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Summary

Three timbers were analysed, two from Newton Mill and one from Newington Bridge. No date was obtained for the bridge, but the main sill beam from the mill structure produced a tree-ring sequence spanning AD 1435-1586. The timber had no sapwood and was therefore felled some time after AD 1596. Further sampling of the mill is recommended.

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TREE-RING ANALYSIS OF TIMBERS FROM NEWTON MILL AND NEWINGTON BRIDGE, CRAVEN ARMS, SHROPSHIRE

This document is a technical archive report on the tree-ring analysis of three timbers from Craven Arms. Newton Mill (NGR SO43838240) is located about 200m downstream of Newton footbridge. It was found on the bed of the River Onny and is composed of a massive oak timber, about 17m in length, with many side timbers and associated planking and paving. Its exact function is unknown but it is possibly the remains of a mill dam and race (Salisbury pers comm). The mill does not appear on any OS maps indicating that it is at least seventeenth-century. The possibility that it is considerably older cannot be ruled out, particularly as the structure is adjacent to the site of the Grange Farm of Haughmond Abbey.

Newington Bridge (SO 43328366) is located just upstream of the Newington Farm footbridge, from where the three massive oak timbers can be seen in the Onny river bed. The timbers are probably the sill beams which would have supported a wooden bridge. Possible reconstructions are illustrated in Rigold (1975, 57 - types X or Y). Dating is unknown but on typological grounds could be between AD 1260 and 1760.

Given the uncertain dating of the two structures, dendrochronology was requested by Kate Clark, English Heritage Inspector for the area, after being alerted to the presence of the two structures by the Craven Arms Historical Society. The project is part of a larger one undertaken by the Society to study the development of settlements in the Onny river basin. The plan of Newton Mill (Fig 1) was drawn by Kate Clark and Paul Stamper of Shropshire County Council; the Craven Arms Historical Society provided the plan of Newington Bridge which is adapted here (Fig 2).

Sampling was restricted because Health and Safety considerations ruled out the use of a chain saw. Instead a sample was sawn off the end of the main sill beam at Newton Mill. At the same site, a sample was also removed from a loose timber found next to the river bank (Fig 1). The end of the middle sill beam was sampled at Newington Bridge (Fig 2).

Methods

The cross-sections of the samples were prepared by freezing them for at least 48 hours and then cleaning their cross-sections with a surform plane. The ring widths were measured to an accuracy of 0.01mm on a travelling stage which is connected to a microcomputer. The computer uses a suite of dendrochronology programs written by Ian Tyers (pers comm 1996). The measured ring sequences were plotted as graphs using a plotter, also connected to the computer. Crossmatching was carried out first visually by comparing the graphs on a light box, and then using a computer program to measure the amount of correlation between two ring sequences. The crossmatching routines are based on the Belfast CROS program (Baillie

and Pilcher 1973; Munro 1984), and all the *t* values quoted in this report are identical to those produced by the first CROS program (Baillie and Pilcher 1973). Generally *t* values of 3.5 or above indicate a match provided that the visual match between the tree-ring graphs is acceptable (Baillie 1982, 82-5).

Dating is achieved by averaging the data from the matching sequences to produce a site master curve, and then testing that master for similarity against dated reference chronologies. A site master is used for dating whenever possible because it enhances the general climatic signal at the expense of the background noise from the growth characteristics of the individual samples. Single ring sequences are tested individually against the reference chronologies. All potential tree-ring dates are then checked by examining the quality of the visual match between the graphs.

If a sample has bark or bark edge, the date of the last measured ring is the year in which the tree was felled. If the outer ring is complete, the tree was felled during the period from late autumn to early spring. For convenience, this is termed "winter felled". Where the ring is incomplete, the tree was felled during late spring to early autumn; this is known as "summer felled". Often, particularly where rings are narrow, it is not possible to distinguish between winter and summer felled trees.

In the absence of bark edge, felling dates of oak timbers are calculated using the sapwood estimate of 10-55 rings. This is the range of the 95% confidence limits for the number of sapwood rings in British oak trees over 30 years old (Hillam *et al* 1987). Where sapwood is absent, felling dates are given as *termini post quem* by adding 10 years, the minimum number of missing sapwood rings, to the date of the last measured heartwood ring. The actual felling date could be much later than the *terminus post quem* depending on how many heartwood rings have been removed during conversion or have eroded away in the river.

Further details of the principles and methodology of dendrochronology can be found in Baillie (1982) and Hillam (forthcoming).

Results

The loose timber from Newton Mill (Newton 1) was a quartered trunk which contained 68 annual growth rings (Table 1). The sample from the sill beam (Newton 2) was a squared timber from which the sapwood had been removed or lost. It had 152 rings with an average ring width of 2.37mm. The Newington sample was also from a large squared timber but the tree from which it was converted had grown faster since the average ring width of Newington 1 was 3.47mm.

There was no similarity between Newton 1 and 2, so the three ring sequences were tested individually against dated reference chronologies. No date was obtained for Newton 1 or Newington 1, but the ring

sequence from Newton 2 was very similar to numerous reference chronologies over the period AD 1435-1586 (Fig 3 and Table 2). Allowing 10 years for the minimum amount of missing sapwood gives a felling date some time after AD 1596. The timber is therefore not of monastic origin since it post-dates the dissolution of the monasteries. One possibility is that the structure was built in the AD 1620s during the time when the Earl of Craven bought into the town (J Clarke pers comm). However, it is also possible that the dated timber relates to work carried out for the Earl of Craven to replace or repair an earlier structure on the same site. Although it was originally intended to keep the remaining structure as intact as possible, it is now recommended that further samples are sawn from the boards at the north end to discover whether or not they support the date obtained for Newton 2.

The data from Newington Bridge will be kept in the Sheffield tree-ring databank where it will be tested against new chronologies as they are constructed. However, the relatively short ring sequence and the fact that it is a single timber lowers the chances of obtaining a reliable tree-ring date.

Conclusion

No date was obtained for Newington Bridge but the sill beam at Newton Mill was felled some time after AD 1596. Further sampling is strongly recommended to determine whether all the timbers from the mill structure are of the same post-medieval date.

Acknowledgements

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Figure 1: Newton Mill, Craven Arms (based on a drawing by K Clark and P Stamper).

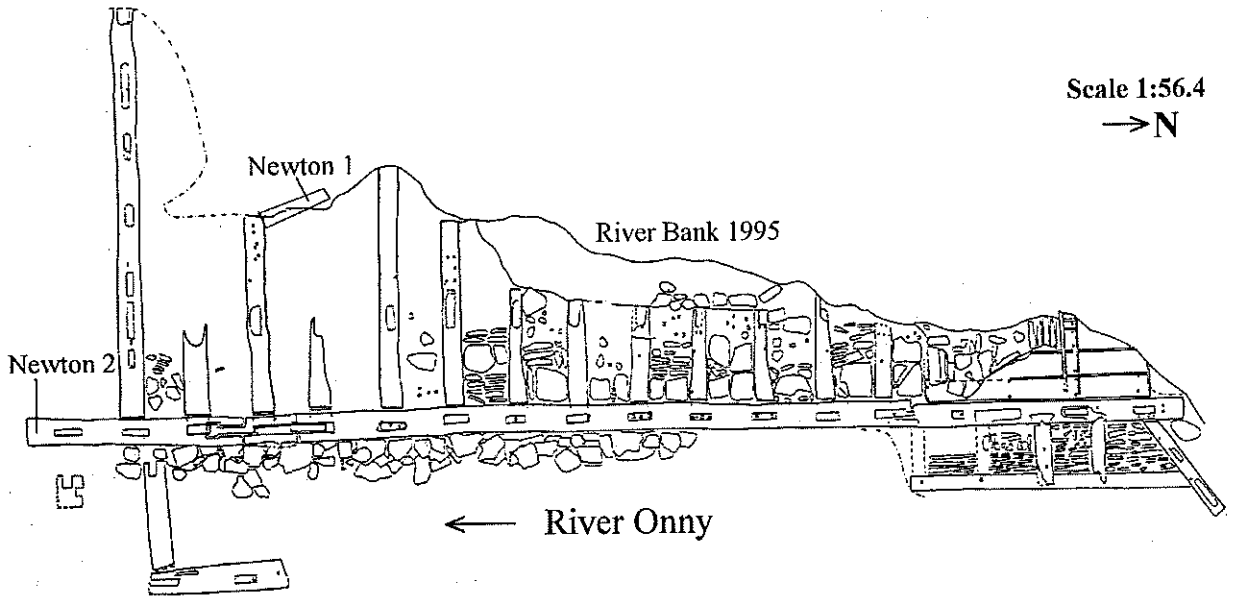


Figure 2: Newington Bridge, Craven Arms (based on a drawing provided by the Craven Arms Historical Society).

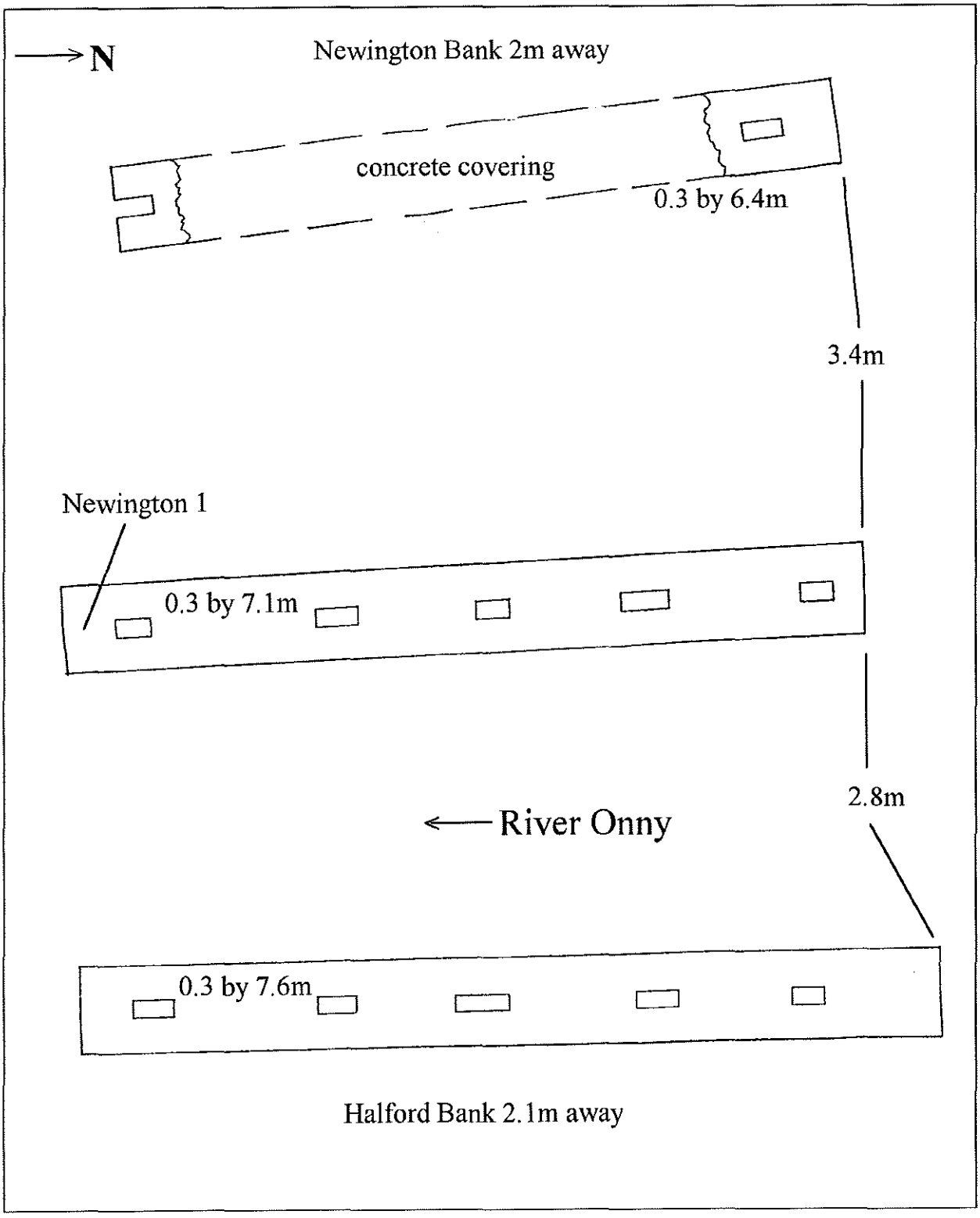


Figure 3: Matching tree-ring graphs. Newton 2 (thick line) compared to the chronology from the Welsh/English border region (Siebenlist-Kerner 1978). The two curves are very similar over the period AD 1435-1586. Ring widths are in units of 0.01mm and the vertical scale is logarithmic.

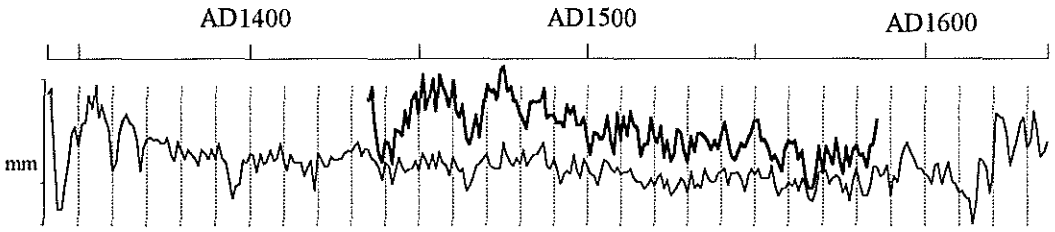


Table 1: Details of the tree-ring samples. All the samples were oak; none had sapwood. Sketches are not to scale.

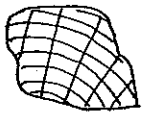
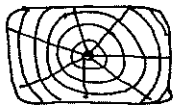
sample no	timber	no. of rings	ARW[1] (mm)	cross-section sketch	dimensions (mm)
Newton 1	loose timber by bank	68	2.40		255x200
Newton 2	main sill beam **AD 1435-1586; felled 1596+**	152	2.37		440x350
Newington 1	middle sill beam	88	3.47		420x360

Table 2: Dating the ring sequence of Newton 2 to AD 1435-1586; *t*-values with dated reference chronologies.

details of reference chronology	date span (AD)	*t*-value with Newton 2
Brookgate Farm, Shropshire (Miles and Haddon-Reece 1993)	1362-1611	6.8
Droitwich, Upwich 3 (Groves and Hillam forthcoming)	1454-1651	6.4
East Midlands (Laxton & Litton 1988)	882-1981	5.1
Exeter, medieval (Mills 1988)	1369-1616	6.4
Hereford City chronology (Tyers unpubl)	915-1617	6.4
Lancin Farmhouse, Somerset (Tyers 1994)	1374-1533	4.2
Sinai Park, Burton-on-Trent (Tyers unpubl)	1227-1750	7.3
Welsh/English Borders (Siebenlist-Kerner 1978)	1341-1636	7.6
Yorkshire buildings (Hillam unpubl)	1320-1696	5.1

[1] ARW - average ring width

Table 3: Tree-ring data from the two structures at Craven Arms. Ring widths are in units of 0.01mm; they should be read left to right, row by row.

a) Newton 1 - undated

450	301	254	315	342	467	603	396	482	427
374	211	286	264	237	355	396	324	244	295
249	266	241	310	263	287	266	218	232	153
135	185	229	222	162	184	200	155	177	173
200	221	164	165	150	148	177	180	169	180
237	261	176	113	144	172	181	230	148	175
189	183	150	147	148	170	194	204		

b) Newton 2 - AD 1435-1586

347	426	242	157	135	186	182	133	222	218
204	295	229	361	392	284	514	302	363	481
297	509	422	367	313	467	296	268	323	198
178	213	276	198	296	434	395	412	353	553
582	401	429	343	347	281	261	227	335	344
336	346	412	265	280	277	245	250	231	325
282	313	241	239	267	198	152	212	207	191
203	270	189	153	287	191	272	205	292	239
230	149	178	181	266	203	184	233	147	188
138	154	222	213	160	136	201	158	207	211
197	187	162	189	164	203	245	195	150	139
158	182	171	196	216	255	259	189	192	168
141	152	135	118	167	189	180	189	142	161
107	90	90	115	172	115	171	153	131	192
146	113	170	126	160	175	150	155	126	176
180	258								

c) Newington 1 - undated

331	249	216	361	350	393	493	635	650	742
636	459	417	366	612	485	557	498	571	315
156	83	82	89	119	396	473	595	476	698
333	424	267	151	159	138	253	494	395	204
433	480	347	453	393	144	247	478	355	529
466	566	386	383	406	404	399	532	355	503
258	298	155	237	501	366	302	267	184	144
112	170	231	183	307	335	177	113	152	211
257	395	261	283	184	262	290	278		