Ancient Monuments Laboratory
Report 4/98

TREE-RING ANALYSIS OF TIMBERS FROM THE BARN AT OLD FARM, NORTH LITTLETON, WORCESTERSHIRE

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Summary

The main body of the barn contains two types of truss which, on stylistic evidence, come from two distinct periods, the medieval and the late sixteenth- or seventeenth-century. There are also an extension at the southern end, also thought to be of late sixteenth- or seventeenth-century date, and a porch of unknown date. Closer inspection of the timbers for dendrochronological study revealed that the replacement trusses in the main part of the barn and timbers in the porch and southern extension were all of elm, and these, with one exception, were not sampled. The oak timbers from the supposed medieval trusses were most likely from non-woodland trees, exhibiting ring-width sequences with abrupt growth changes, and their growth patterns did not date. The pairs of posts to two of the trusses each appear to have been made from a single tree.

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Introduction

A study of the history of this barn (NGR SP 0842 4747) was carried out in the 1980s by a local historian, Bruce Watson. He reports (Watson 1984) that it was built as a six bay barn, but that only three original trusses remain (numbered 4, 5, and 6 on Fig 1) with perhaps part of truss 7 also being original. This numbering follows what remains of the carpenters marks on the original trusses. Truss 5 is shown in elevation in Fig 2. Watson suggests that the barn could be that mentioned in historical sources as the barn built by Abbot John de Ombersley in AD 1367-79.

Part of the west wall of the barn has been rebuilt, probably after subsidence, at which time the trusses at this end of the building were replaced. At this time trusses 1,2, and 3 were replaced with tie- and collar-beam trusses and, on stylisitic grounds, it is thought that this was done during the late sixteenth or in the seventeenth century. Also during the same time period, though not necessarily at exactly the same time, the southern extension and possibly also the porch were added (Fig 1).

The farm complex has been unoccupied since the death of the last owner in December 1996 and, at the time of this investigation, was the subject of planning applications. A dendrochronological investigation of the barn was requested by English Heritage in order to try and establish the date of the original roof structure and subsequent phases to help inform decisions about its subsequent use.

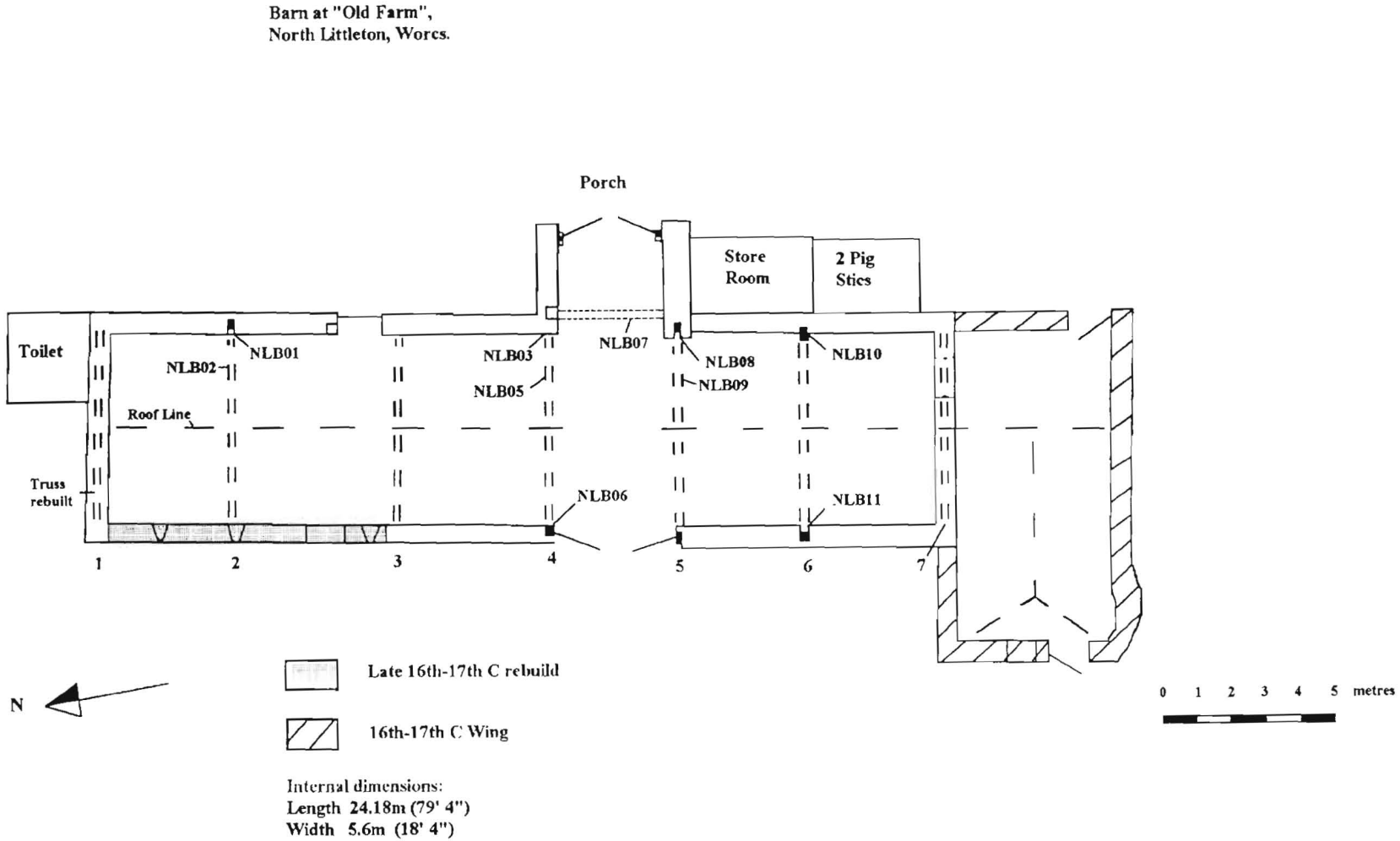
Methodology

The site was visited in February 1998, at which time the timbers were investigated for their suitability for dendrochronological analysis, with those being deemed suitable being sampled. The main criteria used in the assessment were the species of wood used, the number of rings on each timber, and to a lesser extent, the presence of sapwood, which would allow a statistical estimation of the felling period of the trees used to be made.

Core samples were obtained using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis. The holes were left open. The cores were prepared for measuring by sanding using an electric belt-sander with progressively finer grit papers down to 400 grit. Any further preparation necessary, eg where bands of narrow rings occurred, was done manually. The samples had their tree-ring sequences measured to an accuracy of 0.01 mm using a specially constructed system utilizing a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to an Atari desktop computer. The software used in measuring and some subsequent analysis was written by Ian Tyers (pers comm 1992), with further analysis and graphic output from TSAP (Rinn 1996).

Ring sequences were plotted on translucent semi-log graph paper to allow visual comparisons to be made between sequences on a light table. This activity also acts as a measure of quality control in identifying any errors in the measurements. Statistical comparisons were made between the individual timbers from the site using Student's t-test (Baillie and Pilcher 1973; Munro 1984), including the elm series from sample NLB02, to see if there was any inter-species crossmatching. Any *t*-values in excess of 3.5 are taken to be indicative of acceptable matching positions provided that they are supported by satisfactory visual matches (Baillie 1982, 82-5).

Figure 1: Ground plan of the barn at Old Farm, North Littleton, based on an original by Watson (1984)



Crossmatching sequences were combined to produce new sequences. In the same way, the ring sequences of individual or combined timbers were compared with a range of reference material to see if they crossdated.

Results

Upon closer inspection of the timbers it was found that, apart from the re-use of the original oak post encased in the east wall and a fragment used as a prop on the west wall, the timbers of trusses 1,2, and 3 (Fig 1) were all elm (*Ulmus* spp.). Samples were extracted from the oak post to check whether it crossmatched with the other oak timbers, and a sample was taken from the elm tie beam in truss 2 to see what characteristics its rings had and consider whether the elm might be datable, but other than this the timbers of these renewed trusses were considered unsuitable for dendrochronological study.

Similarly, the timbers from truss 7, and all those in the southern extension to the barn (except the oak tie now resting on the internal wall below truss 7) were found to be of elm and were not sampled. The principal rafter on the east side of truss 6 was also made of elm.

Details of the samples taken are given in Table 1. In addition, the principal rafter on the east side to truss 5 was cored through the bark on the timber, but the core fragmented and was unusable.

Table 1: List of samples taken from the barn, Old Farm, North Littleton
h/s = heartwood-sapwood boundary.

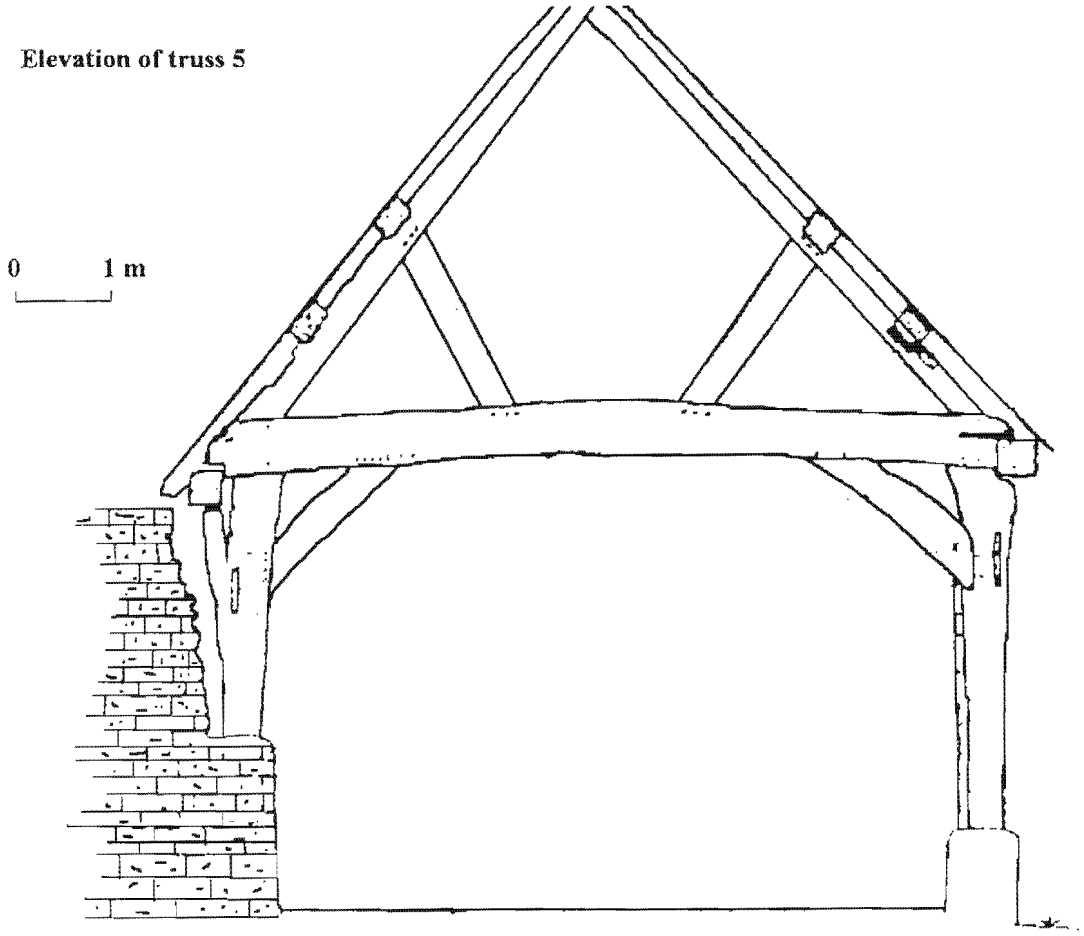
Sample No.	Species	Origin of core	Total number of years	Average growth rate (mm yr^{-1})	Sapwood details
NLB01	oak	East post, truss 2	20	unmeasured	-
NLB02	elm	Tie beam, truss 2	71	1.54	-
NLB03	oak	East post, truss 4	106	2.12	-
NLB04	oak	Principal rafter east, truss 4	71	1.72	h/s
NLB05	oak	Tie beam, truss 4	63	2.00	h/s
NLB06	oak	West post, truss 4	107	1.91	+ *c*9 heartwood and *c*18 sap unmeasured
NLB07	oak	Porch tie beam	43	2.29	h/s
NLB08	oak	East post, truss 5	74	2.64	h/s
NLB09	oak	Tie beam, truss 5	85	2.22	+10 sap unmeasured
NLB10	oak	East post, truss 6	89	2.29	h/s
NLB11	oak	West post, truss 6	78	2.17	-

Crossmatching was found between two pairs of samples, NLB03 and NLB06 (t = 7.3 with 106 years of overlap) and NLB10 and NLB11 (t = 5.3 with 78 years of overlap). These series were combined to form two new series NLB0306M and NLB1011M and they are illustrated along with the other ring-width curves in Fig 3. No further crossmatching was found between the individual samples, nor between individual samples and a wide selection of reference material. The ring-width data for these samples are given in Table 2 at the end of this report.

The degradation of the outer rings on samples NLB06 and NLB09 meant that the outer rings could not be measured, although the approximate number of rings present could be determined.

No crossmatching was found between the elm sample and either the oak samples or reference chronologies.

Figure 2: Elevation of truss 5 of the barn at Old Farm, North Littleton, seen from the south. Based on an original by Watson (1984)



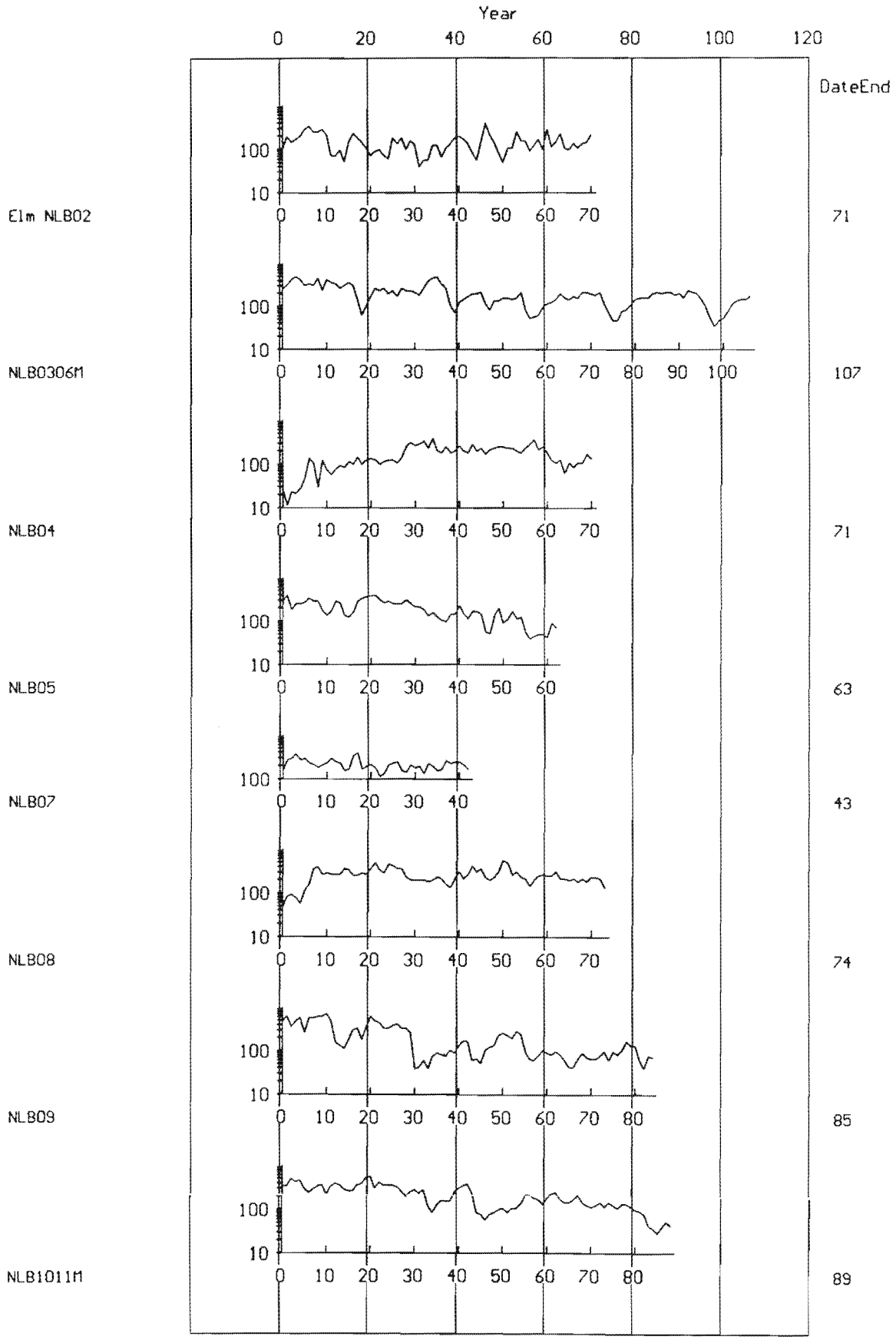
Interpretation

The original medieval trusses have been fashioned from oaks with growth characteristics typical of non-woodland trees (Rackham 1990). They exhibit very twisted grain with several knots at all levels, and the ring-width series shown abrupt growth changes which may be the result of natural or human intervention in removing limbs during the life of the tree, insect defoliation, or some other external influence which is not common to all trees growing in the region.

The only timbers which showed any degree of crossmatching were the quartered trees used for the two posts to truss 4, and the two posts to truss 6. Although the statistical match is not very high, it seems likely that each of these pairs were derived from a single tree. The tie beams to trusses 4 and 5 were made from trees which had been halved, but they did not match each other. The east principal rafter to truss 6, and all the purlins and wall-plates were made from elm. This may indicate either that they were replacements, or that elm was being used in the original medieval phase of construction.

The construction of trusses following the rebuilding of the wall on the west side, those in the porch and timbers in the southern extension all used elm and cannot be dated dendrochronologically at present. The appearance of the larger timbers again suggests that non-woodland trees were being used in most cases, with smaller timbers being made from rather

Figure 3: Plots of the ring-width series (log scale) from the barn at Old Farm, North Littleton



young trees (less than fifty years old), suggesting that they are unlikely to be dated dendrochronologically in the future.

Dendrochronological has not assisted in dating the phases of building at this site, although closer study of the timbers and their ring-width patterns has given additional information about the nature of the trees used.

Acknowledgements

I would like to thank English Heritage for funding this work, Mr M Goggin for helping during the fieldwork, and Mr Patrick Burton (architect) for arranging my visit to the site.

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Table 2: Ring-width data for series from Old Farm barn, North Littleton

Year	ring widths (0.01mm)									
NLB02(Elm)										
1	102	200	154	174	204	311	342	263	265	302
	231	78	79	104	57	156	240	195	148	108
	78	98	101	78	64	194	140	187	107	167
	135	42	63	63	134	128	72	115	146	193
	210	178	145	91	59	151	410	225	154	89
51	54	110	109	269	171	170	93	133	184	107
	298	125	153	242	109	107	144	113	136	150
	229									
NLB0306M										
1	260	330	438	527	446	338	366	334	482	244
	446	389	356	292	340	382	334	150	66	115
	182	274	236	284	212	251	175	292	237	239
	225	195	288	400	467	508	362	283	116	74
	127	155	173	200	205	218	118	90	138	144
51	163	164	147	161	219	90	56	61	66	106
	122	135	147	202	166	153	182	167	216	220
	213	191	218	123	77	48	47	85	92	115
	158	160	161	161	205	216	213	229	217	190
	205	165	235	225	203	149	107	57	35	47
101	58	82	124	142	156	157	179			
NLB04										
1	28	12	24	23	28	47	146	112	31	133
	75	62	84	95	90	121	106	154	106	130
	145	135	102	122	128	135	110	155	255	329
	279	315	366	246	411	212	197	255	189	212
	280	212	199	314	209	248	183	229	236	263
51	267	233	237	212	190	238	296	386	228	256
	198	132	113	128	68	112	91	108	108	181
	145									
NLB05										
1	302	416	186	258	256	288	351	316	303	180
	145	181	293	291	136	129	171	314	348	383
	421	419	325	272	312	268	266	264	328	262
	218	218	199	145	162	130	110	101	153	152
	235	148	123	180	176	153	61	56	139	212
51	95	123	176	120	135	60	40	48	53	52
	45	98	78							

Year	ring widths (0.01mm)									
NLB07										
1	162	278	294	385	288	294	247	225	189	226
	241	294	263	241	163	180	353	417	172	211
	220	195	121	138	221	250	267	170	148	228
	190	208	143	248	202	170	172	285	250	261
	252	216	179							
NLB08										
1	49	87	93	81	62	119	167	371	411	278
	298	284	287	292	371	344	253	267	314	273
	372	538	346	311	482	436	378	371	237	206
	213	212	206	198	208	241	225	168	136	217
	317	221	287	441	335	372	233	201	242	326
51	614	532	289	317	239	216	147	209	261	279
	254	264	317	232	220	202	216	186	218	185
	239	233	220	139						
NLB09										
1	513	656	382	517	604	289	587	604	640	677
	755	540	160	136	121	194	332	344	195	372
	641	540	500	342	354	414	461	367	368	279
	40	44	65	41	83	93	90	80	112	99
	146	172	172	64	70	56	108	131	144	247
51	278	249	201	296	252	106	72	68	84	110
	97	91	104	90	66	44	46	69	93	75
	69	73	80	101	66	107	90	115	172	146
	139	68	41	81	75					
NLB1011M										
1	355	349	511	444	467	301	242	311	359	373
	223	344	427	394	312	273	278	374	411	567
	591	341	456	395	375	375	361	282	215	266
	314	251	295	135	87	129	161	159	170	270
	323	382	417	262	90	81	62	85	86	100
51	113	88	110	108	142	219	218	193	72	144
	193	250	255	182	147	152	177	221	147	131
	122	129	154	123	150	128	113	140	142	117
	101	99	81	44	39	30	42	57	43	