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AN ORAL HISTORY OF BRITISH SCIENCE

Mike Baillie

Interviewed by Paul Merchant

C1379/85

IMPORTANT

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National Life Stories

Interview Summary Sheet

Title Page

Ref no: C1379/85

Collection title: An Oral
History of British
Science

Interviewee's surname:
Baillie

Title: Professor

Interviewee's forename:
Mike

Sex: M

Occupation:
dendrochronologist

Date and place of birth:
November 1944, Belfast,
Northern Ireland UK

Mother's occupation:
Housewife

Father's occupation:
Director of linen
company

Dates of recording, Compact flash cards used, tracks (from – to): 20/10/11 (track 1-2), 15/12/11 (track 3-4), 29/12/11 (track 5-8), 02/02/12 (track 9-10), 15/03/12 (track 11-12).

Location of interview:
Queen's University of
Belfast and
interviewee's home,
Belfast

Name of interviewer: Dr
Paul Merchant

Type of recorder: Marantz PMD661

Recording format : 661: WAV 24 bit 48kHz

Total no. of tracks: 8

Stereo

Total Duration:
9:13:53

Additional material:
photographs and video
taken by interviewer

Copyright/Clearance:
OPEN

Interviewer's comments:

[Track 1]

Could I start by asking you when and where you were born?

I was born in Belfast in November 1944.

And, could you tell me about the life of your father, either things that you know because he told you about them, or you witnessed them, or, perhaps things you've found out since?

Father came from a middle-class background. His father had been a draper, and his grandfather had been both a teacher and then someone who had run a commercial college. So Father had expectations by the 1930s, he was born in 1916, he had expectations of possibly going on to become a doctor, but unfortunately his father, my grandfather, died rather prematurely and quite suddenly, and the result was that he had to leave school in order to get a job to support his mother. And, he was an only child, which was another, I suppose, aspect of that, there was no shared responsibility basically, he was the responsible adult. So, he went through a variety of jobs; interesting, on his marriage certificate he puts himself down as a warehouseman. I reconstruct that to mean that, he was working in Short's, the aircraft factory, during the war, and, presumably he was in charge of stores or some such thing. It's a, I was quite surprised to see it on his wedding certificate. He subsequently went into the linen industry, and spent the rest of his life up until his death in 1976 rising up to being a director of a linen firm. And the thing about that of course was that this was during the demise of the linen industry, which had been huge in Ireland, but had gone into decline really after the war. So, keeping it going, keeping the business going, was a matter of considerable stress.

[02:24]

Apart from that, he was well-educated up to the age of sixteen, he was keen that I would be educated as well as possible. He had interesting political views. Although he was allegedly Protestant, he wasn't really a churchgoer. He was not fond of royalty, for reasons I never fully understood. He didn't like Conservatives because of what he had seen during the Depression, people sleeping in doorways and poverty. I think he was a sort of a natural socialist. For whatever reason his politics/religion or

lack of them ultimately led to me having very little interest in either of those fields. So that's how he would fit into things. He was a golfer [His grandfather George Lockhart Baillie was a scratch golfer when he came to Belfast from Scotland, and he laid out several major golf courses as well as featuring in golfing history]. He in many ways later in his life wasn't a very social person, he was very...[introverted] I think the pressure of work told on him increasingly. And, that's pretty much a synopsis of...[father]

[03:38]

What did you see, in terms of the pressure of the work, of keeping this going, what did you see from a sort of child's point of view of that?

The manifestations of that were, quite a bit of alcohol consumption, and also smoking around about forty cigarettes a day for forty years. So, I think those, in retrospect you would, you would see that it was a reaction to stress, I mean these, these things weren't, weren't done simply out of the love of tobacco and alcohol, but it was sort of part of the job.

[04:18]

Thank you. And, when you say that he was extremely keen for you to be educated well, again, how, how did that come across to you, by things that he said, by things that he did, how do you know that?

He was very keen when I was a small child on practising mental arithmetic, you know, sort of, you couldn't get a bus ticket that you didn't have to add up the numbers in your head, and, things like that. He was also very keen on spelling, and he would have been a stickler for grammar and the like. So, there was a, a tone of, of that. But also he went out of his way to make sure that when the time came I was put into a good grammar school. I don't know quite what order you want to take things in, but, the post-war era, of course I mean I was one of these people who benefited enormously from the way the system had been set up for free education, the 11-plus as a major telling point of course, and he went out of his way to make sure I was well tutored, not by an outside tutor but by him, and also to make sure that I was, my nose was to the grindstone at primary school. Because he recognised the importance of, of

getting the 11-plus, and, and getting into a good school. I think, his attitude I think was that once you were onto that track, you were on your own after that, but that getting you there was the, was the key significant factor. So, as luck would have it, mental arithmetic and, and spelling were two very key issues when it came to performance in the 11-plus. And when I heard that you were wanting to interview about some of my earlier life, I went and dug out some school reports which my mother had kept from primary school, and I was, I have to say, I was shocked to discover that I was in classes variously of forty-six or fifty pupils. This was in a perfectly reasonable primary school, I mean there was nothing deprived about it, but the class sizes were frankly enormous, and between form one where I was roughly twenty-third to twenty-sixth in the class of forty-six to fifty, I managed by the fifth year, the 11-plus year, to have moved up to third in the class. At that stage the class was forty, so third out of forty. But interesting, on the report it says in brackets, '(first in boys)'. So obviously two girls had out-performed me. Now that, I'm not sure how much you know about it, but in, certainly in Northern Ireland, the dice was stacked against girls. It didn't matter what they actually scored, there was a, a tendency to give better grades to boys in the 11-plus, so as to pack the grammar schools with boys rather than girls. That's maybe slightly over-stating it, but there was a definite bias built into the system. But, irrespective of that, yes I did, I did rather well in the 11-plus. In fact, I think it's fair to say I peaked at eleven. [laughs] And, I remember coming home from the 11-plus maths exam, which had taken place in a school I'd never been to before down in North Belfast, and, when I arrived back home, my mother said, 'How did you do?' And I said, 'I answered all the questions.' And, that meant that I not only answered them but I'd checked the answers and that they were all right. Because that was one of the things that Father had been very keen on, that simply answering a question wasn't enough, you had to make sure that it was right by effectively doing it again. And that was, obviously, [laughs] if he left a legacy, that was one particularly good legacy that he did leave. So, yes, my performance in the 11-plus was probably as near as optimum, near to optimum as you could reasonably get. And the result of that was that, I had been put [forward] for about three different grammar schools in Belfast, and in those days you were interviewed, so I was taken along by my father to be interviewed by Belfast Royal Academy, which is probably one of the, it's one of the top three grammar schools. And, I survived the interview because, [laughs] it's, looking back on it now, it's almost hard to believe, one of the

questions was, 'Well what do you want to be Michael?' And, my reply, out of the blue, and to the astonishment of my father, was to say, 'A cook.' This had never been rehearsed, I'd never thought of it before, but on the spur of the moment, that's what came out. So despite that, and the interviewer laughing out loud, I actually was accepted into BRA as it's called locally, and, not only accepted but put into the A stream. So, so, putting that together, yes I, I had a flying start into, into second level education.

[09:54]

Could you describe your father's home tutoring, or home sort of, preparation for the 11-plus? What did he do to, a) keep your nose to the grindstone as you put it, and b) to sort of, privately or informally tutor you, prepare you?

I don't have any clear memory of specific incidents or questions, but, I assume that we had access to the sorts of questions, the logic questions which occurred on 11-plus papers. And, he would have been quite capable of dreaming up suitable scenarios for me too, to work through. Whether we actually had past papers, I'm not sure, because, in those days the, a lot of the preparatory exams were sprung on you, you weren't told in advance the... The 11-plus wasn't just the final examinations, they were what are called IQ tests. I don't think they actually called them IQ tests but that's what they were. And these, there was no preparation for those, just one day inspectors arrived and you were all sat down with papers and, and, told to get on with it. So, he was aware of a fair amount of this, so he was quite capable of producing sets of questions that would be brain-teasing, but, as I say, that's just specific examples, I, at this stage, can't remember.

Thank you. And did he, finally on this, did he communicate to you any sense of why it was important to do well in this way, or, why, why try?

Well, his, his one categoric statement was, not to go into business. I think that tells you quite a lot about the stress that he was under in business. And I think he saw a profession of some description as, as the antidote to that, in other words, do something you're happy doing as opposed to doing something you have to do. And I suspect

that was a direct reflection of his experience and, and presumably disappointment. Because I think he would have made an excellent doctor, to be quite honest. So.

[12:07]

I think we've got there a very good sense of your father. Could you do something similar with your mother's life? Again, things that you know from having been there, but also things that you've discovered or that she told you about her early life.

Mother came from a working-class background in East Belfast, and, the reason she met my father was that, she was working as a damask painter in the linen industry, so presumably that's where they, they met. Her earlier life had been through basic schooling. She came, she was one of nine children, as opposed to my father who was an only child. She was a bright woman. She was an identical twin, and, so, the result of that was, I sort of had two mothers. And, in terms of academic prowess, I really never fully understood, I mean she was an avid reader, she was interested in things, she was a member of quite a strong social group, but, as with a lot of children, you didn't pay a lot of attention. She was a housewife, so, once she married she gave up work, and, looked after my father and myself. And, was always supportive, but I'm afraid that's pretty much all I can say.

What do you remember as a, as a younger child of time spent with her, of things done with her, perhaps up to and including primary school age as a sort of rough cut-off?

Mm. Well, that's interesting because, of course one spent time with one's mother, but because of the extended family on my mother's side, each week, twice in the week we crossed to East Belfast to the, to my grandmother's home, and, it's euphemistically called 377, because that was the number of the street it was on. And there one was involved with a whole series of aunts, uncles and cousins, as well as my grandmother. So that, most of my upbringing was a, a relative blur of different people, and, as a child, certainly my feeling is that you just accept things the way they are. Now in 1947 my mother's identical twin had married a man from Glasgow, and they didn't have children, they moved to Glasgow but they didn't have children, and, the result was that each year from, about the age of four, which is roughly, pretty well as far back as you can remember, I went over to Glasgow for some weeks, and eventually

for, quite often, quite a bit of the summer, and had an alternative mother and father in Glasgow, which, [laughs] it, yeah, it's interesting to look back on it, and, and think, yes, you had the benefit of multiple parents. And, each week we went across to East Belfast, on a Wednesday, and then again on a Saturday I went over and stayed the night usually to Sunday. So again I had another aunt and uncle who were permanently in my grandmother's house who acted as a third set of parents. So I was, I was educated, not... Sorry, not educated, I was brought up by sort of an extended family. So when you say, what time did you spend with your mother? The time spent with Mother would be, holiday times, where you're actually locked up together in a holiday location.

[16:12]

Could you describe in as much detail as you can remember then, time spent in Glasgow with this sort of second mother and father? What did you do on those summer visits that became longer, I think you seem to suggest as you got older perhaps?

Oh yes, by a teenager I was quite often there for a month or six weeks. Well, Uncle Jack [John Ryder Alison Inglis] had, was by far one of the most interesting of my in-laws, because, he had served in the Army during World War II, and, the result was that, you had someone who had been a bank clerk up until 1939; he had then been called up into the Royal Artillery in 1939, and served for, basically five years with, being in charge of shelling Germans with twenty-five-pound guns. And, so he had been, as I think all sergeant-majors have to be, a rather stern disciplinarian. But he was actually an extremely charming, mild man. And after the war he went back to being a bank clerk. He refused promotion, he went into work at six every morning and had tea with the cleaners. He was then a teller during the day, and then he came home late afternoon, and lived a very quiet, orderly life, which, when you think back to what he had been through during the war, it was sort of fascinating. So, he was a wonderful figure, I mean he, he taught you how to hang wallpaper exactly vertical; hedges had to be cut within a millimetre of, of, correctly, and paths had to be, you know, de-weeded to the point of extinction. Which was great, because of course, he wasn't, he wasn't a father figure, he couldn't actually lay hands on you [laughs], so, you got the discipline but in a very nice way. He was a fantastic sort of role model.

And, yup. And my, my mother's identical twin was, as the name suggests, extraordinarily similar to my mother, so, one, one could, one could just imagine one was at home most of the time. The only problem ever came when you put my mother and my, my aunt [Meta] together, because then they vied for... I was one child between the two twins, and the result was, I was vied for, which is, was amusing at times and infuriating at others, but it was sort of, fantastic to see the dynamic that developed. And, yes, that was...[Meta and Jack my Glasgow mother and father]

How did they, being identical in appearance, how did they differ sort of, character, aunt and mother?

I... Mother was a much softer creature, I mean she, she was... My aunt would have been a lot more dynamic and demanding, travelled a lot more. And, Mother would have been a home bird in comparison. So yes, they differed quite a bit personality-wise, even though they were identical. And, in fact up until they were forty I was one of the few people who could tell them apart, so, mhm.

And how did, how did they vie for you, sort of over you, or, or...?

They each treated me as if I was their child. [laughs] Which of course, occasionally made you wonder which, which was my actual mother. [laughs] Because I had no actual way to tell. But it's this sort of, intriguing dynamic between them.

[19:59]

And what are your key memories as a younger child of time spent in the East Belfast, 377? I think you said there were at least three visits a week, one at weekends.

Well, two visits a week, one midweek and, and, at the weekend.

What did you do when there?

Well the, the Wednesday visit was normally after school, so we were there for a meal, and, whatever social intercourse was going on between visiting. My grandmother's house acted as a focus, so if relatives were home from Canada or South Africa or from

North, South, East and West Belfast, there would virtually always be something going on in the house. So that, it gave a, again, sorry to overuse the word dynamic, but it, it was a dynamic place. It was very much a focus. At the weekends, my uncle [Sam Fletcher] who lived in 377 was a great allotment person, and in those days there were, presumably rentable allotments just outside Belfast. So we would take a tram journey, which cost a halfpenny in the early days, up to the, what is now the ring road, and beyond the ring road you were out in the countryside and these major sets of allotments. And, my uncle had green fingers so he grew everything. He grew chrysanthemums, tomatoes, umpteen sorts of vegetables. So I would spend the time up there. There was also a dam, which presumably had originally been a flax dam, and then been used for water supply during World War II, and, was a great source of playing around with frogs and tadpoles and, and, sticklebacks which are called smicks in this part of the world. And of course you had a free run of a bit of countryside, and of course lots of dug-over ground of other people's allotments. So, I spent most of my time not interested in growing plants, merely in eating things, but [also] in collecting things off field surfaces. And, I suspect this was a forerunner to the fact that I'm interested in old things, and I am also a magpie, that I, I just accumulate stuff. And, I was doing that from an early age. So while my uncle was running an allotment, I was collecting clay pipes and bits of broken pottery and anything else I could find. And, that kept me more than occupied.

What did you do with those things once you had collected them?

I tended to, yes, keep them in boxes. I didn't do anything more with them, I simply kept them, and then looked for more things, so... [laughs] It's, it's something which develops eventually into a collecting mania, because the world is made up of collectors and non-collectors, and collecting is a, is a disease really I think, it's, perhaps it's genetically programmed but, I suspect it's more like a disease.

Did you collect anything before you started collecting things from this dug-over allotment ground?

Probably not. We didn't have an awful lot. I mean, you could say I collected Dinky cars, but two Dinky cars was all I ever had. So... [laughs] Because a Dinky car cost about 2s.6d which was an outrageous amount of money back in the 1950s.

Are there, from this sort of range of memory, are there particular finds that you made during these allotment visits that stand out in your memory, things that were particularly striking to you then?

One of the, one of the things which I found and was intrigued by was a, a yellow glass bead, and, a little glass bead doesn't sound like much, but this was a, the size of your small fingernail, and a bubbly, strange colour of yellow. I subsequently, many years later, found out it was an Iron Age glass bead, so it had survived in the topsoil for, 2,000 years before it was... And I still have it, yes, it's one of those things you, you tend to keep, just because it has a nostalgic value. But there were other things went on, I mean, my uncle was great at making kites out of bamboo and brown paper, and, we could fly kites up to many hundreds of metres. It was on a hillside, so it wasn't that difficult, but it was fascinating to watch. And then you had highlights, like the famous Brabazon earth..[aircraft]. the famous Brabazon airliner, flew up Belfast Lough at one stage, and, so we got to see things like that. Of course aircraft coming into Short & Harland's.

[25:06]

Thank you. Your home, your sort of, first home then, with your mother and father, in Belfast, do you remember it clearly enough to, to take us on a tour of it if you like in your memory, to...? Perhaps you had various homes and moved about, I don't know, but, if there is one that you were at a long time, or at the right age to remember it, could you stand at the sort of front door and take us on a tour of it? Pointing out, if you see any family members doing certain things in certain rooms as you go on the tour, if you see what I mean. Perhaps you ought to start off with where this house is.

Well you see, we, we moved house when I was between four and five. So, the first house was, I wasn't actually born in the house, I was born in a nursing home in East Belfast, but, at the time my parents were living with my paternal grandmother, my father's mother, in 21 Fortwilliam Parade. And, it's probably worth having a, a brief

excursion into the history of Belfast, in the sense that, these had been long sets of, of tenement housing, terrace housing I suppose, and, the Blitz had focused on the, the massive shipyard and aircraft works in Belfast. But the German navigators had been misled by the waterworks, which are two large lakes in North Belfast, which are about a mile from the, the shore of Belfast Lough, and the result was, they had plastered that area of Belfast with high explosives. So that, the row of houses we lived in, opposite was simply a green space where another two rows of houses had originally been, they were obliterated in one of the blitzes, and similarly, out at the back of the house you were into a wasteland, which I, funnily enough I've quite strong memories of, of messing around in, finding interesting bits of rubble and things, given that I must have been at most, four and a half before we, before we left. It had a garden with Michaelmas daisies and a wooden fence, and there are some wonderful early photographs which look like something out of *Homes & Gardens*. But this was a, basically a working-class house, and, rented house. You went in to a small front parlour. You had a kitchen at the back, which I assume had a range, but I can't actually now tell whether that's a memory or whether that's an implanted memory. A steep staircase taking you up to two bedrooms. I have no memory of a bathroom, whether it had an internal bathroom or not, I just at this stage don't know. We may well have had an outside toilet for all I can remember. The image which hangs with me most is that, one night there was a, there was a, a big storm, and, in the wind the, we had gas lighting, and the, the flame from the gas is capable of actually blowing out from the, the mantel and forming a stream of flame. And this was happening in my, this was the back bedroom upstairs. And that, that's an image that lives with me. In fact I, I once saw in a jotter that my mother had kept, I had written a story early on in primary school about the big, big wind and how the gas had flared out. So that it obviously was a, [laughs] probably gave rise to my interest in catastrophes. [laughs] The front room, which was presumably my parents' room, the only time I remember being in it was when I had measles, and I was quarantined in it for a week, and, with the blinds drawn, which is of course, [laughs] not, not very informative. But, that's the, that's the nature. The only other thing about the setting was that, across the road on this blitz site which was just a grassy sward at this stage, there was one enormous boulder, which I presume would have been about a ton and a half, and, how that had got there other than possibly by high explosive, I've never known. But it's just one of those images that, that lives with you.

Could you describe the wasteland, if you can say any more than you have? Which was the bit at the back of the house I think.

Yes. Behind our back gate there was a, a track which would have allowed people to get access to the backs of their, their houses, and on the other side of that cinder track you were into, something between a blitz site and a quarry site, and ideal for small children. And of course, looking back on it now, I mean, what height would I have been when I was four and a half? So, it was probably not anything like as dramatic as it appeared to me. But it was overgrown, and bushes and, and rubble, so on. A fascinating, but a safe place.

Were there other children at this stage that you were, I realise you're very young here, but other children that you were exploring with?

There was one other child, but I've never fully understood who the child was that I, I presume it was a neighbour, mhm.

[30:47]

Thank you, that's wonderful. And, can you do something similar with the house that you then moved to in at four, four or five?

Well we moved, we moved up, in terms of distance, probably, three-quarters of a mile, to a group of prefabricated bungalows which had been built after the war, or, I think they were euphemistically called asbestos bungalows, which, [laughs] nowadays leaves a, a bit of a chill when you think about it. But, again these were new municipal housing in a sense. And we moved up there, and there were then lots and lots of children to play with, it was a much more dynamic place than, than had been in the, in the first house. And, we were there until I was, twelve I think. So, during that time, for example my father had his first car, and one of the very few cars on the estate, you know. You are talking about a period when people had very little money. It's almost impossible to imagine now just how little disposable income people had, and if you wanted something like a fridge, you would have to buy it on hire purchase over, I don't know, years. So that, there wasn't a lot of material comfort. And certainly my

father had inherited almost nothing, I mean virtually everything in our house was Utility furniture. The only other things being a barometer which had somehow survived the various moves and, and, poverty. And where does one go from the west London [Westland Road] bungalows? Presumably that, that was the time when I was going to primary school, and, that's, that's the period when, you know, preparation for the 11-plus would have been ongoing.

What did you play with? Well start with inside. So what sort of things were you playing with inside, toys and games, what did you have?

[pause] [laughs] That's a very good question. I, I must have had just the, I mean the usual sorts of, boys' toys, supplemented with cardboard boxes and wooden swords, things of that sort. I think, by and large we, we really classically did just make our own amusement. There would be a bunch of boys and girls just playing around. If somebody had a bicycle everyone shared it. If you were over in somebody's house, you'd be supplied with cream crackers and a glass of water or a glass of milk or something you know, so, it was a very easy-going time from the point of view of, of living. People, there was very little actual stress that I'm aware of at all.

And what did you play with outside, what did you do outside, were there, in the same way that you had the wasteland and the sort of, the flattened area in front of this other house, were there significant sort of outdoor play places here?

No, there were, there were merely people's gardens, which very often, the front gardens weren't partitioned off from one another, so there was just a general play area. So that you played with a group of anything up to about a dozen other children. But one of the snags about moving houses is of course that you rapidly then lose touch with whoever you've known in the, in the previous location. So, so, moving again at twelve broke any connection with the various people that I had known between four and twelve.

[35:01]

Do you remember what you read at this young, this younger age, other than things that perhaps you were reading in connection with primary school, but were there things that you read for, you know, for fun, because you wanted to?

Well I mean I think the high point of, of living, would have been something like *Eagle* comics, you know, this was an important aspect of life, because it gave you a little inkling into things like space, which I found interesting. And you know, maybe in that sense I liked the fantasy aspect of it, but... But I suppose, given, given what was happening, I mean I remember my uncle [Sam] in East Belfast taking me either out to try and see Sputnik in 1957 passing over. People were well aware of what was going on, and were interested. So you were, you were very much drawn to this idea that, there was like, serious science going on. We would have listened to the radio quite a lot. *Dick Barton Special Agent* had you hiding behind the sofa at the end of each exciting instalment, and, *Quatermass, Journey Into Space*, those sort of, issues. As to reading, I don't know when I would have started reading and when I would have had access to... I did become obsessively interested eventually in World War II, and would have preferred reading that sort of factual type of information rather than fiction. I never read *Winnie the Pooh*, or any of the classics which all educated people seem to have read, those passed me by.

Is there anything in particular you remember about the Eagle, about the content of it?

There was a green character in it, yes. [laughs]

The Mekon I think, yes.

The Mekon, that would be the one, yes, uh-huh.

And, and anything you can remember of this attempt to see Sputnik in '57?

Yeah, I can't remember now whether it was, we were hearing it on the radio, or whether it actually was on a flight path which might have made it visible. Because, the implication of even remembering this is that I'd been taken outside to try and see

it, so the implication... Well, it would be interesting in retrospect to find out if its orbit did cross this airspace. Mhm.

[37:37]

Thank you. What do you remember of teaching and learning at primary school? We've covered the sort of preparation for the 11-plus, but, not many people do remember teaching and learning at primary school, but do you have any memories of lessons or teachers or, perhaps there wasn't any science but, even natural history perhaps, but, anything that you can remember of teaching and learning at primary school?

[laughs] Yes. Well, one of the things, it's sort of irrelevant in a way, but, it, it... The school was built between two avenues which diverged with an angle of about forty-five degrees. So it was, it was a triangular school, which made it unusual. [laughs] And the playground narrowed down to a point, with the toilets at the other end, so it was, it was sort of, fascinating. It was called Skegoneill [Skegoneil Primary School, Antrim Road, Belfast]. The things I remembered, there were three masters, I remembered. One of them had been at Dunkirk. You begin to see a theme developing. And he told us yarns, possibly only the once, but you got the impression that, you probably heard it more than once, that he had, he had actually seen a ship being sunk by a, a bomb going down the funnel. Which is a very impressionable thing for youngsters to hear. Anyway, he had survived Dunkirk, and had then, as with a lot of demob military, moved into teaching. He was from Wales. The headmaster throughout was Captain Robinson, and, in those days officers kept their rank. So he, he was the headmaster throughout my experience at school. One of the astonishing things to me at that time was that one of the teachers had taught my father, and the idea that you could, that teacher could be so old that he had taught two generations, seemed unimaginable, but in fact the man wasn't actually that old. [laughs] But it's, yeah, that, that sticks with me. One of the things, because I was a good and quiet pupil, it says so on my reports, [laughs] so I must have been, I spent an inordinate amount of time doing messages for the headmaster, in other words, I was frequently taken out of class to go and take messages to other places and, I don't know, which suited me fine, because the less time spent in the classroom the better as far as I was concerned. So... Those are, those are the principal memories. The actual teaching,

mm, I do have the memory of surprise tests, and I do have memory of being able to answer spellings really quite well, because you were, we were frequently bombarded with spelling tests, including verbal spelling tests, so that was, interesting. Most of the rest of it... Well, towards the end of school, I mean clearly we were, we were either being trained with past papers or exposed to the types of questions that, that we would face in the 11-plus, so, I'm sure there was quite a lot of that went on.

[41:09]

You moved from being, towards the bottom to the top, the top boy anyway, at primary school, but you, from what you just said, you implied that you didn't necessarily like it, like being taught, in the sense that, you would take messages round and that was fine with you. Do you actually have a memory of not liking being in school, or not liking study or...?

Well I... Hm. There's an interesting question. As we'll probably get on to at a later stage, I, at that time, was not really conscious of issues to do with things like memory. I've formulated an opinion, really in quite recent years, that I possibly have a slight hint of dyslexia, because I found incredible difficulty learning vocabulary. Now I attributed that to laziness on my part, that I just wasn't willing to put in the work, because it would have been a lot of work for me to learn long lists of words. But, the people I was going through, certainly by the time we got to the grammar school, people I was going through with, many of them had extremely good memories, and in many cases photographic memories, so that they, their homework and learning twenty Latin words was to read it once [laughs], whereas, learning a single word, in order to latch it on to something so that I could remember it was a considerable chore. And I suspect there must have been elements of that at primary school where, which perhaps made me, some aspect of schooling that I didn't really appreciate.

[43:05]

What do you remember of any churchgoing as a, as a younger child?

Well, my, my in-laws in East Belfast were all churchgoers, and, my parents, although I was originally taken to church at some stage, they stopped going, and sent me instead, or not instead, they sent me. So I was quite used to going to church services.

And, so I was, I was inflicted with all the usual aspects of guilt that comes with religion. But I was never really affected by it, I, I found it hard to understand how it was relevant to me, and, especially in the North of Ireland, that may seem slightly strange, but, maybe it was the seriousness with which other people took religion; I certainly, didn't regard it as a serious issue. Didn't mean I didn't go, because I was sent, I mean... [laughs] So I soldiered on with going to church up until my mid-teens, so... But as to the earliest beginnings, I would imagine I was taken along from the age of maybe, four or five or six, to various churches, because obviously I was, if I was in East Belfast on a Sunday, that was one church; if I was at home, that would be another church. Interestingly, I only found out since the 1911 Census went on to the Web that although I thought our family were Presbyterian, in fact they had in a previous generation been Church of Ireland. But, doesn't make a terrible lot of difference one way or the other. [laughs]

And over that period, from when you were first sent to the, your mid-teens I think you said, what was the nature and extent of your belief in what you were being told, whether or not you thought it was relevant to you, or, or whether you felt distanced a bit by the seriousness of it, and of others, to what extent did you believe in the content?

Say while I was at primary school, I... I think it's probably fair to say I didn't really think it was relevant to me, it was almost, you went along and you listened to a sermon, which I have to say was normally fairly boring. Because unless you have a fairly in-depth knowledge of the Old and New Testament, trying to follow the storyline in a lot of sermons would probably be quite difficult. So I think, young, young children in my memory, you're subjected to a lot of things that you're supposed to believe, and, you're not really supposed to question these beliefs. So, you're handed a package of information which I simply found, I suppose intriguing's a word, but not relevant to anything I was seeing in my everyday life.

And how did that feeling develop as you got to your mid-teens? Did that change or develop in anyway?

I... I can remember... Well, I can remember several things about church. One of them was having... The choir attempted to sing a particular, a new version of an anthem with a truly bizarre set of music, and I had a laughing fit, and there was nowhere to run, that is, in retrospect it was one of the most excruciating but also one of the funniest things [laughs], you know, I remember. But on a more serious note, no, I can remember the day and hour, I don't mean the date, but I mean, I can remember the day and hour, that a minister finally drew a line under religion for me. And, what he said in a sermon was that, it was a sin to question. And I was sitting there thinking, you're given a brain by this divine creator, and you're not allowed to use it. I said, to myself, I said, well, that'll be an interesting discussion when I get to meet this character, because frankly, he seems to have made all the rules. And from that day forward I took no active interest in religion. It was just being told that, that one straight statement, it was a sin to question. And you think, well what's the point in that? I mean that's... So.

You said you remembered the, the day.

Although I can remember that, I can remember that, him saying that, I can't, I couldn't give the date, but I mean I could, I can... And, from that day forward it was, religion was no longer of any significance to me.

[48:29]

Could we take you then to your, to Belfast Royal Academy, is it?

Yes.

And, what I'd like is memories of the teaching science to begin with, we'll do other subjects as well though. Let's start with one which may not feature. What did you remember of the teaching of biology at various stages at that school?

That's a completely ridiculous, [laughs] off-the-wall question. Right. Let me, let me give you some context first of all.

Mm.

As I told you, I did very well in the 11-plus and I was put into the A stream in grammar school. Now, you may think I was a very naïve child, and I probably was, I, I just took life as it came along. And, when you went to the A stream in grammar school with an 11-plus, highly selective system, you were in what would now be called the nerds and a lot of other extraordinarily intelligent individuals, quite a few of whom had already been at the prep school for the grammar school. So you were suddenly subjected to people who had learnt some French, they had read mythology, they knew about the world, almost none of which had impinged on me at all at primary school. So that was a bit of a shock to the system. The other thing is, because the, most of the people in the A stream were coasting, simply because they were so well primed, I found that by the second year I was in the B stream [laughs], because, yes, there was a bit of a shock to the system. I may have been at the top of our primary school, but I certainly wasn't at the top of the grammar school. Which was fine with me, I didn't actually mind that, it was just like, finding one's own feet. So basically, the A and B stream mixed, simply because there was mobility between them, and, so the same, I still was in many classes with the same people, but, there was a bit of cross-fertilisation. Now, biology, I don't think have any memory of biology whatsoever, except I knew I didn't want to be involved in anything that involved cutting things up. So, if somebody produced an earthworm, basically I was out of there. So, I was happy to give up biology at the earliest possible stage. And I don't ever remember any dissections or, so, it was presumably plants and frogs and, yes, not a lot.

And memories of the other sciences?

Probably mathematics was... I was relatively, still relatively good at mathematics. I hadn't saturated out by that stage. So, I, in a sense I looked on the maths quite, quite fondly because I could do that, and, I could, I could sustain a sort of position in that area. Chemistry, some of the teachers were, well they weren't physically brutal but they were, they were stern, let's just say. So you, you had lots of information thrown up on walls and you spent a lot of time writing it down. It turned out that was quite a good thing, because my memory is such that, writing things down is the way that I memorise them, in other words, verbally, I don't pick up verbal information easily.

So, that was also quite intriguing. Of course you had all the usual fun with dissolving hair with acid, and, blowing down Bunsen burners to turn off the gas in other labs, and, scrapes like that. I'm not sure I would necessarily have done that, but I was certainly with people who would. You had people who were quite capable of, of making high explosive and, and exploding it. So you had, yes, the usual range of, of school types, and you were sort of involved in science in a sort of, vague sort of way.

Where would the explosions happen?

Oh they, these would be, you know, the doors of garages, and, and people, people could, you know, fire ball-bearings through planks, you know, with... I suppose, these days we would call them pipe bombs, but these were just, these were long pre-Troubles, this was just, adolescents learning to do interesting things. [laughs]

Were you involved in, in doing any of this, or are these things you saw happen?

No, I was, I would have, I would have been someone in the background, mhm, yes. I let the other people take the, [laughs] take the risks.

[53:47]

And, any memories of physics at this school, and if so, what are they?

The Wheatstone Bridge come to mind. Simple electrical experiments. But actually, not an awful lot. If I'm going to be honest, and I'm just telling you like I remember it, there was a tension developed at school, and the tension was this, that, when you got to grammar school, they told you that everything had a pass mark of forty per cent, and, it turned out I was very good at scoring forty per cent. But of course what they actually wanted was eighty per cent. But they never actually told you that. So the result was that, I proceeded along doing as little as I could get away with. Because by that stage at the grammar school I had formulated an opinion, for some reason the Government was locking me up five days a week for seven years, and I really couldn't understand quite why they were doing that. It seemed like a cruel and unusual punishment for somebody who hadn't done anything wrong. [laughs] So, you can see that... Well, anyway, that, as I see it, there was a certain amount of

tension there. And, the system then fostered my approach, because, our year was subjected to a series of experiments you may or may not have ever come across before. It was decided by the Education Department in Northern Ireland that instead of doing eight O-levels, we were to do four O-levels, and the following year we would do four A-levels, but all of that a year early. It was an experiment to see what would happen. [laughs] So, so the result was, instead of having to work for eight O-levels in the fifth form, I only had to work for four O-levels, and I managed to produce scores all between forty and forty-four per cent, which of course didn't go down well with the staff, but, passed the exams, so I got that part of my Senior Certificate. And, the next year, we were doing four A-levels, and we were doing them a year early. So there was no expectations that we would do well. And I fulfilled that by again scoring three marks in the low forties, and geography for reasons I never understood I scored sixty-five per cent, which just tells you how easy geography must have been that year. So the result of that was that I had never had to try particularly hard for O-levels, I hadn't had to try hard for A-levels, but I got into university on the strength of those A-levels, even though I went back and did them again in the upper sixth because there was nothing else to do but... No one had prepared us for going to university in the sixth form, in other words, they, they'd performed this experiment, can you do four A-levels? and the answer was, yes, and then you didn't have to do any better because you had already got into university. So, if you wanted something not far short of a scam, the system provided me with an ability, or, sorry, the opportunity, to go through the system without really trying. And, yes I think that would, if you had, if you had some of the teachers that I had, Mr Spence[ph] for example who was the physics teacher in the upper sixth, one day he, he said... It's funny the things you remember. He said, 'Baillie, what is ever going to become of you?' Because I wasn't making a good job of whatever he was expecting us to do. And I drew out of my pocket my acceptance to Queen's University [laughs], and handed it to him, which stopped him pretty well dead in his tracks, you know. What was the point in going on really with...? So that was the, that was the outcome. The system played into my hands, that you could get where you were going with the minimal amount of work.

Was it because they were performing this experiment that they had set up this sort of system of automatic acceptance to Queen's with low grades...

No...

...or this was just how...?

That was just how it was. There was no automatic acceptance, but I mean, if you had... Most people, most people would have had three A-levels, so the fact that you had four just gave it an edge. And the four A-levels were physics, chemistry, maths and, and geography, so it wasn't that difficult to get in to university with those four A-levels.

[59:01]

What was, what were your parents, what was your parents' view of this attitude you were taking up towards school?

They didn't know about it, they, they blamed the school basically for... I think the way it would have been articulated was, when I brought a report home, they would go, 'Tuh! these people know nothing.' They obviously knew I was slightly brighter than, [laughs] I was letting on. But, that's just, just the way it was. I mean it's a... We did have some incredible highflyers in the classes, I mean we had, the year before sixth form, a guy in the form above, he had, he had taken the maths teachers to beyond where they could go. He was doing third year university papers in the sixth form. And he went off to do a double first in Oxford. And then there was a, another chap, euphemistically called Smart, who did exactly the same thing in our year, he went off [to a double first]. So these guys, a) had ability, and they were willing to work. I'm not sure, but, [laughs] I certainly, I did my best to do as little work as possible, because of the, you know, I didn't... Well I didn't see where it was all going. And, my parents never really took any active part in my education after the 11-plus, they just rolled their eyes at reports that came in, weren't surprised when I went to university, mm.

[1:00:34]

Was there, were there things though that interested you at school? I mean, in the context of this general sense that, of not knowing why you were there, and why you,

why you had to turn up every day and all of that, did anything sort of stand out in terms of sort of, interest in you? Across all the subjects. Because presumably, you did subjects other than those that you were examined in.

A lot of discussion went on amongst the sort of peer group on issues to do with space and galaxy [galaxies], and, I suppose, yes, the universe. I mean these concepts which are mind-bending. There was quite a lot of interest in, just discussing issues about time and space. So, there was in that sense a, a good informal intellectual climate. But in terms of what actually interested me in school work, I suppose there was, there was a certain amount of satisfaction in doing maths well. You see the procedure that I adopted was, if you had to answer four questions out of ten, was to make sure that you had four topics that you could pretty well guarantee to answer, and if you got those four questions then you got forty per cent and that was fine. This must have absolutely infuriated the staff, but, that wasn't my problem. So, yeah you can see that, [laughs] what other people would regard as character defects were, were well-manifest at school. But what, what I did do a lot of reading on from the library was, World War II. I was absolutely fascinated by something I had just missed. And, you see, the comparison between what was happening to people flying bombers over Germany or fighter planes or, you know, fighting in the, in the jungles of Burma, compared with the lives we were living, which were ordinary, calm, ordered, largely unadventurous, but only a couple of decades before, I found it hard to get my head round that, that ordinary people, including people you would meet, you know, who had, who had, who had been involved in, in all of that, I just, I just found it a fascinating sort of contradiction, that we were living in this sort of never never land where there was no immediate war, and, yet there had been this truly unbelievable episode. And I've never really recovered from that, I mean still find World War II, unbelievable is the only word for it. I mean when you watch the Battle of Kursk, or, or, you know, the Greatest Tank Battle on the Eastern Front, or Stalingrad, or the Battle of the Atlantic, or, the Enigma, the code-breaking, you know, you just think, it's... How did they all get away with it? You know, it's, it was just on a scale which is unimaginable. When you see the amount of shipping that was being built for the war in the Pacific for example, you just can't get your head round that they could organise all that. And especially Britain, because after all, if you were, if you were living in the UK in the Fifties and Sixties, you were, you were post-Empire period, a

lot of things were run down, things were not going particularly well, and yet, two decades earlier they'd been able to fight a war on several fronts. I'm thinking, wow! And of course they could call on university academics to staff Bletchley Park, you know, it is... I love the contradiction of that, you know, that the, the Germans thought their codes were unbreakable and yet the, the British were reading them, because nerds from British universities [laughs] had worked out how to do it. There are some lovely stories of course about people from, when they were first called up, one of the questions was, what was your, what was your hobby in peacetime? And one of the academics wrote that his hobby was working out the legionary dispositions of all the, the Roman legions in Britain. And, so they took him and put him in a basement and fed him all the de-crypts and everything else that was from prisoner debriefings and what have you. And it's believed that this one individual knew the location of every German division, which nobody in Germany did, which... [laughs] You know, you couldn't make this stuff up, I mean it's just, fascinating. And, you know, that had been going on, and here we were, in, in the late Fifties and early Sixties in the UK where nothing much was happening, and they thought nothing much of importance, and...

So where do you think that the, you might have been... I realise you, you were excited by something that you've just missed, but, but who was, who... Can you remember who started off this interest, was it for example going up to Glasgow and speaking to someone who had been in the war, was it speaking to other people who had been in the war, was it a schoolteacher, how did it... Why did you first go to a library and take a book off the shelf about World War II?

I think... Well I mean I think the influences were undoubtedly from brothers of, of aunts-in-law and, and my uncle in Glasgow. Even as you say, the teachers at, at primary school. But, I think what I liked was the factual nature of... I mean, at that stage I really did not like fiction. Fiction was made up. And, I liked the blow-by-blow logic of, of real life, and, war was real adventure as opposed to made-up adventure. So, that was, that's what I found preferable about it. And there were endless books of course, I mean just, and lots and lots of derring-do. I mean, when you're reading about someone who was willing to climb out on the wing of a burning

bomber and, and tackle the flames, I mean, [laughs] you are, you know, it makes *Treasure Island* look a little bit lame. Though *Treasure Island* is a wonderful read.

Thank you. And when you said that you had an obsessive interest in it, could you sort of, quantify that almost? I mean...

I read about the war to the exclusion of just about everything else. Mhm.

All aspects of the war, or were there particular accounts, sort of technological accounts or, accounts of violence, or accounts of, you know, the Holocaust or...?

I particularly, I particularly liked the air war. So, just, I think the technology of it. And of course the, the sheer risk of flying an aircraft packed with high explosive for several hundred miles where people are actually, actively trying to shoot you down, makes ordinary air travel look a bit lame you know, so it's a... Mm.

[1:08:23]

And what did you do out of school at this time? So, you're becoming a, older child, almost at university. What were you doing when not at school and not reading about World War II, what, how did you fill your time?

I avoided taking up active out, out pursuits like golf, things like that. I spent a lot of time kicking balls and just generally knocking around with a bunch of guys from the same age group mostly at the same school. That sort of peer group. So we would, mosey around. There were plenty of parks, there were swimming pools, you know. So you could just, yes, put your time in. [I forgot being a Scout, playing chess to interschool level and cross country running again to interschool level] There would occasionally be parties, which of course were mixed. So the school was mixed, but there was a tendency from most of the after-hours activity to be segregated by, you went out with the boys rather than boys and girls.

[1:09:31]

Could you tell the story then of, of starting... Well perhaps to begin with, decisions about what you might do at university, having, having got in and being able to produce...

Well the decision, the decisions, as I said, about grammar school were really quite easy. I mean, let's just go back to that for a second. Up until third form you all did the same subjects, you know, French, maths, science, PE, whatever, whatever the curriculum was that we all had to do. When it came to the decision as to whether to be streamed to arts or science, that was an easy decision, because, everybody I knew was going into science, so I went into science as well. And, I knew I didn't want to do biology, so that basically left physics, chemistry and maths. And since we were doing four, I took geography as the, as the fourth subject. When you've got A-levels physics, chemistry, maths, and you're going up to university, it's a pretty obviously combination that you're going to do... You had to do four subjects in the first year, it was a four-year degree, so, I did physics, chemistry, pure and applied maths, just to make life as difficult as possible. So, that was the decision-making. I always remember the interview. There were a whole series of us from the same school, and, as we were each called in, we had one honours blazer between us, the sports honours blazer, so we swapped it, so each one of us went in with an honours blazer, not that it made a pin of difference [laughs], but it was the sort of, typical thing you would get up to. So one was accepted simply on the basis of the A-levels from the first attempt. And, and, then, you really hit the wall, because, attempting to get through university courses on a minimum amount of work wasn't going to work easily. And, yes... [laughs] You'd probably better ask another question.

[1:11:59]

Yes. Well just before, just before I do, I wondered whether there was any, given that you've just mentioned that, just earlier you mentioned that the school was mixed, was there any distinction, did science have a particular gender attachment at that school?

I would have said it had a slight edge for boys, but only slight. The girls were intellectually exactly the same as the boys, I mean there was no, no differential there. In fact the girls took most of the prizes most of the time if I remember rightly. I never

had a prize for anything, which go[goes] with the general, [laughs] information I've already given you.

[1:12:39]

Where did you live in the first year at university?

I lived at home. I think it's important again to realise what things were like. In, this was 1963, and in, in those days relatively few people went across the water to Scotland or England to university, the majority of people simply went to their local university. The grant was £250 for the year, which really precluded you moving out of home. And in fact it was means-tested, so because my father insisted on living in council accommodation, he didn't believe in property ownership, which presumably is something to do with his social outlook, because of the means-testing, I only got a grant of £150 a year, so that was, even more limiting. And to supplement that, I then went and worked in Birds Eye in England [Grimsby] during the summers in order to earn the difference, so as I had enough to make my way through the year socially. So there was, all of that. And I've forgotten the question.

[1:14:04]

Yes, no, that's right, it was just, where you were living. Could you then sort of tell the story of your first year at university, rather than... You, you've mentioned that you might have attempted to get by again. [laughter] But if you could more generally tell the story of encountering university for the first time.

Mm. Well, it was, it was radically more difficult, I mean, just, that's the only word for it, radically more difficult. Some of the things were quite salutary. Pure maths, we had a bright young new PhD who was in his, basically first or second year of lecturing, and, the pure maths, as he would put stuff up on the blackboard, he would say, 'From this line, you can easily deduce the next line.' Well he might have been able to, but I certainly couldn't. So, this involved large amounts of time, at home or in the library, trying to work out how on earth you got from line A to line B. So, I think the word is that I had saturated out on maths by the time I got to university, I just, I, I didn't have enough memory to be able to carry the stuff in my head. And, that was even worse in applied maths. Applied maths was taught by people like, one

of the world's most, fifty most cited scientists, a guy who had done the maths for the Moon landings, this sort of, [laughs] well he basically couldn't get down to, [laughs] to, I nearly said our level, but certainly my level. And I certainly couldn't get up to his level. So, applied maths was a particular bugbear. And, chemistry, again, you had to memorise an awful lot of stuff, and I just, I, I found out, I didn't have the capacity for learning huge amounts of factual information, it just didn't work. And physics, well physics, you just took down absolutely endless amounts of notes. We were, we were lectured five and a half days a week. There was a roll taken at every lecture, so, attendance was compulsory. And, there were just frightening amounts of information. So you spent, basically you took your notes that you had taken, there were no hand-outs, you had to take the notes down, and you took them to the library and you tried to make sense of them, and if necessary you were going to look up the sources to see if they explained it better than the lecturer. So life was an uphill struggle at university, which was well attested to by the fact that I scored, well, they don't give you a score, they simply told you whether you'd passed or failed, at that, in those particular courses. And, pure maths, I knew I had only scored thirty-five per cent, because I'd only done three and a half questions, but I, I managed to get a pass, which implied they had tweaked the pass rate, which, that was fine. Applied maths, I failed, so I had to repeat it in the autumn. And, I passed physics and, and chemistry. But, I have to admit, I think I was thinking [laughs], this is not going to be easy without absolutely prodigious amounts of work, which, didn't really suit my character, so...

Yes, so how did you feel about being in that position, what did you...?

Oh I thought it was quite justified, yes, I mean I obviously... [laughs] I wasn't putting in the amount of work necessary to get on top of the subjects.

So what was your response, what did you...?

I just kept on doing the same... [laughs] Well I didn't get thrown out, put it that way. So, so I was then into the second year, and, and we proceeded onwards.

Any switching of courses, or any, any thoughts about not staying and so something else?

I think I was able to drop chemistry. [laughs] And I was left with physics, which I could do, and pure and applied maths which I, [laughs] were an uphill struggle. So, it, it's all sort of a blur really. You know, you had your social life, you know, which was, you know, quite important. And, you had this endless amount of information being thrown at you, just endless amount of information, which you had to try and make some sense of. But, none of that ever worried me, it was just the way things were, you know, it's just, why am I doing this? I don't know. Because I'm doing it. And, we'll see how it goes.

[1:19:43]

Did you have similar feelings about being, I mean this is sort of optional isn't it, university, but you'd had these feelings about school as being a sort of, involuntary sort of, imprisoning really almost. How did you feel about university, which was a sort of...?

I, I think, I probably rationalised it as, look, we'll give this a try, but I mean if it doesn't work out, well, we'll go and do something else. It had never really... It wasn't that I was thinking of a career, I mean I was very much along the lines of, well if one can make it through this, maybe, you know, there would be a teaching job or something at the other end. But, getting to the end was so distant that I don't think I thought about it very much. It was, university was what you were doing at that stage in your life. And I think, again it's salutary to think back on it, in the physics first year lectures, there were twenty-one of us from the same class at school. Now they might have been doing different things, they might have been doing medicine, but they were, because they had to do a series of subjects in the first year, that was the sort of proportion. I mean, it's hard to imagine now, twenty-one people from the same class, all in university lecturing [lectures]. One of the reactions I had to this was that I broke away from that peer group and moved in with people from another grammar school, who I just felt more comfortable with. Maybe, maybe it was because most of my peer group were out-performing me, which wouldn't have been hard. [laughs] So, yeah, that's the, that's the nature of that.

Were you in any sort of clubs or societies, student...?

I had been, at school I had been in the chess club and I had been in the cross-country teams and what have you, but, when I went to university I, I basically, shied away from, from that.

And what did social life consist of?

Playing cards, drinking, going out with girlfriends, going to dances at weekends. Just, normal student existence.

[1:22:04]

Did you have significant relationships at this time, significant girlfriends or...?

I did, because I met my future wife in the year I left school, mhm. We didn't know it at the time, but we, we would eventually be married.

How did you meet?

We met at a dance.

Did she go to university?

She didn't, no.

Were there particular things that you did with her, shared interests?

Apart from, just the usual social activity, I think it was mostly family-oriented. I mean, we either moved around with her family or with mine.

[1:22:52]

And, how did university then play out as we go into the sort of final year?

Oh, well, now that's, that of course is where it becomes interesting. The structure of the university was that, you had to, as far as possible, pass all the subjects each year.

The end of second year I had still failed applied maths 2a, which is ludicrously complicated mathematics, which I simply couldn't do. So I carried that into my third year. Third year physics was the preparatory year for Honours physics, and you had to pass it in order to be allowed to go on to do Honours. So by the summer of my third year, I had passed the physics course which would allow me to go on to do Honours physics, but I failed the applied maths yet again. So, I was going to have to come back and re-sit that in the autumn. And, I duly did that, so my last chance that year to go into physics Honours was to pass applied maths 2a, and I failed it yet again. So then I, the only option is to take a year out. So, I thought I'd better get some work. So I applied to a couple of schools and was taken on as a science teacher. And, I was teaching in a secondary intermediate school in Lisburn which is about eight miles from Belfast. And that was a culture shock, because, when you've been to grammar school, I certainly had assumed that everyone was equally intelligent, and it just mattered how much you worked, see my own case. When you go to a secondary intermediate school, you discover that there are people of very mixed ability, and people with serious learning difficulties that the system was not catering for. So that was a very rapid learning curve from my point of view. It told me that I didn't want to be a schoolteacher. But I soldiered on for three months full-time. I say, learnt a lot about it.

[1:25:31]

But the really formative thing that happened was that I became interested in archaeology. And, I had been wandering through the Ulster Museum, and looking at displays of flint artefacts, spearheads and arrowheads, axe heads. And, I remember consciously thinking, I'm sure those have all been found, in other words, you know, well everything from the past is found and is in a museum. But, by chance they had just put some new flowerbeds in at the back of the university, and, I was wandering over them one day and I found a flint scraper. It was self-evidently a prehistoric flint implement. And, that sort of triggered something in my head, and I went systematically over and picked up about six or seven worked flints. And I took them up to the Ulster Museum, and was lucky enough to bump into a young research assistant there called Peter Woodman, who was eventually to become the professor in Cork. And, Peter was extremely interested in the things, and, the two of us hit it off pretty well immediately and we started going out field walking together, in other

words, doing searches over ploughed fields looking for scatters of Mesolithic and Neolithic material.

[1:27:01]

And, behind the school I was teaching in in Lisburn, was a large area which had been bulldozed, stripped, for future building, and in the lunchtimes or, whenever, I would wander across those, and pick up, quite an interesting selection of Mesolithic flints. Because it was close to the River Lagan, which is, Mesolithic people tended to, to like lake edges and, and river banks, because a lot of their subsistence was, involved fishing. So, all of that put me into the notion that, I didn't want to be a physicist, I wanted to be an archaeologist. The past just, I had always been a collector of things, and, and collecting something as tangible as prehistoric implements was, very attractive. And then I had one of those formative things. Having seen this display of arrowheads in the Ulster Museum, there was a building site in South Belfast, and a large pile of topsoil had been bulldozed to build a house, and I was walking past, and of course by this stage I was used to looking for flints, and a lump of clay had simply rolled down this heap of soil and split open. And on it was a perfect barbotine [barbed and tanged] Bronze Age arrowhead, in white flint. And, if you were superstitious you'd think it was a sign, because, again, from that day I was really absolutely hooked on, you know, finding material from the prehistoric past, was what I was going to do. So I immediately signed up to go on excavations in England and I went on excavations here.

[1:29:03]

In the rest of that year off, I went and sat in on the physics lectures for the final year, somehow you could get away with that, I don't know how. And, that meant that I got a slightly flying start towards finishing the physics degree. I did get rid of applied maths 2a eventually so that they would actually let me back and finish the physics degree. But I had no intention of going on beyond the, the degree. I made an all-out attempt to break the mould by getting a 2:1 degree, but I think I fell about four per cent short and got a 2:2. But that was fine, because I was leaving anyway. That was, that's the, the end of, of the university career. I had morphed from science into something approaching an interest in archaeology.

What was your parents' view of this change?

They had long since stopped worrying about what I was doing, I mean they just accepted that, you know, if I wasn't doing well enough, it was somebody else's problem, not theirs. And, they had great confidence that I would sort myself out anyway, which it seems that I did.

[1:30:36]

And why had you gone into the Ulster Museum on the day that you said that you were looking at these spearheads?

Well to, to find somebody who could confirm what they were, or identify them, or, you know...

But the first time that you were to a museum and you...

Well the first time... It's actually in a sense more complex than that, because, because of this slight awakening interest in archaeology, I went along to, just an open meeting of the Ulster Archaeological Society, and at, at that lecture, which was inherently boring, and could well have put off a whole career decision [laughs], I did meet up with a guy whose name is Paddy Shannon, and he and I went down to the local bar afterwards to have a pint, as you would often do, and, in the course of discussion I was telling him about flints, and he said, 'Oh, you must come and meet Peter Woodman, he's a flint...[expert]' So that was the day I went up. Because I had a, someone who had facilitated contact, he sort of knew who to go to.

[1:31:45]

And, you know, in a sense, in a sense the rest is history, because of course what actually happened was that, I went over and saw the professor of archaeology, and, he basically said, 'Well, there's a project going to look into building a tree ring chronology, and, you might well be the right person to do that with a science background.' So, in due course that's what happened, I became a part-time research assistant in the radiocarbon lab. Because in those days, professors had the ability, or the power if you like, to manipulate things, and what Professor Jope did was, he took a single research assistant post and split it into two, which provided a small amount of money, £500 a year, for you to work part-time, and for that you had to actually work. But the rest of the time was your own. So you could do research in your own time if

you like, through the back door. It was a way into research without getting a research grant. And I wasn't, I was one of a number of people who benefited from this foresight by Professor Jope. And I spent two years as a part-time research assistant, preparing the samples for radiocarbon work, but also collecting wood samples to begin, well if you like, to test the idea that it was possible to build a tree ring chronology in the North of Ireland.

[end of session]

[End of Track 1]

[Track 2]

Before we continue from where we got to yesterday, I've got a few follow-up questions on yesterday, and the first is, taking you back to perhaps not a, not a fantastic memory for you, but what do you remember of the content of the applied maths course that you struggled with a little bit at...

[laughs] Struggled.

...at Queen's? I mean, both in terms of what applied maths at Queen's involved at that time, but, what was it about it that you found challenging if you like, or not interesting?

Are you recording at the moment?

Mm.

Oh right. I have almost no memory of the actual questions, topics. So, it was, it was a part of my life which basically I put behind me when I moved away from...[physics] It was almost like when I finished those examinations, I walked out the door and never looked back over my shoulder. I, from then on, all I ever needed were fairly basic mathematics, I didn't, didn't need anything sophisticated. And it was a bit of a struggle to actually get through that final retake of, of the applied maths 2a, which notice I even remember down to the course name. [laughs] So, I have just effectively screened that out over forty years.

[01:31]

Thank you. And the next thing was that, you said that the three months I think you said you did of secondary school teaching, that made you realise that you didn't want to do teaching. What was it about it that made you realise you didn't want to do teaching in the future?

I, I found that, the pupils weren't responsive even to what I have thought was, was really relevant information. I mean I could, you could ask secondary pupils like, what

was it they were thinking of doing? And they would say things like, 'I want to be a car mechanic.' And I was saying, 'Well, OK, well, I'll take you through how an internal combustion engine works.' Because I mean I, I knew about all that sort of practical stuff. And, they had no interest in learning at that level. And I thought, oh, that's, that's sort of intriguing. And I found this time after time, that, even things which I thought should have been very interesting to them...[they wouldn't listen to] They were sort of resistant to education. Now of course this was a secondary intermediate school, which is really at a fairly low level; it wouldn't have been like that if I'd have been teaching in a, in a private school or a, or a grammar school. But, it still gave me enough of a taste of, of managing twenty-five or thirty pupils, I thought, no, that's not something I want to spend my time doing.

What did you encounter in terms of what would be called now behaviour management, what, how did they behave?

Well I was in the worst of all possible schools. The schools that had a, the school had had a serious discipline problem, and, six months before I arrived the headmaster had actually been sacked, which was unprecedented in Northern Ireland for a headmaster to actually to be removed from post. And they had put a school inspector in as a sort of temporary head. So it, it had a very very chequered history, and, as I said earlier, it was a culture shock to go from a top grammar school to a, a secondary intermediate in that particular stage. But it just gave me a flavour of, you know, teaching, you know, I... I had always regarded school as incarceration, and so the thought of being incarcerated further was, yeah, I decided not to go down that line.

[03:49]

Thank you. Could you tell me about the composition of the Ulster Archaeological Society, is that the right title, that you joined?

Yes, yeah, that's the... The Ulster Archaeological Society appears to go back to the middle of the nineteenth century when a journal was produced for a number of years. It then went into abeyance and then it came back for about twenty-five years from the 1890s onwards. And then it went into abeyance again, and then it was resurrected as the Third Series of the *Ulster Journal*, which was the, the mouthpiece

of the, of the society back in the 1930s. And that society was still going. Its membership was, in the 1960s, was mostly rather elderly, long-term members, probably a lot surviving from when the society had started up again. Plus a few staff, and, and a few students. So that was, an interesting introduction to, to issues which I had no prior knowledge of, like, had the Neolithic, the early agriculturalists come in from the East or the West, is a sort of, slightly esoteric type topic. But, you know, obviously, if you're interested in prehistory, it was an obvious place to, to go to to find out.

[05:18]

And was it with this society that you went on your first excavation?

No, no my first excavations were with somebody writing off to excavators in the UK who would take volunteers, and, I was particularly interested, presumably because of this, this liking for flints, in the earliest possible flint industries. And, there were digs going on in Mildenhall and Elvedon in eastern England. And, I wrote off and was accepted to, to go and dig for some weeks with the, the excavator [G De G] Sieveking I think was his name, from the British Museum. [clearing throat] Pardon me. And, basically that was an interesting trek. I mean I hadn't travelled much in England apart from going to Grimsby to, to take part in, in shelling and processing and quality control in peas. [laughs] So I trekked across England, which seemed to go from large railways to smaller railways to horse-drawn railways virtually, right out into the, the wilds of the countryside. And, duly stayed in a deserted farmhouse with a bunch of other guys who had volunteered, and girls. And, we lived there for several weeks, digging on a Palaeolithic site, which produced the excitement that you, you actually on a day-to-day basis were trowelling up Acheulean hand axes and Levallois flakes. And, these had been sitting in the ground since they were last set down or dropped by earlier human ancestors, let's say a quarter of a million years ago. It was just like, wow, you know, it, if you like objects, and I have always had an affinity for objects, this was just as good as it gets you know, so...

[07:36]

For an audience of people who, because we, we can't sort of anticipate who's going to be listening, but, it's possible that anyone listening doesn't know at all what goes

on at an archaeological dig, or, or, you know, what you do day-to-day. So I wonder whether you could, first describe in as much detail the, in this first excavation, the actual site, what were you faced with when you went out into the field, what did the site consist of?

I presume that at some stage, either due to quarrying or some other reason, the upper soil levels had been stripped away and you were down, basically excavating through a fairly fine sand. Essentially you were on an ancient riverbank or lake shore, presumably where these people had lived and hunted and, and cut up animals and, whatever else they'd been doing. And, you were, you were working down in trenches, which had already been laid out. I think, this wasn't the first season of the excavation, so the trenches had already been laid out. And, you were trowelling down in intense and unusual east English heat [laughs], through this material, basically finding only lithics. There were no animal bones, there was nothing much else other than the industry left by, by the people themselves. And, of course one of the things about these particular artefacts is that, the Levallois technique is where the, the core, i.e. the, the parent block of flint, is carefully pre-worked, so that a very specific individual flake can be struck off at the end of a whole series of pieces of action. So, from the object itself you can tell the amount of thinking that had gone into its production. So that's really quite exciting when you, when you find things like that, which, you can see they've prepared the core, and they have then attempted to strike off more or less a ready-made implement. And of course sometimes it fails. So you've actually got the, the mark of what they...[intended] You can see what they were trying to do, and you've got the damaged bit where it didn't quite work for them. And of course they'd then just thrown it aside and, and presumably gone on and made another one. But, that had a real fascination, because you're looking at a pre-modern human, thinking their way round a piece of flint, which of course, I then, with the assistance of some of the other people on the site, mastered the art of, of making these things. So, it, it turns out, if you've got the knack, it's not actually all that difficult, I mean, I heard people on site saying, 'Oh, you know, a hand axe would take several hours of work.' It actually takes, probably one or two minutes if you know what you're doing. So. Because, the working of the material is an art in itself, you know, there's a technique to it. So, that was, that was sort of, fascinating. And you can become completely obsessed by the material and wanting to see more of it, and

wanting to find it, and... Remember, when you are trowelling through this sediment and you, you come upon a Palaeolithic implement, you are the first person to touch it since, you know, a pre-human ancestor set it down, which is, well, [laughs] it's, it's a very simple pleasure, but it's, it never loses its excitement really. Mhm.

[11:26]

I'm quite surprised that as well as collecting these things, you attempted to, to make them, almost to emulate the work that was going on at the time. Was that, was it common for archaeologists, whether the student volunteers or the archaeologists that were sort of managing the site, to, to try to, to try to do what these early humans do, had...?

No, it's quite common for a few people to do that. You don't have legions of archaeologists who can knap, simply because it, it is... [a skill] There's a...[knack to it] Even hitting a piece of flint with another stone, and you have to use something like a quartzite pebble, because otherwise, if you hit two bits of flint together, you get pieces of flint flying off in every direction, so you would end up with blind flint knappers, which would be a bad idea. So you, you hit the flint with a, say, a, a quartzite pebble. There's a throwing action involved which just, frankly not, not many people can do easily. And, if you can't do that...[well, you can't flint knap] It involves, because you are throwing the pebble at the, at the nodule, you're generating a really very hard strike, which, it's not a, it's not like a dead thump, it's an actual click, almost like the sound of a golf ball being well struck. And, if you can do that, then you can flint knap really comparatively easily. Now if you can't, you can't. So, so the world divides down to those people who can easily develop this knack and those who give up after, after hitting their thumb the first few times. So what I discovered of course then was, when I went back to, to Belfast, that I was, I think it's fair to say I was only person in Ireland who could knap flint. And in an archaeology environment, because, by the time I, we haven't quite got to when I was a research assistant in the radiocarbon laboratory, but when I was there, I was working literally in the back yard of the archaeology department, so it became known that I was the only flint knapper, so, I got to demonstrate to students, which was, a useful foot in a door.

You found that you could do it, but, who, can you remember who sort of, taught you how to do it? Because, I can't imagine that you would sort of extrapolate from seeing the end result to how it was done, maybe you did.

No no, there was, I think, I think one French postgraduate who had pretty well perfected the knack, and, he, he was quite happy to show people how to do it, but, I was one of the few people that had picked it up easily.

[14:18]

And were there at this time, in this area, people who were flint knapping in order to, a) produce sort of souvenir type objects, or b) to, there's a story, isn't there, of people producing sort of, forgeries and that sort of thing, sort of, fake finds if you like?

Yes, in East Anglia you have flint mines, and, we, I think we actually went to visit some of the people who still knap flint. There had been a whole industry. I mean a lot of buildings in England are, are clad with split flints, and, so the knack of breaking flint is quite widespread. But in terms of making specific implements, one of the things was that, because of the, the interest in people using old musketry in, presumably military re-enactment activities, there's a need for a constant supply of gun flints, which are little square tapered flints which are made for producing long blades and then snapping them into short lengths. And, the flint in East Anglia, if you get it from well underground, knaps particularly well, and produces extremely regular flakes which make, are perfect for, for things like gun flints. And of course anyone who can do that, can also fake implements. So, faking, faking is, is difficult on archaeological sites, because it can, it can give rise to, [laughs] bad feeling with the professionals. And, indeed on another site, at Clacton, I, this was a couple of years later, I made a, a hand axe just from the flint from a spoil heap, and, one of the, one of the other volunteers inserted it into the stratigraphy, and then, put his hand up and claimed to have found it. And it caused consternation, because Clacton's a pre-hand axe culture, where, a hand axe would have changed the date of the site by a quarter of a million years or something. And it took quite a lot of convincing. I hadn't actually planted it, but I had made it, and, and took quite a lot of convincing the principal archaeologist that this was in fact a, a fake. So. Mm, yes, you don't want to go down that line, it's, it's an invidious thing to do.

[17:03]

What else did you make, once you realised that you could do this?

Basically simple... One of the most common implements in prehistoric sites would be the scraper for processing animal hides for example. And, a scraper is, is basically a flake which has been trimmed round the edge with a series of other small flakes, so that it's not actually sharp, but has an excellent scraping action, you could, you could run it across the palm of your hand without cutting yourself, but you could feel it would allow you to scrape fatty tissue off the inside of animal skins. So you could make things like that. You could certainly make hand axes, and a variety of other flint axes. But, certainly, certainly good enough to demonstrate the procedure of making blades and flakes and, and some basic implements.

Did you get to know Sieveking while...?

Only as the guy who was running the excavation, yes, mhm. Yes.

Do you remember, do you remember anything of him in particular? I know that he's fairly well known I think for at least, in association with Grime's Graves perhaps, and, wasn't there a sort of, a white goddess, sort of, figurine found, which may or may not have been a hoax?

Oh, that, that escapes me. I mean I, I wasn't a Palaeolithic archaeologist, I mean I was just someone interested in lithics and the whole concept of excavation, so... What I do remember, [laughs] was, some of the lunches were extremely odd for someone who came from here and was used to very plain food. I had never had mulligatawny soup before, which was a shock to the system. And devilled kidneys for lunch was a whole new experience, but, that wasn't every day, but, it was memorable when it happened. [laughs]

And were there finds that you could keep, or did everything discovered have to be handed over to the...?

Oh no, no on a, on an excavation like that, I mean, the material belongs to the excavation. No one has any expectation of, of acquiring things. But the thing is, if you wanted to find flints, I mean you, you could simply walk fields and pick up flints, I mean they are extremely widespread. Obviously not Acheulean hand axes, but, if you just want a few work flints, and if you're lucky the odd arrowhead, they're out there, mhm.

[19:34]

Thank you. Could you... And then, there was a dig after your degree. Is excavation and dig all the same sort of thing? I'm thinking about the notes that you gave me, and you talked about two excavations and then, you completed your degree and then went on a dig. I wondered whether these are, are we talking about the same things here?

Yes, they're the same thing. I mean, basically, an excavator, a professional archaeologist will have his own, or her own, research interest, and, Peter Woodman, who I had fallen in with at the Ulster Museum, was very interested in the Mesolithic which is the hunting and gathering culture immediately before the agricultural Neolithic. And, Peter was running an excavation, very small excavation, up the Antrim coast at a place called Glenarm. And, so I acted as his site assistant on the excavation, laying out the trenches and, and recording the stratigraphy. I mean one of the things that, thinking back on some of what we discussed yesterday, I, I actually had a, although I wasn't that academically inclined, I was fairly practical, you know, I'd been a Boy Scout and I could light fires and tie knots and, dismantle clocks and put them back together and make them work, and, you know, so, when it came to the practicalities of excavation, I was fairly natural at that, and, and no problem at all being a site assistant who, you just had to aim at the, [laughs] at the excavation and, I would get on with it.

[21:20]

What are the practicalities of excavation then? You've mentioned trenches, which is, as I'm imagining, digging, but what else is involved, what are the...?

Well, everything is done in, in a controlled environment. I mean you've got to strip the, you've got to lay your trenches out square to begin with, strip the turfs off and

stack them in a location sufficiently far away that you're not going to end up wanting to dig under them, as you extend the trench, because you don't know in advance what you're going to find. And then you go down in a series of spits, so that the spoil has to be removed. You might want to sieve through the material that you're taking out so you're not missing any small finds, especially in Mesolithic where a lot of the implements were actually called microliths, they, they're roughly, two centimetres long and about two to three millimetres wide, so they can pass the notice of inexperienced volunteers. So, you would want to recover things like that through, through a process like sieving. As, as the trenches go down, you want to keep an accurate record on paper of the various layers that you've gone through, so, so drawing sections is, is another art. And then you've also got to describe those sections in terms of what they are made of, a sandy, silty clay, as opposed to silty, sandy, loamy clay, as opposed...[loam] You know, there's an almost infinite number of variables. And then the finds all have to be located in three dimensions, so you've got to triangulate everything in. So it's, yes, there's quite a lot going on. Somebody, somebody or, or several site assistants might have to keep check on a largish excavation.

And at this stage, in these excavations in the 1960s, what was done in terms of, on these excavations, what was done in terms of dating? What was the, what if anything was the dating method for the finds?

The dating method was entirely radiocarbon based, or, or dating by association. In other words, if you were finding shards of early Neolithic pottery, you knew you were in the early Neolithic. So I mean, there was that sort of associated dating. But if you wanted a radiometric date, radiocarbon was the only dating method available. Radiocarbon was only available in Belfast from, around about Christmas 1968, so these digs at around about that time were, were some of the first excavations in the North of Ireland to be actually getting radio carbon dates, because the facility had become available.

[24:08]

Let's go then to the laboratory, and, could I ask how it came that you were working there, in other words, how did you apply for, or be invited to work there?

Well, the, the situation was that, that jointly between biology and archaeology at Queen's, they had gone out of their way to get funding from, I think the Nuffield Foundation, to acquire a radiocarbon laboratory. And the reason, the driving force behind that was pollen analysis which was going on, there was a big interest in reconstructing the environmental history of, well, of many areas, but I mean, there was quite a concentrated effort in the palaeoecology centre at Queen's. And in order to facilitate the chronological backbone on pollen studies you would want to get radiocarbon dates. So they thought the best way to do that was to actually acquire a radiocarbon set-up. They did that in 1966, I think, and the problem was that although, although the kit theoretically came with a manual and you simply plugged it in and turned it on and it started doing things, they rapidly discovered that this wasn't something to be undertaken lightly, and they realised they were going to have to get an expert in. So on the 1st of October 1968 they employed Gordon Pearson, who was a employee of the Atomic Energy Authority in, in GB, who had nineteen years' experience of low background counting, which is what radiocarbon counting is all about. And, they brought him in, and within a couple of weeks he had the system up and running, and from then on was producing dates. Once, once he'd got the system stabilised they were... [coughing] Pardon me. Sorry about this. They were running a commercial service. [drinking]

[26:18]

Could you just define the term 'low background counting' for the non-specialist, like me?

Well, how would one put it? The... Radiocarbon is, is a natural isotope of carbon which is produced in the upper atmosphere by cosmic radiation from space striking nitrogen atoms. And, basically it permeates down through the atmosphere, and is mixed with ordinary carbon dioxide which of course is taken in plant food by humans, and the result is that, our, our bodies, and in fact all living organisms, have, have an amount of radiocarbon in their tissues. Now, how to translate that into low background. If you took five grams of carbon from your left leg, [laughs] which you wouldn't want obviously, but, let's do it for the sake of imagination, well you could just as easily take this table. Take five grams of carbon and convert it to gas and put it

into a, a counting chamber. The number of atom, radiocarbon atoms disintegrating per minute, would be around about sixty. And, and indeed in the early days of the lab, Gordon would wire the counters up to a loudspeaker and you could actually put a sample of carbon into the chamber and it would go, bip-bip bip, it's a random process, radiocarbon, OK. bip-bip bip bip bip-bip And you would, you know, count those bips, and you could work out roughly, just on the back of an envelope, what age the sample's going to be. If you put in a very old sample it would be bip bip-bip bip, like that [slow bips one every four or five seconds]. If you put in a modern sample, as we did before, roughly, sixty counts a minute. So, that's low background counting. It's not strong radio activity, obviously it's not doing us any harm, it's, it's a natural component of, of all living material. So, in order to assess the age of an ancient sample of carbon, you reduce the sample as it comes in to the laboratory down to, as pure carbon as you can get, and, introduced into a counting chamber, usually in the form in those days of methane gas, and, effectively count the blips. And you do it for, 100 minutes, and you then maybe repeat that ten times if you want a fairly accurate measurement. And, it's, it's delightfully simple once you actually break it down into those terms, there's nothing magical about radiocarbon, it's a very very practical use of radioactivity to get very reliable estimates of age.

[29:32]

Thank you. So, this was the laboratory; how did you become associated with it yourself?

I had, I had gone over to see the professor of archaeology, basically to say, 'Look, I've just graduated in, with a physics degree, and I would like to move into archaeology.' And, it's probably worth mentioning that at that stage, apart from the professor himself who was a biochemist by training, there were no other scientists effectively employed in archaeology in Ireland, with the exception of one botanist. So it was, I think Professor Jope saw the advantage of bringing another scientist in. And the project they had devised, or, which was sitting if you like waiting to be undertaken, was that, because they now had a radiocarbon laboratory, which was going to be sitting there capable of producing radiocarbon dates, an obvious thing to do is to build a tree ring chronology, which is a year-by-year record of, of the growth of trees, and use that to provide precisely-dated samples of organic material to then

calibrate the radiocarbon method. Because this in the 1960s was a very big issue. It had been done in America by a man called Suess, Hans Suess, and, he had, he had gone to dendrochronologists, people who study tree rings, in the western United States, and they had supplied him with many, many samples of the giant sequoia, which lives for up to 3,000 years, or bristlecone pines which live up to 5,000 years. And they had given him samples all the way back through that, and he had measured the radiocarbon activity of the samples and produced a calibration curve which allows anyone to then take a radiocarbon date as presented by the laboratory and convert it to a measure of real age using this calibration relationship. Well the problem, the problem with that was that, although this was, you know, big and interesting international science, a lot of people in Europe said, 'Ah, these trees in America, bristlecone pines, live 3,000 metres up, they're on a different part of the planet; maybe that calibration curve isn't valid in Europe.' And, there was another issue in that the, the calibration curve that Suess produced had wiggles, in other words, it wasn't a smooth curve, it was a wiggly curve, and there was a lot of controversy as to whether those wiggles were statistical fluctuations, merely problems with his counting of the samples, or whether they were real.

[32:36]

So, three [four] people in Belfast, Professor Jope, the archaeologist, Professor Simon, the botanist, and Alan Smith who was another botanist, and John Pilcher who was already in archaeology, they sat around a table and decided, why don't we attempt to build a tree ring chronology in Ireland and duplicate Suess's work, to see if he's right or not. Because of course, if we were able to show that, that an Irish curve was more appropriate to Europe, low altitude Irish rather than high altitude American, if we could show that our curve was more valid, then, we would become metaphorically rich and famous, you know, in other words, our curve would be used as opposed to the Suess curve. And also from a scientific point of view, it's important to replicate experiments. I mean in a sense, in a sense Suess had performed an experiment and the question was, was he right or not? So they had, they had this, dare I say it, fanciful idea. It was based on one particular important piece of information, which was that, in the 1960s the people doing pollen, like Jon Pilcher for example, or, or Alan Smith, they had been out round the countryside collecting sections through peat bogs, and they had noticed that because of economic situations, the economic situation, large numbers of bog oaks were being pulled out of farmland all over the

place, in other words, that there was a ready supply of ancient timbers. And, they knew these timbers were obviously of the order of thousands of years old. And the possibility therefore existed to build a 6,000-year chronology in Ireland. And, so I innocently arrived at the door effectively saying, 'I'd like to try and move into archaeology,' and they said, through the mouthpiece of Professor Jope, 'Right, come and see if you can build a tree ring chronology.' And the deal, the deal was that I would be employed in the radiocarbon laboratory effectively as a technician in the mornings, five days a week, and that the rest of the time I could have a go at building a tree ring chronology, on a salary I suppose, a half salary really, of about £500. And in those days that was quite an attractive proposition. And that's, that's how it started. So, I also started the same day as Pearson, we both turned up for work on the 1st of October 1968.

[35:41]

Before we go on to look at what you did there, could you describe, sort of imagine yourself in the radiocarbon dating laboratory, and describe what it consisted of as a physical place? Where was it, what did it have in it, what was it next to, all of that sort of thing.

The... I presume what must have happened was that the, when Nuffield provided Queen's with the money to buy the radiocarbon machine, Queen's itself had built a purpose-built building in the back yard of the large sort of, late Georgian, early Victorian terrace which runs down the side of the main building at Queen's, and in the back yard of No. 16 and 17 University Square they set down a concrete glass building about the size of a Nissen hut, and that was the radiocarbon laboratory. And in the stable block behind that, that was the palaeoecology laboratory, so the people doing pollen work, or, as we then started doing, tree ring work, we were, we were all living in the, in the Victorian stables behind the, the new purpose-built radiocarbon facility.

And standing in the new purpose-built radiocarbon facility, what would you see if you sort of, stood in the room and turned around, what...? For people who have never been in a...

Well I mean, a lot of, a lot of one side of it would have been, you know, benches and sinks, because of course you're, you're preparing samples chemically, cleaning them. You would have a variety of furnaces for burning material, because you're wanting to burn CO₂ and then convert CO₂ to, to methane to put into the counting chamber. The actual machine itself was about, eight feet long, about eighteen inches from front to back, and about six feet high. And basically, it had a whole series of glass, spiralling glass tubes, which allowed you to move gas around. It's, it's a fascinating idea, I mean, you produce gas; what do you actually do with it? I mean you've got to first of all compress it down into something and then move it by creating a vacuum somewhere else. So, there were, there were gas lines for moving the gas once you had produced it, into a conversion apparatus to turn it from CO₂ to methane, and then to actually move, physically move that gas at a set pressure into the counting chamber. Once the gas was in the counting chamber you could simply turn on the electronics and count the disintegrations of the, the radiocarbon atoms.

[38:59]

What was your role then in the morning, sort of step by step, when you arrived in the morning, what did you do in those years, in the late Sixties? The morning being the time when you were a technician in the laboratory.

Yes, that's... I, well I did whatever was, was necessary. You could be cleaning glassware, you could be, there were several weeks when I was actually drawing designs for new glassware. I would be chemically pre-treating samples when they came in. There were all manner of, of washings and picking out of suitable material. One of the things in those days was that, that, archaeologists were almost universally not scientifically trained, and there had been, the tendency was that they had been told to collect charcoal, as much as you can get, and, and provide it to the lab who would then date it. The trouble was that that gave rise to a lot of contaminated samples, because people were taking charcoal from different layers if you weren't careful. So one of the, one of the duties which had developed fairly quickly was that, people from the laboratory went out to take the samples, to stop archaeologists mixing things. And, the other thing was, it was very evident that you didn't want to use pieces of wood, charcoal, which were from large trees, because they could be, that wood could be much older than the actual action of felling the tree. So you wanted things like

twigs and hazelnuts and other short life samples which had better integrity. So, this was all a learning process. Common sense in many ways, but you know, as you watched these things developing, you realised you had to take charge of what was going on in order to minimise the risk of, of contamination.

[41:00]

So, you had, as I say, a wide variety of procedures in simply, you were there basically as a, as a dogsbody to do whatever was necessary in the, in the radiocarbon lab. But of course the great advantage of that was, you actually saw the whole production process of radiocarbon dates, and that gave a lot of insight into, let's just say mistakes that were being made, you know. I mean to try and give you a simple example, if, if a ditch was being excavated, and at the bottom of the ditch you had twigs, which would be a high integrity sample, and the top of the pit, the top of the ditch was, was sealed and there was a pit dug into that, which had hazelnuts, which is another high integrity sample, if you dated the hazelnuts and the twigs, you basically had the top and bottom of the ditch, you had the history of that, that piece of archaeology. The problem would then come that in the middle of the ditch there was a charcoal layer, and the charcoal was finely divided charcoal, so you had no way of knowing what it had come from. So, I found myself in the position as a technician dealing with really quite senior archaeologists, and trying to explain to them that, there's no point in dating the charcoal layer in the middle of the ditch, because if it gives a date which is between the top and bottom date, you'll accept it, and if it gives a date which is older, which it could do because you've no idea what the charcoal is, and it could easily be a long, you know, from something like the centre of a tree, if that date comes out older than the bottom of the ditch, you'll simply explain it away. Now if you can explain away both options, you know, in other words, accept it if it suits you and explain it away if it doesn't suit you, there's no point in getting the date done. Now trying to get that logic over to archaeologists was actually quite difficult. And there are some wonderful suites of early dates where it's very clear that the archaeologists are all now dead so we can speak frankly, hadn't had a clue, and they had been working on the basis that, if we get charcoal, we'll get answers, and, if you don't sample with, if you like, a lot of forethought, what you get is nonsense. And they had wonderful series of dates from prehistoric tombs which span 6,000 years. [laughs] And of course, because of that, were completely useless, because, if you've got charcoal of that many different ages on the site, the chances are, some of them are also mixed, so they're

actually very inaccurate. So, one of the things we had to do as a laboratory, because everyone was on a learning curve, was to try and get this information out to archaeologists, that sampling for dating was critically important. Because the one thing you don't want to do is put wrong dates into the system, because they're very hard to get rid of afterwards. Dates take on a life of their own.

[44:17]

How did your position as a, as a research assistant affect your ability to sort of, convince, as you say, senior archaeologists of certain things? I'm partly asking about how you, how you were treated as a technician by scientists. Because later in your career you're going to be the sort of senior scientist with assistants, but I wonder at this time how, how you were treated or how they related to you as a, as a technician.

Actually, very much as equals. There was no real sense of hierarchy within the, the sort of, the, the archaeological dating, palaeoecological community. We just all got on and, and did stuff. That, that's slightly because of this interest that there is in what you're doing. You know, it's not like you're producing something in a factory which is, is of no personal interest to you. Everything we were doing was of interest to us. And, you're constantly learning new things. And relative to that, everyone just, basically got on pretty well together, so that, there wasn't really a boss/underling set of relationships, we were, we were all part of a team really. Which is, I mean I must say I enjoyed, I found that easy to work in.

[45:52]

And what do you remember of the characters of the other members of the laboratory? You've got the man Pearson who started with you, I've forgotten his Christian name, is it...

Gordon Pearson.

Gordon Pearson, who started the same time as you. You've got Professor Jope and, and other people involved, and other assistants I think you mention, perhaps these are later, Elizabeth Halliday, Martin Munro and people like that. Are these, are these all people in the laboratory at this time?

No no, in the early days there were, well, a very small number of us. The history, the history basically develops, I think, I think that the same basic people were there for, for the first few years, and, I'll try and take you through it. Pearson and I arrived, working with, particularly with Jon Pilcher, who was, who was the palynologist, biologist, botanist, expertise in the, in the enterprise. We immediately... You can't separate the part-time work in mornings from the personal research, which was also partially team research, in that we were going out and collecting oak. Now, remember, this is from a standing start, we wanted oaks of all periods, so we, remember the target was something like 6,000 years, so we wanted lots of oaks from bog sites, from, where farmers had pulled them out of bogs; we wanted archaeological timbers, we wanted historic timbers, and we wanted modern recently felled timbers. So we, we put out information, I think we actually, even had a couple of newspaper articles in the local press saying that, what we were thinking of doing and what we wanted. So we did have contact from landowners saying, 'Oh yes, we've got stumps of trees, and, we've just felled some oaks,' or, 'We've got bog oaks.' And, that meant we, we spent a lot of time...[out in the field] The Botany Department had a vehicle, so we were able to use it for fieldwork, we acquired a chainsaw, and, we basically went off collecting wood, first of all hundreds of samples, and eventually thousands of samples. That all had to be numbered and stored somewhere. And, the... All of that was going on, and, in any fieldwork, anyone who's in the laboratory, so other research students, people doing PhDs in, mostly in palynology because that was the focus of the, of the laboratory at that time, would come out on fieldwork with you and give you a hand, because in turn you would have to go out with them and give them a hand if they were coring a lake or, or digging a trench through a peat bog. So, it's a sort of concentrated group activity, where everybody just gets on with things. And the only person who mostly stayed back in the laboratory was Gordon Pearson, who actually had to run really of the carbon dating system. And right from the earliest days it was obvious that if the grand project was going to work, in other words, if we were going to actually produce a Belfast calibration curve, unlikely as it may seem that that would ever actually happen, because it's a, it's a big undertaking, if that was all going to work, then the radiocarbon system had to be updated to something more capable of producing much better radiocarbon dates. And Pearson right from the start had clear ideas on what was necessary there because of his background experience. The thing

was that, the commercial set-up which Queen's had bought was capable of producing radiocarbon dates at one standard deviation of about plus or minus eighty years.

Now, one standard deviation means there's only a sixty-seven per cent chance that the date's right. If you want to be pretty sure it's right, you need two standard deviation range, which is, is two sigma, two standard deviations. And that of course would be plus or minus 160. So, this commercial lab was only really capable of producing radiocarbon determinations to a range of 300 radiocarbon years, which is all very well if you want to know the difference between the Bronze Age and the Neolithic or the Neolithic and the Mesolithic, but it's not actually any use at all in refining the story. So, it became obvious immediately that a much much better system had to be produced, and Pearson started designing a system which would use bigger carbon samples, so that you were getting more counts, which would be smaller by using a liquid instead of a gas, which would cut down on the background, because of course background radiation both from the earth and from the sky is, is a constant source of problem in any low background counting. So he was aiming right from the start to build a system which could produce radiocarbon dates which realistically had errors of only plus or minus twenty years, which would have been an order of magnitude better than what was, what was available in 1968.

[51:56]

So, all, all of that was ongoing. You had someone in the back of the lab trying to refine the technology, and you had people out in the field collecting material, and then you had myself and Pilcher for the first two, 1968 to 1970, actually measuring the samples, and seeing if we could cross-match tree ring patterns. Because, it's important to realise that back in those days the, the major figures [in] palaeoecology in both Britain and Ireland had basically said, tree rings won't work. You won't be able to practise dendrochronology in Ireland, or indeed England, because, we have so much rain, and quite a lot of sun from time to time. In other words, a variable climate. In their experience, tree rings only work successfully in extreme climates like in this, western United States, in areas which were very arid. So that was, that was, that was not encouraging news if you like, the experts thought it wouldn't work. So basically, it was our job to see if we could make it work. In other words, let's ignore what the experts are saying, and let's see if it will actually work despite them. And it fairly quickly became apparent that, yes, we could cross date ring patterns for oak trees. And again, it would then be important to realise, why had we decided on

oak? Well, by running a series of radiocarbon dates on specimens of bog oak, and knowing roughly what we were finding from archaeologists and building historians, we knew that oak was available from pretty well all periods back for the last 6,000 years or so. Scots pine, which also exists in bogs in Ireland, when a range of Scots pines were analysed, it was found that they were all prehistoric, they were more than 4,000 years old, and that pine simply wasn't an option for building a tree ring chronology. And frankly, there aren't any other species found in bogs in quantity. So that oak rapidly was realised to be the only game in town. You, you can find living oaks, it's used widely as a building timber, it's found on archaeological sites, and it occurs naturally in peat bogs. So, oak was the only game in town. And we knew that within six months of starting.

Leaving aside the fact that it was the, it was the only option for that reason, because it was the only one that gave you the range of samples and the amount of samples, what is good and bad about oak for this method? In other words, if you could choose for other, if you had a choice of any tree, what is good about oak and what is bad about it for this job?

Well, in, in an ideal world, the species you choose should be long-lived, because if you're going to build a chronology, you want long sections of chronology, you want trees that live for hundreds of years. You want the rings to be clear. You want the species not to miss rings, and not to duplicate rings. And, those are the, those are the main criteria. So, it's got to exist from all periods, it's got to be long-lived, it's got to have clear ring patterns, it's got not to miss rings, and it's got not to duplicate rings. Put that suite together and oak is the dream timber. You could, you almost couldn't imagine a better species, unless you've got one that's even longer-lived. But, oak's nearly ideal.

Just because it's long-lived, or is there something else about the way...?

No, it has clear, it has clear rings, it doesn't miss rings, it doesn't duplicate rings, and, and its rings are clear. So I mean, you almost have to look over your shoulder and say, who designed oak, and why is it here from all periods? It's like, you sort of, couldn't help but feel it was a bit lucky that, it was there.

[56:33]

Thank you. Before we go on to what you did with the, in the late Sixties, in this period before 1970 when you brought the stuff back to the lab, in terms of preparing and counting and so on, can I have as many memories in as much detail as you can remember of actually collecting? You've said that you, there were articles in newspapers. And so, can you take us from the point where perhaps people wrote in saying, 'We've got this,' or 'We may have this.' Perhaps you, as well as that, were sort of, I don't know, driving about looking? I don't know. How did you, how did you find the material, and what do you remember of actually in practice getting it, bearing in mind you were going around the countryside having to interact with people who owned land and all of that sort of thing? So yes, how did you find them, and then, what do you remember of actually doing what might have seemed from the outside to be quite a curious activity?

The, notification came from a number of sources. Obviously, archaeologists and the ring [building] historians knew what we were doing, and would tell us if they knew of suitable buildings. But, remember, there's a, a vested interest, I mean if, if they supplied us with information about, say, a building, and we were able to date it, then they would get the date and we would get the timber, so I mean that's, everybody would be happy. So archaeologists were, were a ready source if suitable excavation were going on. In Northern Ireland you had the, what was it called in those days? [pause] I've completely forgotten. The responsible body for monuments, sites and monuments [Historic Monuments Branch of the Department of the Environment]. And, they of course were a ready source of information on, castles, and, since they were responsible for the upkeep of many ruins, they knew where timbers were, and they could also give us access to those timbers. So, a typical piece of fieldwork would be, a landowner would let us know that, you know, he had felled a dozen oaks in recent years, and we would go out and check on the stumps, and, take a chainsaw and, and collect slices. Bring them back. Measure them up, measure up the ring pattern of each individual sample and then cross-date them. And one of the things with living trees that that rapidly showed was that people's memory was extremely fallible, people would tell you, you know, 'Those ones were felled two years ago,' but we could actually cross-date the ring patterns from those trees to trees which we had

sampled ourselves, because we don't have to fell trees, it's possible to take a hollow metal tube and, and basically extract a core. There are purpose-built corers, they're called Swedish increment corers which allow you to take a, a sample roughly the size of a drinking straw out of a living tree without, as far as we know, doing any damage to the tree. And you could establish the ring pattern right out to the final year of growth. So we knew exactly the dates of those trees, and we could then cross-match them with the stumps. And you realise that trees which people thought had been felled a couple of years ago, had been felled fifteen years ago. And, you rapidly build up a repertoire that you can't trust people. It's not that they're being dishonest, it's just that human memory is vague, and I can appreciate that myself. [laughs] And, we, we had many occasions where, in fact I would almost say the majority of occasions, people's memory, if it was anything more than six months, they were nearly always wrong. And, that was, that was sort of intriguing, because, it gives you the feeling that, you can't believe what you're being told. Which, is a useful thing to know. So the tree rings always override what you are told. You have to have confidence in the, in the ability to cross-match the, the ring patterns. With farmers and bog oaks, basically, most of the time that was either, colleagues would say, 'Oh we saw some oaks' at a particular location, give you a grid reference, tell you where it was. You would drive down, wander up to the farmhouse. Traditionally in Northern Ireland you don't go to the front door of a farmhouse, you go to the back door. So, you usually have to wade through several dogs that are intrigued by your presence. And, well I've never had any problem talking to people, I mean I, I don't care who anybody is. I think my upbringing of having a variety of, of different groups of people involved, and aunts and uncles, and, living away from home quite regularly, and also living in different locations, and being different school environments, I mean I just take people as I find them. And, my reaction, my feeling or my, my experience of that, is that they then take me as they find me. So if you turn up at the door... It's very useful being able to say you're from the university, because, Queen's is well-regarded, in fact both the universities are well-regarded in, in the Northern Ireland environment, because so many people have sent their children to those universities. And, so there's a, there's a fondness for the institutions. So, once, once it's established that you're from the university, you're all right. And then you, basically [find] people are unbelievably generous and just simply go, 'Oh help, you know, help

yourself, yeah, just, take whatever you want.’ And, quite often you would then be treated to bread and home-made jam and, a cup of tea. And, [laughs] yeah.

Why is it the practice to go to the back door?

It’s just traditionally... I think your front door’s for taking the coffin out. [laughs] Maybe that’s, well that’s too extreme. But, yeah, you would normally turn up at the back door, which is the door usually into the kitchen. So that there will usually be somebody in the kitchen, I suspect that’s what drives it really. If the farmer’s out, the farmer’s wife or the children will be around the kitchen.

[1:03:33]

You found them then helpful, but what, what did they ask you about what you were doing, what was the level of, the extent and nature of their interest in what you were doing?

It was relatively limited, except that from time to time you would have farmers who clearly, their knowledge was, was based on their Christianity, and, they’d say, ‘Oh, yes,’ they’d say things like, ‘all them, all them oaks is lying in the one direction. They were washed down by the Flood,’ you know, so you would, you would hear expressions like that. Which, we would then say, ‘Well, you know, we’ll, we’ll test that and see if, if they really are all the same age.’ And of course mostly they weren’t. The reason that trees would tend to be lying in the one direction is that they, they’re blown down mostly. In other words, oaks are found as trunks, they’re not found as stumps, and the result of that is that they have tended to blow down with the prevailing wind direction, so the majority of them tend to be in the one direction. So it sort of looks to a, to a casual observer that they’ve, they’ve been washed down in a flood. So it’s a useful sort of, local explanation. They would also tell us things about, you know, how the bogs had shrunk, and then had since been trained [drained]. I mean, there’s no other way to find out than somebody telling you, ‘Well, you didn’t use to be able to see that house from this house, because the peat moss was in between, but ever since we drained it, it has shrunk and now you can see across.’ So, there were houses down in the area around Lough Neagh where people kept a boat tied to the front door because it would flood periodically, and, they would have to

have access to a boat. So I mean things like that, just, local, local interest, local lore. And, widespread occurrence of black oak. A lot of, a lot of farmers had views about them, but, I think in, in the landscape as a whole, there was a tendency to think... I think actually in biblical terms they'd probably, these things were no more than 6,000 years old, since the Earth was only created in 4004 BC; if you believed Archbishop Usher and his chronology of the Old Testament, then, then it was all recent anyway. Scientists, our attitude was like, well, we're just doing science, we're not, interested in getting into an argument on the issues, but we will be as factual as we possibly can in explaining things to people.

Did you find yourself in a position then of, presenting the same people who had, if you like, donated material with the results, and having to present results which were at odds with the way they were thinking about, a) the oaks, and b) the landscape and...?

No, there were relatively few instances where people let it be known that they were interested in the results. I mean they were more than happy that, that you were getting what you wanted, and... If you, if you went back to them, and gave them an article you had written on, relating to the subject, they would, they would like that, but mostly they wouldn't read it. I mean it's, it's a... For a... To be honest, I think, for an ordinary farmer, I mean, they have no knowledge base which makes the sort of information which we would be producing particularly relevant. And let's face it, it's hard enough to get academics to read articles. [laughs] I wouldn't want to try inflicting them on, on, on, [laughs] guys out in the countryside.

How do you know that they didn't read them? Or, is this, do you suspect that they...?

I suspect that they didn't read them. Yah, based on, yah, the sort of, body language as much as anything. [laughs]

[1:07:56]

Thank you. So...

But one of the other, one of the other issues that you would have to address there is that, in an ideal world, every farmer that gave you a bog oak, you would give them a

written report. Life is much, much too short in a university setting, and especially in a research setting, to be setting time aside for niceties like that. That's just basically not going to happen. You've got, you've got a job to do, it involves acquiring wood and building a chronology. As I say, it would be very nice in an ideal world that you would have a system which would provide this information [feed]back. You'd probably have to employ assistants to do that. Somebody would have to provide the money to provide the assistants. Just, it's not, it's not realistic. And there was no expectation. In one or two cases people said, oh they would be interested, but, that was a rare occurrence.

And did you get, the last on this, did you get any impression of how they saw what you were doing as a form of work, it being very different work from the work that they were doing?

I suspect that, that it was their view, that's what people from the university do. You know, that it's, completely, different. Yes, I suppose, it's rationalised quite easily as, these people work with their heads, we work with our hands, you know, it's more that sort of, thinking.

Did they provide any assistance with the sort of, manual lifting and, and moving and collection of things?

If you had a lot of stuff to move, they'd happily provide a, well, you know, come with a tractor and, and move the stuff for you. But most of the time we, we were, if there were, say, four, four people out on a field trip, if you had to walk across four fields, quarter of a mile or something, carrying five or six slices of oak, and you had to do that six times, well, that was just, part of a day.

[1:10:05]

Having got material back to the lab, whether it was brought in for you or stuff that you had collected, whether you had got it from a bog or from a building or wherever, what did you then do? So, if we can imagine you unloading the stuff out of the, of the van, what next, what happens next in order to insert what you found into this attempted chronology?

Well the first thing that was done either in the field or immediately on bringing the material back was, each sample was given an individual Q number, Q for Queen's, and, noted down in a notebook as, the site with some details. Unfortunately, under pressure of rain and work and getting there and getting back, very often not nearly as much information was recorded as would have been recorded in an ideal world, but, the key important thing was to locate that sample uniquely. It was important that we knew where it was from, and that from then on that sample could be identified uniquely by its number. So numbering. They were then stored... The vast majority of timbers except those from buildings come in wet, simply for the, if they're living trees, they've still got sap in them, and if they've come out of a bog they've been saturated at some stage. And even if they've been sitting out for a while, they'll still not be fully dry. So we would bring in the discs of chainsawed wood, and, normally split them with large metal wedges and heavy hammer. So, to take the stress out of the wood, if you leave a disc of oak, especially bog oak, simply sitting, it will start to crack up very badly, and since we wanted nice clean radii, we found it much more advantageous to split the, the discs into wedges, to reduce the internal stress on the wood. The other thing was that, because we had no idea which samples were going to be important for each bog oak, we took a thin slice, roughly one inch thick, for the tree ring work, and a roughly six-inch thick slice for reserve research purposes, which just had to be stored. And if that sample turned out to be particularly important or useful or was going to be used as a source of radiocarbon samples, then that disc would be brought out and, and samples taken from it, as opposed to the, the one-inch tree ring sample.

So one inch sort of, depth?

Depth, yes, mhm. Luckily from our point of view, oaks in Ireland are slow-growing, they are, certainly a bog oak's grand average ring width is one millimetre per year. So the result is, the trees are not huge, they're a sort of, a manageable proportion. And, a typical wedge would be no more than, twelve or fourteen inches in length, from the centre of the tree to the outside. So these, these were manageable samples, I mean, there would be a nightmare storage if these had been big trees, so that, that eased things enormously.

And, this is a feature of oak or this is a feature of oak in Ireland, the slow-growing...?

It's a feature of oak in Ireland. Oaks are considerably bigger in Germany, I think, and most oaks in England tend also to be wider-ringed. I presume it's, we have to assume it's largely genetic, that whatever the, the stock is, the Irish oaks were mostly narrow-ringed.

How did, how did English dendochronologists, I know they had later to cope with the larger size, and German collectors cope with this...

They weren't collecting most of the time in such large numbers. And also you can reduce the samples down, so as you're, you're not storing discs but maybe storing narrow wedges, so it's, it's not a, it's not, it's not really a big problem. It might have been a problem if all our trees had been big, but... We probably would have had to simply reduce the samples more radically; as it was, we were able to store the large disc in either two, three or four wedges, and, and the, the smaller discs we normally chose one good radius, one good regular radius from the tree and that was what was measured. And the rest could be discarded, or stored separately.

[1:15:18]

OK then, so that's, what happens next after splitting and you've got your sort of, reference block and the block that you're going to, the smaller block, or less deep block that you're going to use for the counting, what do you do to these samples next in order to make rings visible and then begin to turn the wood into a paper record?

Right. Well we, we... First of all, we, early on we made the decision that we would dry everything. We had observed what happened with wet wood, that archaeologists had attempted to retain for whatever purpose, and, basically, wet wood takes on a life of its own, basically, you've a large number of organisms and fungi which decide to produce mulch. So you don't want wet wood, certainly not large numbers of pieces of wet wood. So what we did was dry the samples, and then, we took a rotary sander and polished up the surface of the, the wedge in each case. That changed later because, the production of large amounts of fine dust is, is a real nuisance, and a

health hazard, so, eventually, it became more common to simply pare the surface with, with a scalpel, blade. And that then in turn meant that very often the samples were measured wet, because it was easier to pare them while they were still wet, and then dry them afterwards. So, there's a lot of pragmatism goes on in a subject like this. So the important thing was to get the sample prepared. Oak takes a very good surface, the rings are very clear, and we enhanced that by rubbing chalk into them. In an individual year's growth in oak, you've got a line of large spring vessels which are large enough that you can resolve the individual vessels with the naked eye, and then fine-celled summer growth through to about September when the tree goes dormant, and then it repeats that the next year. So when you have a polished surface and rub chalk into it, the chalk goes into the large vessels, and doesn't go into the fine-celled wood. So the result is, these clear lines of spring vessels starting growth around about, late April, and, the whole ring running right through then to September. And, we didn't make any, we didn't try to be clever in what we were doing, we simply measured the full ring width for each year, in other words, the width of the ring is from the start of the spring vessels of one year, to the start of the spring vessels of the next year.

[1:18:14]

It may sound a naïve question, but how did you measure the width of those? We might imagine someone getting a very sort of fine ruler and laying it across the things. But how is it done, do you have to stick it under a microscope, do you have to, put something over it and rub it? How do you count?

This was, this was a low-budget operation we were involved in. We were simply using the fact we were in a well-found laboratory. So we were able to scrounge a low-power microscope which was sitting around the lab. We went up to one of the engineering departments and found a technician who was willing to build us, to our design, a traveling stage, and we produced the world's, well second-simplest machine [laughs] after the development of the wheel, which was a threaded bar, which drew along a stage against two supporting bars. And at the end of the threaded bar, there was a wheel, and we put twenty pegs on the wheel, or he put twenty pegs on the wheel, and we had a micro-switch mounted that, as you turned a handle on this wheel, the, the pegs triggered the micro-switch. And the pitch of the wheel was such that

twenty clicks was one millimetre. So we were measuring twentieths of a millimetre, which was adequate for all of the initial work; in fact we used that equipment for something like the first eight years or something. And it cost £40, so... We converted the electrical clicks into counted numbers on another piece of scrounged equipment, so that we were, we were set up and running measurement-wise for £40 all in, plus the price of a chainsaw. And of course had to go and be trained to use a chainsaw, and also trained how to sharpen the blades, and maintain it. So, that was all done through the Forestry Commission, just phoned them up and they were happy to do that. So, you get a real impression of, the department had a car, so all we had to do was put petrol in it, supply petrol for the chainsaw, and everything else was.....[just time]

[End of Track 2]

[Track 3]

So we've got to the point where you've, you've got your sample and you've put it into this inexpensive machine that you've described, and you're, by doing that now are able to count the rings. What happens next in terms of turning the samples that you've collected into data?

The, the machine which, it's simply a travelling stage, so you've got a microscope with a crosshair in the eyepiece, and you line the crosshair up at the beginning of your first ring. You move the stage so the crosshair is at the beginning of the second ring, and the number of clicks tells you how far the stage has moved for that ring width. And you do that for all of the rings through the, through the sample. We very quickly learnt that you had to mark the sample every, either twenty-five years or every, preferably every ten years, because, it was frequent that you had to move the sample on the stage, and you had to be able to get back to where you were. So we had a simple code of two marks on the wood, these are simply made with a, a probe of some kind. Two marks was fifty years and three marks was a century. So that you could quickly re-establish where you were. And very often, it was important to check. Because if somebody shouted 'Coffee,' or something, you know, you could easily be distracted and miss a ring or something. So it was important that each...[sample was marked up] The thing about dendrochronology is, it's fundamentally important that you have every ring counted, and just counted the once. I mean, it sounds a bit anal, but it really is absolutely fundamental. If you, if you introduce measurement errors, the system is just not to going to work. So, the, the important thing was to, to give an accurate record and measure as accurately as humanly possible, given the limitations of the equipment. And, so we would do that. So we would end up with a set of numbers which we actually, although they came up on a screen, they weren't electronically recorded, we had sheets of paper printed out with columns and we trans... we simply transcribed the numbers onto the columns. That again gave you a running check on things, because every, at the end of every ten you should have a mark on the wood. So, anyway, there was a lot of, of that went on. It's, it's something which some people are good at, and frankly other people are not good at. You would say anybody could learn it and that's true, but you have to want to get it right, and, basically the good dendrochronologists pretty well everywhere are,

compulsive in the way they, they do it. It's very important to them to get the number of rings precisely correct. And I know that sounds simple, but it's, it's actually very hard to keep that going for a long period of the time.

How did you make sure that you were sure that you had counted every ring and every ring only once?

Usually by scanning back through the sample, and, and visually counting. Which, it doesn't take very long once the sample's prepared, just count that each mark is actually at the tenth ring. So, that, that checking is important. And again, that's a, that's something, if you short-circuit on that, if you don't bother to check, you will probably build in the odd error. It just makes the system not work as well as it might. Once you've got your list of numbers, you, well basically we took rows [rolls] of graph paper and took a band saw and cut them into narrow strips about ten centimetres wide, and, as long as the sample was necessary, and we plotted the graphs by hand, because that was just the simplest way to do it. And we used a horizontal scale of four rings to the centimetre, and, that had the great advantage that a century was twenty-five centimetres long, and you can scan that more, you can more or less take that in at a glance. So you could look at a century of time, and when you're matching patterns, that's about as much as you, you can cope with. So, so there was, it was just a pragmatic decision that that's what we were going to do. We didn't tinker with the data, we didn't convert it to logarithmic scale or do anything with it, we simply plotted the widths as, as ring, as raw ring widths. And then, with the graphs we had light tables, so that we could compare graphs, one on top of the other. Now, I mean that's pretty straightforward to do with living trees, because you knew within a very short tolerance where the last ring was, so you could, you knew where you were expecting to find a match. Very early on it became obvious to me that there was subjectivity in decision-making, in other words, I, I could look at the matching position between two ring patterns and go, well I think that's where it matches, but, your question is, would somebody else agree? Now you could get a colleague to come over and give him the two graphs and say, 'What do you think you find?' If he found the same position, then that would reinforce the, the situation. But it became obvious that that was a cumbersome and only marginally less subjective system, and the obvious answer was to write a computer program.

[06:01]

Now, these days that's, that sounds nice and simple. But in those days computers were just coming online in UK universities, and, the procedure was that you went and learnt how to write FORTRAN code, and then you, you devised a system. First of all you had to decide, what on earth is it you're trying to do here? So I looked at the, what we were doing, and I said, when you slide two ring patterns one on top of the other on a graph, on a, on a light box, at the point where they match, you're effectively minimising the area between the two curves. In a perfect match, the area would go to zero. Well I thought, mm, so, so what we want is something that mimics that, and the obviously thing was to use some sort of correlation coefficient which would measure the similarity between the patterns. And, you couldn't do that easily on the raw data, because there are trends in the raw data. So we filtered the data, so we, we basically fitted a running curve to any set of data and then converted the annual values to, to indices, percentages around a mean. And that flattened the curves out which made them easier to, to deal with from a computing point of view. Ironically not easier to deal with from a human eye point of view. And we then converted this, with a bit of assistance from a statistician we converted r values to t values, to give us some sort of measure of the, of the probability. And, we punched this all out on cards, and we took it down to the, to the computer lab, which did a run twice a day, and we, we attempted to... [laughs] Now, we attempted to run the program. Now, the thing is, you only had to punch one hole wrong on all your cards and the program wouldn't work. On the second attempt we actually managed to get two ring patterns to slide past each other doing a correlation coefficient at every position, and showing a high correlation value at the correct relative position, which we had already established by eye. And it was like a eureka moment you know, this actually works. So from then on, we used the computer in what I termed a mutual veto system. If the computer threw up a correlation position that we didn't like when we looked at it visually, we would veto the computer. If we liked the matching position and the computer didn't, wasn't able to pick it out as a significant correlation, then the computer would veto us. And that, that worked really extraordinary well, extraordinarily well. The, the result of that was that we could fairly rapidly run through a batch of samples, and find that we could successfully cross-correlate, you know, eight out of ten of them, in an agreed way, in other words, the computer agreed and we agreed that those were the correct matching positions. And you could then do

other things, you could, you could then make a master chronology out of those eight, and then run the other two against it to see if there were, you know, if you could pick up any correlation. And sometimes you would find there were trees which just had, they gave their correct date, because with modern trees we knew the, the dates very often. They gave the correct date, but with a lowish correlation. So we just had to face up to the fact that there were some trees weren't recording the signal as well as others. And, that's because you're dealing with a biological system and, some trees are optimum recorders and other trees are less than optimum. We just had to accept the fact that a percentage of oaks were just never going to be any use. But because we had lots of oaks, that, that was just noise, so we could, we could discard it.

[10:31]

Why, why do you think those particular oaks weren't recording the signal, what were the...?

That's, that's a very good question. It's, it's never been fully understood. The one thing which did worry us was that there was an alternative signature, in other words that there were oaks that were obeying some other signal. And, so we, we made sure that we, that these trees which didn't match the majority, it was important they also didn't match each other. Because we were worried that there was some sub-species issue, you know, but we were, we were fairly quickly able to eradicate that as a possibility, because we never found any alternate master pattern. So there isn't a sort of, master pattern one, master pattern two, there is only master pattern one. In fact we now know, if you average together forty or fifty trees, really from the whole of Ireland, you get a pattern, a master pattern so similar to the original pattern as to be almost unbelievable. I mean, so, the trees as a widespread grid are recording very accurately whatever the signal is. Notice I say whatever it is, because of course we don't know exactly what it is they're responding to. But they, they know, because they, they do it in an extremely repeatable fashion.

[11:57]

Thank you. Is it, it may be that you didn't do this sort of thing in the late Sixties, but, were there occasions when you were, you had to get a ring pattern from a source that you weren't able to cut or drill. In other words, you had to use one of the methods

that you mention in your book which run from X-ray wet and dry core in ultrasonic probes, body scanners, photography and contact lifting. Were you in the late Sixties having to... I think the contact lifting involved Plasticine for example; was there any of that sort of collection going on at this time?

That early, by and large there was no real need for that. We, we were in the fortunate position that when it came to living trees, we almost always had a physical slice from a stump or a trunk. With building material, we were very, we had dry wood corers. I mentioned earlier we had Swedish increment corers which were for wet wood, or for living trees, but for dry wood we used purpose-built toothed hollow tubes which ran on a standard electric drill, and you could drill a pencil size core out of a, out of a beam. So you actually had physical samples. And very often with buildings you could find the end of a beam which you could get permission to cut off. So we had physical slices. And in the case of demolished houses, we in fact had the entire beam, so we could cut as many slices as we needed to find an optimum slice very often. And with bog oaks we had a completely free rein, we could, we could cut entire discs out of trees. So that, those sort of, let's call them cleverer ways which, which are all perfectly amenable, because I mean, you can get the ring pattern out of nearly anything if you're ingenious enough, those, those become an issue when you've got precious objects in museum collections, or in locations where they can't be, they can't be cut. We, we took a very heavy-handed approach to it. Where, where we, where we were able, we took a slice, because it just made life simpler.

[14:26]

Thank you. Could you say something about the effect of economic development on the availability of timbers in this period and slightly later? In other words, to what extent are, I don't know, is the, is construction work, road building, et cetera et cetera that was happening at this time, bringing these things to the fore, you know, making timbers available that otherwise wouldn't be?

Yes. I mean, we've always been very conscious of the fact that there was a window of time when this work could really be done, and that was because there were grants available for farmers to drain land, and hence they were, they were cutting drains, the land then shrinks, and oaks which are in, in the ground, appear to come to the surface.

Farmers were talking about them floating to the surface, but in fact the oaks are more or less stable, and the ground is, the peaty ground is shrinking round them. So there were, there were, these were then a nuisance to farmers, so they would pull them out into heaps, and then the heaps would sit around for quite a long time being used as windbreaks for cattle, because these are in very often quite exposed areas, because they're former peat bogs. So you had, you had economic activity of that sort. You also had a motorway being put in from Belfast to Dungannon, which ran across the south of the Lough Neagh fenlands, and it went through many deposits and throughout [threw out] large numbers of oaks. So a lot, a lot of our early samples are, are simply labelled 'Motorway', and different, different locations on the motorway. So economic activity made available a large number of bog oaks, I mean of the order of, well we didn't, we couldn't, we probably couldn't have sampled them all, we couldn't have found them all, but we, we sampled certainly, by the Eighties I think we had sampled about 5,000.

What do you remember of contact then with people like quarry owners, quarry workers, motorway construction workers, sort of, I suppose threading in between these people and liaising with them to get stuff?

No, we didn't have to do much of that. I mean basically, if, if the motor... The motorway had already been constructed, and these oaks, because they're, they're heavily stained with iron, they don't deteriorate quickly, so if they'd been thrown to the side, they're now sitting on a farmer's field, so they're, they simply were available through the farming community, you didn't have to worry about the road contractors. We did occasionally get things which were exposed when, when a road was cut through a narrow peat channel or something, but, again, there was no big issue there. One major source of timber later, really quite a lot later, was, commercial peat cutting, where, where entire bogs were being milled for either fuel or for, peat for garden growing, and the result was that, those, those workers would very often come across oaks again as a nuisance, and would heap vast numbers of oaks and pines round the edge of the bog, and if you went and asked they would give you permission to sample those as well.

[17:59]

Could you tell me how it is and why it is you moved from the radiocarbon lab to the Institute of Irish Studies in 1970? Perhaps it didn't involve a physical move. But what happened then at the time?

Well, one of the things is, when you're indulging in research, I think I was registered to do a Master's in dendrochronology, could I produce a Master's degree, and, by 1970 we'd had two years of this, and we knew that the system was going to work when we... All the, the initial questions had been answered in the sense of, were there oaks from all periods, did oak, could it be cross-dated, could we, could we make things work? And the answer was, yes we could. So at that point, by chance, the Institute of Irish Studies at Queen's decided to produce a series of fellowships. And these junior fellowships were specifically designed to allow people to, quote, 'complete their PhDs.' So they were aimed for people who had got some way into doing a PhD, and required funding for one, two, or, in exceptional circumstances, three years, to, to complete it. So, knowing that dendrochronology was going to work, the idea came up that one should apply for one of these fellowships. And, fortunately by that stage we had enough information that we could make a really very attractive present... [presentation] I could make a very attractive presentation to a panel pointing out the potential of the work, what might come out of it if it was successful, and that we were, we were basically tooled up to do it, i.e. we were on the way [we could undertake a project that would put some real chronological backbone into Irish archaeology/palaeoecology]. So, so in a sense the two years part-time research, which of course, [laughs] was a lot more than part-time, because, when you're involved in something like this, you end up working parts of the weekends and evenings as well, you weren't, you weren't just putting fifty per cent of your time into research, you were probably putting seventy per cent in. So, in that sense there was a flying start. It was the equivalent to, in many cases, the first year of a PhD where people are finding their feet. So I already had that done. So I applied and was awarded one of the fellowships. And, that was a very advantageous thing, because, Queen's covered your registration fees for the PhD if you were employed as a, as a fellow, and they also had the unbelievable benefit that, the fellowship was £800 but they gave you £200 expenses upfront, so you, you had the equivalent of a, of a slush fund to, to fund your research, which was very useful because, by that stage it was obvious that we were going to, or I was going to require, a large number of samples

from the Dublin excavations, because, the PhD as I envisage it was going to be building a 1,000-year chronology in Ireland for archaeological dating. And, so by October 1970 we had moved from doing part-time research to doing full-time research, aimed at a PhD on Irish dendrochronology. And, the, the part-time research assistantship that I was leaving was then upgraded to a full research assistantship, and, we employed Jennifer Hillam, a graduate from Bradford, who came over and was immediately identified as being extremely good at measuring tree rings. So that, from that time on, although I had a room in Irish Studies, I was actually working on a day-to-day basis, still in palaeoecology, with Jennifer and with Jon Pilcher, and now all three of us were involved in the, in the tree ring work. And Jennifer was tasked with really making a push into the prehistoric material. For the purposes of the PhD I had selected the last 1,000 years. We knew that most of the bog oaks were prehistoric, i.e., more than 2,000 years old, though there are some that are only 1,000 years old, and that she was going to make a push on, on building what we now call the long chronology. And basically, we were all involved in all of this. We had a computer program that worked, we had procedures that worked, and, we had, from 1970 onwards we were fully engaged, full-time, in putting together this giant jigsaw puzzle.

[23:45]

What was involved in... You said that Jennifer Hillam was identified as somebody who was very good at counting rings. How would you have recognised that, or how would that have been recognised by someone else?

She could produce ring patterns essentially identical to the ring patterns we were producing from the same samples. It's a very simple test. And also she had that innate criticality of getting it right, there were no missing rings, there were no mistakes, there were no... One of the biggest mistakes a beginner can make is to lose a whole decade, but somehow they managed to shuffle...[decades] They're marking the sample OK, but at some stage in the process they accidentally move it ten years too far. There were none of those. Jennifer was a, a born dendrochronologist you would say. And, so we set in with these large batches [of bog oaks]. Sometimes an individual field would provide fifty or even up to 100 trees, and we had... Oh, we, we were learning as we went along. If you have 100 trees and on average they each live for 200 years, if they were all different dates, then you would have 20,000 years of

tree ring pattern, which is actually longer than the whole postglacial period, so, we knew that was unlikely. And it quickly became obvious as we cross-dated batches of timbers from single sites that you could produce a site chronology from maybe as few as twenty trees where, say, for sake of argument, eleven trees would give you 650 years of chronology, in other words, much longer than any of the individual trees, but because they were a regenerating system, which had been living, blowing over and being buried over a long period of time, and you've got a random sample of them, you were able to build these site chronologies sometimes as I say 650 years, sometimes 800 years, occasionally 1200 years. So we, we rapidly moved from dealing with individual trees to dealing with site chronologies. And that put us much more into the same ballpark as the Americans had been in, because they of course had these very long-lived sequoias and bristlecone pines, and oak site chronologies allowed us to move into that same sort of realm. So time began to fill up really quite quickly.

[26:36]

And then there were, again, it's, in a sense it's not really luck, but the right site turned up, up in the north of County Antrim there's a site called Garry Bog, which is the largest, was the largest peat bog in Northern Ireland, and, it started producing copious amounts of bog oaks when the land was drained in the, in the earlier Seventies. So, once we had access to Garry Bog, and we were really aided immensely by, the farmers were extremely good about allowing us total access to their fields and their, the heaps of oaks that they had produced, that radically moved things on. Because oaks had grown on Garry Bog, not continuously but intermittently, from 5200 BC right down to 200 BC. And, that was a, an amazing source of material. Long-lived many oaks, 350 years, occasional 400 years, and, and large numbers of them. So the, the site chronologies built up rapidly during the 1970s.

When you speak of luck there, is it luck that these emerged at all, or luck that they emerged at this time?

It... Well it... Yes, luck that they emerged at that time, because I think if Garry Bog hadn't, if Garry Bog had been, for sake of argument, so protected that it was never drained or cut, it's, there's a good chance the overall Belfast chronology would never have been completed, just, you know, if you're... [laughs] So yes, so, it was a...

Luck's maybe the wrong word. It was a key site, if we hadn't had Garry Bog the whole thing might well have foundered.

And why was it drained at that time? Again, because of grants or...?

I think grants, yes, uh-huh. A lot of the, a lot of the, the area was, was turned into fields, what had been peat bog became fields. And, the amount of shrinkage really quite dramatic, you know, I mean, you go from what is effectively a domed, raised bog, to something which is, flat, for, almost miles, and divided up into, into fields, and with lots of wood coming out. Because of course the original shape of the bog was domed, you've got oaks of different dates which were originally at different levels, and as the bog has shrunk, those oaks of different dates are now horizontally distributed. So, you learnt as time went on what, what the nature of it all was. They weren't completely random, they were, they were ordered. And, they were also extraordinarily good trees for cross-dating, I mean, the system, the dendrochronological operation worked like clockwork.

Why were they particularly, what made them particularly good for cross-dating?

They, they tended not to have a lot of anomalies in them. These trees were growing almost in a sort of, optimum crop on this, this area. Seemed, they seemed not to have a lot of problems. And given their long lifespans, that meant that most of the ring patterns were, were just, immaculate records of, of whatever it was they were responding to, and they were all doing the same thing.

[30:20]

What problems did these lack that others had then? These were sort of, problem, problem-free. What...

One of the problems when we're reconstructing this would be that, if you had trees which were subject to pure actually standing in water, that can, that can disrupt things, in other words, they're, they're responding not to whatever the normal, or whatever the majority response is, but they're responding to their own idiosyncratic local conditions. So sometimes if you're too close to a river, you'll have trees, or, or

indeed too close to a lake which, whose level has fluctuated, the trees will have patters which are, sometimes impossible to, to cross-date, which goes back to that issue of, there are some trees are just never going to date, you just have to accept that they are different.

And is there a reason why this particular place had, in terms of its site, as a site chronology, had such, such a long range of, of growth? As well as having trees that didn't have problems, so you could do the cross-matching well, is there something about the site which, which explains why it had such, this great range?

I, I suspect part of that is simply the sheer size of the bog, that as the bog had expanded, it had oaks, it had kept expanding, and had supported oaks for longer. A lot of bogs had gone over to sphagnum growth, sometime in the first millennium BC, and had tended to stop supporting trees on their surfaces, so that, you have a, if you like, a physical mechanism which is limiting how, how long the oaks could grow there.

[32:12]

Thank you. Going back to the, the Institute of Irish Studies, could you say something about how that was constituted at the time, in other words, who, who was there, and what were they, what were they doing? So who was in the Institute of Irish Studies and what were they doing?

The Institute was originally directed by Estyn Evans, who was the formative geographer in Queen's from the Fifties, in fact earlier, who had done a lot for folk life, and a lot of his students had then been involved in archaeological pursuits of one kind or another, and also building history, in fact they sort of permeated the whole academic establishment in Northern Ireland. His successor and, I think he, I think, Evans was only, still there for the first year, after that Rodney Green came over as Director. But basically, the Institute was very loosely constituted. A number of the fellows weren't resident in Queen's at all but were merely funded by Queen's, and they were working in whatever their specific area was, somebody was involved with boats in Waterford for example. And quite a number of people were involved in purely political type research, in other words they were, they weren't, there weren't...

Irish studies was fairly wide-ranging, archaeology was only one component of it. So, sufficiently loosely constituted that, they, they were no interference at all, so you might occasionally have to give a seminar or turn up at seminars.

I see, thank you. And, anything you can remember at all of Estyn Evans? I realise you said he was only there for the first year that you were there, but what were your impressions? I don't know whether you actually spoke to him or anything like that, but what were your, if not, what were your impressions of him work?

Well the impression, you had to be impressed by somebody who was that famous, I mean he, he was a major figure who had sort of dominated these sort of areas of study for decades, and the result was that he was, he was only marginally approachable, [laughs] would have been my, especially for someone as, as young as I was at that stage. So, yeah, I mean I actually knew one of his sons rather better than I knew him, so...

[34:59]

Thank you, that's great. Now, could we then look at the development of this, the development of the chronology through the 1970s, including the... Well perhaps I could start by asking, as the chronology developed, how did you feel in the Seventies about the gaps that you, that began to emerge? I don't know whether we've got to this point in the story, but, anyone who's read your work knows what you think and feel about the gaps now, but, as you were building the chronology, what did you feel about them at the time?

Well, ooh. We were... The chronology was built in a, in a series of units, and, in some ways Ireland was the worst possible place to try and build a tree ring chronology, and in other ways it was one of the best places. I know that's contradictory but that's just the way it was. First of all we don't have any really long-lived oak trees, we've never come across anything that ran back to earlier than the middle of the seventeenth century, and only one or two of those. The result was that our living tree chronology anchored at the present time ran back only that far. And because of the political history of Northern Ireland, there were relatively few buildings where you could easily acquire timbers from the seventeenth and early

eighteenth centuries. So we had, we had quite a lot of trouble actually bridging between the living trees and the historic buildings. We, we weren't able to find any buildings later than 1716, and we only know that date because the, that's the date the tree rings give us for Gloverstown House which was dismantled when it was being moved to the Folk Museum just outside Belfast, and we had access to the timbers and we were able to sample timbers where they were laid out on the ground. And, these timbers were complete right out to the, to the bark edge, so, we, you know, we were able to ascertain that the main year of felling was 1716. To all intents and purposes we never found any buildings in Northern Ireland with oak timbers later than that. Basically, what seems to have happened, this is an attempt at explanation, is that, the land had been enclosed mostly by landowners, so, the oaks that come down to us now are mostly on enclosed estates. So those oaks were no longer available to people who wanted to build cottages for example. And they weren't big enough, the oaks weren't big enough to facilitate the building of grand houses, which were all built with imported material. So the result is, you basically can't find houses in the North of Ireland with oak timbers after 1716. Now the nuisance with that was of course that the overlap between the longest living trees which ran back only to 1649 and the latest historic building with oaks is only, fifty-one plus, seventeen, so you can work that out for yourselves. It's, it's, it's not really a long enough overlap to be particularly comfortable with. And of course that was a source of worry. It wasn't a gap but it was a weak place in the chronology. Now to get round that, we eventually sampled oaks, albeit later, we sampled oaks in Scotland at a forest site called Cadzow, which was an ancient royal forest, and there we were able to find oaks that ran back to the fifteenth century. And similarly at Sherwood Forest, we were able to get oaks that ran back to the fifteenth century. And we found that we could, we could dendro-date our Ulster historic building chronology to exactly the same 1716 date against both Cadzow and Sherwood, confirming the original short Irish overlap. Sounds like braces and a belt, but, you know, one does want to be absolutely sure. And of course this was useful information, because it also told us that if you had robust chronologies, you could cross-date across a much wider area than just the North of Ireland. We already knew we could cross-date to Dublin timbers, because that's part of what I was doing for my thesis, but now we knew we could cross-date to England and Scotland. And that gave a strong impression that oaks across the British Isles were by and large recording the same climate signal, whatever that signal is. So that

was, that was all useful information. But it shows you that right from the start we were, we were conscious of this overlap problem which later showed itself as gaps.

[40:20]

Now the, the building material then gave us a chronology from 1716 running back to the middle of the fourteenth century. And there we again ran into a problem that, we could find more and more timbers that ran back into the fourteenth century; we couldn't find anything that bridged across the fourteenth century. And on the other side of the fourteenth century, you had all of these chronologies from Viking Dublin, Viking and Norman Dublin in fact, which ran, for many years, it ran from 855 AD to 1306. So, one became very conscious of gaps, because we had a fourteen-century gap, and, how do you bridge a gap? You have to go and find appropriate material. And that is extremely difficult to do, because you're looking for oaks of a particular date in the landscape. You're unlikely to find them from natural sources. So you just have to try more and more sources of timbering, and, we were, I don't like to overuse the word luck, but it, it turned out that, archaeologists were interested in ascertaining the dates of the particular type of lake dwelling called a crannog. So we visited a number of crannogs with archaeological assistants [assistance], and, the archaeologists wanted to know the age of the crannogs, and we wanted access to wood of various ages. So again it was a mutual, mutually advantageous venture. And over a period of a few years in the late Seventies, we were able to acquire timbers from crannogs out in the West of Ulster, which did actually run right across the fourteenth century, and bridged that gap.

[42:28]

By that stage we were also able to consider long-distance, what are called teleconnections between tree ring data, because, the Germans had successfully built oak chronologies for the last 1,000 years, because, I mean Germany is simply full of well-dated buildings built with oak, so building a 1,000-year chronology in Germany is, almost trivial. I mean you, you know, you could do it in a fortnight so to speak. I don't want to underplay the significance of German dendrochronology for the last 1,000 years, but compared with what we had had to face, they, they had it very easy indeed. So that you had German ring patterns which were available for the last 1,000 years. We had put together eventually a 1,000-year chronology in Ireland. And, it's marginal as to whether you can cross-date directly over that distance. But luckily, there were sections of English chronology available, and we could compare from

Ireland to England, and then from England to Germany. And those stepwise correlations showed that we were all getting the same dates. And, so, the chronologies are therefore replicated at a variety of levels. I was always conscious, I think it's where the scientific background helps enormously, that, it was important that things be replicated at more than one level. We could replicate within sites and we could replicate between sites, but ideally what you want to do is replicate two independent workers, that's what I call third level replication, and we were able to do that with these stepwise correlations to Germany. So, beyond a certain point in time, we had a 1,000-year chronology running from the present to AD 855, and, it was absolutely certain that it was correct, which is a very comforting position to be in if you're then dating timbers against that chronology and providing those dates to building historians or archaeologists.

[44:48]

Could you say something about the effect, and perhaps the effect was not, not big, but what was the effect of the development of the Troubles on your work? Perhaps effect isn't the right word, but I mean, to what extent did you encounter the effects of the Troubles in going about doing your...?

Surprisingly, the Troubles had almost no effect on sample acquisition. We just, got on and did it. And, by and large we, we didn't impinge on terrorist activity and we didn't impinge on security activity. I mean you might have been stopped at the odd roadblock or what have you. But it, it meant you had perhaps to be a little more judicious in your approach to, to isolated farms and the like, but other than that, it was business as usual. And, being from the university again opened doors wherever you went. So in that respect it, it had very little effect. It was more, in a bizarre way, it was beneficial to research, because there was a tendency not to be out wandering the streets, but to stay in and get on with your research. So that perhaps we, we worked longer and harder than we might have otherwise. [laughs] It seems sort of, slightly bizarre a point of view, but, the way I used to state it if, giving a talk on issues, would have been to say that, it was a good time to keep your head below the windowsill and get on with what you were doing, because there was really quite a high level of intermittent violence.

Yes, I mean, given that this recording may in the future be used as part of social history as well as specifically the history of science, what, and for those with limited understanding of the Troubles and what it meant to live in Belfast at the time, what sorts of things did you see and hear going on? Whether you saw and heard them directly or, through the local news or...

Oh, well, you were conscious regularly, not quite on a daily basis but not far short at times, of explosions around the city, sirens. When an explosion goes off, you always wonder where that was. And, there had, because some of the early terrorist attacks were effectively random, walking down the street in Belfast, you were never absolutely sure that something wasn't going to blow up. So, it, it gave an interesting edge to, to life in Belfast. There was also relatively little going on at night, there were relatively few restaurants open, and the result was that, a lot of, a lot of social activity tended to devolve to people's houses, rather than people going out a lot. So, it, yes, it had undoubted effects. But, people who live here are very good at rationalising things. I mean I suspect if you, if you were so uncomfortable with the issue that you felt the need to leave, well, that option presumably was open for a lot of people, but, most people decided that they would see it out, that they weren't going to be driven out by terrorist activity. So.

[48:46]

And what did, what was going on outside of work for you in the late Sixties and, and Seventies that, let's take that period. What did you do when you weren't working?

Worked. [laughs] One of the problems with, with research when... Anyone listening to this will have detected a tone that, that schooling and university had been a somewhat chequered occupation for me. And they had been, largely because I, I didn't see what was in it for me. Other people were teaching me things that they always knew more about, and, I had marginal interest in most of what I was being taught. When I discovered archaeology, archaeology, it sounds extreme but it, it's a subject about which you can develop a love affair, it just, takes over your life, and you just want to be involved in it. Now of course, what I was doing was building a chronology which I hoped would put backbone into the whole of Irish archaeology, and, notice I say Irish archaeology, because, I really wasn't that interested in English

or Scottish or anywhere else, the archaeology of anywhere else. I was interested in the history of Ireland, something I had never been taught at school, which I rapidly developed from 1968 onwards. Because of course, if you're becoming involved with oaks of all periods, you're going to get involved with the archaeology of old [all] periods. OK, some of its building history as well, but even that's taking you into local history. And of course this was a voyage of immense discovery, because I had no background in any of this. So everything was new, and everything was exciting. And of course we were actually contributing dates to things, and we were finding stuff out [] right from the beginning. For example, up until we started collecting samples of living trees, it had been assumed that, that oak wood in Ireland was primeval, in other words these were, there had been vast tracts of forest which had been interfered with and cut down at the time of the plantation of Ulster in the seventeenth century by people from England and Scotland settling. But as soon as we started dating these, we realised that there was no sign of these primeval woods, and indeed when we sampled the buildings from the seventeenth century, these trees had all started growing after the Black Death in 1348/49/50. And that again didn't fit comfortably with the idea of primeval woodland. And you suddenly began to realise that, hold on, we've been, what we've been told here had, wasn't right, you know, the idea that, that what historians had said about the landscape was wrong, was really quite intriguing. In other words, our information was actually better than the previous information. And that's addictive. That... I, I think I used to put it like this to people. It's possible to become a data junky, you become, you get a buzz from the fact that you are the first person ever to see this information. And, and that of course is, is the case, you know. And even simple things, like in the course of building the, the modern chronology, you notice that there are consistently narrow rings in 1816 and '17, and when you, you go and look to see what happened around that time, you discover that 1816 is the year without a summer, which was caused effectively certainly by the big eruption of Tambora in Indonesia, which caused all manner of bizarre sunsets and, and massive crop failures in the North Atlantic region. And, in fact that triggered a whole emigration episode of people from, from Ireland to America, and there were outbreaks of cholera and, quite high death tolls as a direct result of, or, sorry, an indirect result of a volcano in Indonesia. Of course that, that information in a sense wasn't available before, but the tree rings gave it wonderful focus. And, stories like that just became everyday in the sense that, if you, if you plot the ring patterns of a large number of

Irish oaks across the last two centuries, you can see a step in tree growth between 1816 and 1830, and the answer... sorry, not the answer, the question is, why, what on earth happened to cause oaks, as it turns out, not just in Ireland but right across Northern Europe, to grow better over that decade? And we don't know the answer. But there's, that's, that's not all that long ago, and there's a phenomenon in trees which is not understood. If you go back to 1740, in the oaks you see a dramatic growth reduction, again right across Northern Europe, at a time that turned out to be the last great demographic crisis over [of] the pre-Industrial Revolution, there was a massive death toll, estimated in Ireland, 300,000 people are supposed to have died between 1740 and 1742 as a result of the, the famine caused by the extraordinarily cold [weather] of 1740 in the aftermath. So there it is, sitting clear as day in the tree rings. And when you start to look around to see what's going on, you find there was this extreme event. And again, the cause of that event's not known. And it makes you wonder, well, wouldn't it be useful to know what it was, you know. So, so, there's a compulsive nature to this. And you could pick other years, you could look at 1783, the eruption of Laki in Iceland, where did it have effects, where did it not have effects you know? And the trees are, are a guide to all of that. And of course we have the ring widths and the tree response to every single year, which of course is again something which is not normally dealt with in history, history tends to jump about to the interesting bits, what humans were doing, whereas the trees are recording every year, you know, so you become very conscious of the, the full extent of time, and it's not episodic, it's continuous.

[55:50]

To what extent did you continue your interest in, for example, digs in flint, in flint knapping, in that side of archaeology?

I continued with that, basically up until the end of my PhD in '73, and thereafter I, my time was much more occupied with, with tree rings, in other words, one where you couldn't afford the luxury of, of going on excavations. Also, you, you can sense the precision of what we were doing, compared with the, the really rather woolly stories that were coming out of archaeology where, you know, you're talking very often in half millennia, and we are talking, quite often in less than a year, because I mean, we can, we can quite often see when the tree was felled, and you're talking about dates

down to months. Again that becomes compulsive, you know, I mean you're just dealing in a different commodity from the, the previous commodity. So, so flints became the problems of other people, and I was happy to, to move. I still demonstrated flint knapping to students, and, and taught about flints, and lithics generally, but, not, I had no further research interest if you like.

[57:26]

And what was the nature and extent of your wife-to-be's interest in your work, or even involvement in your work?

Well there's two schools of thought on, on those sort of issues. I mean, first of all, you usually don't choose your partner on the basis of their profession. [laughs] And, in my case, or our case, my wife had little interest in archaeology, which I think is probably a healthy thing; two compulsive personalities in the same family would, would be too much I think you know, so, she's been quite happy not to be involved in archaeological research.

Did she ever come out with you in the field, or...?

Only very periodically. So...

And what was she doing at the time, in the late Sixties and early Seventies, around the time that you got there?

She was secretary to the director of the Ulster Museum. So she had quite a responsible administrative post.

And I think you've got children. Am I right to say that?

We have two girls, yes.

What was the effect of becoming a father on your work? I suppose the question is, when, when did it happen, and then what...?

Well my eldest daughter was born in 1979, and you can actually see in my CV, there's a sort of, a blip. Basically I didn't sleep for about eighteen months, and... That, that, that had a, a curious beneficial effect eventually, because, I was so used to being up late at night that I decided around 1980 to, to produce a book. To, to backtrack slightly. One of the first bosses I had, Alan Smith, who was the botanist side of the, of the archaeology/botany equation, he had had some bad experience with having data stolen by another academic. Apparently this was not uncommon, for ruthless professors to simply obtain other people's PhDs and mine them for information. It doesn't sound very ethical to me, but apparently this sort of thing had gone on. So, Alan Smith had, had said to all of us younger potential academics, 'When you've got information, publish it.' And, in retrospect that was very good advice, because we, we got used to banging out four or five publications a year, and after a number of years that starts to build up into really quite an impressive CV. And, with all those publications, because they are going into a wide variety of places, you realise how difficult it is for anyone to access them all. So an obvious thing was to take the publications of the first ten years of dendrochronology in Belfast and produce it as a book. And, my first thought was that you would just basically put the reprints end to end, and staple them, but that, that doesn't make for a coherent read. So it required actually basically taking the pre-existing information and producing a book. So, so out of the sleepless nights came a book called *Tree-Ring Dating and Archaeology*, which was published by Croom Helm, who are no longer with us. But that, that was useful, because it sort of stamped Belfast's authority on the issue of European tree rings. Because not everyone's in a position to write a book, it requires, it requires a certain amount of dedication to, to do that. So there weren't many books on dendrochronology available, and this was a, well if I say so myself, a readable guide to what we had done.

[1:01:42]

Can you say something about precisely how you went about, what the link is between sleepless nights and writing the book? In other words, I mean perhaps you were, as someone with children myself, perhaps you were writing this book while sort of allowing your wife of have a bit of sleep and looking after the child. In what circumstances were you writing the book?

No, no it wasn't like that. It was, it was that, by the time our sleep patterns had resumed, I was quite comfortable with sitting up to one in the morning, and I actually found that, I was often in the mood for writing between about, eleven o'clock at night and one in the morning. So that, I was actually most productive then. And, the other strange thing is, I've no idea how it works, I presume it's your subconscious, I could write, in those hours I could write and the text wouldn't require correction. In other words, what you are reading, if you pick up that book now, is exactly what I wrote down when it was written. It wasn't, wasn't edited, it was just written exactly as you read it. So, it's sort of lecturing onto paper.

*And what had you been, what had you been doing in order to, to be so sleepless?
You'd got used to staying up eleven till one, or being happy to stay up eleven till one.
Is that because of sort of crying and having to do feeds, or...?*

Oh yeah, I mean, yeah, there was a lot of night-time feeding and, and crying and disruption, yes, yes. [laughs]. Some children are sleepers and some are not. [laughs] Our first daughter wasn't a sleeper.

That implies thought that you were involved in that yourself, in the feeding and...

Night-time feeds, oh yes, that was quite regular. Or comforting or whatever. Yes, yes. I got to know Terry Wogan very well as well, he was on the radio at that time, about four in the morning, so, mm.

[1:03:47]

*Thank you. You move then presumably from the Institute of Irish Studies that were supporting your research in the early Seventies to an academic post in Queen's?
When did that happen and how?*

Now that, yes, that, that's an interesting episode. I was actually given three years of junior fellowship, and I, I duly finished the PhD in the third year, 1973. And, at that stage Hal Fritts, who was a leading figure in American dendroclimatology, happened to be over in Europe, and was... oh sorry, was going to be over in Europe, and he agreed to be external examiner. So, my thesis was sent to him. I didn't know it at the

time, but it was actually read by about six or seven of the leading American dendrochronologists including Fritts, and, he then came over and acted as external, and, the thesis didn't require correction, which was rather nice. So, I had a PhD. And I think it is, it is worth saying, I had no expectation whatsoever of an academic career, I was not thinking of an academic career, it wasn't something I had thought of. In fact the thesis if you take it off the shelf is basically a manual of, here's how to build a tree ring chronology, here's a computer program that you might find useful, here's the raw data that's used in the construction of this chronology. And basically the thesis was a model for anyone in the off-chance that somebody in the future might want to do it all again. You can see there's a sort of schizophrenia there, because I was working full-time on the prehistoric chronology with Jennifer Hillam and Jon Pilcher. I'd just finished the last 1,000 years, [clearing throat] pardon me, with extensive collections from, from Dublin and from historic buildings. What was I thinking of that, you know, why was I not considering an academic career? And the answer is, that's just the way I was. The PhD was like a piece of work, I'd finished it, and if nothing turned up, I was going to go and start a window cleaning business, or something. Now, it didn't worry me one way or the other. But again, Professor Jope stepped in, because, he managed to cobble together some money and produced a post for a year which was a graduate demonstratorship. Nobody ever knew what it meant, it was just a source of money. And that's what professors in those days certainly could do, they could just, fiddle the system. And, during that year, again for reasons I've never understood, Jon Pilcher, who had a lecturing post in archaeology but basically did his teaching in, in the Biology Department, moved to biology. And that freed up a lectureship in archaeology. And, by that stage, again the, the information coming out of dendrochronology was so powerful that it wasn't difficult to convince an appointment panel that there was potential in the, in the work, and... I also had by that stage done quite a lot of undergraduate teaching at practicals and, and associated things. So, so basically, I got a lectureship in 1974, in the Department of Archaeology.

[1:08:00]

Had you, had you any, apart from thinking that you might set up a business, had you any thoughts while doing your PhD about what you might do next? You did, you didn't have a fixed idea, or any idea, of becoming an academic, but what had you

imagined as your future? You said, you weren't worried, you could go and set up a business as a window cleaner, but had you... [laughter] Did you... So that's one imagined future perhaps. But did you have any sort of, thoughts about what you might do, or, predictions about your future?

No. I mean I could just as easily have gone and become a motor mechanic. I mean, it wouldn't have worried me one way or the other. I, I suspect it was because, work came in in gobbets, you would have, you'd been a part-time research assistant, you'd been a junior fellow. OK, there was a graduate demonstratorship, but it was only for a year. If that money ended, you were going to have to go and find work. I mean it was just as simple as that. And the fact that a door opened up and a lectureship became available and I, I got it, that was fine. But... [laughs] I had, there were no other plans, I didn't have any lifelong ambition to do anything in particular. But I, I seemed to be pretty good at tree ring work.

[1:09:32]

And, relations with your parents over the Sixties and, and Seventies?

I didn't move out of home until, somewhere around 1970, I then moved in with another PhD student, called Quentin Dresser, who went off eventually to run a radiocarbon lab. And, he and I lived in a, in a ground-floor flat somewhere down near the gasworks, and, spent most of our time doing research when we weren't playing chess or, or any of the other games we got out of assorted books.

And, did they express anything, any opinions on your work?

Oh sorry, my parents.

Yes, yes.

No, they, I mean they were... I mean once I'd got a degree and then was doing a PhD, they were, they were quite happy with that. The... To give you an idea of, of the sort of thing that would occasion you to leave home, [laughs] was, I could be away in England or, on a dig or something, for weeks and weeks and weeks, and my mother

wouldn't necessarily even know where I was. Communication in those days was usually by postcard, if at all. And, but if you were at home, and you were out till one in the morning, you would find she was sitting up waiting for you to come in, and, and this just became silly. So I said, right, I'm moving out. So, that was, that was really why that came. But, yeah, the parents were more than happy with what was, was going on. And I mean I was self-supporting, which was, [laughs] important.

Did either show a particular interest in what you were doing? Given that it was quite a, not, well it was a very novel thing to be doing.

I think only as a concept. It was nice that I was doing something interesting, but it, it had no relevance to them. There was nothing in their background which would have given them an interest in the ancient past. You have to remember, there's a lot of people are not interested in the past, I mean it's, it's, you have people who will wantonly destroy archaeological sites, just almost maliciously you know, so. You know, we're, 'We're going to build our bungalow right in the middle of that site, not to the side of it,' you know, it's, and you think, whoa, that's, that seems counterintuitive to someone who really loves the past and, and is interested in it. There are people who are almost actively hostile to it.

[1:12:17]

And to what extent in this early period, in the Sixties and Seventies, was there, what we might call public interest in what you are doing, I don't know, local newspapers wanting to talk to you, or, even local television, I don't know, or radio, taking an interest in what you were doing and attempting to translate it into something that a non-scientific reader or listener might be interested in?

I think in, in the early years, I mean up till 1973/4, I would have said there was minimal interest. I mean people, people basically didn't know about it. If you ran... I mean if you offered text to a journalist, they would run a piece, you know, if you were, as I said earlier, I think if you were looking for access to long-lived timbers, you would get a journalist to put a small note out, and the place is sufficiently small that large numbers of people would read it. And the local radio is even more pervasive, I mean, if you, if you go on or are mentioned on, on Radio Ulster, I mean, ninety per

cent of people appear to hear what's actually said, which is scary in some ways, you know. [laughs] But, I would say there was, there was, at that stage, there was cosmetic interest at best.

What happened in 1973, around 1973 and 4 to change that then?

Well I think it was, we were beginning to get somewhere. I mean we actually could talk positively about being able to date things, so that dates would emerge, and that would then give rise to copy about, you know, such-and-such a house is such-and-such a date, or, or timbers of a certain date have been found. It gives a focus. Or, I mean if somebody suddenly says they've found some old timbers, that's rather boring. If they've found some old timbers from 1623, that's just inherently more interesting. Because there's a context then for them you know, what was happening in 1623. So, so dates do focus attention.

Did you make regular appearances in such...?

No, there was nothing regular about it, no, just, episodic. Mhm.

[End of Track 3]

[Track 4]

Could you tell me about relations with other groups, in other countries perhaps, working on tree rings in the 1970s?

We were aware obviously of the original American work, from Douglass on through Schulman and, who was the, who was the other guy who, who did the bristlecone pine work? Oh his name will come back to me. [Professor Wes Ferguson] And Val LarMarche [LaMarche] and a few, a few others. We, we were aware of the American procedures. But because they were dealing with different species of timber from a long way away, there was no point in attempting to collaborate with them in any way other than informally, I mean, we couldn't expect our tree ring patterns to match up. We were also aware that workers in Germany, Huber and Gaertz[ph] [Professor Bruno Huber and Dr Veronika Giertz] and [Ernst] Hollstein, had built 1,000-year chronologies in Germany. And, one of the issues that we were concerned about was, we didn't want to collaborate too much with people in order not to compromise the independence of the work we were doing, because, what we wanted to do was hold back independent chronologies as a final check, so that, if you rush in and start collaborating, there's a danger of building in a circular argument. We were very conscious of these sort of issues. It applied also to radiocarbon. One obvious pitfall was if we used too many radiocarbon dates to try and pin down where our chronology sections came, we were in danger of cloning the American calibration. And, we didn't want to do that. Fortunately tree rings work in such a way that, well, radiocarbon works in such a way that, it couldn't get you closer than a couple of centuries at the best of times, with the result that the detailed matching had to be on the basis of tree ring matches. So that we, we were happy that we weren't going to end up doing what many critics have since suggested we did do, which was, simply clone other work. It's a, it's a sort of, naïve criticism, because it just doesn't take account of what we actually did. So, we were, we were aware of other work going on, but by and large we tended to distance ourselves from it.

[02:42]

Things changed slightly in 1974 when the first international tree ring conference took place in Tucson, and Jon Pilcher and myself went to that. There were about thirty people, the majority of them of course from America, but we also had a few Russians,

a Pole, a couple of Germans, a couple of English workers. And, basically that was the first time we had actually met people who were doing something very similar to ourselves in Germany, that was Dieter Eckstein from Hamburg and Bernd Becker from Stuttgart. And Becker would be the biggest figure, because, he was, he was doing the serious long chronology construction down in central Germany, and... So that was, that was extremely interesting, and because of my long-term interest in World War II it was fascinating to finally meet some Germans and get to ask what their fathers had done during the war, which came as a shock to them, as they were mostly trying to ignore what their fathers had done in the war. But, yeah, it was all on a fairly palsy [pally] basis. A fantastic conference of course, because you got to go to the Grand Canyon and you got to see Mesa Verde and, and lots of other interesting sites, including sites where tree ring samples had come from in the past in America. But at least that set the ground where we now, we now knew some German dendrochronologists, so if and when the time came to make comparisons between chronologies, we, we knew who we were going to be contacting. And we in fact kept in touch with them and indeed met them at subsequent conferences quite regularly after that. But we resisted the urge to exchange data, in order that we were keeping back ultimate replication.

[04:42]

Were there sort of national differences in, I realise there's going to be different and so on, but were there national differences in the approach to this work, in other words sort of national styles of dendrochronology that were apparent at this conference?

The Germans tended to use a different computer program. They used a program which simply looked at the number of years which were, went up and down together, which was slightly less robust in our view than, than the correlation procedures that we, we used and published. But, other than that, their procedures were very similar, I mean they, they had access to pre-existing 1,000-year chronologies, but then they had all the problems of linking across Dark Ages and, and, Roman times, into prehistoric sections. And they had long sections of prehistoric chronology, and the same way as we had, there were gaps that were identified. And they were publishing block diagrams of this, not the raw data but, you know, blocks of where their chronology came to. And by about 1980 both Belfast and, and the main German labs, which at

that stage had been joined by Burghart Schmidt of Cologne, they had almost identically similar lengths of chronology, but with, with gaps. And, so, so we were all aiming for roughly 7,000 years, that seemed to be what the, what the target had developed into.

[06:20]

And were there differences, national differences in why it was thought to be important to construct a tree ring chronology?

Yes, well, in northern Germany, at that stage there was not much of an attempt to build a long chronology. The Hamburg lab was interested mostly in musical instruments and buildings, and hence they were restricted largely to the last 1500 years. Becker was interested in the development of German river valleys, so he was interested in dating, I was going to say river, river development through time, through the vehicle of trees buried in the river gravels. He also had access to bog oaks but the vast majority of his oaks actually were, were oaks that had grown beside rivers on mineral soils, and had then washed into the rivers and been preserved that way. So he was, he was working with, very much a sort of, geomorphological background, that was, that was the driving force. But he was in strong contact with Minze Stuyver [Stuiver] in Seattle, who is a radiocarbon guru, and they were intending to collaborate on a calibration parallel to the Irish, calibration, but again the idea was to try and keep the data set separate so as you could replicate. So that was, that was pretty much the, the situation.

[07:55]

Now I know that, concerns about climate change, sort of, tend to become much more prominent later in the Eighties and beyond. Was there any... To what extent was there discussion at this time, in the Seventies, of the potential value of tree ring dating in relation to emerging concerns about climate change, including a consideration of natural variability in the past? I know you said that, that the Irish oaks weren't ideal for that sort of work, because you couldn't tell, you couldn't necessarily tell from them what had caused, you know, the observed variation, but I wondered whether, to what extent it was in the mix of discussion about how this information could be used and applied and so on.

You have to remember that in the Seventies the concern was not global warming, but global cooling, because there was a big push that we were going to drop into another ice age. But, I think it's fair to say, it's an obvious thing to make sure whether you can or cannot get climate out of tree rings. And on that basis, we followed a sort of an American lead which was that, we wanted to build a series of fairly robust site chronologies. So, Jon Pilcher and myself went round Ireland with increment corers, and every fifty miles or so we would jump over a wall and core ten oak trees, and, this is reprehensible behaviour, was all done without permission. Probably highly illegal. And, we, we just did it because it was a data acquisition exercise, it was done effectively over a long weekend, and it meant that we had about six or seven Irish oak chronologies covering the last 100, 150 years, so that we could then compare the signal in the Irish tree rings. And then we, we did some equivalent work in England, just dotting out, and southern Scotland, dotting out a few modern chronologies, pretty well to make sure that it was, all of the chronologies were, were responding to the same overall tree ring signal, and that's certainly what we found. I mean by and large they're all just producing variance of one common signal, in other words, if you make one massive British Isles oak chronology, you can date all the site chronologies against it. You won't necessarily be able to date all the individual timbers against it, but you'll certainly be able to date the site chronology. So we, we ascertained that there is only the one signal, which was useful. Jon Pilcher then spent quite a lot of time doing response function work, in other words, by comparing mean ring widths with climate variables by month, you can look to see which months are significantly affecting tree growth. And what that showed was that, there was no really really useful clear pattern. Trees if you like, liked cold winters, and they quite liked warm summers, but you know, there was nothing, not enough there to be able to reconstruct anything from it. And all of that data was then supplied to, the tree ring data was also applied to the Climatic Research Unit at Norwich where Keith Briffa and Phil Jones were working on tree rings as well. So we, we basically increasingly lost interest in that, because we couldn't directly get climate from the tree rings.

What was the climate data that the tree rings were being compared to?

You had instrumental data from, Armagh in Northern Ireland has one of the longest instrumental records in the British Isles, not the longest but one of the longest. So, we had not only that but several other local stations where the data was available to us for making comparison. But it, it became increasingly obvious that you could not get straight climate out of, out of oak tree rings, and, therefore we, we, our attention shifted elsewhere.

[12:35]

Could you tell me something about sort of, working but also personal relations between your sort of, main collaborators at this time? It seems to be you, Jon and Jennifer, mainly working on this.

Jennifer... Things come in blocks of time. Jennifer was... Research assistantships in Queen's were only allowed to go on for six years, there was just an absolute embargo after six years, that, the funding terminated. So Jennifer was with us, was with us for six years from '70 to '76. She then went to Oxford and worked briefly with John Fletcher, an art historical dendrochronologist there. And, subsequently left that and went to Sheffield where she, most of the rest of her career was spent as an archaeological dendrochronologist in Sheffield. So we always kept up strong contacts with her from an academic point of view.

[13:37]

Jon and I were basically the people behind the long oak chronology, and, for some reason I now get credited with the whole thing, which I find really quite bizarre, and obviously people don't read the titles on the papers but... And Jon actually in a sense was even premier to me, because he, I think, he was part of the original team that had thought up the idea, and I came along and then, helped implement it. And, he was a, Jon's a particularly able fieldworker, so a vast bulk of the collection, you would have to mark down to, to Jonathan. So, that, at the time dendrochronology had replaced his interest in palynology, which he had been very keen on earlier in his, his research career.

Did you have any relations with him beyond work, in other words, I mean did you do things together out of work that were not to do with building the, the oak chronology?

Other than informal friendship and visiting each other's houses, no, by and large we didn't. But we did see enough of each other in every other conceivable set of circumstances from teaching to conferences to fieldwork to lab work, you know, so, it's almost like being married in some ways, mm.

How would you describe the difference between, the differences between your characters?

Ooh, there's an interesting question. Well, I'd like to say I'm a lot more happy-go-lucky. Jon would, Jon would be a bit more rigorous. He has an unbelievably dedicated bent to lab work, I mean he will spend hours and hours and hours, day and weeks preparing samples meticulously and going through them systematically. I think that comes partially from his, his make-up but also from all of those formative years doing palynology where you have to just religiously go through sample after sample. I like to try and jump to the answer, and cut things as short as possible, that's just my disposition, so... Yup, we're sort of... I'd like to say we're a good team, we sort of spark off each other.

[16:13]

Thank you. And, could you now then tell me how the, as I understand it, you were in a position to say that the chronology was complete by about 1986, and I wonder how you get from the mid-Seventies where you've presumably still got gaps to that position of being able to say that you, well not finished but at least got a continuous chronology. What was involved in fieldwork and lab work to get that?

The... The progress with the chronology had been really quite fast up until around about 1977. And at that stage, we had effectively got to the situation where we had three gaps remaining in the chronology. And the gaps were, in the first century BC, the tenth century BC, and around 4000 BC. And, that was very similar to the situation which was developing in Germany around about the same time, you could see in their publication, they had long sections of chronology and gaps. And, the, the race was on, because I mean, there are competitive aspects to work like this, who's going to be the first to, to actually finish? And we were pushing any way we could to get more samples, so that there was extensive sample collection from different bogs, and what

we found was that we were merely reproducing the same chronologies and the same gaps were still there. In other words, it looked to us as though the gaps were real. In the first instance you have to assume that the gaps are either real or they're an artefact of your collecting policy, or luck or whatever. But when you've got to a certain stage and then you've replicated that work again, and still have the same gaps, you can be pretty sure it's not a sampling issue, it's, it's, something was going on, there's probably something happened in the first century BC and the tenth century BC. And, at that stage, as you came towards the end of the 1970s, I was publishing articles about these gaps. But we were also beginning to think, are we going to have to bite the bullet and go and start exchanging data with our German colleagues? We didn't want to do that again, because we simply didn't want to indulge in circular argument at any stage. And we tried a different policy. We, we had two female research assistants, they were called Big Liz and Little Liz, Liz Halliday and Liz Francis, and we packed them off with a chainsaw and instructions to East Anglia, and they went, and, and, let's just say acquired, because I think they probably got help from various people, they acquired several groups of sub-fossil oaks from East Anglia. And the outcome of that was that, all of the oaks conformed to a 1500-year period from 3200 down to about 1600 BC. And, there were none appeared to be earlier and none appeared to be later. Which was intriguing, because, there was no particular reason to think that conditions in the fenlands of England had only sustained oaks for that particular period of time, and it probably, it's probably something to do with sea level changes, so, you know, something to do with water tables. But, you know, that's, that's still not been answered. It, it did give us some inklings that we might be able to do some more stepwise correlations to Germany, because we at least now had a long section of English chronology which we could date against the Irish chronology. But we were still loath to, to go, to go to the Germans. [laughs] So I know it sounds paranoid, but it's just, that's just the way it was, I mean, they were our ultimate source of replication, and to, to ruin that by collaborating too early might have been a mistake.

[20:51]

And, and then luck intervened, because, you know, it's, some people would say we had ludicrous quantities of luck, and in some ways we did. The story is written up and has been repeated often, but it's still worth mentioning. I was going to a conference in Durham around 1981, and, I was, it was cheaper to fly to London and

take the train to Durham in those days than to actually fly to Newcastle. And, the result was, I was sitting on a train looking out the window crossing what I took to be the North York Moors, when we suddenly passed several fields, and sitting in one of the fields was a large heap of bog oaks. And I consciously thought, well no one will ever find those. Because they were in the middle of absolutely nowhere. And sometimes it's a mistake to challenge the universe with thoughts like that, because, a few seconds later we passed a large blue signpost which said, 'A689 A1(M)', which of course is the best grid reference you could possibly have. So, after the conference a colleague in Queen's, a mediaeval archaeologist, wanted to visit some Saxon churches in England, so we shared a field trip, and we went to this grid location which is a site called Swan Carr. And, saw the farmer and drove down the farm track, and there was this heap of beautiful bog oaks, long-lived, regularly grown. And we collected twenty samples from there. Now being bog oaks they could be any date, we had no, no knowledge in advance what date they would be or whether they would even all be the same date, or, whatever. But when the trees were measured and cross-matched and turned into a chronology, they gave us a chronology from northern England which spanned 381 A... sorry, 381 BC to 1155 BC. And of course that bridged the tenth century. So in a single fell swoop we went from having three gaps to only having two. And shortly after that, with Irish material we bridged the 4000 BC gap. And that just left one gap remaining.

[23:19]

And it was at that stage that the Germans published a paper suggesting that they had a chronology running back to 2000 BC. And we thought, right, this is now the time to, to bite the bullet. Because we had been putting pressure through English archaeologists specialising in the Roman people [period] in both Carlisle in northern England and in London to provide timbers for chronology construction, and the English colleagues had also built chronologies in London. So we were hoping that eventually we would get a long enough Roman chronology to bridge across the first century BC. And indeed we had a tentative link, so, to... By 1982 we, we felt we had the Irish chronology complete, and given that the Germans were now suggesting that they had chronology back to 2000 BC we thought, this was the time to contact them and exchange data. And that was interesting, because, it's... I'm not quite sure how you, how you would normally describe this in, in real life, but imagine, imagine you were buying a diamond off someone and you were paying for the diamond with a

large sum of cash, and, you've got the diamond in an envelope, and you hand it across and the other person grips the envelope, and you hand them the cash in your envelope and they grip it, and at some stage you've both got to let go of the, [laughs] and exchange... Well, it was almost like that with the data. We didn't give them all the data, we selected 1,000 years of data, 1000 to 2000 BC, and we exchanged that. And this is, this is in the days when faxes were as fast as communication got really. [laughs] So, there were, there was no Internet back in the early Eighties. So, we waited for a very short period of time, and we got a eureka comment, telex, through from, from Germany, saying that the chronologies, this 1,000 years of chronology, matched. The snag was, it didn't match at the date that we believed it should match. There was a, a significant offset between the two data sets. And, that meant that somebody was wrong. [laughs] And, that then gave rise to me taking a serious look at what German data was available. And it became very obvious really quite quickly, and this was published in 1983, that Becker and Schmidt, the principal prehistoric dendrochronologists, had actually used a chronology built by Ernst Hollstein at Trier, which crossed 500 BC, and, let's just say there was a problem with that chronology. He had measured, he had seven small samples and he had measured... He said in the paper he had made 20,000 measurements, which implied he had measured and re-measured and re-measured it, unusual procedure. And in fact he had basically forced this stuff into a chronology which had a, I think a seventy-one-year error in it. So we were able to confirm that, that the error was in the, the journal of [German] chronology, and the two German workers accepted that. And, so in 1984, Pilcher, Baillie, Schmidt and Becker published an article in the journal *Nature* saying that there now was an agreed European oak chronology back for, 7272 years, which would form a basis for, well it depends how euphemistic you want to be. [laughs] A basis of chronology for all time, or until somebody proves it wrong, or, as a basis for calibration, or whatever you, whatever way you want to put it. So, so that was, that was why 1984 marks the, effectively the end of chronology construction as far as we were concerned. That was, 5200 BC, or thereabouts, was as far back as we could get in Ireland. Because peat bogs were not preserving oak trees earlier than that in any quantity, so it would be extraordinarily difficult to build a chronology further back since the material just doesn't exist. Whereas in Germany, they were able to find large numbers of oak trees which allowed them to extend back for, as a continuous oak chronology I think of 10,200 years, back to 8200 BC.

[28:39]

During the period where, I know you say that these chronologies are kept apart in order to preserve this opportunity to do an independent comparison of them, but there also seems to be a little bit of competition as well between the, the Irish and the German group, whatever you like to say. I wondered how that was sort of, coped with informally, I wonder how the two groups sort of, spoke to each other when you met at conferences, or when you were corresponding in this way, to swap. This, for example, this tension about, you know, exchanging the data at the same time, what did the, the two groups sort of say to each other informally, was there any...?

No. All our communications were extraordinarily friendly, on both sides.

Oh yes, I'm not... Yes, no...

I mean they were... This was purely a scientific issue. We, we both recognised that the other person's, the other group's chronology, was the ultimate source of, of checking. And, and so that, yeah, we're just, we were perfectly happy with that. And so... I mean if they had come to us slightly earlier we would have probably, you know, said, 'Well OK, let's, let's do it now.' I mean, given the circumstances of where we are, it just happened, I think it came from us in the end, saying, 'Right, I think this is now the time to, to make this comparison.'

And how did they feel initially about the, about it being pointed out that the error was in, the error that accounted for the difference between...

The thing which was very lucky about that was that, it wasn't either... It was Schmidt and Becker that we were collaborating with. Ernst Hollstein was really of an older generation, and, he wasn't really one of the, of the group. And he also had, had a prior error in one section of chronology. So, there was, there was no loss of face anywhere on that issue. Interestingly, and this is where science really does work in really quite peculiar ways sometimes, anyone listening to this will go, 'But hold on, you have, because you have now used the Irish chronology to correct the German chronology, you have lost that replication ability.' But in fact, because of historical

circumstances, for a long time Burghart Schmidt at Cologne had collaborated with Axel Delorme, and at some stage in the late Seventies those two had fallen out, as can happen in any academic relationship, I mean, these things undoubtedly do happen. And, Delorme had then gone off and, and started working with Hubert Leuschner in Göttingen, as a completely independent set-up. And in 1984 they published an article saying that they had a chronology which was continuous back to beyond 4000 BC. So we immediately contacted them. And, and the Irish chronology agreed with the Göttingen chronology to the year, back to, as far as the available chronology went at that time. So, that was like, that was the ultimate replication, because there was an independent group who got exactly the same answer as, as us. So we weren't relying on a broken German chronology, it was an independent continuous German chronology. And, so there's, there's a case where academics falling out had actually been a good thing, because it had produced a whole other level of replication. And that's why, I mean, given the replication between the two German chronologies, between Ireland and one of the German chronologies, and also between Ireland, England and the German chronologies, it would be extraordinarily difficult to move any of these chronologies. There are many critics of dendrochronology for many reasons, but so far none of them have been able to prove that there is a fundamental error in the base chronology. And indeed the radiocarbon results from the calibration virtually preclude there being a serious error. Because you've got continuous radiocarbon measurements, and if you were to break the chronology and either shift a part of it back or forward, you would produce a step in the calibration which would be self-evident, and which would require explanation. So, I think it's pretty safe to say that, the, the chronologies which were completed in 1984 were absolute.....

[telephone ringing]

[End of Track 4]

[Track 5]

When you talked about actually arriving at Swan Carr for the first time, you said that there was a, a pile of beautiful bog oaks. Why did you describe them as that? What made these, what made this a pile of beautiful bog oaks as opposed to a, a pile of ordinary bog oaks, or, average bog oaks?

[laughs] Beauty is in the eye of the beholder. It's, these were nice, regular trunks, in other words, there were no sign of anomalies. They, when we... Yeah. You could tell just from looking at them that these were long-lived trees, regularly grown, and that's a good thing, you know, that these were going to be nice trees. And certainly when we cut them, some of them were extremely long-lived, 400 years. So they were an ideal batch of, of trees.

And what was the response of the, the farmer, was it a farmer? You said that it was a landowner here.

It was a farmer, yes. He, he just simply gave us permission to take the samples. There was no, no further communication.

But what was his reaction to the arrival of someone interested in his pile of...?

'Help yourself.' In many cases these, these trees sitting about are a nuisance. They're actually quite awkward to get rid of. They contain, quite often, grit, and the result is that people don't want to cut them up for firewood because it blunts the chainsaw. And the only alternative is either, well you don't want to burn them because that's sort of, environmentally not very friendly. So they have to dig a large hole and bury them somewhere out of the way. So, so actually somebody who's coming along and reducing the pile is, is performing a bit of a service.

[01:53]

Thank you. So, we've got then to 1984, and the comparison with the German work has been done, and you feel that you've now got a base chronology complete. One of the, one of the applications of this, I understand, is in attention to the art historical

chronology, and I wonder if you could tell the story of becoming involved in re-dating that, or in questioning that.

Yes. The, the story goes back right to the beginning of dendrochronology in, in England, because the first person who was seriously involved in it really was John Fletcher at Oxford, who had, when he finished a career as a research chemist had taken up dendrochronology as a sort of hobby, and he was particularly interested in looking at panel paintings. Sixteenth- and seventeenth-century paintings were often painted on wooden boards, and in Northern Europe they were often painted on oak boards. So you had long ring patterns in the timber on which the painting is painted. Now, being based in Oxford, and being well-connected, he was able to get access to high prestige paintings, many of them obviously genuine, because one of the problems with panel paintings generally is, if you find a panel painting, how do you know it isn't an old church door that's been painted on, you know, in the last fifty years, as opposed to a genuine Holbein? And the answer is, if you go to Her Majesty's paintings, the paintings tend to be genuine [laughs], since they've been there since they were painted. Or if you go to the Society of Antiquaries, you're talking about high, high quality, high prestige, genuine paintings. So, John spent a lot of time measuring the ring patterns, obviously he wasn't allowed to cut any of these, it was bad enough even getting them taken out of their frames quite often, but he used a measuring loop and called out the measurements to an assistant. And, very successfully cross-dated a lot of these panels into an art historical chronology. And, that was when a problem began to arise. The art historical chronology was claimed to be dated, and when it, when it, a chronology is stated to be dated, you tended to take that at face value. But it became increasingly obvious as we were building chronologies and other people were building mediaeval chronologies in the UK, that we weren't getting cross-dating between what we would call these sort of, standard local chronologies and these art historical chronologies. And that was paralleled by something very similar which was taking place in Hamburg where Dieter Eckstein had been working on panel paintings from the Netherlands, and again they had built a chronology, and that chronology cross-matched with, with Fletcher's art historical chronology, but the Netherlands chronology didn't really match that well with the German chronology. So it became obvious there was some sort of problem. And I've mentioned earlier that we went round making sure by building modern chronologies

that there was only the one tree ring signal. So when you knew that, it became more and more obvious that there was something different about these, these panel, painting panels, and the most obvious likelihood was that they were in fact imports. Now the problem is then, proving that. And, when I first started suggesting that they were imported, this produced a very hostile reaction from John Fletcher, including a threat of prosecution for interfering with his livelihood, which, well, presumably he was charging money for dating panel paintings. So, the result of this was that, unfortunately an antagonism developed that, that, there were two schools of thought, one which was that art historical chronologies are all from somewhere else, and then the Fletcher idea was that they were, they were actually from, in his case England, but that they were different in some way, which would raise the question, well how did people manage to select them? And the answer given to that question was then, that these were very elite trees, that they were extremely regularly grown. And again you would have to ask, well how did someone felling a tree know that it was going to be elite before they felled it, you know? So I mean, the whole thing begged a lot of questions.

[07:10]

And eventually, the whole situation was resolved on an issue of sapwood. The art historical chronologies and the dates given for them suggested really a lot less sapwood, those are the outer rings of an oak tree, which are normally cut off, because they tend to attract insect attack, because they've got food reserves in them. And, in Ireland for example our sapwood is around thirty-two plus or minus nine years; in England it's around twenty plus or minus five. Well, the art historical panels, at the date we suggested these panels should date, would have had sapwood way down at the level of twelve to fifteen years, which seemed unnaturally short. And then one day Keith Briffa from the Climatic Research Unit in Norwich brought a bunch of cores over to be measured in Belfast, and these were from Eastern Baltic, and, one of the first things that I did when he showed them to me was, I went and measured the sapwood, and the sapwood was, I think fourteen plus or minus three years. And so, suddenly we knew that if these art historical panels had come from the Eastern Baltic, that would make sense of the sapwood issue, and we also had some correlation suggestive of the dating. So, we sat down and... It's sometimes interesting how academic work, [laughs] works. We sat down with a bottle of whisky at a table in our kitchen, and, we knocked out the text of the note to *Nature*, which only required

minor modification and the addition of a couple of collaborators' names, and, we sent it off. And that was published. And that basically said that the art historical chronologies had to be re-dated. And, shortly after that there were responses in *Nature* from both Fletcher and from Eckstein saying that they agreed to this, which resolved the whole issue. So we now know that all those elite panels had in fact come from, probably Lithuania, from the vast forests that were being exploited and traded through the Hanseatic League into the North Sea region. So if you were in eastern England in 1580 and you went down to the local woodworkers to buy a panel, you wouldn't be getting an English panel, you'd be getting a Baltic panel. So that all, that, that was very satisfactory from our point of view, because it, it, it effectively confirmed that we could tell if things were exotic, in other words, we, we could be pretty sure if, if things were local and if they weren't local. And in fact that's given rise to a whole lot of dendro-provenancing whereby you can now compare the ring patterns of samples with lots of different regional chronologies within, say, England or Scotland or Ireland, and see where they contour down onto most clearly.

How does that affect though being able to make arguments about tree rings as a way of identifying global events, the fact that you can identify local response in that way? In other words, you can, you can decide where a, where timber comes from. If there were... In other words, if there was a sort of, global response of trees to a global signal, why doesn't that obscure differences between trees from different localities?

No, I, I think you're looking at that possibly the wrong, the wrong way round. Issues of similarity or dissimilarity between ring patterns would relate to the local environment of where the trees are growing. If you then superimpose on all trees a major signal of some kind, that will only be for a few years, which won't really affect the, the matching potential of long ring patterns. So it's, it's, yah, it's just, it's apples and pears, I think you're comparing two very different phenomena.

Mm, so, so at a wider, at a sort of more global scale, it's only these extreme...

Events that are lining up.

...that match up.

The ring patterns aren't lining up, yes. In fact you, you would be worried if they did line up when, how would you explain similar responses in arid pines in, in Arizona, with, with moist trees from Ireland? I mean, it would be very unlikely that the ring patterns would match up. But if you get an extreme event, then you can see that happening simultaneously. Remember all these trees are predated, so that you know the exact dates that you're looking for.

[12:22]

Mm. I wonder why it mattered so much to John Fletcher that these were all, you know, why did it matter that you were saying that these were imported timbers, why was he resistant to that explanation? Why might that affect his...? Is it just that he would, in terms of affecting his livelihood, is it simply the fact that, his chronology was, was wrong and that he, and that people would know that? Or is it anything to...

Well I, I suppose it doesn't look good if you're offering a commercial service for dating high prestige paintings if there's some question over the dating. Even a very small question is, is still a question. But I think, I think it's, it's actually more profound than that. When we were dating buildings as part of our chronology building, we weren't charging people for those dates, we were simply dating the timbers to the best of our ability. Now if we had had to move our chronology, and we changed the date of some random cottage by a few years, who would it be affecting? And it certainly wouldn't have any financial implications. But, when you're locked into high prestige paintings which you have published results about and which you have made certain claims about, because, remember, it can be very edgy, if a panel is painted very close to the death date of a known artist, moving that date a few years could make the difference between a copy and, and genuine. So these are, these are tense issues in, in the world of art history, but probably not in vernacular architecture. So basically, I think John Fletcher had painted himself into a corner, he had made certain claims from which it was difficult to climb down. Though he eventually had to when the evidence was overwhelming. The real question would have to be whether he in fact knew all along that there was a problem but was just not willing to admit it.

What's your suspicion?

Well it was interesting. In his, in his acknowledgement that our re-dating was correct, he, he actually said, 'And we can add additional information.' Which I thought was an interesting throwaway line, it suggested that he had prior information which had been held back. So. It was also very interesting, that while this was a debate, very very few people would come out in support of what we now know is the correct answer. In other words, people were very open-minded, they would, they would say, 'Well, we can't, we can't decide on who's right, or, who's not right.' As soon as the *Nature* article was published and then the comments from both Fletcher and Eckstein, then everyone was, 'Oh we knew that all along.' It was very interesting to see that, no one was willing to come out with statements like that before it was actually proven, but then after it's proven, well, everybody's an expert. And I thought, I thought that was really quite intriguing.

So you felt there was a lack of support before the Nature from other scientists in your field before the Nature article came out?

Well I didn't think there was, there was, there was just, you could not get anyone to, to take sides on the issue. And, of course, I suppose they weren't working intimately with the data, so it would be, the nature of the, the issue.

[end of session]

[End of Track 5]

[Track 6]

Could you tell me about the development of your teaching in the, in the Seventies and Eighties? You, you started as a, I've forgotten the name of the post, the demonstrator in archaeology?

A graduate demonstrator, mm.

And then, presumably you moved to a lecturer and, and, through different levels of seniority. But I wonder whether you could talk about the first, your first experiences in the first few years of teaching undergraduates, and, both your approach and its, I don't know, its possible effect on your, on your work, of teaching.

[pause] Initially when I accepted the lectureship, there were very few lecturer [lecture] slots available in the Department of Archaeology, and one had to actually effectively force the issue that it was, it was necessary to teach students about different dating methods, to give them detailed information on techniques like dendrochronology and particularly radiocarbon, which all archaeologists use, but which frequently was treated as a bit of a black box. And I felt that it was important for people to really understand the nature of sampling, the nature of what the errors meant. And, I felt I was in a good position to, to do that. So gradually, I took on the responsibility for teaching chronology, and, that was then supplemented by, somebody had to do it, and I was chosen to be the one to teach human evolution; coming from a science background, that was again relatively easy to take on, and it was also interesting, because I, I had dug in Palaeolithic sites and, had a working knowledge of, of, of human evolution. So, with that as a basis I started teaching the whole of the first year early man course. And then, second and/or third year, scientific dating methods. And those became a sort of a yardstick. Those were my slot in the, in the firmament of the department.

And, can you say something about your experience of teaching, your, about interaction with students, about the decisions made in presenting scientific information to students?

I felt it was important to give people a, a feel for what was actually happening and the methods. In other words, that these things were not mysterious, they were really quite basic physical principles underlying things like radiocarbon. Which, obviously everybody can understand tree rings, I mean tree rings are just, user-friendly, everyone is aware of, of trees putting on a ring each year and, and, building up patterns of rings. So, there's no, there's no great problem teaching that, though there are lots of ins and outs when it comes to the detail of, of the refinement of tree rings. In fact, things like the art historical controversy for a number of years were, were a main feature in the teaching, because of course there was, there was a literature associated with it which you could give students, and it was also sufficiently convoluted that you could tell the difference between a very good answer where the student really understood the issues, and, and someone who had, who had only taken a cursory interest in it. So, in that sense, this business of, of research aiding teaching, I mean I would be a strong advocate that, it's important that academics do have a research interest, because they can bring an immediacy to their teaching, which is not otherwise there. The other thing was that, from my own experience, I, I knew latterly that, that a lot of the teaching which had seemed particularly obscure when I was a student had been because the, the issues were not well put over, they were not put over in a user-friendly way, and things, concepts which could have been explained quite easily, had been made deliberately or mistakenly obscure. So my attitude was always to make things completely freestanding units of information which were fully explained, and if the student was willing to stick with the notes they would, they would really be able to understand the mechanisms of what were going on. And that, I think, stood the lecturers in good stead. And this worked particularly well with human evolution, because, all of the really big breakthroughs in the human evolution story were all in the early Seventies. The famous Lucy find by Richard Leakey and co... Was it Richard Leakey? No, actually it wasn't, it was... [obviously Don Johanson] This is the trouble with being retired. It was whoever found Lucy. [laughter]

OK.

Basically, the whole australopithecine picture clarified itself, that you, you finally knew from the early Seventies onwards what the main stages of, of the early story

were, and that meant that you could, you could produce a framework which was robust and which, even as the story developed and new finds were made, these could just be latched on to the framework. And if you had the framework, that didn't change. And that was, that was a very useful, a useful situation. Because you could make a coherent story with no gaps. The old criticisms of human evolution was, but there are gaps, there are gaps, but in fact there really are no gaps now, I mean, they have a pretty well complete story. So that was developed over, over really many years, and seemed to go down extremely well with students. Because, this is something which most students have never come across, and, the vast majority of archaeology students are not coming in with any archaeological foreknowledge, they are, they are completely blank slates, and you are able to excite them, because you are taking them into areas which most people have not thought of, like, you cannot help but start talking about evolution by going back to the beginning of the solar system, 4.6 billion years ago.

I imagine they still come in not having been taught...

Oh I imagine they still do, yes, mhm, but...

...because, history and evolution are not taught.

Mhm.

[07:01]

What was the response of the students in particular to a course on evolution, human evolution? I'm thinking about the, the sort of, range of responses of students who may or may not have particular ideas on this themselves.

Well I think it was, it was eye-opening for them. But, I think, I think the biggest response was the surprise that the story was so complete. I think, I think the word on the street amongst the general public is that, oh it's, it's a put-up job, there's just a few skulls, and really we don't know much about what happened, and, and evolution doesn't really work, and, most people don't give much thought to long timescales anyway. So, then when you discover that you can trace the whole family history right

through, I mean there are some very interesting questions, you know, what happened with the, these jumps from early homo sapiens through to modern humans, I mean that's, I mean, some intriguing, very narrow evolutionary windows. And that, that again gives you an opportunity to hammer home to students the idea that, in our evolutionary pathway, we may well on more than one occasion have come through a single individual, and that everyone on the planet is ultimately descended from one early human, and that may have happened more than once, which is, does give you an idea of how, how, how difficult it is to produce an intelligent species. You've got to go through, be lucky enough to get through all those little evolutionary windows.

Did you find that for any students their religious faith was an obstacle to accepting this, this sort of information, or...?

Rarely. I mean there were students who sometimes... They couched it in terms of, 'Sir, do you really believe this?' implying that they didn't believe it. But, basically my answer to that was that, yes I did believe it, I mean, all the evidence is there, so it's, it's not really a question of belief, it's a question of, size up the evidence, and it's pretty self-evident that you can see the whole pattern working right the way through. What does come home to you is that, if, these ideas about some of the evolutionary windows being so narrow, is that, if, if a, if an infant is born who is the first of a new line, who ultimately would be a mutant of course, what would have happened if the parents had gone, 'We don't like the look of that,' and, bang its head on a rock? [laughs] Then, suddenly none of us would be here. And, perhaps a few Neanderthals would still be wandering [around]. So it's a sort of, it's quite a salutary science fiction thought.

[10:04]

To what extent had your, your personal religious views developed by this point? The last time we spoke about this, it was a kind of, personal dismissal of religion based on a particular priest saying that, to question is sin. OK, so that suggests a kind of atheism, but I wondered how that developed as you, as you got older.

Yeah, I would class myself as a working atheist, yeah, I mean I just, I, I saw no reason to change my view, and lots of reasons to stay with it. Just, simply that, the, the

timescale of the planet, and our occurrence at the last effective seconds of, of existence, just doesn't make any sense in, in, in terms of religion as, as I was taught it. So it's, it's, quite easy to simply put it aside and work on the basis that it's, it's not particularly relevant. It's certainly not relevant to the story of human evolution. And, it... We have had quite a lot of experience of, let's call it denial with regard to the tree rings, because our tree rings run back to earlier than Usher's date for the creation of, of the world. Now, I don't really think that many Christians believe in 4004 BC, I mean they tend to believe in a short chronology, maybe 10,000 years or something like that. But, basically, you can't argue with the tree rings, I mean, other people have built much longer chronologies than ours, and, they all go back before 4004. So.

Could you tell me about your experience of people who nevertheless tried to argue with the tree ring chronology once it had been published, on religious grounds? In other words, to what extent you had contact, you know, unsolicited contact if you like with people who were arguing against.

Yes, we, we were approached, or I was approached on a number of occasions since, I suppose really since 1984, of people wanting to contest tree rings. I mean my response to that is, well, you have the problem that they're replicated, and, I don't see quite how you're going to get round that. But the arguments tend to be rather conspiracy theory based, they're along the lines of, 'Oh you use radiocarbon to place your tree ring patterns, so really, yours isn't a real chronology, it's only a version of the American chronology that underpinned the original calibration.' And that's just simply wrong, I mean that, there's, there's no way we fell into that trap. I mean radio carbon, radiocarbon isn't good enough to allow you to clone a chronology, that's just, it's a nonstarter as an argument. But of course, people who don't want to believe in the tree rings, equally well cannot afford to accept... [laughs] You... If they can't believe in them, they can't then suddenly believe in them. So the result is, they have to hang on to sort of, abstruse objections and, and the like. Throwaway lines. For example, a dendrochronologist in America at one stage took the filter out of our computer program, and, [laughs] and claimed then that, that you got lots and lots of different correlations, and, you're left going, but the program only works by having the filter in it, you know, so... And yet this article, which should never have been published, I mean I don't know what referees were thinking of [laughs], but... But

this is commonly cited as, 'Oh well, dendrochronology doesn't work, I mean, Yamaguchi said so. And you're left going, well no, he didn't, he fiddled with a program and, and, really published a very stupid article. But there's no point, no point in me saying that, because of course, you know, that's, I'm the, I'm the one who's claiming the chronologies are correct, so...

What was his motivation for doing so?

I don't honestly know what he was trying to do. It seemed to be a misunderstanding of some kind. Because, in order to, in order to, to pick out the unique matching position, you need to pre-filter the chronologies, and, if you don't do that, then you're matching trends. And of course if you match trends, you're going to get lots of agreement over periods of time, so... So, taking, taking the de-trender out of the published program, to me was nonsensical, I don't see why anybody would do that.

And, and, these approaches, these approaches from people making, having a religious motivation, wanting to question...

Well, it's not necessarily all religious. In some cases we have no idea what it is. It could be people who believe Immanuel Velikovski, who wanted to shorten the Egyptian chronology, or it could be people who are, who are interested in the ideas of, a chap called Iligan[ph] [Illig] in Germany who has proposed that 300 years be taken out of the AD period, and that basically you move I think 600 to 900 AD, which is an idea sufficiently bizarre that most people would simply ignore it. But, it's, it's got a lot of attention in Europe, and there are people, certainly trying to, to show that he may have some validity in that, but I mean I can assure you, [laughs] there's absolutely no way that can be correct.

For whatever reason they contact you, how do they tend to contact you? Buy letter, by ringing you up, by coming to the department, what happens?

No no, you would, in the, well in the Eighties it would have been by letter, and then it increasingly would be by email, so it's just...

And, is there any attempt to present evidence on their part?

[pause] Evidence. Well it, it... No, it's, it's usually couched in ways in which, you have made a mistake, in other words, they're saying you... For example, the misuse of radiocarbon, they, the wiggles are an artefact of errors in the chronology rather than actual changes in the, in the amount of radiocarbon being produced in the atmosphere. Those sort of, sort of things. But in... As far as possible, I answer critics. But there does come a point usually when they stop listening to what my answers are, and, and at that point there's no point in continuing. I mean that's the, that's on a number of occasions that's been the course. I, I go through a series of explanations. Their replies then show that they're not accepting the explanation I'm giving, and if they're not accepting the explanations, then, what's the point in explaining more? So it's a... I'm sure I'm not the only one that suffers from this, but dendrochronologists in a sense do put their neck out when they, when they claim these long accurate chronologies. Interestingly we've never had any queries from the entire radiocarbon community, who use the, the, the long chronologies, and who also would, in my view, be the first to see if there were glitches in the tree rings. Because, you know, if you had for sake of argument a seventy-year error, the step in the radiocarbon calibration would have a whole manner [cluster] of, of geophysicists wondering what the mechanism was to produce this sudden change, and, so in other words, you would immediately have got attention if there were strange shapes in the calibration, but, there aren't.

[18:34]

Thank you. Could you then go on to tell the story of the development of the English prehistoric chronology, which I think begins from the mid-Eighties, through relations with Cambridge and Liverpool, and then, I think particular sites in, Croston Moss is one.

Yes well I'll, [laughs] I'll try to dredge through my memory and see what... We've already had the two Lizes from, from Queen's going over to East Anglia and producing enough material to give us roughly 1500 years of chronology. By the time we had finished the, the Irish chronology, because, as far as we were concerned, 5,200, I think we have now extended I to 5,400, but to all intents and purposes it was

finished as far back as we were going to go by 1982 and then agreed in 1984. After that, it did become fairly obvious that, Germany had a whole chronological system, and Ireland had a whole chronological system, and there was no equivalent continuous chronology in England. There were various workers in England building chronology sections but none of them were employed to build a long chronology. We were actually in a sense tooled up for that sort of work. And we knew from contacts that workers in Cambridge had accumulated a large number of, of subfossil oaks, with the intention of building a long chronology for eastern England. And we also knew that workers in Liverpool had accumulated a lot of oaks from Lancaster. So we, we basically contacted them and saying, 'Look, we are tooled up to do this; would you be willing to let us have access to your samples?' And at the same time we applied to the SERC, [Science and Engineering} Research Council, for funding to support Dave Brown for three years to, to put together an English chronology. And certainly they could hardly have objected to that, because it was, serious value for money. So, we got the funding. and we basically went ahead. We visited East Anglia, we collected not only the samples from Cambridge but also some fresh samples ourselves, and what we immediately discovered was, we got exactly the same chronology as we had already, that East Anglia is limited to those 1500 years, and that, we weren't going to get much further there. Lancashire gave a much broader chronological spread.

[21:39]

And [a]gain, we had one of those strokes of luck, or intervention, whatever you like to call it. We got a letter from a schoolmaster in, or around Preston, saying that some of his pupils were wanting to know the age of some of these bog oaks that he had been collecting as firewood from a site called Croston Moss. So we were over in England anyway on fieldwork, and we said we would call in on this schoolmaster, whose name I have totally forgotten, and...

Mike Harvey I think.

[laughs] Mike Harvey.

In your book. Yes.

Apologies to Mike. It's the price of old age. So when we arrived at his house, we discovered that in his back yard he had enough bog oaks stashed to keep him in firewood for about a millennium. [laughs] I'm exaggerating slightly, but certainly he had a very large amount of material. And we took a random series of selections [sections], and brought it back to Queen's and processed it, and it became obvious even from the first handful of oaks that it was, it was going to be a potentially valuable source of information. And, so we went back, and went to the original site and sampled about 100 trees from across the North [Moss] itself. And, that provided a chronology which ran from 3200 BC down to 1600 BC, and another section from 1500 down to, 900 or whatever. So, we got the guts of 2,000 years of chronology out of that one exercise. So, so the pupils got to hear what age their oaks were. And, we got a long section of English chronology. And we've basically just kept going, collecting more and more samples and processing more and more samples, until the site chronologies joined up. And of course we had an enormous advantage compared with the original Irish work, or indeed with the German work. When you are building a chronology for the first time, it relies entirely on finding overlaps between site chronologies, so you have to eventually have all the, the chronology sections. When you've got pre-existing chronologies in Germany and Ireland, you can cross-date the English chronology sections against Ireland and Germany. And, for example that long Croston, Croston Moss chronology, dates against England and Germany with enormously high correlation values, at exactly the same date. So, you, you then know where that section comes. And that makes life a lot easier. Now, it does mean of course that the English chronology is not totally independent, but, there's no need for it to be totally independent, given that the other chronologies are independently replicated. So we proceeded on, and in about, it probably took something like five years in total, but we then had a chronology from 381 BC to, to 5000 BC, and, that meant that there was yet another chronology unit in, in Europe, spanning... Because the English dendrochronologists, with a bit of help from us also, had the last 2,000 years, so, when you add that through the Roman chronology, it's actually a continuous English chronology back for 7,000 years. And that's interesting in itself, because again, you're finding in various places, in northern Sweden and in Siberia, that a lot of chronologies seem to run back about 7,000, 7,500 years. So something must have happened around about 7,500 years ago that caused trees to start being preserved on really quite a large spectrum of the Northern Hemisphere. I don't know

what it is, but, the logic's quite clear, if a lot of independent chronologies run back to roughly the same point in time, something must have happened, you know.

[26:11]

Thank you. As your children, as your own children grew up and became aware of what you were doing, what was the extent of their involvement in it, or, if not, going out on fieldwork, if not involvement, then, interest, if not interest, then curiosity?

[pause] Maybe, maybe they got too much exposure to it, because I, I think it, it didn't interest them. It wasn't, it wasn't something that was transferable, if you like, as an interest. [laughs] And that's fine, I, I think parents bore their children enough without, without making them go through the, the ramifications of tree ring research you know. It's a rather esoteric sort of area, I'm not sure everyone would be attracted to it.

Did they ever come out with you, not aware of why they were out with you, but were they ever with you on field work?

Oh yes, they were, from time to time, mhm.

Did they help?

Oh yes, they'll carry oak for you, certainly, yes. I mean, [laughs] every, everybody does, never found anyone who wouldn't help. So.

And, to what extent did you bring work home in the sense of, bring wood home? Just looking round your home now, I don't think it would be apparent that you worked on tree rings from seeing your house now, but would, at this time, would it have been apparent if you'd gone home?

No, well, there was never any need to bring wood home. I mean, all the measurements were made on, on the systems at Queen's. So, at best you, if you were looking at data or graphs or, something on a computer screen, but, there's no way, wood, mm. [laughs]

But, I wondered whether you ever regarded any particular bit of wood as, as an attractive object that you might bring home.

[pause] I quote often identified pieces of wood as attractive objects, but I don't necessarily bring them home. It's... You give them to somebody or, you know, they're handy... A nice, a nice oak burr...

Being a...?

Burr is a sort of, cancerous growth on a tree you know, it gives this convoluted effect. And sometimes you'll find them on subfossil oaks, and so if you chainsaw those off, they're always handy to have, because you can polish them up and give them as a retirement present to somebody, or... [laughs]

Geologists sometimes, I'm only asking because geologists sometimes have a sort of, an attractive rock on their mantelpiece or something like that, but, you've never turned bits of wood into that sort of thing for your own home?

Nnn... Not that I...

No. [laughter]

No.

OK.

There's quite a few sitting around down at Queen's, but...

Mm.

You, you... You develop a rather... I'm trying to think what the right words would be. You've got to be sensible about wood. You see over the years we have had quite a lot of resistance from museum people to sampling wood, because we would be

destroying it some way. That's why we would sometimes resort to X-rays or photographs or casts or whatever. But one of the things we, we learnt over the years, that, that archaeologists who would go out of their way to forbid you to cut a slice out of, for sake of argument, a dugout canoe, subsequently that dugout canoe was left in an air-conditioned building and fell into pieces and was put in a skip and consigned to the city dump. My attitude would be, well, it would have been far better if we'd had a slice out of that, because at least we would have got some information. So, you develop a sort of, a rather robust view of what should be done with wood. Unless there's something really telling about some incredible woodworking detail which does require to be preserved, then, my attitude would be, well, just, you know, take a slice out of it and stick the two bits back together. Or if necessary you can get the slice back and stick it all back together. But, there has in the past been far too much pussyfooting around. Because very often, and I'm not joking about this, very often pieces of wood which are too precious to be sampled are ultimately consigned to dust. So there's a lack of consistency in, in what is, what is said and what is done. Mm.

Are there particular pieces then that you would have liked to have sampled that you have not been allowed to sample, that you have in mind when you're talking about this? Did you mention the dugout canoe just as an example out of thin air, or was this a...?

It's just a, just really an example. Though there were quite a lot of dugout[s], I think there were something like seventeen dugout boats were eventually consigned to oblivion by one institution. And, yes, we might have been able to date, you know, seventy-five per cent of them you know. At least you would have had dates for dugout boats, as opposed to no dugout boats. [laughs] But that sort of thing comes down... The problem for museum curators is, they're sort of tasked to look after what they've got, and that means that when somebody comes along wanting to interfere with an object, their natural resistance comes out, but, that only, that's only sensible if in the fullness of time the object is in fact properly conserved and preserved, but, in my experience, wood is particularly difficult material, and, unless you face up to that you end up very often losing it. So. But anyway, I mean we managed to build the chronologies anyway, so, but there are some objects that would have been nice to date, but they're no longer around.

[32:21]

I wonder whether you would tell the story now of the visit to the tree ring laboratory in Arizona where you first, I think I'm right in saying, where you first started to write notes on, really look at, particular years in the chronology or chronologies where there seemed to be something happening, or not happening, narrow ring events.

Mm.

I suppose one question is, why did it happen there, why did this happen in 1986 there, as opposed to 1977 somewhere else, or 1981 back at the lab in Belfast?

Well there... You've got to go back a couple of, of years, because, it was in 1984 that Val LaMarche and Kathy Hirschboeck published a paper pointing out that frost rings in these high altitude bristlecone pines from California seemed to coincide with the environmental effects of big explosive volcanic eruptions. And they cited several recent examples like Krakatoa 1883, frost ring in bristlecone pines 1884, big eruption of Katmai in 1912, frost ring in 1912. They had a series of these modern examples of frost rings coinciding with the years of or the years immediately after big volcanos. And they had a pretty plausible case that this seemed to be climatic dislocation as a result of the dust veils then freezing these high altitude trees during the growing season. Which is a pretty, pretty out on a limb sort of idea. But what they also knew was that they had a, a major frost ring in 1627 BC, and, that frost ring, when they looked around to see which volcanos were known about, the only known volcano which might be anywhere in that vicinity was Thera, or Santorini, [in] the Aegean, which was a big explosive volcano which affected the, the island of Santorini, and, and wiped out part of the Minoan civilisation that were on the island at the time. So, that publication had given rise to a lot of excitement, because of course a date back in the seventeenth century BC was much older than archaeologists suggested for the, the date of that volcano on the basis of conventional pottery sequences and known chronology. And hence that was controversial. And it was on the strength of that that, being the same year we had finished the Irish chronology and agreed with our German colleagues, that I was able to look and see what our trees were doing, and, yesterday in the store you saw that sample from Sentry Hill, which actually has a

colour change in 1628 at the beginning of a little band of narrow rings. So I was aware that some of our trees showed narrow growth rings after 1628, and that this seemed to add to the 1627 story, it suggested it wasn't just a localised effect, which had been one of the criticisms levelled at the bristlecone pine work, that it was something just affecting America. Clearly we were seeing something in Irish trees. And I was going to publish a note to that effect. But Jon Pilcher urged caution, he said, 'Well you know, we do have narrow rings, lots of narrow rings in trees, you know, is there any significance to that?' So, that, that was sort of ongoing in 1984/85, with me thinking about publishing and then deciding not to on the basis of advice. [36:25]

And then, one of the senior American dendrochronologists in Tucson was having a sabbatical in 1985 to '86, and, the Americans let it be known to a series of labs round Europe that they were looking for someone to act as visiting professor for that year. The bottom line was that, nobody else, none of the senior figures in European dendrochronology, could get away at relatively short notice, they all had commitments, and I was able to shuffle my teaching into the autumn term and get a six-month leave of absence to go to Tucson from January to June 1986. And again, that was very interesting, because, in fact all they wanted were about three seminars, which one could have done with a stick of chalk, so there was no, there was no need for preparation. However, before I was setting off, Martin Munro and Dave Brown, who were the main tree ring figures by that stage in Queen's, they had, they had been archiving all the dated data in hard copy form and also in microfiche, just as a security measure in case the lab ever burned down. So, when I went to Tucson I had the, the microfiche for all the dated Irish trees with me, and, I had this vague notion that there was something odd about the fact that we were seeing narrow rings at the time of the 1627, 1628 BC event, whatever it was. And, having plenty of time on my hands and sitting in a tree ring lab in sunny Arizona, I decided to go through the microfiche and look at the, all the trees that covered 1628 BC, and it dawned on me that what did stand out, and you've seen this in the data yourself, the really narrow rings stand out as single digits in the lists of data. And, so it was, not a lot [that] long a job to run through 1,000 of these, and compile by decade all the narrowest rings in all the prehistoric oaks. Now, sort of, in a sense it was quite a strange thing to do. I made some arbitrary decisions, I decided not to look too much at the last 1500 years, really because, the only trees that we could be absolutely sure of their source location were

bog oaks, because we know exactly where they came from. All your building timbers tend to be mobile, and you're not really sure where they grew. So, in order to invoke a site component to this analysis I was playing around with, I, I stuck to bog oaks, which limited me really from 5200 BC to about 600 AD. So I went through all of these, and compiled lists of narrowest rings, and a few dates absolutely stood out. Typically you would get one or two, or, or sometimes no narrowest rings in a decade, and suddenly you would find thirteen narrowest rings on seven different sites in the 1390s [3190s], and you found another big cluster at 2350 and you found another cluster at, well we already knew they were there at 1628, because that was if you like the null hypothesis, big cluster in the 1150s and '40s, a cluster at 207 BC, and a cluster at 540 AD. And, these dates just dropped out of the tree rings, and, oh, that's interesting. Now on the way home from Arizona... In other words, I had a list of dates but I didn't know anything about these dates. And, on the way home from Arizona I happened to call in, or the family happened to call in, at Cornell to visit Peter Kuniholm, a fellow dendrochronologist we knew from conferences and, contact, and while I was there I happened to mention, or perhaps I had mentioned in a letter, that there was something interesting at 540. And, this produced several bits of random information that, yes, the Chinese seemed to have had things going on in the period around 540, which I thought, oh that's interesting.

[41:48]

So when I got back to Belfast, after the six-month sabbatical, trying to introduce European dendrochronology to American dendrochronologists, which is a bit of an uphill struggle, because they have their own ways of doing things, you know, we sat down, and, I've always been very conscious that scientists are quite capable when they begin to see a pattern emerging of selectively only accepting the information which reinforces their hypothesis, and subtly ignoring things which disagree. There's a, I think there's a syndrome name for it but I can't remember what it's called. But I'm very conscious that we all run the danger of doing that, we're not to be trusted. And Martin Munro, who at that stage was working as a research assistant in Queen's, was one of the first super computer nerds that any of us had ever come across. He really, really understood computing, he could write you a program at the drop of a hat to do anything. And, and would, and would sit up for thirty-six hours to do it. So, there aren't many like Martin. So I went to Martin and I said, 'Martin, here's one [what] I did. If you write a programme that duplicates what I did with the same data,

and if you get the same answer, then we'll know it's real, as opposed to a figment of my imagination. And, if you get the same answer we'll publish it jointly.' And he agreed to that. I can't remember how long it took him to do, probably a day. [laughs] But I mean it would have been a very short amount of time. And he basically came back and said, 'Yup, you were right, I mean, you, you, as far as I can see, you didn't frig the data at all. The, the figures you got were the figures I get with the computer.' And that was fantastic news, because then you could publish it with some security. So we published an article which I think was entitled, 'Santorini Volcano's Dust Tree Rings', 'Santorini and Dust Veils' or...[Irish tree-rings, Santorini and volcanic dust veils]

This is the Nature one isn't it.

It's, yeah, [Nature] 1988.

[looking at notes] Oh yes, 'Irish Tree Rings, Santorini and Volcanic Dust Veils'.

Yup. So basically, we came out supporting the LaMarche and Hirschboeck assertion that perhaps Thera had erupted in 1627 or one or two years earlier, and we were saying, well yes, we definitely see something in the trees. We can't of course, no way could we say it was Santorini, but we could certainly reinforce the idea that there had been a big event. And of course we also in the paper listed the other dates. And I had no idea in 1988 that, that, '98, that, twenty-four years later I would still be writing about and investigating these dates, because the dates simply wouldn't go away. And I'd recognised that by about 1990 when I published an article in *World Archaeology* called 'Marking in Marker Dates', in other words, dates which you should actually look out for because they probably are real, and they probably affected large swathes of the Earth. And, obviously the most famous of those is the 540 event, which, in 1980... 1994, I published an article throwing some, some new ideas about the 536 dust veil, where I suggested, a) that it was global, because it shows up in trees from right around the Northern Hemisphere and indeed into the Southern Hemisphere, and also, that it was two-stage. And, the really big question was, was it volcanic or was it extraterrestrial? So that was, that was the first hint of even beginning to think that any of these things might be other than simply volcanic.

[46:42]

And, could you say just in some more detail, partly because I think we've got an image of the strips of paper involved, exactly how you went about in Arizona marking out these decade by decade narrow events? So in practice, how you put it down on paper if you like. You had the microfiche. And then what did you do in your office there?

I borrowed a microfiche reader, [laughs] and I sat at it for, well, a fair number of hours, simply scanning visually each list of ring widths for each sample, and picking out the narrowest rings. Sometimes there was one narrowest ring, sometimes there were half a dozen narrowest rings in a sample. And, I had produced a, a long series of strips of waste paper marked off in decades, so, for each century of this 6,000 years or so that I was interested in, I had, I had the ten decades. And then I just filled in the... [narrowest ring dates] And I thought, the only way to do it is to do it honestly. If you, if you start, you know, making value judgements: oh there's one that's not actually the narrowest, it's the second narrowest, if you start doing that, the whole thing's going to become blurred. So I simply was, went religiously through it, and took out the narrowest rings. Which is why the computer then got the same answer, because, you know, I had in fact done it as I had set out to do it. You know, well I say, it's very easy to tweak things, I mean you've got to be careful not to tweak, and especially not on a subject like dendrochronology where everything is basically absolute, you know, it's, it's [laughs], you don't want to start tweaking systems that are absolute. So yes basically I, I went through each one visually and picked out the narrowest rings, and listed them, and once that was done I had a series of slips of paper which still exist with the original writing on them, and, almost comments of, 'Wow! what was that?' you know. [laughs] Because some of these events are really quite profound, in that, large numbers of trees are showing the narrowest growth ring in centuries of life, you know, and you think, wow, I mean, what would... how do you do that? I mean oak trees are responding to many different variables, and, to get them all to agree is really quite extreme.

[49:15]

So when, when we went back to Belfast I had lists of the key, samples from the key dates, and I then went down to the wood store and dug out the actual samples.

Because remember, these samples had been measured and put in boxes and put away. Most of them had never been looked at again, unless they had been dragged out to allow the extraction of, the identification of radiocarbon calibration samples. Because of course we had finished the calibration work by 1986, published, published all of that in the journal of *Radiocarbon*. So, this was the first time to actually go and say, well look, what do these rings actually look like? And then it became apparent why narrowest was an interesting criteria. If you look at the rings in a normal piece of oak, the spring vessels at the start of each year are more or less the same size, they're just dotted along the beginning of the year's growth. And as I say, they're big enough, they're probably not far off .6 of a millimetre in some cases, but, we could check the, the actual figure somewhere else. But, they're big enough to just about resolve with a naked eye. What stood out when you actually went and looked at the samples was that frequently these narrowest rings were narrowest because the spring vessels were reduced in diameter. And that was interesting, because that suddenly reminded me of work that had been done, and even some work published by John Fletcher, and other European dendrochronologists, pointing out that, frost damage in oaks quite often seemed to be associated with SEVs as they're called, small early vessels.

Small...?

Early vessels, the early vessels of the, the ring. And, SEVs, they've not really been researched very much, I mean they've been observed, it's known that in some cases they are associated with extreme cold, but they're also associated, and you could see this very clearly from the bog oak samples, often associated with damage. So these were events that were severe enough to produce physical damage in the trees, without blowing the tree down or killing the tree, it produced physical damage. Now, whether that was gales blowing off branches, or animals under stress eating the bark, or water level rising round the trees, I mean, as with so much research, you have no idea what the actual individual mechanism was. But when you're getting numbers of trees showing this effect at the same time, you do get an impression of an extreme event of some kind. And, certainly, the effects on 540 show up clearly right around the, the globe, you know, you can see it. In fact, there are even SEV rings in some trees in Germany in 536, I think Hubert Leuschner sent me an example of that, and there are some Mongolian trees which show extreme effects as well. So, so trees weren't just

going, 'Oh it's rather chilly' or, 'Oh it's rather damp'; they were going, 'Ow! this is...'
oh! you know, you know, this is hurting, you know. And of course we would love to
know exactly what the mechanism was. And, one of the things about research in an
area like this is, you do have to think outside the box. You don't have to be
constrained by issues like temperature and rainfall. You are allowed to think of, could
it be chemical, is... was something dumped into the atmosphere that actually
physically affected the trees? And if so, could we identify it? You know, you, if
you're going to break through some of the barriers into new understanding, you've
got to sometimes be willing to, to think, well what, just what or could happen? And
then you could try and fit it to what records exist from humans which are often biased,
or, which are often hard to interpret. Because remember they, the pure [poor] humans
in the past had very limited actual knowledge of, of physical parameters, and if they
saw a blue haze in the sky, how would they describe it? If they saw a brown haze of
poison gas, how would they describe it? And indeed, up until recently, if they didn't
record such a thing, would anybody even believe them? Everyone would assume they
were speaking in metaphor, you know. But, my attitude is, be as open-minded as
possible, because, these are big events, we want to understand them, and just taking a,
a simplistic view of them might not be the, the right way to go about it.

[54:26]

So all of this sitting at a, at a microfiche in Tucson gave rise to a series of dates which
are still with us and which I think in every single case still demand explanation. Now
the one which I thought was most important because it was in the historic period
where you could expect to be able to get a better understanding from history, was the
5, what I call the 540 event, and it's very simple, I call it the 540 event because all the
narrowest rings are in the 540s. They're not in 536. 536 was the date pointed out by
Mike Rampino and Richard Stothers back in 1983, '84, as the most severe dust veil
in, in historic record. And, the question has been, what is the relationship between
what happens in 536, which appears to be undoubtedly a dust veil of some sort, and
what happens in 540 when the Irish trees really show the effects, as do some of the
South American trees? In other words, there's a, there's a, there's a two-stage effect
in many chronologies, in Scandinavia and Siberia and elsewhere, but in some areas
there's only the second one. So, I've always talked about the 540 event, even though
I recognise that 536 is the start of whatever the whole package is. And, that has then,
that, I think it's fair to say that it is now widely accepted that there was a global

environmental downturn between 536 and 550, and I don't think anyone's arguing that that is the case, and they accept that tree rings are indicating that. The causes are still up for grabs in the sense of, ice core work has now put clear evidence for volcanos into the decade of the 530s, but the question is, how good are the ice core dates? Could it be that there are two big volcanos in 536 and 540/41, and that's what caused this two-stage effect? Or was there a big volcano in 536 and something else in 540? And of course if it's something else, then it's an extraterrestrial impact of some kind. Because, in the meantime, mythology shows that, that there's all the evidence of a, of a, a cometary connection to, to the 540 part of the event. Now everything there hinges on the ice cores, because if the ice cores are precisely dated, then, there's a volcano in 536 and there isn't one in 540/41, and then, the volcano, sorry, the comet story will come into its own. If on the other hand the ice cores have to be moved, as I have suggested, forward by about, seven years, then, you've got two volcanos, one in 536 and another one in 541. So that, that's an open controversy at the present time. And sooner or later we'll know what the answer is.

[57:56]

Before we go further into what becomes your engagement with sort of, historical sources in relation to these identified, what are called stress events global stress events, where trees are under some kind of stress, could you, this being an experience, going to this tree ring lab in America being an experience of, I suppose American tree ring work compared to Irish, how did it compare, how did the set-up compare to, to Belfast? Just as a sort of, physical place for research, how did the, the tree ring lab at Arizona, how was it alike or different?

[mike noises] [pause] Ooh, radically different. First of all it's underneath a football stadium, in an enormous but thankfully cool part, because it's under so much concrete, it's, it's well-sheltered and you didn't even have to have air-conditioning to keep cool. Because of course it's outrageously hot outside most of the time. You have a series of dedicated tree ring workers. I think, I think the real difference is that, that, by comparison to Tucson, Belfast would be a back of an envelope operation, of two or three guys with a room and a half and a band saw [laughs], and a light table, doing dendrochronology on a relatively small scale. Tucson had been in the game for a long time, it was the world tree ring lab, and you had specialists there who were

working on bristlecone pine, you had specialists working on fire scars, and specialists working in South America, and specialists working in Morocco. And, and many others. People doing tree chemistry and things. So it was just a much, much bigger operation. And big enough to have factions as well. So that you had, you had tension between Val LaMarche and Wes Ferguson, these were the two bristlecone pine gurus. It's one of those things, again a bit like, a bit like Burghart Schmidt falling out with Axel Delorme, or vice versa, I don't know who, who fell out with whom. In Tucson, you had, you had two people who would have loved to have proved the other wrong. Now, I mean I've been involved in that but not with somebody actually in my own laboratory. But in the case of Tucson, what I found interesting about that dynamic is, you can have real confidence in these tree ring chronologies, because these guys would love to prove their rival, let's put it for want of a better word, prove their rival wrong. So they are going to go out of their way to try and find errors in the other chronology, and if they can't, you know, there's a good chance the chronologies are right. So I actually think that antagonism's a good thing, because it adds a certain piquancy to the, to the quest. There's nothing as, nothing as, [laughs] nothing, nothing brings out of the worst in people quite like animosity. So, that was, that was an intriguing aspect of the dynamic, that these two leading figures actually didn't get on together.

Was that apparent in what you saw of them there?

I think it was pretty apparent, yes, just their, their body language suggested that they were, they were not all that matey with each other. Of course I could be proven wrong, I mean you might find somebody who was actually in the lab saying, 'Oh no that was just a front they put up for visitors,' or something, but I, my feeling was, it was quite real. It, it can often be competitive you see, I mean, these guys were, Ferguson was working on the mainstream bristlecone pine groups, which are, you know, they are up at 3,000 metres altitude, quite difficult to get to. LaMarche was then looking at the even more extreme trees just beyond the treeline, very often these were trees that had died but were still surviving up there because there's so much ultraviolet light that nothing can, that you don't get any fungi or anything attacking. So, when you've got two people working at close proximity on, on material like that, animosity can quite easily blow up, it wouldn't take much to trigger disagreement.

Anyway, that, that was my reading of it. Most of the rest of the guys got on perfectly well. Because, as long as you're not actually competing too closely, or working on material that's too close, there's no reason for animosity. Sometime when you get too close to an issue that, it breaks out. You know, why can't we date some oak panels in England, I mean, is a recipe for disaster really. [laughs]

[1:03:00]

So, yeah, so that was, that was interesting. You must also remember that, the approach to dendrochronology in America, especially in the American Southwest, is still basically the approach produced by Douglass back in the 1920s, which is skeleton plotting, where basically, you can take a piece of charcoal, and very often the samples are tiny, but they're very slow-growing trees down there, and they will scan them under a microscope and they will simply, they make no mark for ordinary years, or what we call normal ring width, but if you get a narrow ring you indicate that, or if you get an abnormally wide ring you, indicate that. So you get what's called a skeleton plot, so it would be, nothing nothing nothing nothing, B B B for broad, nothing nothing, extreme narrow, extreme narrow, and then that pattern goes on. So then, take that pattern and slide it against the master pattern, which was built up and refined since Douglass's time. And, when they get a fit they, they can read off the dates. Now, what makes it different to European oak is that, it's very clear from huge amounts of experience that oaks don't miss rings and don't duplicate rings. Pines in Arizona can certainly miss rings. So, you have to imagine a dendrochronologist sliding a graph past another graph, and going, 'Oh that fits, and if I allow for a missing ring there, then that fits. And if I allow for a missing there, then that fits.' And we're left going, 'Uh-uh, you can't do that.' I would never do that, that's, I mean that's too much flexibility. If we were allowed to invoke missing rings in European oak, we would have a million-year-long chronology. [laughs] Because it would be nonsense you know. The thing is of course that in Arizona the, the trees were responding so critically to the environment, that the patterns are almost 100 per cent, so they can actually do what they do very successfully, and repeatably. So they, they work their way through site after site, sample after sample, dealing with hundreds and hundreds and hundreds of, of pieces of archaeological wood, with a very high success rate. So, quite different to the way we would work.

Is this connected to what you said about it being an uphill struggle to introduce American people to your...?

Well, it would be very difficult to write a computer program to, to then do what they are doing visually, whereas we could write a program to do what we were doing. So.

Because you couldn't instruct a computer to decide whether to allow for missing...

Well if you did, you would just end up with infinite numbers of matches, I mean, [laughs] it just, that would, that way would lie madness really. I mean, dendrochronology wouldn't have worked in Europe if we had had to have that level of flexibility. So.

[1:06:09]

Is there, is there something about the Irish oaks that meant they were either good or bad, or neither, for the identification as you identified of these narrow ring decades, is there something about...?

Well, the, the narrowest rings, I think it's important to remember that, in Arizona you will be seeing extreme narrow rings fairly regularly, because I mean the climate there, you can have summer with no rain, you know, so the trees just effectively don't grow over the summer. In Ireland these extreme narrow events are only actually occurring, well the big events are only on average once every 1,000 years. So, there's only a handful of them in the whole record. So they're, they're not something you're regularly coming across, they are highly individual.

Mm. So is it because these, these trees are in Ireland, or because these trees are the species they are, that mean that you're not getting so much, you're not getting narrow rings all the time, is it because what you said before about this being a kind of temperate location being, being an island buffered slightly by seas that these trees are not sort of under stress, and therefore, it has to be a very big problem if they're going to record any sign of stress, as opposed to trees at the limits of perhaps a distribution of trees where the slightest change is likely to show up, is there anything in that?

The question exposes the, the inevitable answer, that we really don't know why the trees show these events. I mean, that, right from the start the question was, well why Ireland? Why, if these are global events, why on earth are they being picked up in this little island? And, we would love to know the answer to that, but we, we definitely don't know the answer. And all you can do is throw out a lot of suggestions and then try eventually testing to see if you can work out which one might be the right answer. Recently Jon Pilcher suggested that, perhaps what makes these events particularly significant is if you get big storm events, bringing masses of salt water across Ireland, and you're actually poisoning the trees. [pause] It's a possibility, we don't have any real evidence that that's the scenario. It could just be that our trees are, and this is fanciful, but it could be that our trees are themselves very buffered, they're just used to very extreme conditions, and when you hit them with really extreme conditions, they just buckle, you know, it's, whoa. But, it'll be a long time I think before we, we are lucky enough to find something that gives us the answer to that, I think that's a long and uphill struggle. But that is the ultimate goal. is to know, what was the mechanism? I mean we do have some instances where it does look like some of the trees were standing in water and, and hence it may well be flood events, and that. Flooding is a very interesting phenomenon. There are peculiar limestone systems in the West of Ireland where under flood conditions, whole areas can flood to the depth of twelve feet or more, and trees can be left standing in water for weeks. And that could give rise to bark burst, and bark burst will produce scars, not dissimilar in some cases to the, these SEV effects that we see in narrowest rings. So, you couldn't rule out that in some cases whole bogs have flooded sufficiently to, to cause widespread bark burst. And it would be fabulous to know if that were the case, but you know, it's just a suggestion. Mhm.

[end of session]

[End of Track 6]

[Track 7]

Before we move on through your career today, could you just clarify one episode which you described yesterday, and that was, a trip, I think it was with Jon Pilcher, and it was a sort of, a fairly rapid fieldwork involving a car I think where you quickly, you were sort of hopping over places and quickly getting some samples, and this was, as far as I understand and remember, this was the fieldwork which convinced you that the Irish oaks were not going to be the right trees in order to make sort of reconstructions of climate history. Is that right? Have I told enough there to, for you to imagine what I'm talking about?

No, but I, I can elaborate a bit about, about something we started talking about yesterday. Basically, there came a point in time when, when we had gone round Ireland, bits of England and Scotland, and made modern chronologies, modern chronologies where you're sampling trees which are still alive, so they all end in the same year, and you've got ten replicate samples. I mean we did that, that was the, the work which showed that there was basically the one overall climate signal affecting the tree[s], whatever the climate signal is. Now, Jon was more involved in looking at things called response functions. That's where you, you plot ring widths against monthly variables of climate for periods of time, and you try to assess what it is that the trees are responding to, hence response function. And this showed that, there were variable responses, but in the main you were finding that oak trees like cold winters, and they also like warm Mays, which made sort of sense, you know, because, if the winter's cold they store reserves, if the winter's warm, they tend to use up reserves, it sort of weakens them for the next year. So there was work like that had gone on. And that indicated that, there was some climate signal in the oaks, but it wasn't going to be easy to get it out. And what you would get out, even if you could reconstruct, for example November temperature and May temperature, it's not really what the climatological community with their modelling would want. They want much more instrumental style reconstructions of like, annual or summer temperature, things like that. So this, this was the first clue really that oak wasn't going to be very much use. We also supplied the, the data, as I said previously, to, to Keith Briffa and co at the University of East Anglia, and they did some work on oak, but it rapidly became clear to them that oak wasn't the way to go, and that's when they moved to looking at

temperature-sensitive pines from more northerly or, or high latitude or high altitude areas. So that's really when we became, it became clear that, climate wasn't going to be a big issue with Irish oak.

[03:22]

Thank you. Having identified these narrowest band years, the... or, or decades, that you, you list sort of certain problem years for trees, years where trees appear to not, to put it mildly, not enjoying, enjoying sort of growing conditions, could you tell the story in as much detail as you can of the relations that you established with, to begin with, ice core scientists as a way of beginning to investigate what these narrowest events could mean, or could be caused by?

When, when the, the dates first turned up, and remember, the dates are 3195, 2345, 1628, 1159, 207 and AD 540, so I mean, you just run off the tongue after a while, when those dates turned up, one of the first things we observed, and this is, this goes back to the paper I published with Martin Munro, which, it brought in ice cores, because in 1980 the Danes had published a detailed record for the first time of big volcanos in the last 10,000 years, and, there were relatively well-spaced out volcanic signals, and there was one around 210 BC, and there was one around 1120 BC, there was one at 1644 BC, and there was, there were a series of big acid spikes which actually sat fairly close to the events in the tree rings. And it was on the basis of that we assumed that all these downturns were probably volcanic. And, that, so that's in the, in the, the 1988 *Nature* paper. So, the way of thinking was, that you have a big volcano, and this is very much what LaMarche and Hirschboeck had basically speculated on, the big volcano, the dust veil reflects away sunlight, causes cooling and climate upset of the Earth's surface, and it could of course be on a big scale, because these might well be big exceptional eruptions. And it looked as if our trees were picking, picking this up. And of course, one of the vagaries of that piece of work was that the ice core dates on that early ice core work were coated [quoted] with, with errors like plus or minus ten, twenty, thirty, fifty years, which meant that you couldn't, you know, the tree rings were fixed in date, but the ice cores were a bit flexible. So it looked as though there was a connection to volcanos, but it would require more refinement of the, of the ice core record. So at that stage there was no contact with ice core workers, it was just material taken from the literature.

[06:28]

But when one became interested in volcanos, the obvious thing was to go to conferences and get to know something more about the, the volcanological and the ice core record. And, just the way things happened, I had the choice of going to a big conference on tree rings in Scandinavia, or going to a volcanological congress in Mainz in Germany in about 1990. And I thought, well I think I know enough about tree rings. So I went to the volcano conference. And that was fascinating, because you had one palaeoecologist, me, and about 600 of the world's leading volcanologists, you know, just like a scary scene. And you think, well, these guys are incredibly approachable, they all have, you know, well, all's not the right way to put it, but, you get the impression they all wear plaid shirts and have beards, and, you know, you could go and talk to, anyone, from [Stephen] Sparks from the UK or, or [Tom] Simkin or, you know, whoever you liked really, from the, from the literature, they were just sitting there at coffee and they're more than happy to discuss any aspects of, of volcanos with you. So out of that, [coughs] pardon me, came an invitation to go to another big volcanological congress in 1992 in Hawaii, to give a talk. And the thing was that, by that stage it had become very clear that, the event to concentrate on was the 540 event. Remember it's 540 because that's when our trees show it, but it starts in 536 in terms of the historic literature which, which refer to a dust veil event. So, basically I went to Hawaii to give a talk to try and bring on board volcanologists and others, pointing out that it was the ice cores which were going to be the key to this, because they might be able to see if there were two volcanos. So, so as, as early as 1992 I was sort of, pushing this two-stage event. And, and remember, in concept, I mean a nightmare scenario for people on the planet is, you have a big volcano, sort of a Krakatoa or a Tambora class, and a couple of years later you have another one. You see that's a non tried and tested scenario in recent times, two big volcanos in a few years, could well have a dramatic amplifying effect on whatever the climate response is. So hence that was my interest in, in 540. Was the severity of what seemed to have happened globally at 540 because you had had two big volcanos in relatively short order? And remember, at that stage there was no thought whatsoever of extraterrestrial aspects [impacts]. So, so that was, that was the involvement of meeting up with these people, actually became [being] invited to their conferences. And in fact if I had wanted, I could have, I could have become a sort of dendro-volcanologist, following up on, I suppose that general line of research.

[09:45]

But shortly after that, in the period around 1993, I visited the American ice core workers in New Hampshire. And, Greg Zielinski had invited me down, because I was actually at a meeting, a dendro meeting up in Hudson Bay. It's actually amazing how you get around in these sort of things, when you're bouncing from volcano conferences to dendro conferences to, to ice core meetings. And, the ice core meeting in New Hampshire was very interesting to me, because, I told them all about the 540 event, and my interest in it, and, it's on record now that, after the, after the talk, some of the graduate students were sitting round at their computer and one of them said, 'You know, we've got fourteen metres of missing ice.' And, I thought, what? And Greg Zielinski said, 'No we don't.' And they said, 'Yeah, no, we, we do, look.' There were seven consecutive two-metre samples came up as ice cubes, i.e. trashed ice. And they actually went back to the original paper log, and sure enough, those, those sections of ice had come up as, quote, 'trashed ice'. So that was the first time, as far as one realised, sorry, an outsider realised, that even the ice core workers hadn't paid much attention to this gap in the American record, of course, effectively across this interesting 540 gap. So, it was on the basis of that when I came back to Belfast, I started saying, well hold on just a second. When you actually look at the published ice core literature, what you realise is, there is no good evidence for the volcano, and certainly not a big, unusual, potentially environmentally-affective volcano, around 540 AD. And it was that which gave rise to the 1994 paper in *The Holocene* which was raising the spectre for the first time, was it possible in fact that, you know, how could we tell the difference between the effects of a big environmentally-affective [effective] volcano and loading of the atmosphere from space? And, now you might say, well, you know, where do you, where do you get an idea like that from? Well, the thing is, you've got... There was no doubt in my mind from the tree ring evidence which shows up, you know, from Siberia right across Eurasia, across to North America and even up... and down in South America, there was no, no doubt that this was a global event. Global events, we already knew from the literature, probably involved a dust veil. There are two ways to load the atmosphere with dust, one of them is to load it from below by blowing it up from a volcano, and then it rains out fairly quickly, because the volcanologists are very clear that there's a limit to how high a volcano can actually shoot dust and gas, about fifty kilometres seems to be the limit, and that's why at the end [it] washes out in about three years. On the other

hand, if you dump material into the atmosphere from the top, you are dumping it in much higher up. And I had talked to people who had worked on bomb carbon, distribution of, of radioactivity from the nuclear testing back in the Sixties, and they pointed out that if you, if you put it high enough in the atmosphere it stays up for a long time. And, that raised the interesting spectre that, what we might be dealing with at 540, in the absence of good ice core evidence for a big unusual volcano, it might be that the loading was from space. And, now, that is pretty radical thinking of course, I mean, [laughs], you... It's probably fair to say, most younger academics wouldn't, wouldn't take the chance of publishing that in case it proved to be nonsense and it got slapped down, but by that stage I was already a professor, so, you know, you probably, probably weren't going to get sacked over something... But even, even if you go back to the, to the paper, it's extraordinarily cautiously worded, it's, it concludes something along the lines of, you know, how could you tell the difference between a big explosive volcano and an impact of a medium-size asteroid on a, on one of the world's oceans? And it's the sort of line you could, you could escape from if it became difficult.

[14:33]

But of course, as, as you probably know, I didn't escape from this, the whole, the whole thing snowballed out of control in some ways. Because once you, once you had actually seriously started to look at the question of, could 540 AD have been an extraterrestrial impact, and you then go in to try and find out, what is there out there in, in history that, that might give you some clues, you run into this, almost [total] lack of information, and you think, hold on, now how is it that there's so little information? There's quite a lot about 536, but there's essentially nothing about 540. And you're thinking... It, it's the absences that, that make you suspicious. It's, it's the fact that there's no, there's no entry in one of the Irish Annals for the year 540, and the one, [laughs] the one anecdotal piece of information, I think I entitle as A Day in the Library, or something like that, was that I was actually up searching for sixth-century material, and I noticed on the top shelf of, of the top deck of the library, that there was a bound set of volumes, *The History of the Popes*. And, I thought, that's, oh of course, the Pope's [t]here, maybe there's something in the Vatican records. So I pulled down the volume which covered the sixth century, and leafed through, and it comes to 539. And it says, '539. The following year 540, nothing happened worthy of notice.' And that's when you sort of go, aha, right, OK, so somebody knew

something, and that's, that's a, that's, that's like a, a nudge or a wink that you might give a journalist if they're on the right lines, but, you don't want to actually specifically tell them what the, what the facts are. In other words, whoever wrote that, in my view, [laughs] notice the conspiratorial way of thinking, in my view whoever wrote that line in this *History of the Popes*, was basically saying, 'If a reader knows something about that year, by me dismissing it, they'll know there is more to it.' Now, I mean you would say, 'Oh come on, this is, this is nonsense.' I'm saying, well, this is just one of a whole series of strange absences of information at around that, around that time. Various writers sort of stopped writing just before. It's sort of, it's almost like, something had happened that got airbrushed out, and, maybe that's needlessly conspiratorial, but, I just think it's worth just keeping a note of these things you know.

[17:25]

So that was, that was a formative period around 1994 and 1995 when it sort of began to become obvious that there was something seriously interesting about this period. I, I christened it 536 to 545, because that really encapsulates the, the bulk of the tree ring information. In more recent years, dendrochronologists also involved [with] the ice core workers, have extended that, they now talk quite comfortably about 536 to 550. Now once you start invoking a period of fourteen or fifteen years, you are not talking about a volcano any more, you are talking about some combination of things happening, multiple volcanos, possibly reinforced events from other sources and other, something triggers something else. Or, worse still, just a coincidence that two or three things all happen in a short space of time. And that's a sort of an open area.

[18:35]

So from 1993 onwards, it was quite clear that ice core workers potentially held the key to this, and that, they needed to go back and look in detail across periods like 536 to 550, to see exactly what was in the ice. And, as with a lot of research, that turned out then to be a relatively slow burn. And later on, I mean after the year 2000, I mean we actually were given ice by the ice core workers, and we found interesting things in the ice. But what we ran into was a real problem of, how do you differentiate between contamination and, and material which has actually, either fallen directly from space, or material which has been thrown up from impacts, or, or material ablating in the atmosphere? And, to put it simply, if all you're looking for are black metallic spherules, or glassy spherules, they, they are now in our modern world the greatest

source of contamination throughout the world, and the reason for that is, they come out of jet engines, they come out of central heating systems. Every time someone cuts a piece of iron with a rotary, a drill or a rotary cutter, they produce, all those sparks you see solidify down as little tiny spherules of, of metal, or if you happen to be doing something with glass, with glass or glassy material. So actually, differentiating between actual extraterrestrial material and, and, and humanly-produced background pollutant, is extraordinarily difficult. So, so, and in reply to your question, yes, we got to the stage where we were actually collaborating directly with the ice core workers, and, receiving ice, principally from a research point of view to look for tephra, i.e. to search for tephra, because tephra doesn't occur as a background pollutant in the same way as glassy spherules do; tephra, because it's chemically-identifiable to specific eruptions, it's either there or it's not there. So, locating tephra is, is, is a key issue on relating ice cores to the volcanological record and ultimately hopefully to events in tree rings. Because you see, in an ideal world, and a world which is not that far away, I mean, in other words, we can envisage actually having this situation, you would have historical references to things going on in the sky, or, or on the ground; you would have tree rings showing actual responses of the trees to environmental conditions; and in the same years as the trees, particularly because history peters out as you go back, in the same years as the effects are in the trees, you could then look sideways at what is actually physically encapsulated in the ice. And, that's the great thing about the ice, I mean it's, it's encapsulating a record of the gas, and, the various things which fallen onto the ice, in that particular year, or even season. And, and in an ideal world you could, you could have that dual record. The problem is that so far, we haven't really got to the stage where we can have complete reliance at a calendrical level in the ice core record. And, and I would have to admit, I have difficulties with, I think the ice core workers have tended to overstate the accuracy of their ice. Because I mean I know how difficult it is to be absolutely certain of getting your tree rings right, and ice is a whole different ballgame. I mean, it may be beautifully stratified but, you know, ice can melt, and snow can blow away, or you could technically have years when it doesn't snow I suppose. So there may well be reasons why the ice core record is currently not as absolutely certain as the tree ring record. But as I say, the, the holy grail is that, somewhere just down the road we'll be able to link these two records sufficiently well that, we'll be able to read off from both

of them. And then we'll get a much, much better picture of some of the things that went on in the past.

[23:21]

Yes, how did the ice core workers respond when you, if you did point out in person, what you point out, for example in Exodus to Arthur, about their sort of overestimate of their ability to count each layer, and did you point that out in person, or perhaps, not one-to-one but in conferences, and if so, what was the result?

Well, you have to remember that, that, academics and research scientists very often have their own views on, on issues. [laughs] And, they, they would maintain that their... In fact, yes, person-to-person, I mean I've actually given seminars in the ice core laboratory in Copenhagen, and I would be quite happy to say to them, 'Look, on the basis of what I am seeing, you know, your dates are, are wrong on this, and need to move by so many years.' And their response might well be, 'Well we see what you're saying, but, we, we think our procedures are good enough that we, we're not suffering from that.' I mean that was quite, that's quite usual, because, remember, you're having to get to a stage where you're actually proving these things. It's one thing to suggest them; it's quite another thing to prove them. And... So, one of the, one of the effects of me raising these issues at conferences, and in papers, was that, of course eventually we did get a major step forward on the ice core record, that was, that in 2008 the European Ice Core Consortium published a paper in collaboration with a series of, mostly Scandinavian dendrochronologists, showing new analyses of the ice. They actually took, there are three European cores, DYE-3, North... DYE-3, GRIP and NorthGRIP, and they re-analysed across this part of the sixth century. What they discovered was, that they had underestimated two previously recorded signals, which were now realised to be very big volcanic signals, in 529 plus or minus two, and 533 to '34 plus or minus two AD. And of course the tree ring events are 536 to 550, with, in my view, these two stages basically, 536 and 540. So the question would then be, what do you do with these two ice core layers, vis-à-vis the two tree ring events? And, what the, what the European ice core workers, in collaboration with Keith Briffa and some of the other dendroclimatology people, what they did was, they, they agreed that you could move the ice cores a couple of years, and bring the 533 to '34 plus or minus two ice core up to basically explain 536. What they

wouldn't do is move it seven years and make the two volcanos coincide directly with the two tree ring events. Now, that of course was very interesting, because, it then fell to me to look at all this information, and [I] realised that in fact in the sixth century AD there are four various big acid spikes, and if you move them all seven years, they coincide with four major tree ring downturns, including frost rings and [in] bristlecone pines, and major downturns in Scandinavian pines. And of course what that would do would be, move the two volcanos, to explain the two, the two tree ring downturns. Now, there is irony built on irony built on irony. Because now you've got the dendrochronologist who has proposed that one of these events might be cosmic, actually saying, 'Look, if you look at the evidence, it's pretty clear the two events are both volcanic.' And of course that reflects back to what I was saying in 1993, which was that, you know, it might be two volcanos going off in a few years, and it was the ice core workers who would have to find that. They had indeed found that, but now, [laughs] they were dating them so that they only explained the first volcano. And even more bizarrely in the paper, they then suggested that this one big volcano in 536 caused the fifteen years of effects, which doesn't make any sense at all. So that's the, that's the state we are currently in. These, these debates take a while to gestate, because, I, on the basis of the paper in 2008, I immediately wrote a reply paper which was published in the same journal in 2008, pointing out that either they had to move seven years, and explain the two events as two volcanos, or, the alternative is, that they are correct, and that, they can explain 536 but 540 is still cosmic. And of course that, in a way that's the dream scenario, because I mean, what a nightmare that is, you've a big volcano and before people have recovered you hit them with something from space, which I think, the best word for that would be, ouch! you know. So, so that's why these events are so fantastically interesting, and you've got different groups of people with different, I wouldn't like to use the word exactly vested interest, but you can see how that, those words sort of apply. The ice core workers don't want to move their ice as much as seven years, but I don't mind moving the ice seven years, because, it's not my problem. [laughs] And, and what is very clear is that, this, this 536, 540 package is, is the big one.

[26:50]

Now, just to pan back from that for a second. If you're having this much trouble with chronology 1500 years ago, think how much worse it is when you go back to 1150 BC or 2350 BC. And all of those earlier events are much more sloppy, in other

words, there's, nothing's tied down as well back there as it is even in the sixth century. So the sixth century in my view is, and always, is and always has been, it's the one to crack first, if you can really understand what happened in the ice in the historical record, in the archaeological record, and in the tree rings, across the middle of the sixth century, then that would be a firmer basis to go back and look at the, at the earlier events.

[30:37]

Who after the year 200 [2000] was giving you ice, in other words, which ice core group or lab, and, and how were you able to deal with it at Belfast, if it was, if that's where you were doing it?

Well you see, you must, you must remember that, that research, especially blue sky research, i.e. research where people are unconstrained, they're just allowed to follow their noses and do what interests them. What really happened, when the interest in volcanos developed back in the 1980s, and, partly to do with that Baillie and Munro paper but [also] LaMarche and Hirschboeck, all of the interest which was beginning to develop, obviously not just in Belfast, but almost globally, in the issue of the effects of volcanism, people started thinking in the British Isles, and elsewhere but I'm only interested in the British Isles in the first instance, they started thinking, well, hold on, we've got Icelandic volcanos just up the road, and, are they dumping material into Irish peat bogs? Because if they are, and we can find these layers of volcanic ash, we can use them as marker dates to improve the chronology of the pollen records. So you remember, the radiocarbon lab was brought [bought] back in the Sixties in Belfast to improve the chronology of, of peat bogs. And, you cannot help but love this sort of, research idea. In order to look at pollen, you dissolve away everything else. In other words, you take the peat and you effectively chemically dissolve the peat. The pollen is extraordinarily resistant material, so it doesn't dissolve when you dissolve away the rest of the organics. And in the course of dissolving away the organics, you also use strong acids which dissolve away any mineral. So, so palynologists had never looked for tephra in Irish peat bogs, or Scottish or English peat bogs, because their procedures would have dissolved it away. Now with the interest in volcanos, if you go back to these same peat bogs, or new peat bogs, and look through sections, can you find layers of tephra from Icelandic volcanos, which you can then, because some

of them are quite well dated, can you then use, put those dates into your pollen profile? Saves you the bother of getting radiocarbon dates. And actually the dates would be better. Hopefully you can see the irony of all that, in all that. And so people started doing that. And, and it was quickly established that tephra chronology was a major research field, suddenly everybody was doing it. The problem actually is, there's far too much tephra. Because you don't just have tephra from Icelandic volcanos, you have a background tephra which is coming from volcanos from, who knows where, because of course, actually you find, tracing them back to every volcano would be extraordinarily difficult, there are lots and lots of volcanos. So I looked at tephra work basically, and went, well I'm not getting involved in that, that is just, that's just a nightmare. But several of my colleagues did get involved, Jon Pilcher for example became a major figure in that, and Valerie Hall also in the, in the lab. So they, they were pushing during the Nineties on, on refining the story of which big marker volcano events were there in the, in the Irish peat bogs, as an aid to interpreting pollen records. And it then became obvious that it would be well worth seeing if some of these same tephras could be located actually in the ice. So that's where the collaboration was coming from. Although I was interacting with ice core workers on the issues to do with extraterrestrial material and chronology, I was just a bystander on the actual collaboration, which was to get ice to, basically, you get ice samples from specific layers, across a specific century for example; they're taken back to the laboratory, obviously, there are workers in Wales and Ireland and Cambridge and other places, all doing similar sorts of things. So the ice is taken back, it's melted down. Effectively you, you filter out whatever's in the ice, mounted on microscope slides, identify it, and then, if you can find these shards of tephra, you can then move them onto microprobe stubs and take them and get them identified under an XRF or, or whatever procedure you happen to be using. So there's all of that's going on. And it can end up as it did on a couple of occasions of, of myself and two or three others, in the minus eighteen-degree stores in Copenhagen, taking out boxes of ice as they had come down from Greenland and been stored ever since, taking out the actual cylinders of ice; band-sawing off a strip of the ice; putting it all back into storage; and then breaking up and bagging and labelling: all the sort of usual lab procedures, [laughs] but in rather difficult conditions, in, in freezing cold and big parkers [parkas] and all the rest of it, so as these samples could then be shipped back to, to be analysed.

And that's, that's an ongoing thing, I mean that, the tephra work is still ongoing, and in fact joint publications are being prepared between the tephra people and the, the ice core people, which is, is all part of the refinement of chronology which, which is, is what I'm interested in.

[36:44]

Could you tell the story of the, I think it was the 1989 Santorini conference, which might have been the third of these. I think it was on Thera?

Yes, that was, that was another what you would call formative conference. Basically, as I've already said, LaMarche and Hirschboeck had published in 1984 their suggestion that their 1927 BC frost ring might have been caused by the effects of Thera. And then in 1988 Munro and myself published the Irish tree ring effects showing that the event in 1628 BC, certainly existed, and, of course whether it was Santorini or not, well, remains, still remains to be seen. But, this is the, the way the world works. LaMarche, Val LaMarche died in 1988, rather tragically, and the result was that when the conference was being put together, because I had published on the, on the Irish tree rings, I got invited in his place. So the chances are, if LaMarche had still been alive he would have gone to the conference and I wouldn't have. But as it turned out, I went to the conference. And of course at the conference you were meeting all the archaeologists, which is always interesting and salutary. I knew some of them but a lot of, a lot of them I hadn't met. And of course the archaeological story at that conference was that this, this early date had to be rubbish, I mean it just, you know, all the evidence pointed to the eruption archaeologically being a century or more later, around 1500 BC. So in a sense, I found myself a fairly lone voice pushing the early date. There were some supporters, like Peter Kuniholm and Sturt Manning who's now at Cornell, I think they would have been supportive of the early date, but the main run of archaeologists was strongly resistant to it. And of course, two of the ice core workers, Henrik Clausen and Claus Hammer, were at the conference, who, I mean again it was a, it was an opportunity to, that was my, the first meeting I think actually with, with some of the ice core big names, where we all met in the swimming pool [laughs], on the most fantastic conference. I mean, Santorini, just, the best place in the world to hold a conference you know, to... And also you were meeting guys like, Steve Sparks and, and some of the other volcanologists who were there. And of

course the whole thing was masterminded and largely run by Colin Renfrew you know, who, [is] Britain's leading archaeologist. So I mean, you, [laughs] this was, this was a fantastic thing to be at career-wise, I mean just to be meeting all the right people. And, and to have, have an actual voice at the conference, I mean to be putting forward the possibility that, that Santorini might indeed have erupted in the seventeenth century. And it's worth saying, I mean, it's, there's now no doubt that it erupted in the seventeenth century; exactly which year it erupted in still escapes us. And whether we'll ever know which were the four days that it erupted, well that's, that's over-refinement, but, the question, the jury is still out on 1628. You're not, you're probably not going to believe this, but my feeling has always been that because the LaMarche and Hirschboeck went out on such a limb to propose 1927 BC, that the chances are, it'll turnout they were right. In other words, not that they were right for any right reasons, but they were right just to, [laughs] screw the system up. And I sort of like that you know, I like the idea that people sometimes get things right, even though they shouldn't have, you know, that's, that's, yeah, I like that.

[41:04]

What was then the immediate, what was the response at the conference then to your arguments? Given that as you say, most there were...

Well, there's a wonderful thing, it's actually, I think, it's partially mentioned in the back of the conference proceedings, which was, on the final day I tried to force a show of hands as to whether the majority of people at the conference thought that 1628 was a viable proposition or not. And this was turned down by Colin Renfrew who was chairing the session. So I put my hand up and, and said, 'Professor Renfrew, have you lost your nerve?' Because he wouldn't, he wouldn't allow a straw poll to be taken. And his response lives with me to this day. [laughs] He said, 'Neither my nerve nor my wits, Dr Baillie.' Which is one of, one of the world's great responses [laughs], that, you know, how to put somebody down. So anyway, the conference was left, there was no straw poll taken as to 1628. But the conclusions, and, and Renfrew summed it up... I mean, watching Colin Renfrew in action, he was able to sit through numerous sessions, and then stand up and without notes summarise amounts of information which would just make most people pall, I mean... So, I mean, yeah, he, he undoubtedly has a great mind, even though he doesn't always agree with things

I say. [laughs] The summing up was this really, that, that the way forward was to find material in the ice and to refine the dates, or to find a tree killed by the eruption, and, and do a high precision wiggle match, i.e. several consecutive high precision radiocarbon dates on it, and fit that to the radiocarbon calibration curve. And those were sort of the options that were left. In other words, to actually more or less find tephra in the ice, and, and, Thera tephra, and, and... And that, basically, in the, how many years since, '89, in the twenty-three years since then, they actually have found, in 2006 there was publication, I think from Friedrichk and all, they published a detailed wiggle match on a carbonised tree that had in fact been located on Santorini. And it suggests very strongly that the eruption took place between 1600 and 1630 BC. So, that certainly doesn't rule out the possibility of LaMarche and Hirschboeck having been right.

How do the, these same archaeologists feel about that now? Given that... What you're saying then is that, the majority of the people at that conference have now been shown to be wrong about the date of the eruption?

Well, curiously enough, I mean I, I, I don't really move in those archaeological circles any more. I mean I think any archaeologist with any sense accepts that it's back in the seventeenth century, but there are still archaeologists fighting rearguard action that you can't believe the radiocarbon dates because, there are, there are complex arguments about, if the volcano is out gassing old carbon and the trees were living in that environment, then, the dates might be artificially old, because remember, they would prefer the dates to be younger. But I think there's little doubt that people are having to face up to, they're having to face up to but they're very often fighting to the last ditch on the issues. It, it's an interesting aspect of academic discussions that, something which radically changes a paradigm, I mean the paradigm was that, that Thera was around 1500, or maybe even 1475, so it's a paradigm shift to move it back to the seventeenth century BC, when, when a paradigm is shifting, you'll get some people who will immediately endorse the shift, so I would be one of the people who were going, 'Oh, seventeenth century, virtually certain,' and, then there'll be people who are saying, 'No, no, it's, we think that's wrong,' and they will, they will look at every conceivable way to, to hold the status quo. And that's just the way the science works. And, you do need people, I mean, if everybody jumped to the first conclusion

that came out, you know, you would have chaos. You do actually have to have people pushing the outer envelope, but you also have to have people testing and testing and testing, you have to... So, then by the time it is finally agreed that it's seventeenth century, then you're really sure it is, you know.

[46:17]

How do you personally feel about the, what other people might feel is the sort of extreme awkwardness of being at a conference where you're arguing something where you're in the minority, and, asking for a show of hands and, and, you know, the leader saying, no, the conference saying, no you can't? I mean, where do you fall on a range from sort of, enjoying that kind of attention, to, absolutely not enjoying it, you know?

Oh no that's, that's part of the fun. I mean, conferences and discussions can be cut and thrust, I mean that's the, that's the nature of the game. I mean if you don't enjoy that, you shouldn't be doing it, you know, [laughs] I mean it's... Part of, part of the, part of idea is to, well, yeah, to wind up the opposition, you know, I mean you, you're wanting to annoy people, so that they respond. And, you see, in science, it's, it's important that, that your ideas get tested. I mean in other words, if I come out with an idea like, 540 might have been an impact from space, I don't particularly want people to say, 'Oh yes, that's a good idea.' I want them to go, 'Oh, well, mm, OK, let's see if we can prove him right or wrong.' And in order to get people to actually prove you wrong, or attempt to prove you wrong... You see I mean that's the best of all possible worlds, where they attempt to prove you wrong and end up proving you right.

[laughs] Sometimes you've got to annoy them, you've got to actually make them, 'I am going to prove him wrong, if it's the last thing I do.' Because then you're really getting attention. Or the issue's getting attention. So, you do actually have to sometimes antagonise people in order to get them to test ideas. I mean, very, a lot of it's done on an ego basis, I mean it is very much a, a procedure where if you can get people's attention, to pay attention to the, to the issues, that's when you might find some new information which will, you know, tell us what was really going on.

Because after all, most of the time we don't know what went on. We want to know, but we don't know. Publicising this sort of stuff is in my view also very important, because, I refer to an ideal world, what I would really like to happen is not that I find

something that proves 540 was an extraterrestrial impact, but that some research student sitting in some department a million miles away is looking down a microscope and is looking at a deposit that they are analysing for their PhD or something, and they go, 'What are all those black balls? Did I read something about black balls before?' you know. And then, 'What date's this? Six... Hold on, did I not read something that a guy in Belfast wrote about...?' you know. And they then suddenly discover that they have got the evidence which shows that, whatever it was happened, happened, and they publish that, and they get a hike in their career, and I go, 'Excellent,' you know, and now we know that this stuff was, well, falling from space or, or whatever it was. You see we don't know the answers to these questions; we want to know the answers. And we, we also don't know who's going to find the evidence. But the ideas, get the idea out there, so people are aware of it. Nothing worse than somebody looking down a microscope going, 'There's an interesting layer of black balls. I haven't time to look at them,' you know, so that the evidence is actually lost or missed or...[buried] You want people to be aware that there's an issue. And anyone looking at anything to do with the sixth century should be thinking, have I got anything in my samples which might relate to the debate about, 540 AD?'

[50:21]

You mentioned the swimming pool, and the, the ideal setting of this conference. Could you tell me about things done at the conference which were not directly, you know, the work side of it, in other words, presentations and discussions and so on, what did you all do as well as that, what do you remember of the...?

Well they had organised field trips out to Akrotiri, to actually see the ongoing excavations of the buried town. Akrotiri after all is a Bronze Age version of Pompeii, where a town was basically sealed by a volcano. And you have to remember, these things are sealed effectively in a day, you know, so you're just, [clicks fingers] capturing what things were like. The people had mostly already escaped, they were, they're presumably somewhere else if they didn't leave the island, but, they're not in the town, so there are no bodies lying around the town, but, but you have basically everything as it was, as it was left. It had been damaged by earthquake, so you could, the archaeologists can actually see that the town was under the course of, of repair in many cases, before things then overwhelmed it. So you got field trips to see that.

You had time to wander about in, really dry but interesting landscape. And also field trips out to see some of the, the volcanological evidence, you know, looking at the different layers of tephra from the different stages of the eruption. So that's when you, you had volcanologists explaining their aspect. And of course there were big questions at that stage, I mean back in '89, the size of the eruption didn't seem to be all that big, but the... And here you're entering an interesting contentious area. The ice core workers had found a big acid spike that they dated 1644 plus or minus seven BC, which is noticeably just, slightly away from 1628. And, I mean I, I argued that in fact they were seeing 1628, but they said, no no, their errors wouldn't allow it to be 1628. So, you can see this tension in chronology issues. But, the volcanologists accepted that the, the big acid layer was from Thera, which is probably a mistake to make that acceptance, but they did accept that. And as a result, there had to be a lot more sulphur from Thera than had previously been estimated. And as a result of that, volcanologists then found more deposit which allowed them to up the scale of the, the sulphur output. Now, I'm outside that sphere, and I'm looking at it and going, mm, but if the, if the layer of acid isn't from Thera, then you're mistakenly imagining how much sulphur came out of that eruption. And you do have to factor in the possibility that you could have an eruption the size of Thera, which actually might have relatively little environmental effect other than locally. So, what had happened between the ice core workers and the volcanologists was, they had built Thera up, and you'll find many assertions that it was the biggest volcano in, in the last 10,000 years, but you'll also find that 1258 is referred to as the biggest volcano, Tambora is the biggest volcano. I mean you begin to [think], what is this biggest volcano? Because of course they don't actually [know], unless they can date them absolutely and see what effects they had, talking about size is almost irrelevant. It's environmental effect that is the important thing. And that's of course looking at it from a tree ring point of view; they look at it either from a rock point of view or from an ice point of view. And sometimes these things require, they require banging heads together. This is where conferences are so important, that you actually have the different viewpoints all bumping up against each other, so that, so that people moderate their views, or, or bring them into, into more sensible relationship with each other.

What did you do in the evenings at this conference?

Evenings were mostly social. There were a lot of opportunities to go out with small groups of people, who frequently you didn't know very well, so you, you would be having an evening of, of eating and drinking and discussing with people who had their own particular interests. So it, it gives you an insight into, into what other people think and the problems they have in interpreting their evidence.

What do you remember of Stephen Sparks at this conference, given that he's going to be an Oral History of British Science interviewee as well?

Well, well the one, [laughs] the one anecdote that comes to mind is that, on the field trip out to Akrotiri, I think I was sitting beside him in the bus, and by way of conversation I, I said to Stephen, and remember this is back in 1989, which is like, almost a pre-catastrophic era, I said, 'What's your favourite volcano?' And his reply was very interesting. His reply was, 'Well, if I was going to be worried about one, it would be Yellowstone.' And I thought, Yellowstone? Is that not Yogi Bear and, and something in the middle of North America? And, to be honest I didn't, I didn't, we didn't elaborate, the conversation went on somewhere else. And it was, it was only... So that was 1989. It was in 1990, the following year, in Mainz, I was talking to a guy, I think he was called Hildreth, over coffee one morning, and something came up about Yellowstone. And, I had in the meantime... Maybe I'm getting the story slightly out of order. I had in the meantime when I went back to Belfast looked up an index of volcanos, and discovered that Yellowstone had erupted three times, big, we're talking mega eruptions here, it's a supervolcano, it had erupted 2.1 million years ago, 1.3 million years ago, and 600,000 years ago. And, you sort of went, oops! I see what you mean Stephen], yes, Yellowstone is probably around about due sometime in the next 100,000 years you know. And the thing is, it's, it's a civilisation stopper, I mean, Yellowstone, big eruption, and, you're back to the dark ages, you know, it's, it's that sort of issue. That's, that gets a lot of attention now on TV, there's numerous TV documentaries about Yellowstone, all pretty gloomy. So, so Stephen was well ahead of the game, raising that as an issue. Anyway, I was talking to Hildreth at the 1990 conference and he was saying, 'Oh yes I, I've been doing a lot of work on Yellowstone, and yes, yes the dome has risen a metre. But then, it's gone down again.' And you're going, so this thing's actually like, ooh, [laughs] does anybody know when it's going to blow? And the answer is, no. You just pretty well have to

hope that it doesn't blow any time soon, because that, that is, that'll just... The way I put it, as I say, I was giving this as a talk, the, the way I would put it is this. You turn on the news one morning and they'd say, 'Reports are just coming in... sssssssssssssssssssss.' [pause] That would be it. You know, I mean every, everything would stop, just everything would stop.

Globally...

Mhm.

...with this volcano?

Yup. It, it might take eighteen months in total, but, everything would stop.

[58:58]

Gosh. Am I right in thinking that certain volcanologists have had their own criticisms of dendrochronology? I think in your book you mention David Pyle.

[pause] [laughs]

No?

Well, the criticisms are not so much of dendrochronology. The criticisms would be, so thinking back to what David probably said, and it's a long time ago now, this would be in, if, when someone like myself asserts that we are seeing evidence which might be Santorini, David would have been saying, 'Yes, but there's nothing in your tree rings that links it specifically to this volcano,' and that's perfectly correct. Yeah, I mean there's no way we could ever have directly identified a specific volcano. So yes, I mean that's, that's perfectly valid criticism. But, what one would then say in one's defence would be, yes, but what we're doing is, we're reinforcing LaMarche's suggestion that it was a big volcano, and the only one we know is Santorini. But then the argument gets more complex, because, over the years a whole series of new volcanos have appeared relating to that same general period. So volcanologically, it's a much more complex period now. Nobody knows exactly which volcano caused the,

the big acid spike in Greenland, or the effects in the tree rings. And they could, they could in fact be two different things, there's no longer any push to directly move the ice cores down to 1628.

[1:00:40]

Did you ever take family members on conferences, Santorini or others, these sort of international conferences? Your wife or your children.

Usually not. It would have been awkward to, to get away to such things. I mean, some conferences, yes, because, the provision was made for, for families. So that you, you could actually organise that. And, to be honest, mostly wives, because the majority of, of academics tend to be male at most of these sort of conferences, there would be organised things laid on for them. And/or for children, because of course if families are coming with children, they really do have to be catered for, so... But most of the time, no. Conferences where they may sound like holidays are actually, they don't have much of a holiday atmosphere. Santorini was a wee bit unusual I think simply because of its location. But, you have to remember, people are sitting quite often from half eight in the morning to about six at night listening to other people talking, at coffee time, lunch time, you're discussing... You're basically under mental pressure all of that time, you're under mental pressure usually in the evening, if you've got to prepare a paper and deliver it, there's a little bit of pressure there as well. Actually that's, delivering a paper is the least pressure in my experience, I don't, I don't have any pressure or nerves giving talks. But, the end result after three or four days of a conference, you are basically washed out, because you've been, you know, you've been up to all hours, you've probably been drinking too much, you've certainly been talking too much, and you've had to be mentally alert for the whole of that time. So these are, they're, they are, there's a word for it, it's not powerhouses, it's, is it hothouses? It's, it..[pressure cookers]. Yeah, it's, there's a lot going on, you're learning a lot, you're disseminating a lot of information, you're making contacts, you're quite often establishing future collaborations. It's, it's... So it's not really a fun thing, it's a work thing.

[1:03:05]

You said that most Earth scientists of this kind were male at this time. Could you give a sort of, for this Santorini conference let's say, as a guide, what would be the sort of very rough ratio, or, you know, relative number...

I'd hazard a guess that, and it really is a guess, but I would hazard a guess that about, ten, somewhere between ten and twenty per cent of the delegates would have been female. They would have been mostly from the archaeological area. Because of course there's many aspects to archaeology in, in the Aegean, with all sorts of interests and issues. But the, the majority of the tree ring people, the ice core workers and the volcano people, because those are fieldwork-related subjects, I mean they tend to be male-dominated. They certainly tended to be male-dominated back then.

In your view, does that, that maleness of the delegates, have any effect on the style of the debate, or the content of the debate?

No. No, not at all.

[1:04:25]

Now, as you moved into considering comets as the possibly cause of downturns, alongside volcanos, because these sort of things seem to overlap I think a bit, could you tell me about relations established with astronomers and astrophysicists? The ones that you mention in the books concerned with this, one is Mark Bailey and then there's Clube, Napier and, Steel, but I imagine there's others. So, in the same way that, perhaps unusually for a scientist, you're establishing relations with quite, people outside your field. We've already got ice core workers and volcanologists. How did you go about getting at astronomers and astrophysicists in order to know certain things that you needed to know in order to make the arguments in your books, in other words, you know, the, the possible effects of comets, times when skies were busier than others, in other words, when there's more activity than others, the possible appearance of comets as observed from different ranges and different places, and so on? So, how did, how all of that happen?

Well, one of the good advantages of having come from a physics background is that, is that one isn't put off by, geologists or astronomers or whatever, I mean they are

perfectly approachable people. But, in the course of developing some of the ideas, because, as soon as you, as soon as you come up with, let's call it a new idea, that, good lord! could 540 have actually been an impact event? first of all you're looking around for any, any evidence you can find which might be supportive of that idea. And let me elaborate on that. It's not, it's not that you're looking for support. What you are looking for are clues as to what you should be looking for. Are you on the right lines? So, you're reading around anything you can find that might be giving you some hints. And, of course as, as soon as, as soon as you even start suggesting an extraterrestrial impact, you've got to go and find out, what are the possibilities? Now, the possibilities really are that you're, you're, you could have an asteroid slamming [in]to the ground. Now, once you start playing around with that idea, you've got to be very cautious because, a big asteroid, something ten kilometres across like the one that probably gave rise to, if not the demise of the dinosaurs, the, the debate about the demise of the dinosaurs, the sixty-five million years ago Chicxulub impact, you would have to scale that way, way down to a 540 event, a 540 event, might at best be a half-kilometre object, which would cause a lot of disruption but wouldn't, wouldn't, wouldn't be an extinction event. Asteroids are awkward, you don't see them coming, they just arrive out of the blue, so there would be nothing in the historical record that would, that would give you any hint that an asteroid was coming. Comets, the other likely source of, of dusting of the atmosphere, immediately become a better and more interesting bet, because, every year we pass through, we see them as meteor showers but we're passing through trails of dust left by comets that have passed in the past. And, so, so there's a whole body of astronomers who are interested in comets, because, you have a variety of options with a comet. You could have a comet come over the horizon, and basically hit the Earth, which would be like an extinction level event, a Chicxulub. So we, we can be pretty sure we haven't had one of those. But the thing is, a comet is friable, it can break up, comets have been observed to break up in, in recent centuries by astronomers. So, you could have bits of comet. And the other thing is that in these trails of debris, you could actually have lumpy bits, in other words, instead of pea-sized fragments which give rise to a meteor or shooting star when you see it at night, that's something just striking the upper atmosphere, it's maybe sixty miles up, and it, it just ablates away in this long streak of, of light. So these are completely non-hazardous. But the question is, if you've got a trail of that debris, is it possible that you might have a, a lump in it which is fifty metres across

which would give rise to a Tunguska class, a 1908 type eruption, impact? Which was estimated, maybe fifteen megatons blowing up in the atmosphere. Now that's the sort of stuff you need to know about.

[1:09:37]

As soon as you start looking at that literature, you're, you're confronted with the fact that, Victor Clube and Bill Napier and Mark Bailey produced a book on comets back in 1990, and once you start reading that stuff, it is, it is, nothing short of scary, because, they propose that due to changes in the Earth's orbit, and, also changes in the orbits of the trails of debris, there will have been periods when the Earth was at increased risk of bombardment by comet debris. So they, they're loosely called the British school of neo-catastrophists I think in the sense of, they, they would see that in recent millennia there may well have been times when the Earth was struck by comet debris. So, when you've got someone like me who's just simply asking the question, well, we've got this tree ring event, it doesn't appear to be volcanic; is it possible that it could be extraterrestrial? you open up a book by serious, I call them hardnosed mathematical astronomers, these guys can do the sums that I couldn't do. They, they, when they actually propose that the Earth may have been at risk, you know, in the fifth and sixth centuries AD, you go, whoof, wow, I mean that, that actually, it doesn't prove anything but it reinforces the idea that maybe we might even expect something to have happened back in the sixth century. So this was the involvement.

[1:11:15]

Now, this is when of course things become a little bizarre, because it turned out that, well Victor Clube had been in Oxford and Bill Napier had been in Edinburgh, but, they were retirement age, and Bill Napier had in fact moved over temporarily to Armagh and Mark Bailey was the professor in Armagh. He's the astronomy professor there. Which is just of course down the road from here. So, between proximity and also meeting at conferences, I got to know Mark Bailey and Bill Napier and Victor Clube. And they would, they would endorse, I think, endorse [is] maybe not quite the right word. They would certainly be open-minded to the sorts of things that I was proposing about the tree rings. And, it's then important to realise that they are only one group of astronomers. If you go to America, there's a whole different group of astronomers who are much more interested in asteroids, and who don't think comets are a big issue. Now if you go and discuss, and I have met at conferences quite a number of, of American asteroidal astronomers, they think the real hazard is asteroids,

and they, they are behind the, the Spaceguard sort of initiative which is to identify all the asteroids bigger than a half or one kilometre in diameter, and be in a position to calculate their orbits and make sure that they're not a danger to the Earth basically. And they've, they're well on the way to their target. They reckon they've got something like, ninety per cent of the, of the one-kilometre-plus objects already nailed down, and none of them are a known hazard in the foreseeable future. And they're now finding... Well they, they find them, basically every week they're finding something using these sort of, in the old days you'd have called them photographic surveys, they're now using LED type technology, to pick up moving objects which are crossing the Earth's orbit. So there's all of that going on. They would be, they would be much more resistant to ideas of, of impacts. They play down the impact rate. They would say, well, probably in the Holocene there would only have been two or three events. They think that I would be overstating the case if I said that all of these big events that I see in the tree ring, with, you know, one a millennium, if they were all extraterrestrial, they say that would be an overestimate. Whereas I, I suspect that, Clube and Napier and Bailey, and [Duncan] Steel and [David] Asher, would be more open to the idea that you might well have these events, you know, once [in] a 1,000 years. So, so it's an, these are all on going issues you know, and, we want to know the answers; we're a long way short of having the answers.

[1:14:54]

I wondered what was the effect of something like the, is it the Shoemaker-Levy 9 impact, which was 1994, had on your thinking and writing the Exodus to Arthur book, in other words, the accounts of a recent impact, not on, not on Earth but, what effect it had on your thinking in writing that book?

Well, I, I was intrigued by Shoemaker-Levy 9 for obvious reasons, I mean we all watched it happening effectively on TV as, as did the astronomers. The debate about it intrigued me, because you actually had mainstream astronomers who are involved in the, the ongoing live transmissions, saying things like, 'But these things are only the consistency of cigarette ash.' I mean, Jupiter will just swallow them up, I mean, we won't see anything. And you're left going, now hold on, whoever thought comets were made of cigarette ash? I mean, they may have a low density, but, they contain a lot of frozen water ice, they contain dust and they may well contain rocky bits as well

for all we know. So it's very unlikely that these things will just, evaporate when they arrive. And sure enough, some of the bigger impacts were in the 100 million megaton range, I mean these, these things would, [laughs] [be] absolute extinction level events if one of those fragments had hit the Earth. So, that intrigued me, because common sense told you that it was going to be, these were going to be big impacts, and yet you had all this nonsense being talked about all the, not by everybody obviously, there were other people who thought, certainly as I would have done, I'm not an astronomer, I'm just looking at it objectively and going, you can't, you can't fire something, even if it had a density of only .3, if it's ten miles across, it's going to cause serious damage when it hits you know. So, so that was, that was a revelation. And of course that's what really spurred astronomers, especially in the States but elsewhere as well, into thinking, hold on, we'd better start doing some monitoring. But notice the slight contradiction. The monitoring is mostly showing up asteroids across the path, the path of the Earth, whereas, there is absolutely no doubt that Shoemaker-Levy 9 was a comet that had broken up in a previous pass of Jupiter, and then came back as a string of pearls as it's called, I mean, twenty-two or something consecutive bits, that all ploughed into Jupiter in the course of a week in 1994.

[1:17:47]

I actually used this endlessly in public talks to local societies and what have you. I would ask for a show of hands of, of what people knew about Shoemaker-Levy 9. And, that was really quite depressing. On average you'd be lucky if ten per cent of the audience had ever even heard of it. I would then point out to them that it was the most profound thing that humans had ever witnessed, which seemed to have escaped their notice up to then, so... What's even more depressing is that in highly educated university level audiences, at best you were getting about twenty per cent recognition of Shoemaker-Levy 9. In other words it just, it just had not got through to the Earth community.

Despite it being on television?

Yeah, who watches, who watches documentaries basically, you know. [laughs] I think, people watch soaps. So. Yeah, the idea that, that this information is widely disseminated, just isn't there. I, I was really quite shocked. And I, I repeatedly asked audiences, not just one two, this is endlessly, and their response was always the same.

Sometimes you could have a room full of people, fifty people sitting as an audience, and only two of them had heard of Shoemaker-Levy 9. Same thing with Tunguska. Tunguska, again, there have been endless documentaries, but they're not the sort of documentaries that the public watch. It's only interested people watch them. So you're sort of preaching to the converted. Actually getting these ideas out to people. So in other words, if you had, if you had a Tunguska class impact now, it would be a surprise to most people. It obviously wouldn't be a surprise to Clube or Napier or me or, lots of others, but to, to the general public, it would be, why were we not told? And the answer is, well, you know, you weren't listening, not that you weren't told.
[1:19:57]

And, and, think back to the clearest example of this, was the Boxing Day tsunami in 19... in 2004. Gosh, as you get older the decades start to blur. Now, I mean, I knew all about tsunamis, I'd been interested in tsunamis because they're a necessary follow-on from some impacts from space. And the west coast of Ireland is littered with evidence. It's not accepted, but it's there, of, of tsunamis. And some of those tsunamis will have been the result of things plopping down in the Atlantic. But the problem is, that the people who study coastal formations and tsunamis think that they're only caused by undersea earthquakes. So, to go back to the Boxing Day earthquake in 2004, there you had a situation where relatively few people even knew what a tsunami was, and, to me the most telling thing about that whole, apart from the tragedy of it all, the most telling thing about that episode was that one small girl who had learnt at school that when the sea goes out, it's going to come back in, in a tsunami. She knew it was a tsunami. But the adults around her didn't know. And that, that, and that, you see that to me is, a shocking indictment, that, that tsunamis are not taught in school. Well they're taught in school now, because everybody in the world knows about tsunamis now. But it had to be forcibly demonstrated you know.

[1:21:38]

More generally, what was your reason for giving talks to non, non-academic and non-specialist audiences, to local societies?

Purely invitations. I mean you, you know, local societies, historical societies, local studies groups, have to fill a programme of lectures every year, and if they hear about

something they find interesting, they'll invite you. And people love tree rings, so, you get lots of invitations to give talks.

Why is that do you think? Why do you, why do people love tree rings?

Well, you know, people are all aware of trees, they're all aware that trees have rings. They know about counting tree rings, and, they want to hear more. So it's, it's something everybody can understand. So they can, if it's well presented, they can follow all the logic of what, how the stories have developed, and... And I have to say, talks are always well-received. Mm.

Could you tell me about...

There's...

Sorry.

There's one thing that's worth mentioning. Not in every talk but occasionally, even, even now, forty years later, you will get people asking questions after, after a lecture on dendrochronology, which, the questions are clearly aimed at suggesting that dendrochronology won't work... Well what, you know, what about the, the location of the tree, and maybe if it was damaged, maybe it wouldn't be recording things the same way, you know. And, they're sort of trying to suggest that dendrochronology won't work, and the irony is, it's all been done, [laughs] you know, it's, we're not at the stage of, of worrying about whether it works or not, I mean, it does work.

Do you... In these non-specialist, non-academic audiences, do you get any opposition from people with sort of strong faiths? This might be another place where this could happen. Does it?

Almost never. No, in fact, the... The... Most of these groups would be self-selecting, interested people, and they're interested in the, in the issues. I mean you'll get, you'll get arguments about things, but it's usually not fundamentalist-based.

[1:24:13]

Could you tell me about the, in detail about the writing of Exodus to Arthur, beginning with how you came to write it, why you wrote it, given this, as far as I can see, is the first book which is very very self-consciously, not a, not for a specialist audience necessarily? And so, how sort of, the invitation to write it which you say a little bit about in the foreword or the introduction to it, but also, any relations with historians and mythologists at the time of writing it. We can talk later about the response of historians and mythologists to the publication of it, but, involvement in those groups in writing it. Because, for listeners who don't know, it's a mix of the dendrochronology with, sort of scholarship if you like, historical scholarship, so...

Hold on a second.

Yes.

Right. Well, the reason for writing it is extremely straightforward. In 1995 I published a book called *A Slice Through Time*. It was, it was actually published by Batsford but it was a, it was then taken over by Routledge, and Batsford were in the course of decline at that stage. And, the, *A Slice through Time* was aimed at a student readership with plenty of nice, hopefully clear examples of, of dating issues to do with dendrochronology and some, to some extent radiocarbon. It was also aimed at lecturers who would be teaching courses on chronology, and they could then use material from the book in their, in their lectures. So it was very much a, a typical academic exercise. Again, trying to update the first book. If, if the book written around 1980 had tried to encapsulate the first ten or so years of the story, ideally *A Slice Through Time* was updating the next dozen years or so. The book was copy edited by a girl in, Cambridge I think, and, after it was published, or at the time it was being published, she contacted me and said, could I write a popular version? And as I said to her, well I thought *A Slice Through Time* was the popular version. But, she said, 'No no, something, you know, with no references, but just, you know, a bit more, a bit more edge to it.' And, I said, 'Well OK.' So the idea was, could you write a £7 paperback really. Now that, that produced an interesting reaction, because I mean I was quite used to writing, you know, I was, I was banging out, you know, I don't know, five or so articles a year, and I'd just produced the other book. And, I

thought, yeah, imagine that you've got a piece of paper with 'Popular' written on it above your word processor, so that you don't have to worry about referring to where the information... I mean you just go with the flow. And I thought, well we'll give that a try. And of course the first half of the book was basically a reiteration of *A Slice Through Time*, because you, you got to sort of, give the reader even of a popular book the background to what's going on. So we went through the, the, why we thought it was volcanos and what the tree ring events were about. And then roughly halfway through I threw off the shackles of academe and started exploring more speculatively. And that was, that was an interesting period, because I was obviously talking to colleagues, and there are some colleagues who are very supportive of odd ideas, and other colleagues who are absolute death on new ideas. So, I mean, yeah, it, it doesn't even divide fifty-fifty, there's probably about ten per cent of colleagues are supportive and ninety per cent are, they don't want to know. I mean it's just, it's too far outside their comfort zone. So, the colleagues who would be supportive would mostly be more scientific, or scientifically-oriented, than, than art-based, in my experience. So, what would happen is, people would say, 'Oh, oh you're into... Yeah, have you read such-and-such?' you know, and they would point you at a chapter somewhere, or they would, they would give you a, a Xerox of an article they happened to know about. And you were, so you were exposed to some really quite novel ideas. Many.....

[knock at door]

[End of Track 7]

[Track 8]

Could you continue to talk about relationships with historians and mythologists during the writing of Exodus to Arthur? Or, your own engagement with history and myth, independent of...

Mm. Well, the text was going along with allusions to various issues to do with, particularly 540. Because I'd been spending quite a lot of time trying to find out things about what happened at that point in the sixth century, I was aware of, you know, the scholarship already produced by Stothers and Rampino about the various texts which referred to the event, and I then found for myself that there seemed to be gaps in some of the records. So I knew about that. But then, one could begin to add in the first glimmerings of mythology, because the, the breakthrough in a sense was, realising that King Arthur had died in, traditionally his death date is given as 542, and I thought, well, maybe we should go and find out a bit more about Arthur. And I would stress that nothing in my upbringing had prepared me for looking at Arthurian tales. I had in the distant past tried reading some of these things, but found them so fanciful that, you know, characters just appeared, I don't know where, stuff appeared to just be out of control. I was much more interested in factual things, and my work certainly pushed me towards, if you like, absolute fact, because we're dealing with absolute chronology all the time. So, being confronted with the death of Arthur, I went to the library and started pottering through relevant books, and was immediately struck by the fact that Arthur, although he is dressed up as a British warrior, who, who's, you know, involved in battles and, and various other activities, he, he's basically just one aspect of a whole series of Celtic stories, some of which survive in Wales and some of which survive in Ireland. And if you started reading through these stories with a new view, in other words, you go in with the idea that you're thinking in terms of comet, because after all, this is what had triggered all of this interest, after 1994, one was thinking that there might have been an extraterrestrial component, there I was, reading about Arthur in the library, copious books on Arthurian romance, and what I noticed was that you were very quickly looking at, surprisingly, our local hero Cúchulainn, and that, stories which involved the Celtic god Lugh. And, Lugh came as a complete surprise, because as soon as you started reading about Lugh, you discovered that in one of the stories he is described as follows: the Irish king Bres

comes out one morning and says to his Druids, 'Why is the Sun coming up in the west today, when every other day he comes up in the east?' And the Druids say, 'Oh that it were the Sun.' In other words, they'd prefer the Sun to what's coming up in the west. 'That's Lugh, [of] the Long Arm.' And you're left going, oh! Now what can come up in the west, as bright as the Sun, with a long arm, other than a comet? And the answer is, pretty well nothing. So it's got to be that Lugh is a comet god. Now in the course of then reading through a whole series of these texts I stumbled on a book by a guy called Loomis, writing in the 1920s, a vast text on Arthurian romance, and that, that was an eye-opener, because in the book, and let's, let's be frank about this, Loomis was one of these scholars who was effectively given a lifetime fellowship, because he was so bright, he had a brain the size of a planet, he had read effectively all of world mythology, and there he is, sitting writing a book in, say, 1922. And he, he says about Lugh and Cúchulainn, these are solar deities, but we know they're not the Sun. And I'm there thinking, now hold on, you've got something in the solar system being referred to that's a solar deity but it's not the Sun. Come on Loomis, even you must be able to see, they're describing a comet. But he doesn't. And you're left thinking, now, that's positively bizarre. Here's a guy who got this close to the answer, and, couldn't see it. Was it because he didn't do science at school? You know, it's... It, it almost defies the imagination that someone as bright as Loomis couldn't make that last little jump. But to me of course he was, he was telling me what I wanted to know, that these, these gods are solar deities, but they aren't the Sun, of course they're not the Sun. If you've got a comet which is close to the Earth, even relatively close to the Earth, it's picking up so much sunlight it could be dazzling to look at. And of course it's got a long trail. And, so everything, everything I started reading, as I was writing *Exodus to Arthur*, was all pointing in the same direction, that the, the fact that Arthur dies at the 540 event, and Arthur is clearly related to these Celtic deities, I don't need to know the detail, it's, it's self-evident that Arthur is a dying comet, and that's what happens. And all the, all the imagery about swords and all of the rest of it, that's how comets are described in many ancient texts you know. Now if you, if you try and use that as evidence, of course people say, 'Oh but a sword's a sword.' I'm saying, yeah but that's not what I'm saying. I'm saying that the imagery is sort of concealed in these stories, and, you don't have to, you don't have to... It doesn't have to be spelt out chapter and verse. And, so the key issue is the date and the concept of comet, and suddenly everything starts to make sense. And

then when you've chased this up, you could find more and more of the allusions in these tales made sense if they were talking about events in the sky, and didn't really make sense of humans running around killing 1,000 people and cutting the tops off hills with their swords and things. These are, these are non-possible human events, but they're quite clearly things that could be carried out by, by these hero characters. So, the beginnings of all of that came out when one was actually writing the text. And you could find the same allusions in Old Testament texts, and in, in texts from a whole variety of these mythology people.

[08:04]

Now, there was a major snag with all of this. All of these great mythologists, the guys who seemed to have been close to the answer if you like, or had been interpreting the tales in the right sort of way, are all long dead. In other words, one would have needed to be writing *Exodus to Arthur* in 1920, or 1910, and then you could have actually gone and talked to the guys who were studying the myths with open minds. Unfortunately what we now have are bands of scholars who believe that all these myths are made up, they have no factual core whatsoever. And, and to me that is, that is, that is ironic. It's as clear as day that these stories have an important core, and they were deliberately encoded by people who thought they were important. I mean they were actually trying to tell us something. And the, the examples, although many many more have been produced since the book was, that book was written, it was in that book that I was finding these things out for the first time. And the whole thing was pointing to the fact that the biblical Exodus was cometary inspired, as indeed was the death of Arthur, i.e. that the 540 event was, was extraterrestrial, and also that the, let's loosely call it the 1628 BC event was, was also probably extraterrestrial. And, so that's why the title is *Exodus to Arthur*.

Where were you reading these myths at this time, while writing this book? I mean literally where, where did you find them?

I was finding them in, mostly in Queen's library, but I was also being given pieces of information. Also, I was buying books in second-hand shops, and, and even buying some texts on the Internet, because it was easier to get hold of them by simply buying them using a, a book buying search engine. And of course it became, it became fascinating, because you were, you were looking, you were looking at people's

interpretations, and seeing how they were, how they were dealing with the issues, but with a, with a template which allowed you to see past their, their reactions and to see that they were actually giving information which was frequently much more, much more relevant to, to extraterrestrial explanation than to an Earth-based explanation.

So that, I mean that was, that was basically fun.

[10:58]

What also happened, which is, amusing I suppose, was that although the initial idea for the book was popular and about a £7 paperback, Batsford were in a, in a period of, of contraction leading towards eventual collapse and takeover. And, the result of that was, people were leaving, so, the girl who had originally suggested the book be written, had left, and whoever had taken up the folder was trying to turn the book into a £25 hardback. And I was going, 'No hold on, this was supposed to be like, a paperback that you would buy at the airport, rather than, rather than a textbook.' So things got very muddled by the time the book was actually published. The other thing was, again because of the problems at Batsford, time kept drifting on. The book was actually probably written eighteen months before it was actually published in 1999. And in the meantime, it was sitting with a copy editor somewhere, and, as I would find out a new bit of information, I would write it as an appendix, and send it to the copy editor and say, 'Look, just stick this on the back.' So by the time the book was published, there were I think eight appendices. Now whether people know to read the appendices, they're actually just little additional chapters, and, they're about things like Ragnarök and, you know, how, how you could tie it into the, into the, the whole 540 story. And in fact, a publication has just come out this year from workers in Scandinavia where they're pointing out that Ragnarök fits perfectly well, and, you could, you see an appendix in, [laughs] in *Exodus to Arthur*, that was already pretty well spelt out. So, there were things like that which were just coming online. And of course, just because the book was published, the information kept on flowing in.

[13:03]

But what was very interesting was, the complete lack of reaction from any modern Celtic scholars. My feeling was that, they should be going back to the original texts in old Irish, or whatever, and, and re-reading the texts now with the concept in front of them that the texts might be containing information relevant to a comet story.

Because of course what we're still looking for are hints as to what we should be looking for on the ground to prove the reality of whether there was an impact or not. I

mean that's, that's what drives all this, is the, the quest to know what actually happened in the past. All the rest of this is just, is just relevant information which might be pointing you in the right direction.

So when you say lack of reaction from Celtic scholars and mythologists, do you mean literally no, no reaction, or, or, was there some reaction but not enthusiastic or...?

There certainly has been no reaction that I've been aware of. In other words, it's, it seems to be that it's easier to simply ignore this idea. Because, well the way I look at it is quite pragmatic, I mean, if you are Celtic scholars who have been studying these stories for a long time, the last thing you want to hear is that somebody who knows nothing about them has actually tripped on, by accident on the right answer, and in fact, you know, Lugh was a comet, and, and Cúchulainn was, who's the return of Lugh, was Lugh back again, in fact was, was the comet. And in fact when you see the descriptions of, of Cúchulainn's paroxysm where he, he has these multiple layers of hair and it goes through these incredible distortions, well a human couldn't possibly do anything that he is doing, and yet, a comet could easily do that, especially if it came close to the, the Earth's magnetosphere, you would have these unbelievable auroral displays and the whole works. So, yeah, so Cúchulainn, in my view, is, is without doubt a comet [laughs], and, and, it's almost like, people don't want to accept that, but, mm, that's how I see it.

[15:29]

And what was the response to Exodus to Arthur of fellow scientists and in particular dendrochronologists?

Well the world seems to divide into, into two groups. There's a, there's a tiny group who like this sort of thing, and who think that that could be on the right lines, and then there's the rest of the world who simply pretend it didn't, it doesn't exist. Which was aided and abetted of course by Batsford collapsing. [laughs] So... So the book went out of print, and, is now out there, and, you can buy it on the Web. There's hardly a week goes by I don't hear from someone who's says, 'Oh I've just read *Exodus to Arthur*. Did you know about...?' So people, people do send you information which they know which relates to the story. And... It's very well received by local society

audiences and things, who, the educated public at large by and large think mythology has a core of truth. As far as I can see, professional mythologists believe it's all made up. So, well, one or other of those two schools of thought is wrong. [laughs]

[16:44]

And what was the response specifically of Velikovski scholars, or enthusiasts? If it was. I mean you say, you, there isn't a week goes by without some contact about the book. I wonder whether among those people who contact you are these people who are enthusiastic about Velikovski. Because the book, or, the particular bit of Exodus to Arthur, in some ways supports him as well as pointing out things where he was almost certainly wrong.

Yes. Velikovski you see is a cause celebre in scientific circles. You definitely wouldn't want to be seen as a follower of Velikovski. I mean he, he's, he's, his ideas were ruled out of court. And quite rightly so in some ways, because, he, he came out with these outrageous proposals around 1950 that the Earth had had catastrophic events in the past involving comets. Now obviously I would be happy with those ideas, but where Velikovski went wrong was, he, he suggested that these comets weren't comets as we know them, but were large gobbets of material fired out from Jupiter by some unknown mechanism that then circled the inner solar system causing mayhem on Earth, I can't remember what the dates are, 1300 BC and 700 BC, something like that. And one of these gobbets settled into the orbit of Venus, and the other settled into the orbit of Mars, so that Mars and Venus are actually two comets that came out of Jupiter. I mean, you couldn't even imagine how non-sensible that is, I mean it's just, yah. So, you can see why scientists when he first proposed some of this stuff went absolutely mad and tried to get his books banned, which was a bit of an over-reaction really, because they might as well just fit into the science fiction genre or something. So there you have an interesting contradiction, I mean, you don't believe for a second what Velikovski was writing about some of the effects on Earth of these objects that he was proposing, but you do have to accept that, yes, he was probably broadly correct on the idea that there have been catastrophic events on Earth involving comets. I mean that's basically what *Exodus to Arthur* was, was demonstrating. So there you have a nice contradiction. But my attitude is always to excite [cite] prior work, which is an old academic axiom which is largely forgotten

now, but when I was, when I was being educated, the idea was that, if you're writing on a subject, you cite where the ideas originally came from, and then build on those. Now, now in the modern world it's, quite often you don't cite prior work, you only cite your own work. I suppose that's part of the, the cut and thrust of modern academia. So anyway, if you're going to cite prior work, you do have to mention Velikovski, and, and where he was right, he was right, and where he was wrong, he was wrong, and you just tell it like it is.

[20:01]

Is there any particular reason why you dedicated that book to your mother? Other than it's the sort of thing you...

I think I dedicated a previous one to my father. [laughs] So, fair is fair, yes.

And did they have a view on these, on this book, or...?

Absolutely not. Other than they were pleased to see I was writing books. [laughs]

Did they read, did they read it?

I doubt if either of them... Well, let's be frank. My father couldn't have read them since he was dead before any of them were written. And my mother pretty certainly didn't read them, mhm. But then... But, they're a read which requires you to actually have some sort of framework of knowledge relevant to them. I mean, to read them from a cold standing start, they would seem, there's a lot of special pleading or something in them. You do actually have to know the, the framework, on really quite a multidisciplinary level. I mean that, that's of course what intrigued me was that, I mean here, here I am, with, you know, a science background who has spent his career building tree ring chronologies and being involved in trying to interpret what past environmental events might have been like, and getting involved in subjects like mythology and, and, that, that's really borderlining strange. Most people wouldn't do that. But, the key factor in all of this is that some of these myths come with dates. You see, I wasn't invoking Arthur because, because I'd seen a movie or something, I was invoking Arthur because he comes with the date 542. And subsequently, I mean

it's referred to in a later book, when you search through the Irish annals, there's a very very cryptic reference in 539. And the only, the only reason you would read it and make any sense of it is because it comes with that date, 539, the beheading of Abacuc[??] at the fair at Telltown. And, most people would read that and it just wouldn't mean anything to them. But when you know there's a catastrophic event which might have had cosmic aspect to it, and you already know that Arthur leads you to Lugh and Cúchulainn, as soon as you read that, you go, Abacuc's[??] not an Irish name, and it's quite clear that it's referring to Habakkuk, which is a small book at the end of the Old Testament. And, the other thing is that the, the fair at Telltown is Lugh's Fair. So whoever wrote, and the monk, I've even heard it suggested that it might have been Columbkille who actually wrote this in. What he was doing, he was, he was giving you a biblical reference to what was happening in 539. And if you go and read chapter three of Habakkuk which is the, the chapter which has the beheading motif in it, it basically tells you all you need to know. You've got, you've got this entity in the sky causing mayhem on the ground, you know. So my attitude would be, that's a perfectly valid use of abstruse information, because it comes with a date, and it comes with a date which only means something if you know of the 540 event.

[23:32]

What, what contact did you have in the Nineties with those scientists, including Keith Briffa, who were, who were using dendrochronology in relation to what were now becoming very, sort of, politically and publicly popular arguments about climate change, including contributions to IPCC and so on?

Well, as... The way things happened, we had, we had from around 1980 been collaborating with the Climate Research Unit supplying them with data, and they were on occasions using that data for climate reconstruction attempts, but we increasingly in Belfast were distancing ourselves from that, because we felt that we couldn't, we couldn't get climate out of Irish tree rings, and hence it was really, you know, if they could do something with it, well and good, but we didn't need any part of that. But during the 1990s there was a move to actually amalgamate large amounts of European tree ring data, and Keith Briffa was, was the head of, of that enterprise, so that, so that workers in Scandinavia and Germany, right across Northern Europe, including England and Ireland, were supplying data to this centralisation exercise, the idea

being to get lots and lots and lots of tree ring data together to try and do these broad-scale reconstructions of temperature, rainfall, whatever could be done. So we were, we were involved in that but purely at the level of data suppliers. We ourselves were not up to trying to extract climate from tree rings. So, so as I say, we were, we were simply supplying the data. And really from the end of the 1990s onwards, I mean my interests had moved towards catastrophic events, and, Keith's, Keith, as far as I was concerned, was interested in more and more extreme tree ring series from high altitudes and high latitudes, and that was, you know, it wasn't that we parted company, it was just our research interests were diverging, so that, there was less and less attempt at climate reconstruction. In fact almost no attempt at climate reconstruction, we basically didn't think we could reconstruct climate.

[26:16]

When IPCC first started to appear, I mean I, I have to admit, I was slightly concerned that trees were being used in such a main-scale way, because, one of the things we don't really know about trees is, are they actually adapting over time to, to circumstances? So, even if you calibrate trees against climate in the last century or century and a half, can you assume that the tree's response has always been the same in the past? Now in Ireland particularly we have very good reasons for, for being suspicious about that, because if you think of our 7,000-year Irish chronology, it starts off with living trees, and in fact we have strong suspicions that these living trees are not even original Irish stock. Their ring width patterns, and in fact average ring widths suggest that they were actually trees that were brought in and planted in, in Ireland from England or the Continent in the seventeenth and eighteenth centuries. So, we have, we have one group of trees which would be the ones you would calibrate against climate; you then have the oaks that were used in historic buildings, and we mostly don't know where they came from, and they could have been shunted around. Archaeological sites similarly, and even worse with bog oaks, I mean these are trees which grew on the surface of peat bogs so that they, the chances that they would respond to climate in the same way as are [our] living trees, is frankly extremely unlikely. So if we calibrated, if we were able to calibrate oak ring widths for the last 150 years against Armagh climate, the idea that we could then read off climate back for 7,000 years would be an absolute non-starter, I mean it would be madness, you just wouldn't do it. So this is, this is one of the other reasons why we, we preferred not to be involved in trying to reconstruct climate, we just didn't think Irish trees were

going to help, and we just, they would just add confusion. And the question then is, well, does this same sort of thinking apply in other areas? Are tree ring chronologies, I mean can you run back 600, 6,000 years in terms of reconstructing climate from tree rings? And the answer is, I don't know. And the IPCC is forced to use tree rings because they are one of the best attempts at reconstructing climate. So it's somebody else, it's all work that somebody else is doing, and I was quite glad actually that we weren't involved in it.

Why were you glad, for those, for those reasons, or for other reasons?

Well simply because I couldn't stand... You see, the... In, in your research work, I can stand over the links between the tree rings, in other words, I can take you back to the original pieces of wood, I can show you the graphs, I can show you the correlations between the ring patterns. If I give a date, or one of the group that I work with gives a date for, for a piece of wood from a crannog, and that date happens to be 1027 AD, we can stand over that date absolutely, we can go back and re-do it again if necessary. When it comes to things like climate reconstruction from tree rings, I wouldn't be able to stand over it. I wouldn't want to be in the position of having to stand over it. So, it's, it's somebody else's problem really you know. And, let's face it, that's how things work in many areas. Because I come out and discuss comets, my colleagues don't all accept what I say, I mean most of them are deeply sceptical about it. I mean that, that's, that's a good thing.

[30:06]

How do you know that your colleagues are mostly deeply sceptical?

They'll tell you that. [laughs] Yes. They think it's, it's a, a sort of madness that I've indulged in. But that, that's fine, I don't mind that. They'll, they'll find out I was right eventually. [laughs]

Are these colleagues in dendrochronology, that have the...?

No, they, the more scientific colleagues tend to be a bit more open-minded about it; my arts-based colleagues tend to be very resistant to it, they... The problem, the

problem is, I think simplifies down something like this. Catastrophism is, is tied up with environmental determinism, and, environmental determinism, i.e. the idea that big natural events affect what humans do, has been largely airbrushed out of history and archaeology for the last century or so. So someone like me coming along and saying, 540, you know, really affected things, they go, 'No no no, you can't be, you can't have that, that's, that's environmental determinism.' So that, and that's, I mean I'm stating that very simply, but that's basically the, the elements of it. People don't like these out-of-the-blue type phenomena. And to be honest, archaeologists really can't see them, because their, their chronology isn't, isn't good enough to actually identify them. So they, they're more comfortable with a, a slow acculturation view of history, whereas I would be, now, because of the tree ring events, be more comfortable with a punctuated view of history that, that things are going along pretty well and then, something happens, a big volcano impact from space, some climatic reorganisation, who knows what? But things like that happen, and people then have to pick themselves up afterwards and, and sort themselves out again. Now whether you can see that in the archaeological record is a very interesting question. You'd certainly have to be looking for it, and it would be quite easy to miss.

[32:19]

Though pleased that you weren't involved yourself, did you read IPCC reports in order to, see how trees were being used in...?

Oh yeah, I mean, the basic, the basic principles of using trees to reconstruct temperature should work perfectly well if you're, if you're working in regions where the trees are all subject to a single climatic parameter. And if you go up to the north of Scandinavia, then, basically the trees are very dependent on summer temperature and the length of their growing season. So, yes if you, you should be able to reconstruct temperature there. But I mean I, it's, I don't do that, it's somebody else does that. The question I would still have is, as you go long distances back in time, are you sure the trees will still be responding in the same way? And that is, that is still a moot point.

What I mean is, there's a difference between sort of, when the IPCC report comes out, sort of taking a general interest in what it's saying, or are you actually, when the next one comes out, do you actively, you know, click on the Internet and read it, or get...?

No, I would, I would be in the sphere of, just taking a general interest in what it says. And, being very aware of all the scepticism there is about it. So.

[33:43]

Could you tell me what the effect of retirement was on your work?

Well I, I retired early.

In, what date? We ought to get that.

In 19... It wasn't 19... Of course. Decades slip again. In 2005. So I, I technically could have worked on till about, I probably could have worked on till, 2009 or '10. But, I found that, as a senior academic, more and more of your time was being potentially taken up with administrative and other tasks, and, and research, which was the one thing I felt I was good at, was having to take a sort of, back seat. So by by taking early retirement I'd continue on with the research. And in that sense it hasn't, the retirement had almost no effect at all, because, in the modern world, you're still in touch with people by Internet, and they don't know whether you're retired or not, you know, so it's...

[35:00]

What else has the, what other differences has the Internet made to how you work, or how you are able to work?

[sighs] For someone who has been involved for forty years in, in research, the Internet has, has been a total revelation. I mean it's, the ability to find information at your fingertips is, is unlike anything we had in the past. You know, when you were waiting for an inter-library loan to come, to look through a book, and discover it wasn't what you wanted anyway, you know, it's, now you can, you can, you can search all manner of material at your desk. There's another side issue which I found

fascinating and that is that, interested lay people, in other words, non-academics, but, I call them a band of retired librarians and engineers, these are guys who, for sake of argument, spent their working careers building bridges that didn't fall down, in their retirement follow their, their interests or their hobby, and it very often involves catastrophism. People are, there's a lot of people out there interested in catastrophes, and, for a whole variety of reasons. And, these guys have access to huge amounts of information. So, sometimes if you can't find things, it's easier to just ask a couple of cronies on the Web. I mean, it's exaggerating very slightly but there was a point, say, ten years ago, when it could be quicker to simply email someone in Oklahoma than to walk across to the bookshelf to try and leaf through a dozen books to find the answer to a question. Because, some of these guys work 24/7 on their hobby, and they, they have access to enormous amounts of information, they are, they are dyed-in-the-wool researchers. But, they're not doing it to publish anything, they're doing it out of their own interest. And that also makes them extremely generous, they just give information away. You see academics now increasingly have to think, do I need to publish this? I mean is this part of my career profile? Is this, is this, is this going to affect my job? Whereas a retired librarian, for sake of argument, can just go, 'Oh, you want that chapter? Well,' you know, 'here it is,' choo! PDF. And... [laughs] And, you know, it, it has opened up a window which just wasn't there before. I mean, young, young academics, young researchers, guys doing their PhDs, probably have no idea, we had to type stuff on manual typewriters, we had to draw the diagrams by hand, we had to walk over to the library to get a book. You know, I mean if we had, if we had the standing start they now have, think where we might have got to, you know. [laughs] We, we were, everything worked, like, in slow motion in the 1970s and '80s, compared with the way it works now.

[38:29]

And, how do you find these, these people on the Internet who are these sort of, private enthusiasts, are there sort of, blog sites or websites or sort of, internet sort of clubs of these people that you...?

Almost exclusively these people have found me. So, they, there's a, a coterie of people that, that I, I now am aware of and who, who would fairly regularly contact me. And they may well actually also be running news groups, and quite often I'm

copied in to, to news groups, so, you could, you could access them in other ways, but I, most of them have, in first contact have just simply come to me. They've read something I've written. *Exodus to Arthur* obviously opened a lot of people's eyes, a lot of people sort of went, [click fingers], that's the answer. You know, yes. And now... And, they could see all things, all sorts of things that they knew which were directly relevant to the, the basic premise, and, you know, being, being the sorts of individuals they are, they just, emailed you and told you. And some of them, we've kept up correspondence basically ever since.

When you said that, when you said retired bridge builder, was that just an example picked out of the air, or is, is there anything significant in, are you saying something about the type of person that tends to be involved?

It... I think, yes, retired librarians and, and engineers, would give you a sort of flavour of the, of the types of people I believe them to be. [laughs] So... I haven't necessarily gone and checked their credentials. But, the information which they know and have access to, tells you a lot about their interest and their reading, and their knowledge base implies in many cases that they, they have an intimate knowledge of science. And, yup, interesting.

[40:33]

Why did you write Celtic Gods in 2000... well, it was published in 2005 but...?

Ooh. Well the *Celtic Gods* really came about because of Patrick McCafferty. Patrick had been a practising chemical engineer, but had decided that he wanted a, a change and had moved towards archaeology, and had at some stage been given a copy of *Exodus to Arthur*. [coughs] Pardon me. And when he read it, Patrick was an Irish speaker, he had read the Irish stories, and, he immediately recognised that the basic premise that comets explained a lot of these stories, he immediately recognised that in his view that was also correct, and... Anyway, he ended up in Belfast doing a Master's degree, and, he said to me that, 'You need to write another book.' And I said, 'Well, if I'm going to write a book on this, you're going to have to be a co-author, because you, you know the Irish stories better than I do.' And that's why the *Celtic Gods* is, is authored by McCafferty and Baillie. And basically, we took, we

took some of the things which I had made the beginnings of in *Exodus to Arthur* and turned it into a, a coherent narrative, or, I think it's readable. And, it basically shows how you can, you can explain a lot of the Irish stories in terms of things that people witnessed happening in the sky. And... [pause] Yes. [laughs] It had the, it had the benefit of, of being published by a publisher that also collapsed [laughs] in short order.

[42:55]

Who... Having read it, the prose sounds like you've written it. I wondered how the work was divided up. It sounds like you writing.

We, we toyed around with various possibilities, and decided that we would agree the basic shape and that I would, I would sort of, edit it into Mike speak, so that, yes it has a, a sort of, simplified language which I, is the way I, [laughs] the way I write. So I hope makes it readable, you know, more readable than if it was a, a textbook. It's meant to be a, a relatively easy read.

As an example of the work involved in producing it, I wonder whether we could look at one particular plot or graph in the book which is on page 158, figure 66, and, what it is is, the reason I picked it really is because it, it links dendrochronology with Irish stories. And I just wanted to know what, what is the work behind it. Perhaps we know what one half of the work behind it is, and that's the, the building of the oak chronology that you've already described, and therefore we would, we would want to know what was involved in getting the other half of the information if you like which is about, mentions of the god, was it god Lugh...

Mhm.

...in the Irish stories. So, so how is it produced, how was that diagram from, from having nothing, to having that diagram in a book produced?

Well, if you have a copy of the Irish Annals, which were, a published and edited version were published I think in 1856 or thereabouts, by O'Donovan, if you happen to have those out of the library, you can simply sit and read through the text, and

every time the word Lugh appears, make a note of it. You could find exactly the same thing on the Web now, because, the Annals are all on the Web, and you could probably do a word search and save yourself a few hours of time. But basically that's how that was done, simply... The Annals, the prehistoric section of the Annals are not very copious, in other words there's not all that much of them. It just intrigued me that, that the very first reference to the name Lugh in the Annals is in 2341 BC in terms of a place name, and of course the 2350 event has occupied quite a bit of my time recently. So I just, well, when you plot them out, you can sort of half convince yourself that the name Lugh seems to occur at around about the time these events take place, maybe giving a hint that, you know, several of the events were extraterrestrial.

[46:13]

And I also wanted to know where you found the images of comets, which just in my opinion seems to be one of the most convincing inclusions, especially when it's combined with texts such as that on page 40, where you say, 'Looking at the images, we are forced to imagine how such a wide variety of comets might have been interpreted in a pre-scientific era, not seen through a telescope but frighteningly close.' And I think it's very important in the book to be able to see various different shapes that, that comets might assume other than which you talk about in the book, you know, the kind of stereotypical comets seen from the distance, merely a head and a tail. And, as these images seem to be, as far as I'm concerned, crucial in sort of, making the argument, I wondered where the story of finding them, where these images were from.

[laughs]

I think possibly there's one sort of, blown up and coloured on the front cover, but throughout, one particular part of the book, there's quite a lot of these reproduced.

Yes, the... Serendipity basically came into that. There's a, a charity shop just round the corner from Betty's Tea Room in Harrogate [laughs], and, I was browsing through the used book section there, and they had two enormous volumes of a very, what must have been a very expensive late 1930, [19th, early 20th] twentieth century astronomy book. And, well put it this way, they appreciated them too, because they cost £40.

But I couldn't resist having them, because they had these unbelievable illustrations of, of the variety of comets that had been observed during the nineteenth century. So these were, you know, professional astronomers who had been looking through the telescope at Comet Donati or whichever, and drawing it each night as they observed it. And, a lot of these comets change shape, and of course one of the aspects of, of deities, Celtic deities, particularly ours, is that they're known as shape changers, which again, it's another clue that you're on the right lines. So, comets change shape. And also some of the shapes were an absolute revelation to me, I mean, especially the figure you're referring to, Donati's Comet in 1858 went from being, went from looking like a bright white circle with a sheet of hair to a, [laughs] a horrendously distorted human face with, with again flowing hair, over the period of a few nights. Now, given that that's almost a blow-by-blow description of Cúchulainn's paroxysm, whenever that description came about, and given that we know there were no telescopes in the distant past, the only way someone could have seen that would have been if a comet was really close and looked like that. And there's a scary thought. Because of course, the whole issue of Lugh coming up in the West only works if the comet is close to the Earth, because it's having to overcome the rotation rate of the Earth. So, perhaps in the past we have had close brushes with comets that are unknown except in these strange mythological stories. And the bizarre thing with that is, you see what that's saying is that, ironically, Velikovski, for all the wrong reasons, was partially right. Now I mean it's a dangerous thing to start saying that, because you know, you don't want to be seen as a follower of Velikovski, but credit where it's due, I mean the guy called it right, or that several of these close approaches were cometary. And, yup, there you have it, there is an illustration from professional astronomers, pretty well confirming that those descriptions may well be of, have been of real objects.

Do you remember anything about your selection or the selection made between you and Patrick of which images from those second-hand books from the charity shop round the corner from Betty's were made?

[laughs]

You know, how, how did you decide which to include?

We, we included the ones... Well in fact we included most of them. I mean, you know, we, basically we wanted to show that there were a wide range of, of, of ways to view comets, which effectively nobody has seen in recent times, and, to open people's eyes to, to that. I mean, the two books were actually very interesting. Very very few people would have owned these expensive volumes, and, the chances are that the vast majority of people had never seen such things. And yet there they were sitting on a, on a shelf. So, we felt that it was wise to disseminate them, you know, let's let people see just what comets could look like. So, we selected widely from the book. It was also very handy because they were essentially all out of copyright, so you could use them without having to try and find somebody to get permission from.

[51:49]

Any progress since the publication of that book in investigating possible impact craters, the circular ritual ponds that you have discussed?

No. That was a fanciful area. I mean remember, this was a popular book; again, we were not trying to be fully academic. So, we, we... [pause] Could we just stop there for a second?

[pause in recording]

Right. OK, OK. The idea that there might be craters in an area as small as Ireland, is an interesting one, because, to all intents and purposes no one has ever looked. And, one of the, one of the most likely craters is actually Portmore Lough, which is a small near-circular lake beside Lough Neagh, just to the east of Lough Neagh. Portmore Lough is, is peculiar because, it's about a mile across, and it's uniformly three feet deep, which is not the normal profile of a lake. And, it really shouldn't be there, it should have long since filled up and become a peat bog, and, the question actually is, was it a peat bog that got blown away by a, a Tunguska style impact? And, the jury is still out on that, because it's actually extraordinarily difficult to prove that, that a lake was produced by an impact. You see if you, if you imagine you had a shower of debris coming in from space, and a piece of it either hits or explodes over the Irish Sea. Well OK, you get a bit of tsunami evidence around the coast, but that might or

may not be findable. The sea, [laughs] turns back into the sea. If it strikes over an upland area and blows away the vegetation, you get bare rock on the top of a hill, nobody would bet [bat] an eyelid about that, they would accept it. If a piece exploded over a peat bog, and the shockwave blew the peat bog away, or blew a shallow depression in the peat bog which then filled up with water, well, you might be able to find a peculiar lake, but actually proving that that's how it was formed would be difficult. And that's the situation we're still in, in other words, it's going to require a piece of lucky evidence somewhere to, to substantiate the idea that Portmore Lough might have been an actual impact crater. But circumstantially, it's, there is some evidence, because, about a kilometre south of Portmore Lough, you actually have trees which show dramatic effects in 540, including trees being pushed over, one in 539 is actually pushed over to forty-five degrees, and you can see from the ring pattern, it then tried to straighten itself up. And several of the trees have really severe scarring, in other words, physical effects, they're not just, they didn't just think it was cold or something, they showed actual damage scars. And that raises some interesting questions. Is it conceivable that the, that the little lake at Portmore Lough was actually created around 540, and that there was a real physical, tangible effect on the island of Ireland?

[55:30]

Now, when you come to circumstantial evidence, the really bizarre thing is that, there's an ancient graveyard on a little drumlin in the edge of Portmore Lough, and that graveyard, which is now known as Ballinderry, was originally called locally La Lugh[ph] [Loo], because, up until the eighteenth century there was a, an annual festival of Lugh meeting at this site. Which leaves you going, Lugh, but, that's the god, you know, it's clearly the Irish comet god. Why was he located at a vicinity, effectively standing in the margins of, of Portmore Lough? I mean, did they know something? So, you can't use it as evidence, but you can certainly point it out. Because if it turns out eventually that Portmore Lough was an extraterrestrial impact site, then, then that'll be, [laughs] part of the story.

[56:36]

And you can become more fanciful if you like, because, there's a little story that every child in Ireland hears, and it's not clear where they hear it from. I think they either get it at primary school or from their grandmothers. And it's about Finn McCool, the Irish giant. Now Finn McCool is just another aspect. Finn would be a, you know,

long, fair-haired giant, giant's a sort of euphemism, and, he is chasing a Scottish giant, and, they are obviously heading east. And, the Scottish giant is getting away, so in the story Finn bends down and scoops up a huge handful of, a clod of earth, and he throws it after the Scottish giant, and it falls short and drops into the Irish Sea, and it becomes the Isle of Man. Now of course, to every child, or indeed everybody, the story makes sort of sense, because you've got a hole in the ground the size of Lough Neagh, and you've got the Isle of Man which is roughly similar in dimension. And, yeah, so it's, it's a nice sort of, fairy story explanation of the two natural phenomena. But once you realise that Portmore Lough, even in your most fanciful thinking, might conceivably be the crater left by an airburst, and Finn might be the comet, then you're left going, now that's interesting because, the symbol of the Isle of Man, who is named after the Irish god Manannan, who is just another version of Finn and Lugh, Manannan's symbol is the triskele, the three-legged swastika, which of course is a comet symbol, and if you, you don't think that, just go and read Carl Sagan's book *Comet*.

[58:35]

So, you, you've got circumstantial evidence pointing, and then adding to more circumstantial evidence. But what is even more bizarre about that story is that the god Manannan is believed to have been buried standing upright in a lake that was formerly a red peat bog. Now, you, [laughs] you tell me if that's not the answer. I mean, how could those stories be sitting out there, known to everybody, and, and actually telling you some, a real truth about the fact that, that, that there's a hole in the ground that was caused by a Tunguska class airburst? Or it's all just chance. My feeling would be, I think we probably know what the answer is now, that that little Finn McCool story, because it links to Manannan, and the comet symbol, and the story of Manannan, that, the very... Where would the concept of a lake having formerly been a bog have come from in the past? You could almost put it that, the only conceivable explanation would be that people knew there had been a peat bog, there was a big bang, and it went away, and the cause of the bang was the, the Celtic deity. Now, maybe you think I'm being too fanciful, but it's just, I'm just telling it like it looks to me. [laughs] And I just love the idea that the person who encoded that little story that has been handed down for who knows how long, maybe 1500 years, encoded it so cleverly that people have been telling it ever since. And it only makes sense to somebody who knows the answer. The cleverness of that is almost unbelievable.

[1:00:28]

In what circumstances did Patrick tell you about the Irish stories? I mean, what do you remember of, of that? How did you, did you sit in an office and he went through what he knew, or did you...?

No, we would have probably been sitting over a glass of wine somewhere of an evening more likely. Or, or over a cup of coffee down in the lab at Queen's. We would just have been mulling over some of these, and, you know, seeing, could, could you interpret some of the stories? I mean he, there were some that he pretty well had already decoded, and then there were other ones where I had ideas and then we would knock them back and forwards. They're not all in the book, I mean there's, there's probably nearly as much stuff again, wasn't used. I mean, we did try and keep it fairly, fairly narrow. I mean you could expand it. We've known ever since it was published that you could easily produce another book on it. I'm hoping Patrick will in fact produce a, a completely freestanding volume.

[1:01:35]

At the end of the Celtic Gods, you, you write, 'It's now important that Celtic scholars go back to the original documents and look at them again in the light of the comet paradigm.' What, to what extent has this happened in the last seven years?

As far as I know, not at all. And in fact it's worse than that. I was at a meeting about two years ago of Celtic scholars in Queen's, a one-day meeting, and at the end of the meeting I, I more or less repeated that to them, I said, 'Look, I'm a scientist, I've got events, I'm trying to understand the events. I need you to give me any hints that you can possibly get from these Celtic stories. But the sense I'm getting is, that you can't help me.' And one of the delegates at the meeting stood up and said, 'You are correct, we can't help you.' Which I thought was almost unbelievable, because I mean, in, in the scientific areas that I've worked in, be it volcanology or ice cores or cometary, astronomy, people are always willing to help. The very concept of a group of people who would say, 'We can't help,' what's wrong with Celtic scholarship? would be my reaction, there's something fundamentally flawed somewhere. Is it that they're not willing to be tainted by such ideas that there could be a core of truth? And

I think that's what it is. Celtic scholars have accepted the idea that all these stories are made up, and there is the irony, here's a non-Celtic scholar saying, 'Well it looks to me like they've got a core, not just of truth, but of important truth.' And they are saying, they can't help. Well, hm. [laughs] What, what do you want me to say? So in other words, it's left to other people to, to make the effort to understand these tales. And ironically, there's a whole band of them around the world, they're called [laughs] retired librarians and engineers, and those guys will crack it, you know. And, if Celtic scholars end up with egg on their face because they were warned and they didn't take the lead, well that's entirely up to themselves.

[1:03:54]

Could you now tell me something about your children growing up, their education and where they went in terms of their carers? I think you said two daughters, is that correct?

Yes I have two daughters. They, they both went to university in Scotland, one of them graduated in, in economics and geography, and the other in art history. And both of them are pursuing careers based on, on their degree choice. And, they... Well I don't know whether they've been influenced by me one way or the other, I mean I think it's just, in the modern, the modern world, most people go to university, they certainly were well capable of going to university, and, and benefiting from it. So they're, they're pursuing their own pathways.

Has their level of interest in your work increased, or decreased, or stayed the same as they grew older and became perhaps more and more aware of what you were doing and what were you writing about and who you were and so on?

I think it's fair to say that they, they, there's a minimal interest in, in what I was doing. And this is pretty fanciful stuff you know, I mean it's, it's, it's not necessarily something that... [pause] You have to know a lot of different things to be able to really appreciate the blend of, of different disciplines which are being involved now in this. And, so, [laughs] my, my daughters are no different to the vast majority of the public who are not aware of any of this, or, or would have little interest in it. I think

they're more intrigued by the scrapes I get into with arguments, and, yep, I mean that, that's part of the fun of it. Mm. What's Dad up to now? you know, he's...

What happens when you do, I don't know whether you do, but what happens when you do talk about your work, to your wife or to your daughters?

[pause] Well, I mean they're always interested, I mean, you know, if, if issues come up and, as, as issues inevitably do, yes, I mean you will of course talk about them, and they are supportive. I mean they assume I'm right. [laughs]

[1:06:41]

Can you tell the story, just because it's something that's likely to be of interest in the future, and I know you're outside of it, but tell the story of the, what became known as Climategate or the UEA email, event or, whatever it was called, your view of that from the outside? I don't know whether you followed the story, but, what was your view of it from, from the outside?

Climategate was interesting, oh, for many reasons. Email crept up on us really if you think about it, I mean, in the old days you would communicate by phone or at conference or by letter, and that, that provides a sort of formality. But email is incredibly informal. And I think most of us thought that our email discussions were effectively confidential, you were just communicating with one person. Though I think our institutions probably did try and warn us that, you do have to realise that, you know, you shouldn't say anything in an email that you wouldn't say in a written communication. But then most academics are fairly flippant anyway, you know, so if you're, if you're conversing with a colleague on, on an issue academic or otherwise, there's a lot of informality, and in fact, I would be the first to admit that one frequently indulges in non-grammatical writing, rather more like texting, you know, because after all, it's, it's an informal communication. So it was rather salutary to see a group of people whose email history was dumped out into the public domain, because of course, there's, none of us would want all our emails dumped out, because I mean you say things about colleagues, you write referee's reports, you, you know, the stuff that you don't... You know, confidentiality still has some bearing in most parts of professional life. So yes, it was interesting to see what went on. And of

course the, the critics were looking for, for grounds to, to undermine the work that the Climatic Research Unit had done, and of course they could find a few really quite unfortunate turns of phrase. And, I mean give you an example. I mean, the sort of thing was, for sake of argument, Phil Jones was communicating with Michael Mann and he said, 'You know, maybe we should redraw that figure and not to show something,' or to... You know, OK, if you, if you are a conspiracy theory aficionado, you can see that that that is clear evidence that they were covering something up. But, think back, a few minutes ago you referred to a figure in the *Celtic Gods*. I mean, how we drew that figure and what we showed in it was just, at the whim of, of when we were doing it. I mean it seemed to show something relatively sensible, vis-à-vis references to Lugh and... You know, did we, did we tweak it in some way? I mean, and if we had tweaked it, would that make it any different? And the answer is, well we didn't tweak it, unless we actually missed a reference to Lugh when going through the compilation. Now, take that as an example. Say somebody listening to this says, 'Well I'm going to redo that, I know the dates of the 2350 event and they...' or, or the dates of the other events. 'I'm going to use the computer now to search for the word Lugh in the, in the Annals.' Because I did it on a hard copy. And imagine they find a reference to Lugh that I had missed. They are going to go, 'Ah! you see, they deliberately suppressed that one.' And the answer is, no we didn't. If it exists at all, we missed it. And, it's at that level, it depends on your point of view. In the one case it can be an innocent mistake; in the other case it's, it's part of a grand conspiracy. So, when, when you get conspiratorial minds all round the world looking at a body of emails, of course they were able to find lots of things to criticise.

[1:11:22]

The question has to be, was there anything fundamentally wrong with the temperature reconstructions produced by Jones and Mann and the rest of the dendroclimatologists? And the answer is, almost certainly not. And their scholarship I would, is well enough reviewed, and duplicated by other workers, that, the sceptics really don't have much real ground. But that doesn't mean they can't fill pages and pages of copy with conspiratorial overtones. And the question really has to be asked is, where are they coming from? I mean are they paid by the oil industries or the coal industries? Are they just interested in individuals? Because it, global warming is a really, really big issue. I mean, it's a mega issue, it's, it's an issue which is frightening. And, and, to play it down for the wrong reasons would be a really, really serious mistake. Because

I mean, I think, I think we, we have to remember, if, if the human species gets global warming wrong, and we trigger some runaway greenhouse effect. I mean, I went to a meeting in the early Nineties, or maybe it was the later, or in the later Nineties, about clathrates. These are these huge deposits of methane held in the ocean beds. And, the tone of the meeting, which was mostly by geologists and, and engineers, interested in extracting clathrates as a source of energy, the sort of things that were worrying them was, if we take too much of this stuff out, might we collapse the Continental Shelf and cause tsunamis? This is the level that they were worrying at back in the 1990s. If that clathrate's there, and if rising, raising the temperature triggers a massive clathrate release, then you could run into a runaway greenhouse effect, as seems to have happened I think back in the Permian, at one of the other extinction events. You could produce an extinction event on Earth and, and run us up into temperatures like Venus, you know. That's quite possible, I mean there's no reason to be coy about it. And, pumping more and more gas into the atmosphere is an interesting experiment, and one that shouldn't be taken lightly, but of course, [laughs] the human species at the present time is taking it extremely lightly, so.

[1:14:07]

Do you have any sort of feelings about likely prospects for the Earth from this large...?

I would be extraordinarily pessimistic. You see, looking at events in the past and how little we know of them, tells me that we don't really understand how the system works. So we're tinkering with the system, and we don't know how it works. And the Earth is quite capable of just, deciding it wants to exist in a different pattern, which might or might not have a place for modern human life, mm? Yup. Now, sort of... I, I wind audiences up now by saying, the luckiest generation ever to live, because you stand a reasonable chance of actually being in at the end. That, that frightens a lot of people, but I actually think that's quite fun. [laughs] But maybe people, you see maybe, if you, if you pan back from that rather flippant statement, I think people have almost always thought that, you know, the end of the world scenarios have been played out from the eighteenth century and the nineteenth century, and, you know, there was somebody thought it was going to end last year, and somebody thought it was going to end the year before. So I mean, the end of the

world is a concept that, people seemed to actually enjoy, you know. Mm. [laughs] Maybe that's it, maybe I enjoy the concept of the end of the world. But, it, it's, it's... It's a scenario that worries me, and I'll tell you, the simple reason for it, and, and people can laugh if they like. If you go back to the 1980s, people went on holiday to the Mediterranean or America and they came back and they said, '[blows], it was over thirty degrees.' And thirty degrees when you live in Ireland is unimaginable. It's just simply unimaginable. Up until relatively recently it had never been above eighty degrees Fahrenheit on this island, and that record's only been broken I think about one and a half times. Now people are coming back from various parts of the world and complaining that the weather was over forty degrees. So, warming does appear to be real. And, if it keeps on happening, and it keeps increasing, life's going to become very interesting, and it'll be short order. And as I say, the big danger we run, the ice core workers show this very clearly with the, the rapid warm-up at the end of the last ice age, where they are definitely suggesting that it can happen in as little as a year. In other words, the system can flip suddenly. And, that's why understanding these events in the past is so important. We need to know what the system can do. If you wanted my candid opinion, I think the system will flip before we can understand it. You know, it's that sort of, that's the, that's what you're up against. [laughs] I like irony, you see that would be the ultimate irony, that the scientist who actually has cracked the system and knows how it's all going to work is, is about to give his paper at the conference, the data for the system flips and he's left, with paper in his hand. [laughs]

[1:17:32]

And what has been the effect on you personally in Belfast of the various Freedom of Information requests that followed Climategate?

Oh yes, we, we, I suppose the word is, suffered a, a request for the release of all our data. There are certain... I... The word irony starts increasing, starts to occur increasingly in this. When we built the chronology, we've always been aware that there would be, there would be critics of dendrochronology, people who would want us to prove that we were right, or they would like to prove that we were wrong. And our attitude was always, look, the data is all sitting here in files as graphs, and if anybody wants to come, they are welcome to go through it with us. But, as far as I

know, there's never been anything other than that belief on our part. And in the 1990s we actually gave virtually all our, all the dated data certainly, because, what's the use of the undated data? We gave all the dated data to the international collaborative effort that Briffa had been involved in. And, so when somebody comes out of the blue basically saying that they want all our data, it raises an interesting question. One of the, one of the interesting questions is, the two main leading protagonists of the data, which are Jon Pilcher and myself, because we were the originators who did the vast bulk of the fieldwork and the collecting of the samples, there's a question, is it our data? Well, it sort of is our data, because, when you actually make a set of measurements, if I gave you, or indeed anybody else, the same piece of wood, you would not get exactly the same measurements you know. These are done down in, whatever they are, I think they're now mostly in fiftieths of a millimetre they're measured. Depending on just where you measured across the rings, you might vary by a few fractions of a, of a millimetre. So that the pattern would still be the same, but the actual set of measurements is unique to the person who makes the measurements. So I would say we actually do own the measurements. So that, our attitude was, if somebody else wants to really redo this, then they should come and re-measure the samples of wood, and the samples of wood are there. But in this case, the request was for all the, the raw data. And I would have to say, even though I'm retired, my attitude would have been, well no, you can't just demand all of somebody's data, it's not realistic. I mean the data is still being used of course for research purposes, and, and it's also being used for commercial purposes, because, the surviving dendrochronologist in the laboratory, David Brown, runs a commercial service, so it's important that we have control of the, of the raw data. But anyway, the request was eventually dressed up in terms of environmental information, and the commissioner found on behalf of the plaintiff, i.e. that, that the data should be released.

[1:21:04]

Now, again, irony comes into this. I mean our attitude was, well do you know, somebody wants the data, really, the data, we may have made it as difficult as possible for them to get it, but, you know, they can have it, because, we do want that data to be out there and to be useful. We just didn't think that this was an appropriate way to, to get, get it moved out. An amount of our data is already on the International Tree-Ring Data Bank, and a plan is actually in hand to gradually put it out in a

controlled fashion. But as it happened it was simply put out as, whatever it is, 10,000 tree ring files. And, I don't think that was really in the spirit of the Freedom of Information Act, that's not what the Act was designed for. And, it's sort of a lesson to academics to be careful with their data, because, if you don't want it to be released, don't, don't, [laughs] don't do whatever allows it be released. In other words, you know, keep it in a format which is private to you until such time as you want to disseminate it to somebody else. But the ironies continue, because, in fact the data was then taken up by two different groups of people in Scandinavia with of course modern computing power, and they did what we had never done, which was simply, take the data blind, as an entire group, and use it to rebuild the chronologies. And, the nice thing about that is that they basically have shown that the chronologies are correct, which is, oh well I'd have been surprised if they found anything else. But, that's the, that's the current status of the, of the issue. And, what that means now is, if anyone quibbles with our chronologies, we don't even have to bother answering, we can just refer them to the independent people who have built them without using radiocarbon dates or anything else, just built them purely on tree ring patterns. And, yeah, no it's kind of nice really.

[1:23:15]

And, could you give us a sense of what you might read or watch when you are not engaged in your sort of, immediate interest, your sort of research interests, in other words, I suppose another way to put it, I would say, what do you read and watch for pleasure, but, I mean, you take pleasure in doing your work, so, but I mean, what do you read and watch that is sort of non directly work-related if you like?

I would watch quite a lot of documentaries. There are some incredibly impressive documentary series now. I mean, Iain Stewart has produced a way of looking at geology that is just so entertaining. I mean he just, you, you watch his documentaries and he, he's just talking to you, and he's talking just casually. There's no sense of notes or prompts or anything, he just, knows the stuff, and he just explains it beautifully. I mean he, you could watch that stuff all day long. Attenborough is the same. So there's, there's an infinite amount of documentary material. And I would watch a fair amount of that. Movies? I, I prefer to be entertained with movies. I think most movies now try to be too graphic, they don't leave enough to your

imagination, and so... But I actually enjoy romantic movies more, because they're, they're not full of violence and swearing which is, I mean, you can get on every channel every night, I mean, and in the real world, and, you want to be removed from that as far as possible. And I watch a lot of war documentaries, because so much more information is coming out on World War II, which I always read about when I was a teenager. And, I'm more and more glad that I missed World War II, because if you'd been born at the wrong time and got caught up in that, you stand a good chance of being dead. Because those romantic Spitfire pilots with a life expectancy of three weeks weren't really that romantic when you put it in that context. I still love the sort of, code-breaking issues, and, and some of that. And there's endless amounts of new documentation obviously coming, since the Eastern bloc opened up, lots of archive material, and especially film which wasn't available before, is now being shown. So you can really get a fuller impression of the, the, well not just the, the, the details of World War II, but the, the graphic horror of it, and, not, not that I watch it for horror reasons, but, just, to think that that all went on. And I was actually born, you know, a year before the end of the war, had my own gas mask I believe. [laughs] But, it, it has an immediacy, this wasn't that long ago, and all of that could happen. And, ironically could probably happen again, but under different circumstances.

And reading? That's watching, but...

Reading would be a mixture of... I still basically prefer factual reads, but I occasionally get seduced into Alexander McCall Smith. I know Edinburgh relatively well, and some of his, some of his books are just so charming. My memory is such that, I can read a book and within three or four months I can read it again and have almost no memory of it. And, that, that makes it quite nice, because as, as new books come out, you can actually go back and read all of his series again if you feel like it you know. So. So that would be probably a, an encapsulation of the, the sorts of things. But I do make excursions into what I call pre-read material. I actually like charity shops, I like pre-owned books, in other words, if you go to a major bookseller now, or go to Amazon, there are too many books. How do you choose? Whereas in a charity bookshop, you only have to select from maybe fifty, and somebody else has already bought them and discarded them. And then you've the advantage that, the

charity gets the money and then you give the book back to another charity shop and they maybe get money again. [laughs] So it has, multiple benefits.

[1:27:57]

And finally, could you say something about being interviewed for National Life Stories, your experience of it?

Oh, oh this? It's really, really quite intriguing. I am sort of used to, to relatively large amounts of informal speaking, because I, I do a lot of local society type talks. And, the other thing is that, by and large everything I'm doing is, is ultimately factually based, so it's not, it's not hard to stick to the storyline, because there only is the one storyline. It may be a very diffuse story, but there is only the one actual storyline. So it's fairly easy to, when you, when you're prompted to, to just, come out with what you, what you think. I think the only thing that you've really missed, and I brought out a few props, is that, when I was a child I would collect clay pipes and, and, things off field surfaces, and, when I, when I was first starting in archaeology I did a lot of field walking, particularly with Peter Woodman, and we unmasked massive amounts. The idea being that you were identifying objects and then you could put them on maps to show where activity had taken place in the past.

[1:29:32]

But, sometime in the late Sixties and early Seventies that morphed into an interest in old objects, and, I discovered that, I, I really, really liked antiques, but couldn't afford antiques, so that, by applying knowledge it was sometimes possible to pick up very interesting objects for very little money. And, so I just, I just looked out three objects I've had for many, many years. When we used to go up to Garry Bog in the 1970s, there was an antique shop about a mile and a half from Garry Bog, in a little cottage, and one day... We used to call in any time we were passing, because some of the other guys were also interested in, wooden bowls or bits of pottery and what have you. I was always interested in Chinese things. And one day the lady who owned the shop had bought a collection of snuff bottles, and, in the collection, there were about twenty snuff bottles, and they were nearly all brand new, except for one which is probably eighteenth century and it's a carved russet jade snuff bottle with baby dragons carved round the sides. And, what I loved about the whole exercise was, all of the snuff bottles were the same price. [laughs] So, although it cost £15, which in

1974 was, you know, mm, was a definite amount of money, I have a beautiful, probably eighteenth-century Chinese snuff bottle, picked out of mass of snuff bottles, and obviously under-appreciated by the, the antique dealer who, who owned them at that particular day. And that, that has intrigued me ever since, because, the Chinese in my view have the best taste in the world, I mean their, their workmanship and, and ceramics are unquestionably, in my view, world-leading. And, so, so there's a little Song pot. This is made about, roughly 1,000 years ago in China. And the nice thing about this one was, it wasn't buried with somebody and hence is now nearly the state it was in when it was new. This little pot has been used for, who knows what purposes, storage of some ointment or precious object or something, for probably the whole of that 1,000 years, and it is worn and crackled and... I bought that in Edinburgh, again in the 1970s, and that cost, well, I never told my wife what that cost, but it was an outrageous amount of money. Because it's just, to me it's one of the best objects you could conceivably imagine, it's just, nobody in Europe could make anything like that at the time, and, the Chinese have it, and somebody was using it for some utilitarian process, mhm.

[1:32:54]

And then, down the Lisburn Road that you walked up this morning, there's now a derelict site where there used to be an old furniture shop run by a Mr McCullagh[ph], and Mr McCullagh[ph] would clear houses for the furniture. And just occasionally he would find something in a house and, that little Chinese vase, which is late seventeenth century or just very early eighteenth century, in the reign of Kangxi, with that really peculiar café-au-lait coloured glaze, blue and white. It's effectively a water dropper, you would, a scholar would have used that at this table. That cost £1 about thirty years ago one day in Mr McCullagh's[ph] shop. And I've always kept it, not just because it's a lovely object, because it reminds me of, him.

For those not in the know, how undervalued is that at £1 thirty years ago? Just as...

Oh even thirty years ago it would have been, it should have been somewhere in the £50 to £100 range, yes. Mm.

And where did you get, where did you acquire the knowledge of, of Chinese pottery in order to be able to make decisions about what to buy? Given that your archaeology was, sort of, British-based in terms of field archaeology.

Queen's Library had a, had a wonderful selection of books of, of the world's leading collections of Chinese ceramics. And you just had to leaf through them and go, wow, look at that, you know, gosh I can see why, I can see why the King of Sweden owns that, you know. [laughs] So really, what you're doing is trying to emulate in a very small way collections that are, you know, held by the Metropolitan Museum or the V&A or what have you. So you, [laughs] you can have a collection like that, well, you know, what's it worth now? A few hundred pounds sort of thing. But it's, it's, it's the fact that they have so much taste, and were... Yeah. Yeah, yeah, just leave it like that. [laughs]

[End of Track 8]

[End of Interview]