

Addressing the claim that the Defynnog yews in Powys may be 5,000 years old

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Abstract

A pair of yews in the northern section of Defynnog churchyard (Powys, Wales) is claimed in The God Tree (Fry 2012) to be 5,000 years old. DNA evidence confirms that the two yews are genetically identical. Fry's argument rests on the suggestion that the yews are fragments of the trunk of one large prehistoric yew.

In this paper it is shown that the ground plan of the yews in question and particularly the distance between them precludes that possibility. Instead the smaller of the two yew specimens has probably layered from the larger one. Such dendrochronology and growth rate studies as have been carried out to date suggest that the yews are likely to be half to one third of the age claimed by Fry.

The claim

The claim of an age of 5,000 years for two of the Defynnog yews made by J. Fry in her book *The God Tree* (1), ratified by the Conservation Foundation and researched by Allen Meredith is immensely suspect. A booklet also exists, undated and with no author attribution: *The Defynnog Yew: the Oldest Tree in Wales Perhaps in Europe* (2); and the content is reported as being similar to the matter in *The God Tree*. The evidence presented by Fry is not couched in botanical terms, but relies largely on diffuse historical and mythical conjecture. The one piece of scientific evidence, a DNA test matching the two trees concerned does not exclusively prove any part of the case. The AYG has received repeated requests for clarification of our position on Fry's ageing, and it has become essential to produce this work.

The flawed basis and uncritical propagation of the claim

What has occurred is a collision between a quasi-religious belief and observable fact. It is perfectly acceptable to believe things which are unfalsifiable; human understanding is informed by both belief and knowledge; the problems begin when quasi-religious ideas are put forward as the basis for making assertions which properly lie within the realm of science and firm reality. It is necessary here to draw the line between knowledge and conjecture.

The vector for this error is to a large extent the press who reported the claim made in *The God Tree* as if it were intended to be an accurate scientific discovery instead of the product of an admittedly fascinating tangle of mythical supposition. For instance The Daily Telegraph (08/07/14) reported: "The yew, in a churchyard at Defynnog...is more than 5,000 years old,

according to tree dating experts. Scientists have run DNA and ring-dating tests...” The Telegraph’s presentation of the nature of the core evidence was faulty, creating the illusion that scientists are able to date yews, and that by extension the date of 5,000 years was a firm scientific finding, although Clive Aslet’s later article in the Telegraph (09/07/14) was more balanced. The Times and other publications made similar errors.

Why disagree?

There are concerns from Welsh authorities that damage is already being done to the trees at Defynnog as a result of their sudden fame, which has caused the number of visitors to rise dramatically. Attempts to take wood from the trees have been suspected (the very reason why a wall had to go up around the Fortingall yew in Perthshire: in order to prevent it disappearing completely at the hands of souvenir hunters), and it is certain that soil compaction will increase over the root system. If the soil compaction issue is not addressed then any or all of the four significant yew trees on the site could realistically go into decline and eventually die – if they are not picked to pieces first by individuals who want a souvenir from the trees Fry considers to be scions of the “original Tree of Life”. The Ancient Yew Group fights the cause for these ancient yews, and this deconstruction of the spurious claims associated with the Defynnog yews is part of that attempt at protection.

The DNA evidence



Larger Defynnog yew – girth 1106cm



Lesser Defynnog yew –girth 629cm

The DNA testing of these two yews which are alleged to be the remaining parts of a single vast yew was an intrinsically valuable exercise, but was insufficient for proving the argument that they were both once parts of a single bole as it also supports a different and far more likely explanation.

Yews quite often layer from branches which are allowed to touch the ground, creating a new and smaller bole near the original trunk. Both boles can go on to thrive as individual trees when all trace of the connection between them has gone, as at Tandridge churchyard in Surrey. It is extremely likely that this is what has happened at Defynnog. Another hypothesis suggested by Peter Norton is that for various reasons cuttings could have been taken from the larger yew, and this also meets the case.

When Tim Hills visited the Defynnog yews in 2005 he discovered a single male branch on the largest female tree. Perhaps geneticists might ponder whether self-fertilisation is a possibility on yews containing both sexes and how this would show up in a DNA test.

In short, the fact that the two yews are genetically identical proves nothing about the shape of a supposed original trunk, or its age. A particularly appropriate illustration of the kind of layering described above is to be found at Langley Park in Buckinghamshire:



Langley Park Yew in 2006 showing layering in the early stages, and at an identical distance from the main trunk as that at Defynnog. The twin trunk layout of the layering is also similar.

Ageing the Defynnog yew (AYG)

I do not propose to put forward the AYG's age analysis for the largest Defynnog yew and its smaller clonal companion as a competing idea to Fry's claim in this work, although my estimate here can be seen as a provisional alternative. The AYG ageing for these trees is work in progress, and the argument over the 5,000 year ageing can be settled using logic and firm evidence that already exists. It is extremely important to be clear that although many yews have ages given by one authority or another, and some reasonable suppositions have been made, no-one genuinely knows the exact ages of yews like this.

Yew ageing is an exceptionally difficult and cursed branch of enquiry, and the field of knowledge is very much open to imaginative and flexible dendrologists.

Despite the dispute over the age of the Defynnog yews let us be under no illusion about their importance. The debate is not about that. It is about evidence. The trees are very ancient and of international significance. The largest is 10 metres (1006 cm) at its minimum girth at ground level (Tim Hills 28/09/2014 survey). That gives a projected age on the hard evidence currently held by the AYG of a minimum 1,300 years. That is not the correct age however, merely a graphic and broadly linear extrapolation from firmly known ages of a large number of smaller yews up to 600 years old. The processes which a yew goes through in order to reach such a size and fragmented state are only now beginning to be fully investigated, and relate to Hindson's "stages of growth" illustrated in F. Hageneder *Yew - A History* (3).

So there are also other strands of evidence not yet taken into account, specifically those strange changes in the rate of trunk increase noticed at different stages of the yew's life history. These are being quantified by way of "reference stream" data: time lines of many individual trees which show how fast yews of varying morphologies and sizes typically grow; and once these indicators have been fully worked out and published then the AYG will be in a position to be more specific about the likely ages of individual ancient yews. At present the best evidence we have, official and unofficial, implies that the largest girthed Defynnog yew might have begun growing during the Iron Age: so it may quite possibly be over 2,000 years old, but is very unlikely to be as much as 3,000.

There are actually four significant yews at Defynnog churchyard, the clonal pair which are in question and two others. All four trees were included in the DNA study, but the two further yews proved not to be part of the clone group. Peter Norton's hypothesis that the smaller yew of the clonal pair is a cutting would have become the most likely scenario if they had been, although who might have done the propagation (or why) would have remained a matter of conjecture.

Comparison with the Fortingall yew

The yew at Fortingall has for many years been regarded as the oldest in Britain. The yew at Defynnog has now come into competition with it for the title, so it is useful to use Fortingall as a basis for comparison in order to highlight some problematic issues with the Defynnog claim.

To briefly introduce the known accounts of the Fortingall yew; it was given an age of 5,000 years by Meredith in *The Sacred Yew* (4) and that number has somehow stuck, however, no evidence has in fact been presented to support the claim. Moir's very conservative empirical graph (5) (Appendix) would yield an age of 1,800 years if extrapolated, and Lowe in his work *The Yew-Trees of Great Britain and Ireland* (6) tells us that Augustin de Candolle gave an age of 2,500 to 2,700 years based on ring density - that was in 1770, so the yew would now be approaching 3,000 years in age at that rate provided that it is (as the evidence available at present suggests) a single fragmented trunk comprising two remaining sections.

A reasonable provisional age estimate for the tree on that basis would be in line with de Candolle at approximately 3,000, and because of the progress of AYG growth rate studies carried out to date we can calculate, using the above assumptions, that it did not begin growing in the last two millennia.

The main difference between the cases for very extreme age for Defynnog and Fortingall is that in the instance of Fortingall physical evidence does exist that the pair of tree fragments, seen below from 1774 to the present day, were once parts of a single tree.

Fortingall Yew drawn by Pennant in 1774



Fortingall yew in 1822 by Strutt



the layout of the tree at Fortingall shows the old interior of the tree on both fragments facing their common origin, the old centre of the bole, whereas the Defynnog yew does not.



A more recent photograph of the two Fortingall fragments

Secondly, there is excellent historical evidence relating to the Fortingall yew covering the loss of the connection between the fragments, as well as the aforementioned contemporaneous measure by Augustin de Candolle, a renowned botanist of his day; clearly these two individuals are part of one old bole. No such evidence exists at Defynnog. One can be quite sure that if the two Defynnog yews were once one tree, a yew of such a size would have been noted by some diarist or commentator: if the two trees are considered as parts of a single bole then the whole tree would describe a notional circle no less than 32 metres (over 100 feet) in circumference, and that assumes the fragments happen to be directly opposite one another on the supposed original bole. If they were not, then the circumference would have been larger still. Such a specimen would have certainly been recorded somewhere, it would have been the largest yew tree or perhaps tree of any sort ever seen in the British Isles.

The 5,000 year age bracket is not viable for either yew. The evidence presented to support either claim is entirely insufficient, although considering all of the available hard data the Fortingall yew is certainly the older tree by a substantial margin.

A lack of coherence in the Defynnog claim

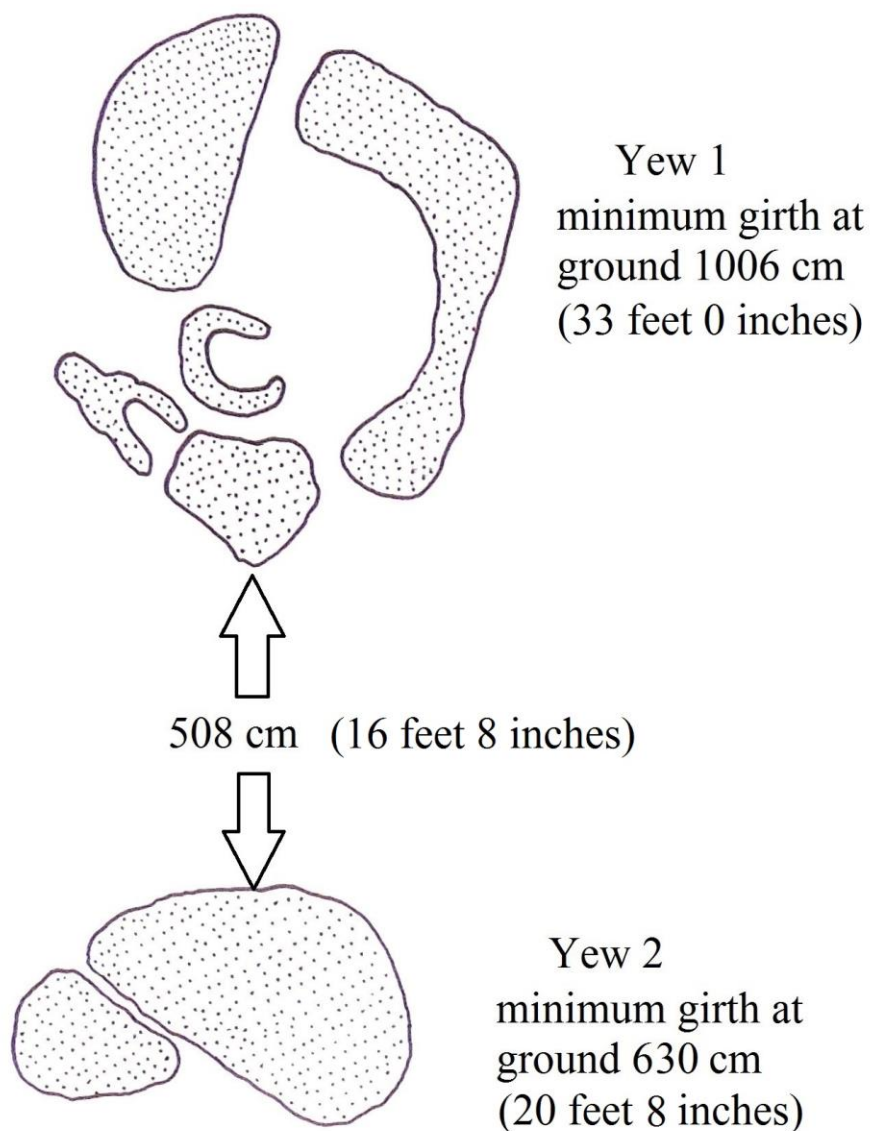
Entering for a moment into the argument presented in *The God Tree*, and pretending that we believe the Defynnog yews to be fragments of one yew in order to assess the credibility of the claim, it is useful to think about issues related to the ground plan of its two trees.

Let us consider the possibility of Fry's claim that there was once a primordial yew of unimaginable size, and that the yew was damaged, creating separate sections. This would have had to happen so long ago that the original yew has not been a single huge entity during recorded history. The newly created fragments continued growing outwards from their new individual centres, rounding themselves off with flows of cambium over gaps, splits and dead wood.

This idea is intuitively attractive, but it can't work mathematically. Whatever growth criteria are applied, the same mathematical incongruity described below occurs.

Applying the fieldwork: from a dedicated site visit by Tim Hills on 29/09/2014

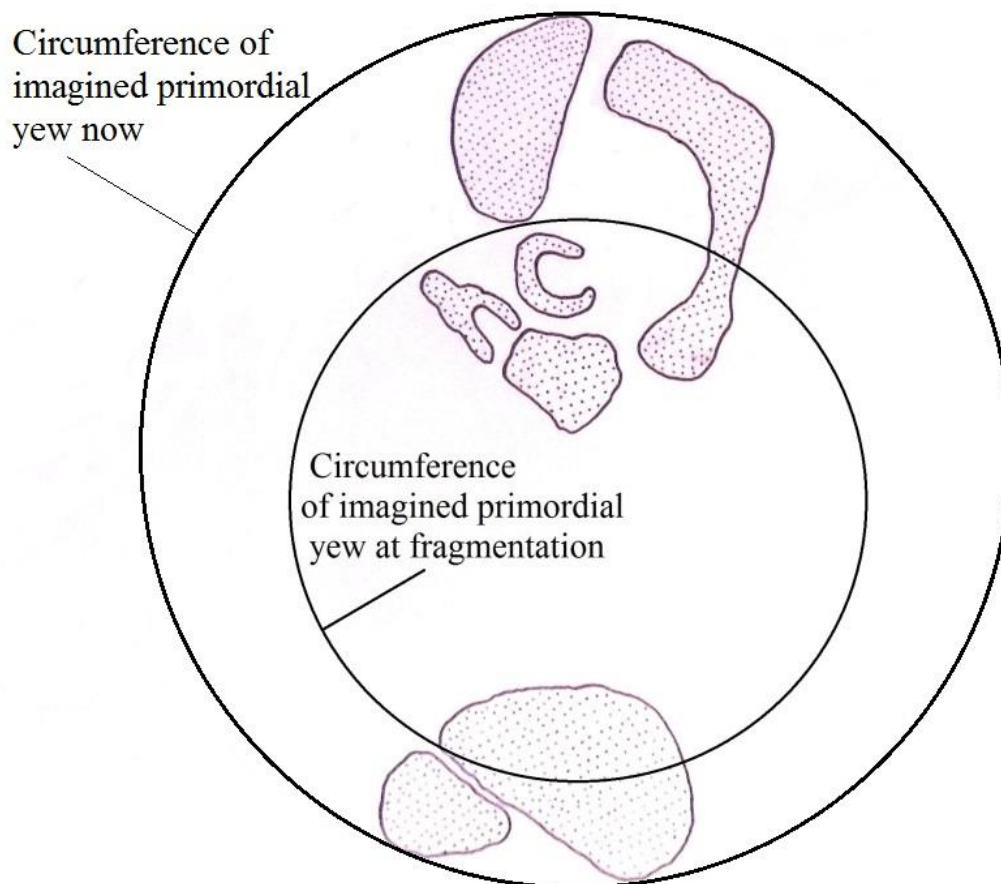
The Defynnog yews- plan view



After Tim Hills 29/09/2014 survey

*Ground plan of the two Defynnog yews showing where existing trunk sections touch ground
(from field sketch, not scaled)*

The Circumference of the imagined yew

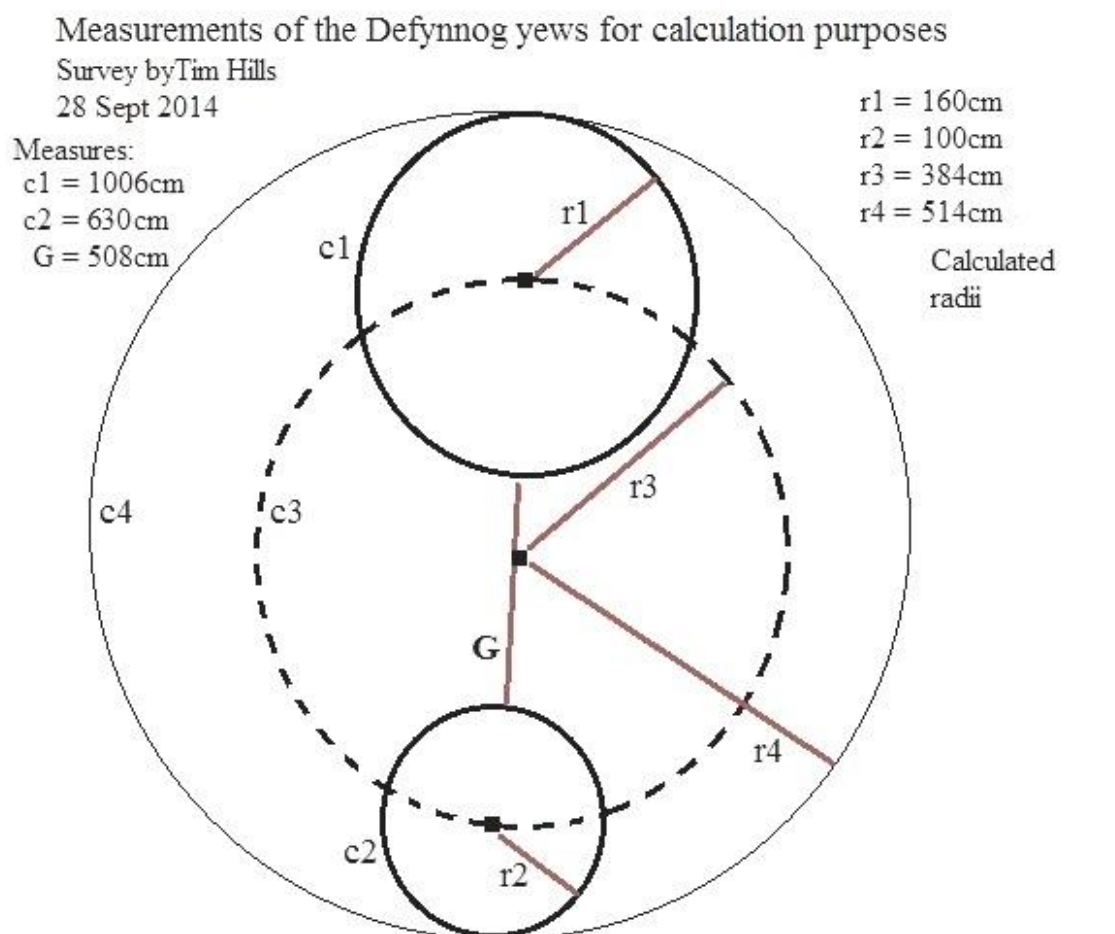


*Envisaging the imagined primordial yew
(from field sketch, not scaled)*

Each of the two trees in question has a centre from which they evidently grew, the larger one having started growing (quite possibly) in the Iron Age. These centres, if a circle is drawn through them to represent the yew bole as it was when it fragmented imply a notional bole with a girth of about 24 meters. That, as before, assumes that the two “fragments” were directly opposite one another on the bole. The inner circle on the diagram represents this 24 metre girth bole. The outer circle represents the circumference of Fry’s imagined yew if it were intact now.

Calculations

Method of finding a notional girth of the imagined primordial yew at two separate stages.



$r3$ is the notional radius of the imagined primordial yew at fragmentation. $r1$ and $r2$ are the calculated radii of the existing yews. $r4$ is the notional radius of the imagined primordial yew as it is now. G is the shortest distance between the existing yews.

Finding $r3$ and $r4$	$r3 = \frac{G+r1+r2}{2}$	$r4 = \frac{G+r1+r2}{2}$	where $r1 = \frac{c1}{6.28}$ and $r2 = \frac{c2}{6.28}$
Finding $c3$ and $c4$	$c3 = 6.28 \times r3$	$c4 = 6.28 \times r4$	Circumferences of the imagined primordial yew

These calculations give a picture of a yew that fragmented at a girth of 24 metres and has now grown to the point where a complete tree would be 32 metres in circumference.

If the supposed primordial yew fragmented at a time when it had a girth of 24 metres or more, perhaps 2,000 years ago (a reasonable working estimate of the age of the larger existing yew) it would make the projected growth rates of the supposed primordial tree impossibly high by Fry's own logic. If Defynnog's largest yew now standing has grown to 10 metres girth in perhaps 2,000 years then we have to consider just how much longer than

this it might have taken its clonal parent to reach 25 metres in circumference. Even if the calculation is made in a conservative way the layout of the trees would make this primordial yew an uncertain but large number of millennia older even than the 5,000 years that Fry needs for her narrative to make any sense.

The creation of a growth scenario to fit the ground plan, and achieve the suggested 5,000 year age works adequately only if Moir is correct that yew girth increase is broadly linear through time. He finds that the rate is an average of about 1 cm increased girth per annum. His idea would have to be (spuriously) adjusted to allow that an average 0.75 cm per annum is realistic for such an old tree. That circumstance would negate all of the higher age claims made by Allen Meredith, who has relied on an exponential curve to calculate ages for larger yews and on whose work Fry's claim for Defynnog rests.

In reality Moir's actual graph, if extrapolated, would make the imagined primordial yew at about 30m/100 feet in circumference approximately 3,000 years old if it had ever existed, and not 5,000 years old.

Fry's advisor Allen Meredith gave these as rough guidelines in 1982 and 1985, but also stated that 'the girths and ages are all possibilities'. N.B. The table does not appear in *The Sacred Yew*, but was submitted to the AYG website where it can be viewed.

18' – 720 years
 21' – 1020 years
 24' – 1440 years
 27' – 2000 years
 30' – 2400/2660 years
 33' – 3000/3500 years
 35' – 4400 years
 35' 6'' – 5000 years
 36' – 5600 years

In essence Fry and Meredith can have one but not the other from within their own logic; either:

(a) If the tree at Defynnog is 5,000 years old then logically all large yews are very much younger than Meredith claimed, for instance Moir's work would make most 27 foot girth yews around 800 years old whereas Meredith gives 2,000. Evidently Meredith's typical growth scenario shown above does not remotely match the overall age Fry claims for Defynnog. Interestingly Meredith claims an age of 3,500 years for the single stem of the largest existing Defynnog yew in *The Sacred Yew* matching his chart above if the real girth is used, although he gives the girth in his gazetteer as 40 feet.

Or (b) the other case would be that Moir's work cannot be legitimately applied in this way, and then Meredith and Fry's growth scenario for the two Defynnog yews can't work. That would mean that the pair of yews at Defynnog are not a single tree of two fragments, but

the inflated higher range ages given in *The Sacred Yew* could make sense within Meredith's framework, although not in the light of the new ageing work carried out by the AYG, and separately by Moir.

But as I remarked, that situation is only as seen from within Meredith's and *The God Tree's* frame of logic. These calculations simply show the spurious and ill-considered nature of the assertions made, and demonstrate that Fry and Meredith have created an illogical case; the workings above regarding scenarios (a) and (b) do not suggest that there is any reality or substance to either calculation at all.

Yews that move apart through time?

Apparently in order to ameliorate some of the problems described above an idea dubbed "the moving tree hypothesis" was advanced (although the original source is uncertain) that the supposed disconnected sections of bole at Defynnog moved apart through time and were once nearer one another, but when I presented the idea to a certain forester the concept caused him to spit out his tea, and I must confess to a similar reaction. Such a fantasy only implies a negligible grasp of the properties and physical realities of resistant materials and living things. The idea is devoid of credibility, and no evidence has been presented.

Largest yews in history for context

The largest yew ever recorded, now sadly lost, was at Brabourne in Kent. It was recorded by Evelyn (7) at 58 feet 6 inches in girth (17.83 metres), Evelyn also reports another of similar size at Sutton churchyard near Winchester in Hampshire; that one has also vanished. The only remaining yew of similar magnitude known is the one described above at Fortingall.

Conclusion

It is possible to say with some certainty that the Defynnog yew is not the age suggested in *The God Tree*. The layout of the trees on the ground do not allow for the possibility, and on the vast balance of probability the yews claimed to be parts of a single trunk have always been separate stems.

One can also say that the method used to suggest the age of 5,000 years is at the least intrinsically flawed if not chaotic, as it has generated a vast anomaly in the age calculated for the Defynnog yew when compared with other ages calculated apparently by the same method found in *The Sacred Yew*. It is illuminating to compare both claims for the Defynnog yew. The change in age for this tree between being thought a single stem in *The Sacred Yew* gazetteer (3,500 years at 12.2 metres or 40 feet) and being thought a pair of fragments in

The God Tree (5,000 years at a notional 32 metres or over 100 feet) is entirely opaque to reason or sensible calculation. The probability is that these ages are quite simply made up.

It is unsurprising that such claims take root; the potential for immortality of the yew has an eternal fascination for any mind with a hint of imagination and spirit, for mystics and scientists alike. It is likely that this running battle between folklore, rumour, myth and scientific endeavour will never really be won. I'd say that was a good thing if it were not for the consequent damage being done to the yews at Defynnog as I write.

References

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Appendix

A. K. Moir's graphic empirical representation of his dendrochronological findings regarding the ages of yews by girth (4).

