

William Crabtree and the date of Easter

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A previously unknown treatise by William Crabtree (c.1603-c.1644) has recently been unearthed in the Lancashire Record Office. The treatise, in manuscript form and written in 1640, deals with the controversy over the long-term impact of the Julian Calendar – then in use in England – upon the ecclesiastical dating of Easter. By Crabtree's time, the timing of the Easter celebration in England was often several weeks adrift of the intentions of the early Church Fathers. The Gregorian Calendar, which Roman Catholic countries had adopted as long ago as 1582 in order to resolve the problem, was still vehemently resisted by the English state.

This is possibly the only surviving manuscript in Crabtree's own hand. In it, he displays noteworthy dispassionate objectivity as he outlines the astronomical basis for the Easter date and explains why it has gone awry.

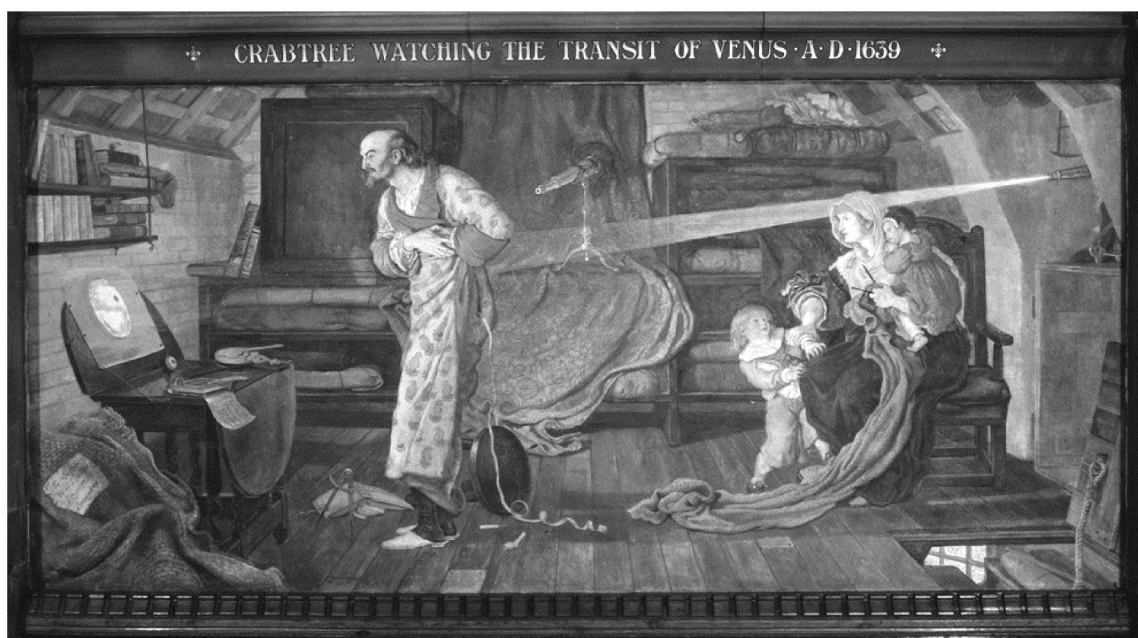


Fig.1 Crabtree watching the transit of Venus A.D.1639 – One of the twelve magnificent murals in Manchester Town Hall, completed by Ford Madox Brown in 1893, the year of his death. At the time of the transit, Crabtree would have been in his mid-thirties – somewhat younger than depicted here!

Image by Courtesy of Manchester Libraries, Information and Archives, Manchester City Council

Introduction

The astronomer, William Crabtree (c.1603 – c.1644) of Broughton in present-day Salford, is best remembered for the observation of the 1639 transit of Venus – the first to have been witnessed – that he and his friend Jeremiah Horrocks conducted. With each transit of Venus season – they occur in 8-year separated pairs no more than once a century – the story of Crabtree and Horrocks has been

retold and their memory has been reinforced. Horrocks considered his friend ‘a man who has few superiors in the mathematical sciences’, and yet very little of Crabtree's work has been published.¹ Indeed, very little of it has survived.

The only material potentially in his own hand hitherto known to have survived is of a non-astronomical nature: a Book of Rates for Lancashire,

and a plan of the Booth Hall Estate.² Recently however, a six-page treatise in his name, which has an astronomical theme and appears to be in the astronomer's own hand, has been found in the Lancashire Archives. The manuscript, entitled *A Discourse concerning the Moveable Feasts*, was brought to light as a result of researches by the Lancashire playwright, Eric Northey, for his play 'The Transit of Venus'.³ The play was premiered at Manchester's 24:7 festival in NW England in the summer of 2012.⁴

Calendar Reform

The manuscript in the Lancashire Archives, written during 1640, is a treatise on the date of Easter and its astronomical basis.

At the time, Protestant England was still using the Julian year – steadfastly refusing to implement the calendar reform instituted by the Papal Bull, *Inter Gravissimas*, of Gregory XIII in 1582. The ecclesiastical calendar being operated in England in Crabtree's time, and until 1752, was still essentially that decreed by the Council of Nicaea in 325 CE and modified in 532 CE by Dionysius Exiguus at the behest of Pope John I. The calendar reform of Gregory was viewed with great suspicion amongst the English Protestants – especially those of a puritan outlook. The mathematician, John Wallis, was typical in arguing, as late as 1699, that behind the proponents of calendar alteration there was

a latent Popish interest, which (under other specious pretences) sets it on foot; in order to obtain (in practise) a kind of tacit submission to the Pope's Supremacy, or owning his Authority. And though they be so wise as to say nothing of it at present (for the Bait is designed to Hide the hook till the Fish be caught,) they will please themselves to have gain'd de facto, what in words we disclaim.⁵

The Julian Year, Wallis claimed, was much more advisable than the Gregorian Year, 'which is a thing so notorious, that no Astronomer (who understands the Methods of Astronomical calculations) though a Papist, can be ignorant of; however they may please to dissemble it'.⁶

Nevertheless, by the mid-seventeenth century, it was a source of consternation to many that England celebrated Christmas 10 days later than Catholic countries and, more crucially from a doctrinal point of view, Easter and all the moveable feasts derived from it – such as Lent, Palm Sunday, Ascension Day and Pentecost – were celebrated at different times.

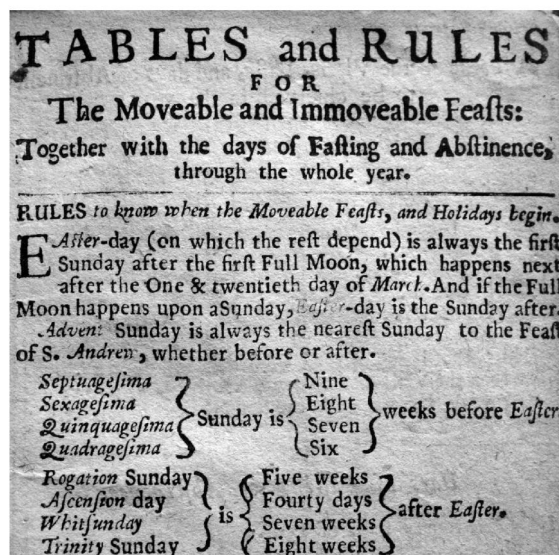


Fig.2 Rules for calculating the date of Easter and other feasts, in the Church of England's Book of Common Prayer – 1668 edition.

Image by D. Sellers

Courtesy of Leeds City Library

This 'crisis' of dating is the subject taken up by Crabtree, at the request of acquaintances, and he commences his *Discourse* by explaining that,

Forasmuch as a Rumor hath of late beene spread that the Moveable Feasts are not kept this yeare by the Church of England at the right tymes, but that all our Almanacke Wryters are mistaken therein, And thereuppon, many have inquired of mee what I thought concerninge the same, I thought it not amisse, briefly, to collect some few generall notes concerninge this occasion (though not in Defence of our Almanacke Wryters, many of whom I knowe to followe their Ephemerides like a blynd man his uncertaine guide).⁷

The basis of the Easter date

In order to have his readers understand how matters have become so problematic, Crabtree first of all explains the history of the process for assigning the dates of Easter. It is clear from the outset that the date has an astronomical basis. The Biblical account of the Passion places the Last Supper at the time of the Jewish Passover Feast. This feast was commanded to be on the evening of the 14th Nisan. Nisan was the first month of the Jewish year and it started on the day of the New Moon nearest to the vernal equinox. The Passover consequently was necessarily in Spring and was roughly halfway through a lunation – i.e. at the time of a full moon. The Crucifixion was on a Friday,

the day before the Jewish Sabbath, and the Resurrection, three days later, which Easter commemorates, was on a Sunday. Thus, already, the dating of future Easters was going to involve pretty difficult harmonization of astronomical periods which were basically incommensurable: in other words, the length of the tropical year (the period between successive vernal equinoxes) and the lunar month (the mean period between successive New Moons).

Nevertheless, as Crabtree puts it, 'soe it [Easter] might agree most seasonably with the tyme of the resurrection and be alsoe distinguished both from the Passeover of the Jewes & those Judiaized Christians – which in those days were called Quartadecimanall hereticks', the Council at Nicaea in 325 CE concluded that Easter should be on 'first Lord's day followinge the 14th day of the moones age in the first moneth (which moneth take beginning at the new moone next to the vernall Equinox).' Moreover, the Nicaean Church fathers, taking advice from mathematicians in Alexandria, deemed the vernal equinox to be fixed at 21st March. The quartadecimans, referred to by Crabtree, believed that Easter should simply be on the 14th day of the lunar month, regardless of the day of the week. For more detail on the origins of the dating, he directs the reader to the detailed exposition of St Ambrose (in his *Epistle to the bishops of Aemilia*) and to the lengthier treatise on *The Reckoning of Time*, by the Venerable Bede (c.673–735) – especially chapter

57, which gives a formula for finding the age of the Moon on 1st January (the Epact).⁸ Clearly, Crabtree had access to a good library.

Having 'fixed' the date of the vernal equinox, the next step of 'the Mathematicians present at the Counsell', according to Crabtree, was to establish a procedure for determining the dates of the full moons. This was facilitated by devising a

Decemnovenall or Paschall cycle consistinge of 19 numbers, which in continuall succession were attributed to every yeare ... These numbers in respect of their notable use were written in lettres of gould, afterwards called goulden numbers and of these (in Imitation of one Meton an Athenian who lived about the 86 Olympiad, with some little alteration and correction) they composed a Table (1 Copy whereof I have) wherein first setting downe the dayes of everie moneth, they soe disposed these 19 numbers unto the dayes of the moneths, that the number belonging to everie yeare should stand against the day of the moneth wherein the moone did change. And from hence, they gathered the tyme of the next newe moone to the Vernal Equinox (or 21th Marty) in everie yeare, from whence, accountinge 14 dayes inclusivelye, the next Lords day followinge was to bee celebrated for Easter day.

This was the method was later improved by Dionysius Exiguus, 'a Roman Abbott', in 532

1635.	ii	20	29. Jan.	2. March.	April. 17.	23.	26.	5. June.	27.
1636.	iii	21	14. Feb.	22. Feb.	9.	15.	18.	28. Mai.	3. Decem.
1637.	iiii	22	5.	7.	March. 25	30. April.	3.	13.	2.
1638.	v	23	21. Jan.	19.	April. 13.	20. Mai.	23.	2. June.	1
1639.	vi	24	10. Feb.	10. March.	5.	11.	14.	24. Mai.	29. Nov.
1640.	vii	25	2.	21. Jan.	25.	31.	3. June.	13. June.	28.
1641.	viii	26							

¶ The Golden number.

The Golden number is so called, because it was written in the Kalender with letters of Gold, right at that day whereon the Moone changed: and it is the space of 19. yeeres, in the which the Moone returneth to the selfe same day of the Sunne: and therefore it is also called the Circle of the Moone, in the which the Solstices and Equinoxials doe returne to all one point in the Zodiacue.

To finde it every yeere, you must adde one yeere to the yeere of Christ (for Christ was borne one yeere of the 19. already past) then divide the whole by 19. and that which releteth, is the Golden number for that yeere: if there bee no surpluse, it is then 19.

¶ Note that the Golden number and Dominicall letter doeth change every yeere the first day of January. Note also that the yeere of our Lord beginneth the xxv. day of March, the same day supposed to bee the first day vpon which the world was created, and the day when Christ was conceived in the wombe of the Virgin Mary.

Fig.3 The Golden Number explained and the feast days – at the time Crabtree was writing – in the Book of Common Prayer (1633 edition). The columns (1) the Year; (2) the Golden Number; (3) the Dominical letter; (4) Septuagesima; (5) the first day of Lent; (6) Easter; (7) Rogation week; (8) Ascension Day; (9) Whitsunday; (10) Advent Sunday.

Image by D. Sellers, courtesy of Leeds City Library

Easter adrift

By 1640, however, Crabtree explains, the English ecclesiastical calendar, still following Dionysius, ‘fals wyde of the intention of the Counsell in Celebration of the moveable Feasts, some tymes one some tymes 2 yea 3 4 & 5 weeks’. Consequently, he continues, ‘in 40 yeares last past wee have fayled in 19 and have Celebrated our Easter some tymes uppon the second Sunday after the second full moone after the Vernall Equinox as in the yeares 1603 1614 1617 and soe it wilbe againe in the next yeare 1641 if our account be not reformed.’

The disarray of the church calendar was, at root, due to stubborn astronomical facts that were not appreciated by the Nicaean Council and Dionysius.

‘True it is’, explains Crabtree, ‘that those Calendars of theirs, would have exactly shewed the dayes of the Lunations and the tymes of the moveable feasts in all ages, if that the Solar yeare had beene of the same quantitie which the Politicall year [has] which wee observe. And if that alsoe, the Lunations themselves did exactly returne to their pristine termes every 19 yeares. But neither of these are exactlie soe ... And therefore, it is that in processe of tyme, many little errors, heaped together, are now become apparent.’

The first problem was the discrepancy between the Julian year and the tropical year:

...our Politicall yeare, which wee observe, consists of 365 dayes & 6 howres, whereas the true Solar yeare containes but 365 dayes 5 howres 49 min...about 11 minuts less than the Politicall yeare ...

This value for the tropical year compares with the modern value of 365d 5h 48m 46s (Copernicus had assumed 365d 5h 49m 29s and the Gregorian calendar implied 365d 5h 49m 12s).

Secondly,

... the Paschall Cycle, ordayned by the Counsell of Nice & Dionisius, was not exactly answerable to the period of the moones meane Lunations. For the Moone returnes to her meane Luration in 6939 dayes, 16 howres, 32 min circiter, but 19 of our yeares contayne 6939 Days 18 howres. Soe that the Revolution of everie true Paschall Cycle, in that respect, comes short of our Civill Cycle 1 houre 28 min. And by this meanes, since the tyme of the nicene Counsell, the dayes of the moones true Lunations & the true seates of the Goulden numbers, are anticipated above Foure dayes before the dayes whereupon they fell in those tymes.

Most of Crabtree’s contemporaries would have turned to one of the massively popular almanacs for enlightenment about calendrical matters (by the 1660s, one family in three was buying an annual almanac).⁹ They would have looked in vain he claims, however, for any explanation related to the errors introduced by the second cause: the lunar motion.

The former of these causes hath beene touched by some of our Almanacke wryters and amonge the rest by my Friend & Countreyman Mr Booker, but the latter not taken notice of by anie of them, that I have seene, though many tymes (if they understood it), this hath not the lesse share in causinge the difference, as I could shew at large if I had an Artist to heare mee.

John Booker (1603-1667), whom Crabtree interestingly describes as his friend, was a celebrated astrologer and almanac compiler – ‘the greatest and most compleat astrologer in the world’, according to William Lilly in 1640.¹⁰ In his 1641 *Almanack et prognosticon* he did deal with this second cause.¹¹ In 1664 he went on to produce an in-depth treatise on the date of Easter.¹² Booker was a contemporary of Crabtree and may even have been a fellow pupil at the Manchester Grammar School.¹³

The slippage of the date of Easter from its true position, as a result of these causes, could only get worse:

Neither will this inconvenience (if it be one) stay where it is, but as it hath by little and little come to this, which we see, soe (if it bee not reformed), it will proportionallie increase still.

It is worth noting that the phrase ‘if it be one’ presages Crabtree’s ambivalence to the importance of such an anomaly.

The problem had been recognised at least since the mid-fourteenth century – for example, Pope Clement IV in 1345 wrote to John of Murs and Firmin of Belval, seeking their advice on the correction of the calendar.¹⁴ The solution, if one was desired, had long since been found and implemented, at least beyond English shores:

This imperfection of the Julian or Dionisian account (though not then soe great) was perceaved and complained of 300 yeares since. And in tyme reformed in the Roman Church by the authoritie of Pope Gregorie the 13th, Anno Chr 1582 by the helpe of Aloysius Lilius and Christopherus Clavius, and ten dayes added to the number of the dayes of the Julian moneth. Soe that day which is the 11th

Days	Jan.	Feb.	March	April	May	June	July	August	Sept.	Octob.	Nov.	Dec.
1	9		9	17	17	6				11	19	19
2		17			6	14	14	3	11		8	
3	17	6	17	6			3			19	8	8
4	6		6	14	14	3		19	8		16	
5		14			3	11	11	19				
6	14	3	14	3			19			16	5	5
7	3		3	11	11	19	8	16	5		13	
8		11		19	19	8	8	16	5	13		
9	11	19	11	19	8	16	16	5	13		2	2
10			19	8	8						10	10
11	19	8					5	13	2	2	10	
12	8	16	8	16	16	5				10		18
13				5	13	13	2	10			18	7
14	16	5	16	5			2	10	18	18	7	
15	5		5	13	13	2				7		15
16		13			2	10	10	18	7		15	
17	13	2	13	2			18	7		15	4	4
18	2		2	10	10	18			15			12
19	10			18	7	7	15	4	4	12		
20	10	18	10	18			15			12	1	1
21	18		18	7	7	15		4	12			9
22		7			15	4	4	12	1	1	9	
23	7	15	7	15			12			9	17	17
24			15	4	4	12		1	9			6
25	15	4			12		1	9	17	17	6	
26												
27	4		4	12		1	10	18	7	6	14	14
28	12	1	12		9	17	6	14	14	3	3	
29	1		1	9		17	6	14	3		11	11
30					17	6	6	14				
31	9		9				14	3		11		10

Fig.4 A table of Golden Numbers – said to be valid in the New Style calendar until 1900, from the 1778 edition of James Ferguson's *Astronomy Explained*.

Image by D. Sellers

of our moneth is the 21th of theirs, whereby they have brought the Equinoxes neare to the same day of their moneth which they fell uppon at the tyme of the Counsell of Nice. And by the helpe of the Epact have reformed the seates of the Lunations in the Paschall Cycle and ordained the omittinge of certain Leape yeares, (viz) in the yeares 1700, 1800, 1900, 2100 etc., omittinge three Leape yeares in 400 yeares, whereby their Calendar for keepinge

the moveable Feasts, will hold without sensible errors for many hundred yeares.

The argument that the adding of 10 or 11 days to the date in the English calendar, so as to match the Gregorian one – i.e. a one-off deleting of this number of days from a given month – might then ‘breed a confusion’, Crabtree dismisses, saying that ‘confusion (if anie) would be onlie once’.

In any event, he claims, there is ‘a middle way’, avoiding the insertion of extra days. The ecclesiastical calendar could be so reformed that

by the Epact & Golden number, newlie therein inserted and certaine Equations to bee there unto annexed, the moveable feasts might bee certainly designed, in their due tymes, as at the first institution, without sensible error for many hundreds of yeares, and yet, the dayes of our moneths bee numbred still as they are, As I doubt not is knowne by authoritie, if they thought fit, soe to alter our former Calendar.

Presumably, this would have left the English calendar at odds with the Gregorian one, but with the requisite link of Easter to astronomical phenomena more credibly secured.

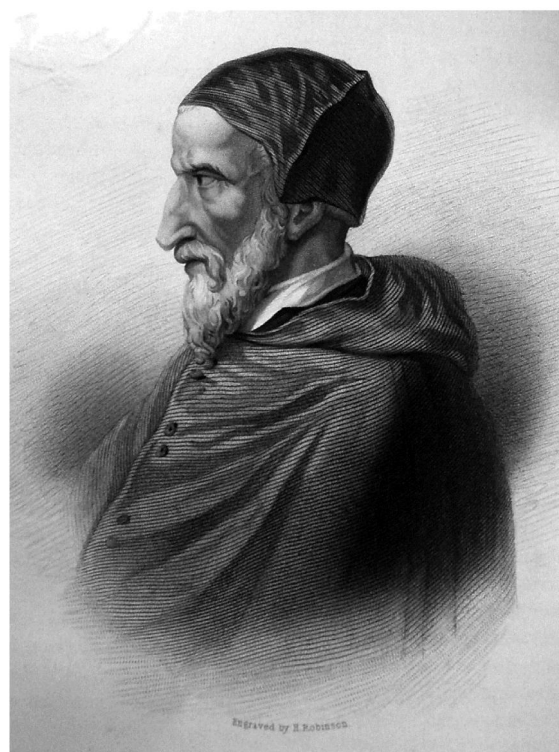


Fig.5 Pope Gregory XIII.

A History of the Popes of Rome
by Leopold von Ranke (1850)
Courtesy of Leeds City Library

Origin of the discourse

Why did William Crabtree write this treatise? It seems reasonable to take his explanation at face value: He was prevailed upon by acquaintances, in view of his expertise in the 'mathematical sciences'. He himself is not campaigning for a change. Nor is he strongly defending the status quo. He does not seem too concerned about whether or not the date of Easter, together with all the associated feasts, is correctly computed.

In the meane, for Conclusion, I say that though our moveable Feasts here in England be not kept at such tymes of the yeare, in respect of the Suns Course as by the Nicens counsell was appointed or intended, yet are they designed and kept by the same Rules which our state hath ever observed.

And in that respect our Church differs not from her former customes, nor our Almanacks from their accustomed formes. And thus hoping that these

few lines may give satisfaction to some and, rightlie understood bee offensive to none, I submit my selfe & them, to the Candid Censure of indifferent Judgments, And rest, Frend to all ingenious Artists, Wi: Crabtrie

This stance seems to confirm the longstanding supposition that Crabtree was from the protestant section of the community, since a Roman Catholic would hardly have viewed the alternative calendars with such equanimity.

Is the manuscript in Crabtree's own hand? It is possible, of course, that it, the two surviving *Books of Rates*, and the Booth Hall Estate map are all simply copies of originals. Each one is in a different script. However, the existence of marginal notes in several places, apparently by Crabtree, suggest that this is the author's own draft of the treatise.

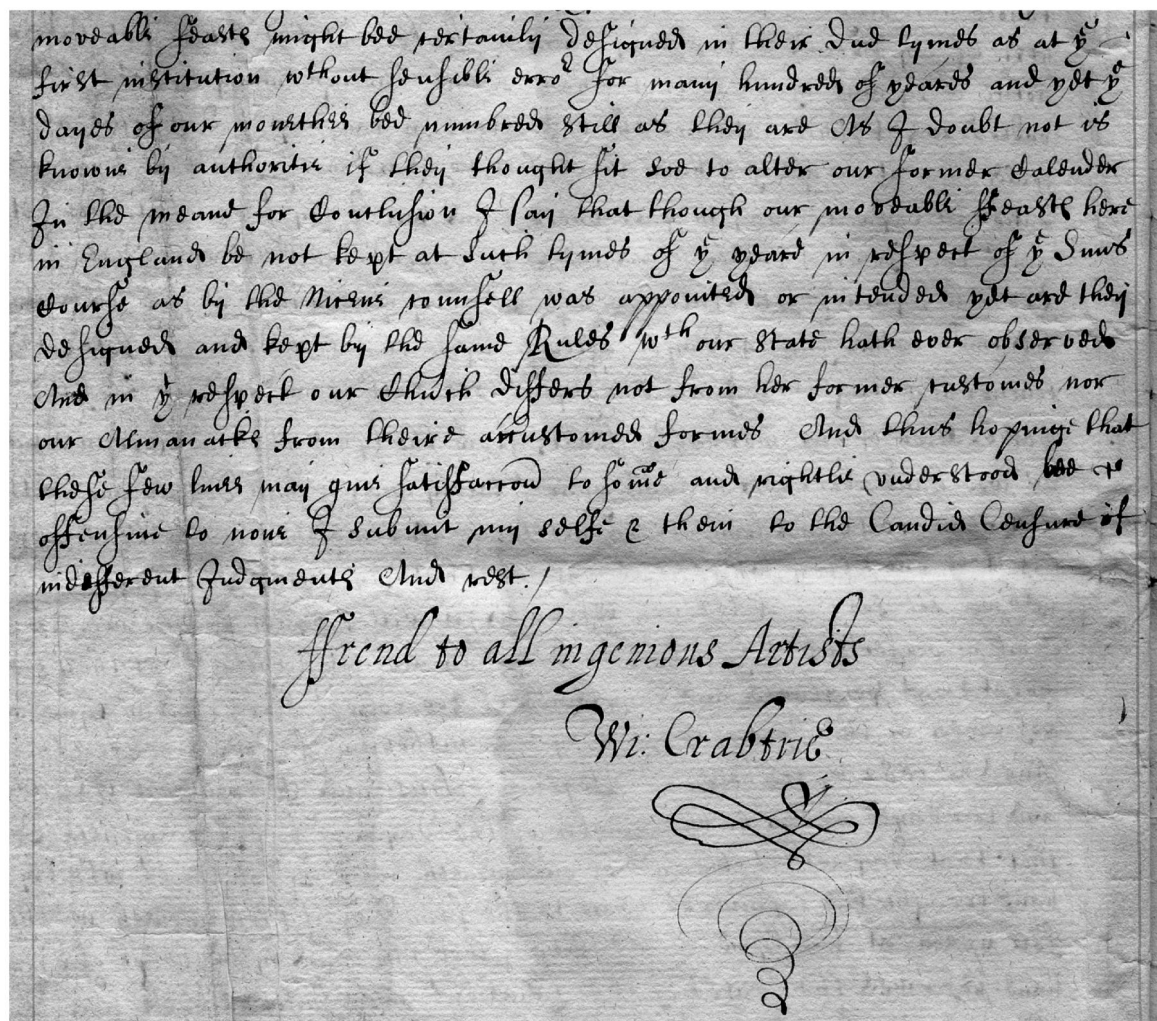


Fig.6 An extract from the final page of Crabtree's *Discourse concerninge the Moveable Feasts*.

From the Kenyon Family of Peel Hall collection, Lancashire Archives (ref DDKE/Box 36/11).

Reproduced by kind permission of Lord Kenyon.

How did the manuscript come to be in the Kenyon Family of Peel Hall Collection at the Lancashire Archives? There is a good chance that it was Dr Richard Wroe (1641-1718), Warden of the Collegiate Church in Manchester, who discovered this treatise and that it found its way - upon his death via his third wife, Dorothy Kenyon - into the estate of the Kenyon family. Flamsteed, the first Astronomer Royal, believed that Wroe was a 'neighbour' of Crabtree; though he was a child when Crabtree died.¹⁵ Presumably this merely meant that he lived in the same locality or region. Nevertheless, it was Wroe who helped John Worthington (his former university tutor) in the search for surviving Crabtree-Horrocks papers that ultimately prepared the way for the Royal Society's publication of Horrocks's *Opera Posthuma* (1672).¹⁶



Fig.7 Dr Richard Wroe (1641-1717/8),
Warden of Christ's College, Manchester.
Palatine Notebook (Jan 1882), p.1

Like many churchmen of his day, Wroe had wide-ranging interests - including ones of a scientific nature. A tiny notebook in the Kenyon family collection reveals that he was familiar with some of the most important astronomical texts of the time. In the notebook, in Wroe's careful hand, is a list of books and their purchase price.¹⁷ It is not clear whether these were purchased, or to be purchased, for his own use or

to stock a library with which he had a connection (e.g. Chetham's), but they include works by Kepler, Harriot, Longomontanus, Lansberg, Ramus, Scheiner, Clavius, Schöner, and other notable astronomers or mathematicians.

It is possible that Wroe came across the Easter discourse following the search for Crabtree material instigated by Worthington. At any rate, he had a personal interest in the astronomical basis of the Easter date. Indeed, he had corresponded with Flamsteed about it in February 1671, for it was still a matter of controversy in England long after the death of Crabtree.¹⁸

Conclusion

There is, of course, little that is original in Crabtree's discourse and he does not claim to be doing any more than giving the reader a dispassionate technical explanation of the Easter dating issue. The chief interest of the manuscript is its very existence - as the sole known astronomical manuscript in Crabtree's own hand - and the non-partisan nature of his treatment, testimony to the modest and courteous style that is so evident in his known correspondence with Gascoigne and Horrocks.

Acknowledgements

I would like to thank the following: Eric Northey and Kathryn Rooke for locating the Crabtree discourse; Kathryn also for her excellent transcription, which was a useful reference; Costel Harnasz for bringing the manuscript to my attention; Mike Frost and Canon Albert Radcliffe for valuable comments on the draft of this paper; Phil Wilde (Leeds City Library) for picture research; and Lord Kenyon for permission to photograph the manuscript and to reproduce an extract here

Notes & References

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2. Chetham's Library (Manchester), Mun.A.7.31, *Book of rates for the county pallatine of Lancashire ... compiled and published for the generall good and benefite of the whole county by W. Crabtree*. A further copy is held in the collection of Western Manuscripts at the British Library (Lansdowne MS

- 907), but this is in different handwriting; Manchester Libraries, Information and Archives, GB127.MS ff 912.4273 C3, *A true plott or topographicall description of one messuage and tenement of Mr Humfrey Booth's lying in Blakeley in the Countie of Lancaster* (1637). See also, Ernest Axon, *William Crabtree's Plan of the Booth Hall Estate*, Transactions of the Lancashire and Cheshire Antiquarian Society, xxiii (1905), 30-33
3. Lancashire Archives, Kenyon Family of Peel Hall collection, Miscellaneous religious records (reference number *DDKE/BOX36/11*)
 4. *The Transit of Venus*, by Eric Northey, directed by Alyx Tole, music by Christopher Cotton.
 5. John Wallis to the Archbishop of Canterbury, June 13, 1699, *Philosophical Transactions of the Royal Society*, xxi, 345
 6. *Ibid.*, p.347
 7. *Crabtree's Discourse*, f.1r (modern punctuation and spelling has been added sparingly for ease of reading and to avoid ambiguity). Parentheses in the quotations are Crabtree's own. Interpolations in square brackets are by the author of the present paper
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 9. Capp, Bernard, *Astrology and the Popular Press: English Almanacs, 1500-1800*, (London, 2008), 44
 10. Parker, Derek, *Familiar to All: William Lilly and Astrology in the Seventeenth Century* (London, 1975), 89.
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 14. North, John D. 'The Western Calendar', *Gregorian Reform of the Calendar: Proceedings of the Vatican Conference to commemorate its 400th anniversary* (ed. G.V. Coyne, M.A. Hoskin and O. Pederson, 1983), 84-5
 15. Letter from Flamsteed to John Collins (13 Aug 1672), *The Correspondence of John Flamsteed*, v1, ed. E.G. Forbes, L. Murdin & F. Willmoth (Bristol and Philadelphia, 1995), 181
 16. Letter from Wroe to Worthington's son (25 April 1712). *The Diary and Correspondence of Dr John Worthington*, ed. James Crossley (Manchester, 1847), 383. Wroe says "I was also imployed by [your fater] near 50 years ago, to make some inquiry, after the papers of two remarkable men of this County, both Mathematicians, Mr Horrocks, and Mr Crabtree"
 17. Lancashire Archives, Kenyon Family of Peel Hall collection, The Collegiate Church, Manchester and Chetham's Library (reference number *DDKE/BOX 123/3*). Notebook of William Wroe. In a letter of 5 Oct 1959 to Lord Kenyon, the County Archivist, R. Sharpe France, said 'I have compared the writing [in the notebook] with the Will of Richard Wroe and feel fairly certain that the notebook is in his hand.'
 18. *The Correspondence of John Flamsteed*, v1, ed. E.G. Forbes, L. Murdin & F. Willmoth (Bristol and Philadelphia, 1995), 78-80

The Author

David Sellers (david.sellers@ntlworld.com), a retired flood defence engineer, is the author of *The Transit of Venus: the quest to find the true distance of the Sun* (Leeds, 2001), co-author of *Vénus devant le Soleil* (Paris, 2003), and recently published *In Search of William Gascoigne: seventeenth century astronomer* (New York, 2012). He is currently researching the life and work of Gascoigne's friend, William Crabtree.

