used all over SE. England[56] (even possibly in northern France). Certainly it may have been used elsewhere in London other than just the White Tower.

TIM TATTON-BROWN

NOTES

[40] *Medieval Archaeol.*, VIII (1964), 115–17.
[41] Pages 60–61. His account is largely based on Anderson and Quirk, see note 40.
[42] My interest in the stone was sparked off by a remark by Mr S. E. Rigold, and I am grateful to him, Derek Renn, Dom. Frederick Hockey, Margaret Sparks, F. W. Anderson, John Harvey and Richard Morris for commenting on an earlier draft of this article.
[43] See V. H. Galbraith, 'Royal Charters to Winchester', *English Historical Review*, 35 (1920), 382–400 — Charter IX for Bishop Walkelin's permission from William Rufus to use it (*c.*1087–98) at Winchester; and S. F. Hockey, *Quarr Abbey and its Lands* (1970), 2 and 118.
[44] Found in 1978 in the excavation of this now demolished church.
[45] See *Archaeol. Jnl.*, CXXVI (1970), 270–72. Mr Rigold suggests, in correspondence, that the church may be pre-Ernulf and the tower Ernulf.
[46] See F. R. H. Du Boulay, *The Lordship of Canterbury* (1966), 36–47.
[47] See the detailed contemporary accounts by the monk Goscelin: Migne, *Patrologia Latina*, CLV cols 15–62.
[48] A large piece of Quarr has even been found very recently (Nov. 1979) at the bottom of a hole for a scaffold post erected for the work on Ernulf's choir either in *c.*1100 or possibly in the 19th century (as yet unpublished excavations by the Canterbury Archaeological Trust).
[49] *Excavations at Canterbury Castle* (forthcoming, 1980). See sections by D. F. Renn and the present writer.
[50] Martyn Owen of the Geological Museum has kindly confirmed the Quarr stone finds in Canterbury, but has not yet examined the other finds in Kent.
[51] I am indebted to Brian Philp for allowing me to inspect the remaining portions of this great unfinished church in his excavations.
[52] Only William Rufus's Winchester Charter, see note 43, survives as documentary evidence for this, but other royal charters for Canterbury, Lewes, Chichester, Romsey, etc., must have once existed.
[53] See D. Sturdy, 'Nine Hundred Years of the Tower', *The London Archaeologist*, 3, no. 10 (1979), 270–73.
[54] See Hockey, op. cit. note 43, 59.
[55] Ibid., 118.
[56] As stone mortars, Quarr was exported to Sussex, Kent, Essex, Middlesex, Cambridgeshire, and Kings Lynn. See Dr Gerald Dunning's note in H. Clarke and A. Carter, *Excavations in King's Lynn, 1963–70* (1977), 327–29.

TREE-RING DATING: A REPLY TO D. J. SCHOVE

Many dendrochronologists consider a reply essential to correct some of the erroneous and misleading statements made by D. J. Schove in the last volume of this journal.[57] Archaeologists must not be left with the impression that dendrochronological dating is such a haphazard process ('dating . . . appeared to be the only possible one'; 'agreement . . . is only fair, but there seems to be no alternative') or is less reliable than radiocarbon dating. Schove's methods of dating on floating chronologies, particularly when this involves other people's data, are unacceptable.

From the start, Schove lists his failures and abandoned attempts at dating in an unpromising way. He uses phrases which are anathema to the dendrochronologist, such as 'visual agreement was not good'. The success of tree-ring dating is entirely dependent on the visual correspondence of the annual ring-width variations over 50 years or more, and if such matching cannot be found then accurate dating is not possible. A match is or is not correct — there are no alternatives. It is true that occasionally a tentative date is quoted which is subsequently proved incorrect; but further checks invariably indicate the correct match where there is a choice.

He quotes a previous warning that 'various methods of dating must often be used before certainty is attained' (p. 219). This is completely untrue. Dendrochronological dating is the most accurate method of all, and results override any possibly conflicting archaeological or other evidence. Archaeological and radiocarbon dating can only give a very rough guide as to the likely tree-ring date. A timber is often much earlier than the stratigraphic deposit in which it lies. Radiocarbon dating usually has such a high standard deviation, of more than $\pm$ 60 years, that its value is limited.

It is interesting that the computer programs we use to evaluate the quality of ring-width matches are unlikely to succeed in locating matches between places as far apart as

Old Windsor and Dorestad at the mouth of the Rhine (para. 1, p. 220). Yet at the end of the note (p. 221), Schove would like to link tree growth patterns in Asia Minor, Ireland and the USA. In fact there are many examples of correlations between oak growth in parts of Britain and in Germany,[58] and the non-appearance of a match with his data may only be the result of his inability to recognize it. A student's t value of 3.7 is not necessarily considered low, and several chronologies have been dated by interconnected series of t values of that order.[59] There is no reason to suppose any similarity in growth patterns of different tree species between continents except in a most general way.

All through the note, matches are conveniently found just where some new evidence suggests they ought to be ('. . . must be revised to fit and indeed a good fit is found . . .'); this is not the basis of the dendrochronological method nor what could be called 'turning the art into a science' (pp. 220, 221). Dating cannot be dependent on 'the more probable hypothesis' but on well-authenticated fact.

As already mentioned, radiocarbon dating cannot assume the importance attributed to it (para. 3, p. 220). Of course the radiocarbon results from Old Windsor fit both his 489 and 476 hypotheses because they have $\pm$ values of 74 and 78 years,[60] and thus a range of about 150 years even at one standard deviation.

Schove has had one example of success in dating the Great Coxwell barn[61] and this has evidently led him to assume the success of his technique when applied to any tree-ring chronology. One misleading assumption is that every curve can and will be dated. In fact some long high quality floating chronologies show no indication of match with available reference data, and we must simply be patient and hope that dating will eventually be achieved. It is nonsense to say that there is 'no alternative' to a series of matches (para. 1, p. 221) when there is a combination of many thousands of alternatives.

The attribution of a calendar date for the floating chronology of 282 years based on the Roman revetment timbers of the Thames in the City of London[62] is also misleading (para. 3, p. 221). Extensive comparative studies between this curve and the few available German reference chronologies for this period have revealed no definite matches. Only a relative framework has been established with several other local floating chronologies.[63] Archaeological evidence would suggest a late 2nd-century date, while radiocarbon dates cluster around the late 3rd century. Neither justify the late date given by Schove and the words 'appears' and 'assumption' lead to further misapprehension. Schove makes no mention of how he has dated the Roman curves plotted by Lowther cited in the previous paragraph; the examples I have seen look unpromising. We would be overjoyed if all our Roman curves could be connected and dated with the ease suggested here.

The final paragraph is particularly controversial; perhaps some of the evidence could be considered if the reasoning behind these statements had been published, but as far as I am aware it has not (the 1978 paper referred to here barely mentions tree-rings). How can we justifiably compare the growth patterns of Irish oak with Californian pine or Turkish juniper, for a prehistoric period for which at least one of the chronologies is not yet exactly dated?

As for Appendix 1, I would question the assumption that 'abnormal seasons would correspond with abnormal tree-rings' (para. 6, p. 221). Research into the potential of oak growth as a climatic indicator is now under way at Belfast, Norwich and Liverpool[64] and suggests a greater degree of sophistication. Naturally an unusually wet or cold season, for example, will affect growth but via many different channels depending on the time of year, and not necessarily in the calendar year concerned.

Very little value can be found in Appendix 2 because of its tentative nature, as with the other results which Schove is presenting here. If only he would await accurately dated tree-ring results from the various laboratories on which to test his hypotheses, he would receive far more co-operation and acclaim for his undoubted hard work. Meanwhile, premature anticipation of these may hamper the free exchange of data and thus the progress of dendrochronological research in the British Isles.

RUTH A. MORGAN

NOTES

[57] D. J. Schove, 'Dark Age tree-ring dates, A.D. 490–850', *Medieval Archaeology*, 23 (1979), 219–23; see also id., 'Cross-dating of Anglo-Saxon timbers at Old Windsor and Southampton', ibid., 3 (1959), 288–90; id., 'Dendrochronological dating of Old Windsor oak, A.D. 650–906', ibid., 18 (1974), 165–72; id., 'Summer weather in South-East England, 54 B.C.', *Weather*, 32 (1977), 314.

[58] For example, R. A. Morgan, 'Tree-ring dating of the London waterfronts', *London Archaeologist*, 3 (1977), 40–45; J. Hillam, 'Tree-ring analysis of timbers', B. Ayers, 'Excavations at Chapel Lane Staithe, 1978', *East Riding Archaeologist*, 5 (1979) (Hull Old Town Report Series, 3), 36–41; V. Siebenlist-Kerner, 'The chronology, 1341–1636, for certain hillside oaks from Western England and Wales', *Dendrochronology in Europe*, ed. J. M. Fletcher (Oxford, British Archaeological Reports, International Series 51, 1978), 157–61; J. M. Fletcher, 'Tree-ring chronologies for the 6th to 16th centuries for oaks of Southern and Eastern England', *Jnl. Archaeol. Science*, 4 (1977), 335–52.

[59] For example Hillam, op. cit. note 58.

[60] Calibrated Fletcher, op. cit. note 58.

[61] V. Siebenlist-Kerner, D. J. Schove and J. M. Fletcher, 'The barn at Great Coxwell, Berkshire', Fletcher (ed.), op. cit. note 58, 295–302.

[62] R. A. Morgan and J. Schofield, 'Tree-rings and the archaeology of the Thames waterfront in the City of London', Fletcher (ed.), op. cit. note 58, 223–38.

[63] J. Hillam, pers. comm.

[64] For example M. K. Hughes *et al.*, 'Climatic signals in British Isles tree-ring chronologies', *Nature*, 272 (1978), 205–206; J. R. Pilcher, 'A statistical oak chronology from the North of Ireland', *Tree-ring Bulletin*, 36 (1976), 21–27.

THE NEWCASTLE-UPON-TYNE CONFERENCE, 1980

The 23rd Annual Conference of the Society was held in Newcastle-upon-Tyne from 28 to 31 March 1980. The theme was 'Post-Conquest Northumberland: the archaeology of a Border County'. Members were welcomed by the Lord Mayor at a reception in the Mansion House and, after dinner, were addressed by Professor Geoffrey Barrow on 'Medieval Northumberland'. On 29 March the following lectures were given: Dr Philip Dixon on 'Military Architecture', Mr John Weaver on 'Aydon Castle', Mr Laurence Keen on 'Prudhoe Castle', and Mr Eric Cambridge on 'Church Architecture and the Border'; there followed visits to Aydon and Prudhoe Castles, as well as to Hexham Abbey where Dr Richard Bailey was the guide. In the evening members were received by Professor Martin Harrison, on behalf of the University of Newcastle-upon-Tyne, at a reception in the Museum of Antiquities. On 30 March Dr Brian Roberts lectured on 'The Northern Village' and Miss Barbara Harbottle on 'Medieval Newcastle', after which the members were guided round the city on foot. A full-day excursion took place on 31 March to Belsay, Elsdon, Brinkburn and Edlingham, under the guidance of Miss Harbottle, Dr Roberts, Mr Cambridge and Mr Graham Fairclough. The Society places on record its considerable gratitude to Miss Barbara Harbottle for her assistance in acting as local secretary for the Conference.

JAMES GRAHAM-CAMPBELL