 139 134 149	6 6 6 6 6 6 6 6 6 6
117 165 145 120 163 121 101 122 132 158	6 6 6 6 6 6 6 6 6 6
120 120 140 129 111 090 127 145 143 141	6 6 6 6 6 7 7 7 7 7
135 114 096 145 148 103 103 100 109 119	7 7 7 7 7 7 7 8 8 8
110 122 144 138 141 156 151 181 164 186	8 8 9 9 9 9 9 9 9 9
140 123 106 104 097 123 185 150 117 128	9 9 9 9 9 9 9 9 9 9
097 180 165 153 162 144 100 119 126 142	9 9 9 9 9 9 9 9 9 9
145 118 136 145 177 119 120 091 150 145	9 9 9 9 9 9 9 9 9 9
117 162 116 173 140 119 098 180 140 152	9 9 9 9 9 9 9 9 9 9
115 092 092 110 123 129 108 118 143 151	9 9 9 9 9 9 9 9 9 9
118 142 135 123 184 157 114 132 107 124	9 9 8 8 7 7 7 7 7 7
113 076 121	7 7 7

Table 13: Dating evidence for the site chronology ***CLRNDNOX*** (AD 1539–1711) against reference chronologies. **Bold** denotes regional chronologies

	County or region:	*Chronology name:*	*Short publication reference:*	*File name:*	*Spanning:*	*Overlap:*	*t-value:*
	Hampshire	Hampshire Master Chronology	*(Miles 2003)*	**HANTS02**	443–1972	173	8.38
	London	London Master Chronology	*(Tyers pers comm)*	**LONDON**	413–1728	173	8.44
	Derbyshire	The Keep, Little Bolsover Castle	*(Arnold et al 2003)*	BLSBSQ01	1532–1749	173	8.49
	Buckinghamshire	Claydon House	*(Tyers 1995)*	*CLAYDON*	1613–1756	99	8.71
*	East Midlands	East Midlands Master	*(Laxton and Litton 1988)*	**EASTMID**	882–1981	173	9.06
	East Anglia	East Anglia Master Chronology	*(Bridge pers comm)*	**ANGLIA03**	944–1789	173	9.72
	Oxfordshire	Manor Farm, Stanton St John	*(Miles and Worthington 1998)*	STNSTJN3	1533–1637	99	10.67
	Berkshire	Maidenhead Bridge	*(Miles et al 2003)*	MDNHEAD2	1605–1750	107	11.07
*§	Oxfordshire	Oriel College Tennis Court	*(Miles and Haddon-Reece 1994)*	ORIEL1	1534–1776	173	12.39
	Oxfordshire	Manor Farm, Stanton St John	*(Miles and Worthington 1998)*	STNSTJN4	1480–1646	108	12.51
	Great Britain	British Isles Master Chronology	*(Haddon-Reece and Miles 1993)*	**MASTERAL**	404–1987	173	13.16
	Oxfordshire	Oxfordshire Master Chronology	*(Haddon-Reece et al 1993)*	**OXON93**	632–1987	173	13.74

* Component of MASTERAL
§ Component of OXON93

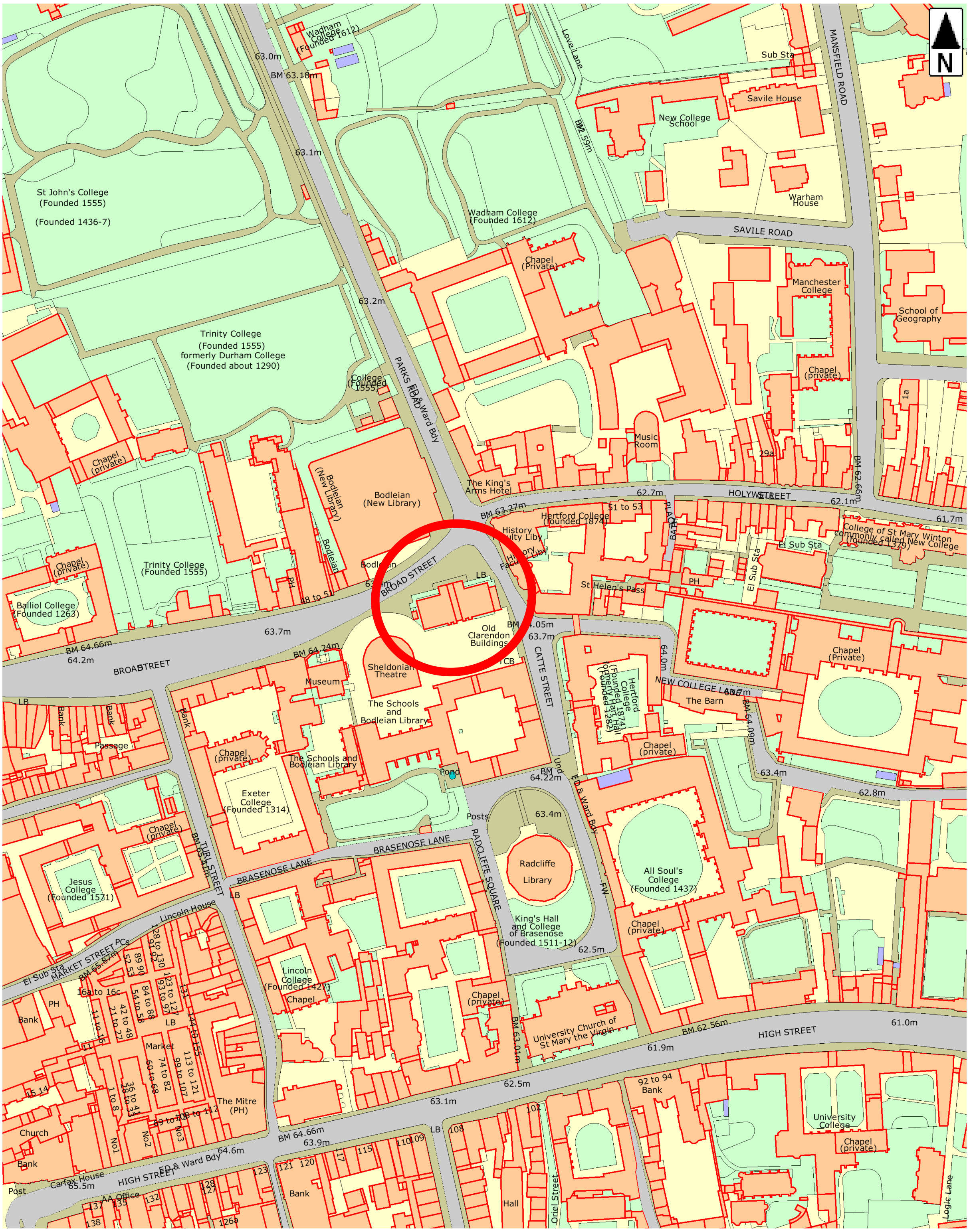

Figure 1: Location map showing Old Clarendon Building, Oxford.

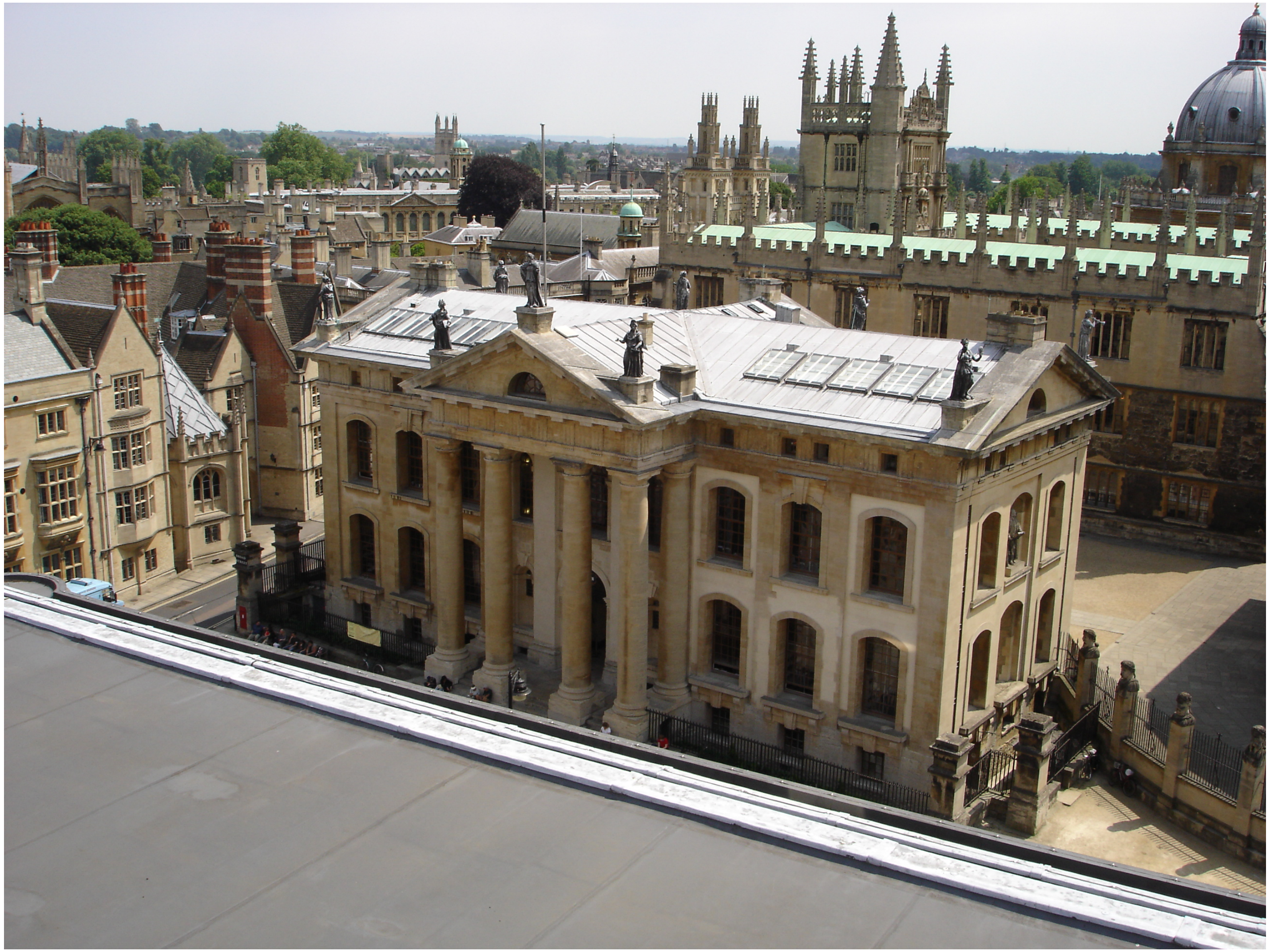

Figure 2: The Old Clarendon Building from the north (photograph: D Miles)

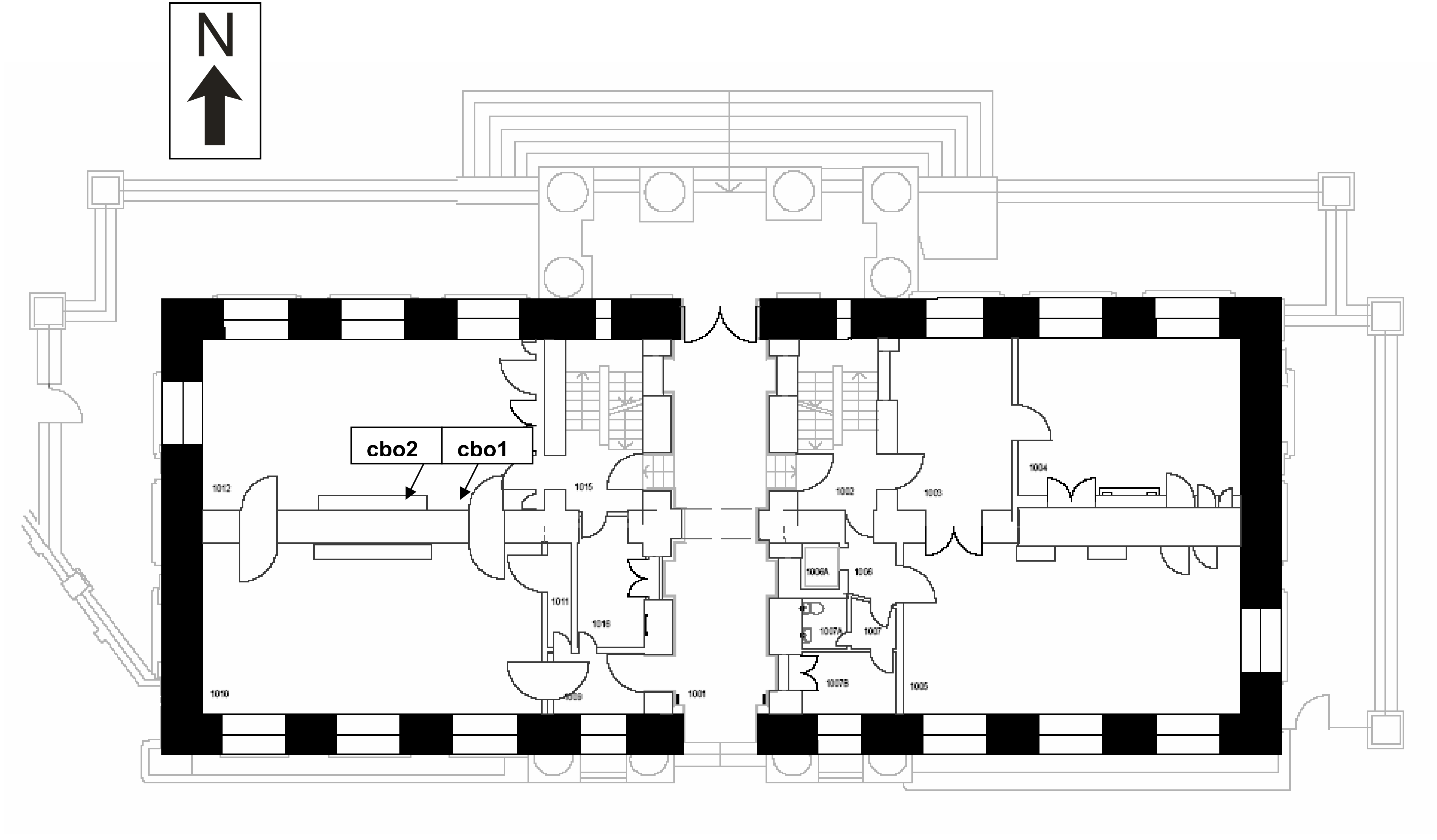

Figure 3: Ground Floor plan (drawing supplied by Colin George, University of Oxford Estates Directorate) showing the approximate location of timbers sampled for dendrochronological analysis

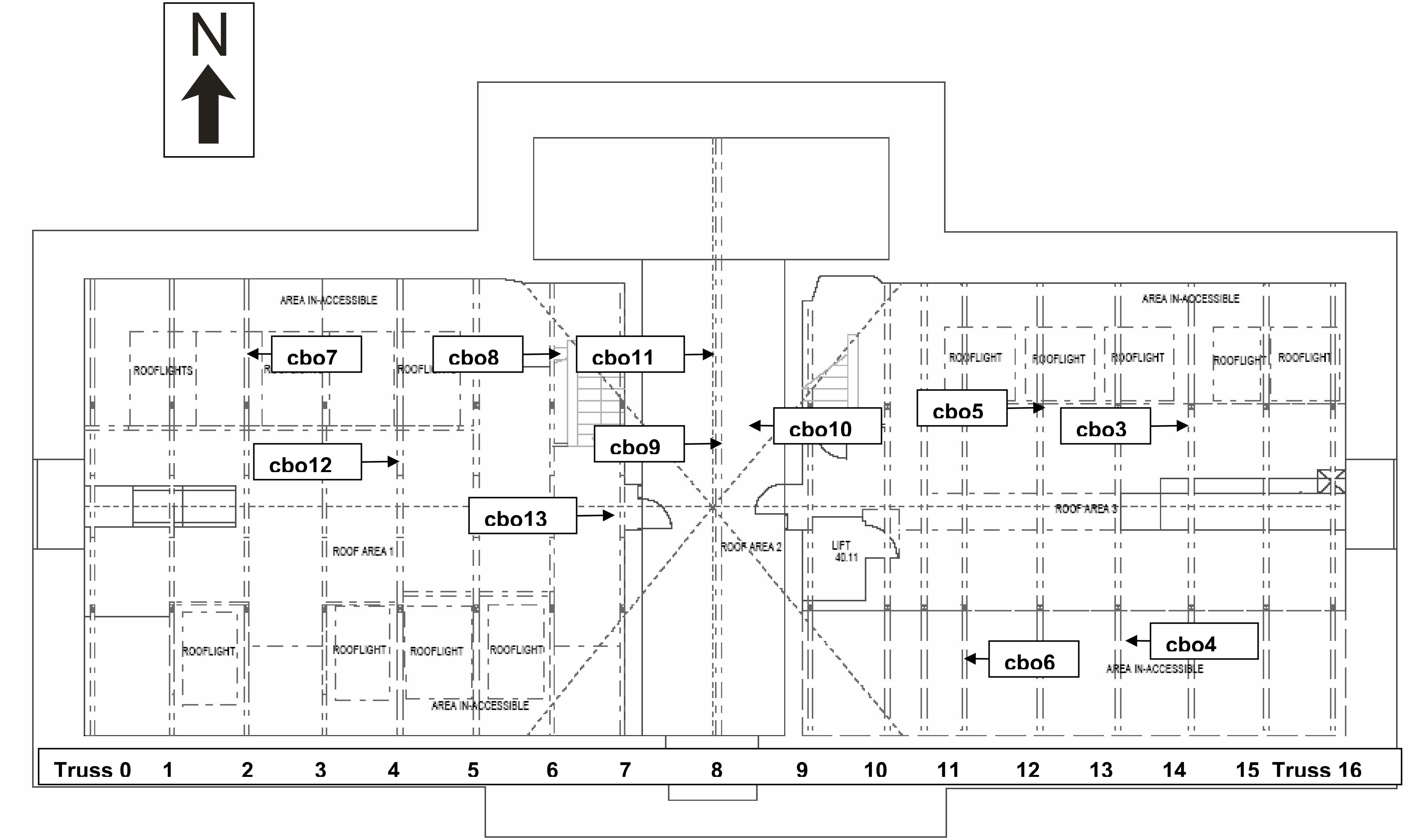

Figure 4: Roof plan (drawing supplied by Colin George, University of Oxford Estates Directorate) showing the approximate location of timbers sampled for dendrochronological analysis

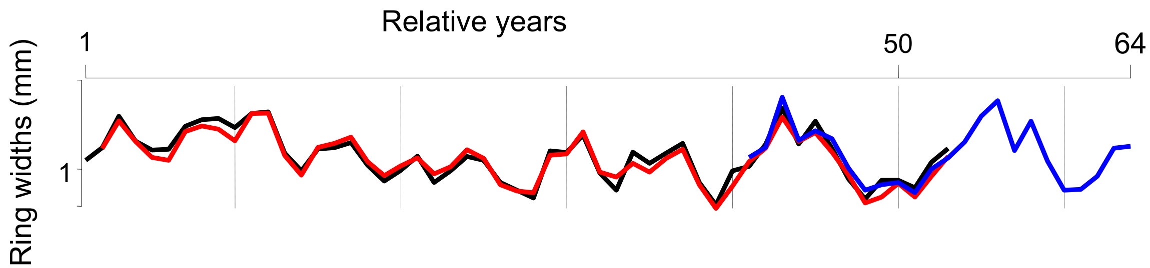

Figure 5: Diagram showing the visual similarities between the ring sequences of the individual components of **cbo2**. Black – **cbo2a2**; red – **cbo2b3**; blue – **cbo2c**; y-axis is a logarithmic scale. The sometimes very short overlaps between fragments and duplicates increases the importance of visual cross-matching

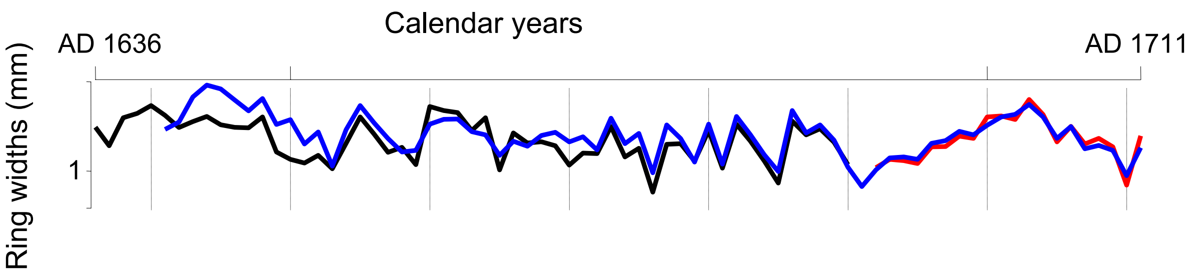

Figure 6: Diagram showing the visual similarities between the ring sequences of the individual components of **cbo12**. Black – **cbo12a1**; red – **cbo12a2**; blue – **cbo12b**; y-axis is a logarithmic scale. The sometimes very short overlaps between fragments and duplicates increases the importance of visual cross-matching

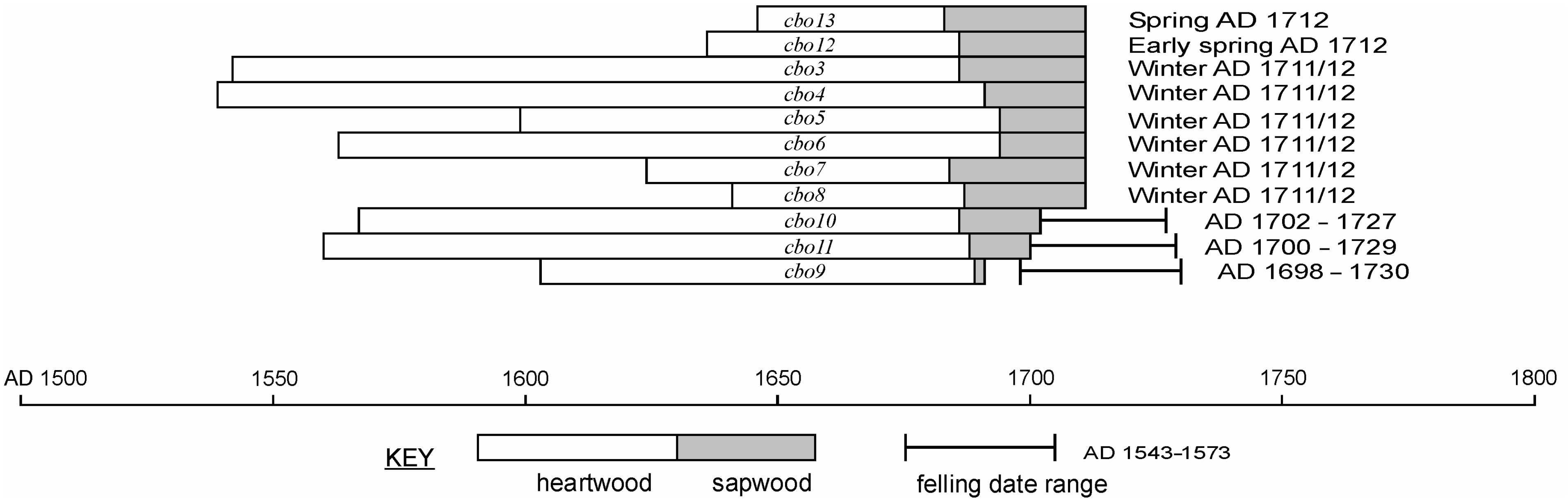

Figure 7: Bar diagram showing the relative positions of the dated samples