AN ECONOMIC GEOLOGIST TURNS TO RADIOCARBON DATING

In the year or so following the adverse tenure decision on my behalf at the University of Arizona, my career path in the earth sciences took a new turn. I could scarcely have understood or believed the full implications at the time (and, even in retirement, I still marvel at the personal reinvention that ensued). One of my duties would turn out to be managing the Arizona Radiocarbon Laboratory, already a venerable laboratory, having begun operations in the 1950s. Of all the analytical services I would provide over the course of my career, radiocarbon dating would be the one that exposed me most to alternative systems of belief, and in a confrontational way.

In the USA, much of the confrontation arises with fundamentalist Christianity. Austin Long, whose laboratory I was managing, had prepared me for this situation with some of his "war stories". The creationists would look for opportunities to catch us off guard. He recounted a situation in which some sweepings of petrified dinosaur bones had been obtained by certain creationists, who submitted them to the Arizona lab in the hope that the lab would measure the radiocarbon content and come up with a result other than "too old to date". The best practice for the lab consisted in identifying such samples as unsuitable for dating because they were petrified, and refusing to accept them (or to waste resources trying to date them). Austin was, nonetheless, a tolerant and liberal man, and he served many years as editor or the *Radiocarbon* journal. In that capacity, he once undertook to consider a manuscript submitted by a creation scientist if the standards of investigation were defensible. The manuscript failed to live up to the most minimal of standards. To me (and I judge this on the basis of happening upon creationist talk radio while driving up Interstate Highway 5 in California), the creationists seemed to have an inconsistent attitude to radiocarbon dates. The dates ranging up to about 6000 years were acceptable, but not those over 6000 years. Why the method should work in the former range but not in the latter was something they might explain only by a labored interpretation of Scripture.

My exposure to creationist attempts to discredit radiocarbon dating turned out to be limited to the occasional email I would receive from a student who had probably been incited by a creationist teacher. The student, who would be working on a research paper, would try to conceal any leanings in the set of questions, but usually not very successfully. I eventually wearied of responding to such inquiries.

Paul Damon, the other senior scientist associated with the Arizona Radiocarbon Laboratory, counseled us never to accept for dating any material with religious connotations. The clients, he said, would simply ignore any results that failed to conform to their expectations. Nonetheless, the other radiocarbon laboratory at the University of Arizona, which measured very small samples on an Accelerator Mass Spectrometer, did undertake to date some religious objects over the years, notably the Shroud of Turin and the Dead Sea Scrolls. Samples of this kind did not come the way of the Arizona Radiocarbon Laboratory because we would have needed larger amounts of carbon than the Shroud or the scrolls could provide without impairment. In the case of the Shroud, the results (a Medieval date, consistent among three different laboratories) produced the expected disbelief and strained allegations of error from partisans who would have preferred a date from the time of Christ. The most intriguing response, however, came in Elmar and Holger (1995), *The Jesus Conspiracy: The Turin Shroud and the Truth about the Resurrection*, a book claiming that the Roman Church had conspired with scientists to concoct a Medieval date for the Shroud. This they would have done because the Shroud image showed evidence that Jesus was alive after the crucifixion; if the Shroud were accepted as genuine, it would demonstrate

that there had been no resurrection. If only people would put as much energy into more pressing matters!

In the end, I did allow myself to be coaxed into examining a sample that had religious significance for its Muslim owners. A man with an Arab name phoned me from Texas to ask whether I would consider dating artifacts with a connection to the Prophet Adam. The artifacts were in the possession of a relative of his in Saudi Arabia, and he told me that they included pieces of skin and bone. I take a metaphorical approach to scriptural stories like those in *Genesis*, so I was in no mood to consider his identification of the relics as likely. Nevertheless, I did agree to look at the material; perhaps I could tell the man why this wouldn't be an ideal project. Two of three months passed, and I had almost forgotten about the conversation. Then one morning, a small parcel with a return address in Texas was delivered to the laboratory. Over the years, I had developed an automatic reflex – judging a parcel by its weight – before opening it. This package clearly felt as though it wasn't going to contain datable organic matter. The contents proved to be a ceramic form that could have been none other than a penis, uncircumcised, possibly detached from a classical statue. The sculptor had fashioned it by rolling up some thin sheets of clay, with results that were realistic enough to draw a surprised response from a co-worker. (Later, I would joke with the rector at my Episcopal church about having held the fossilized penis of Adam in my very hand.) I returned the object to the Arab man in Texas, along with a note advising that the object was not datable, and asking exactly what he considered it to be. No response came.

The ceramic penis

Convincing non-scientist clients that material suitable for radiocarbon dating actually had to contain some carbon was a duty that came my way quite regularly. A large section of the population, including many collectors of antiquities, has very little grasp of chemistry, and my experience in the laboratory demonstrated the point glaringly. I responded to numerous questions about dating stone or metal objects that had been removed from their original contexts. However, explaining the chemistry was simple in comparison to getting them to understand that it is not possible to resolve radiocarbon dates in the interval AD 1650 to 1950 (a result of cyclic changes in solar luminosity during that period). So, for example, I had to try to convince a European client that it was most unlikely that he would get a useful result from dating a portrait of Beethoven. The client was indignant – a professor of art in Austria had recommended radiocarbon dating! I felt like putting my response more bluntly than I actually did – whom did he expect to know more about radiocarbon dating?

So to the topic of dating putative antiquities. Some radiocarbon daters see this as the underbelly of the "trade" and refuse to get involved in it. As far as I was concerned, it was a forensic service that certain clients needed for valid reasons. The group of potential clients inevitably also includes many who are dealing in objects obtained under questionable circumstances. I was able to examine some wonderful and genuine objects: a 6-foot wooden Buddha statue from Cambodia (it proved to be about 600 years old); a Siberian mammoth tusk (22,000 years old) that bore Chinese Buddhist carvings; a pair of wooden Japanese temple guardians in a house filled with beautiful Japanese art (the guardians had been repaired over time, and yielded a range of dates); a set of Shang Dynasty oracle bones in Beijing (the dating project didn't work out in that case) and numerous wooden carvings of humans and animals from Mali.

The carved mammoth tusk

The sculptures from Mali provided me with my one instance of expert witnessing. A dealer in San Diego suspected that a Malian importer was knowingly passing off recently-manufactured items as antiques. We tried a few tests on material the dealer sent from San Diego, and proceeded to a heated argument about the interpretation of the results (once again, the meaning of dates that would fall between 1650 and 1950). Eventually he obtained a second opinion that confirmed mine, and engaged me to spend a day in Los Angeles sampling most of the sculptures in the importer's warehouse in Los Angeles. Intuition suggested to me that I would receive little help in carrying out the sampling, so I set out on the early flight to Los Angeles equipped with drill, drill-bits, cameras, sample bottles, labeling equipment--everything I could think of including an extension cord and a blanket to rest the sculptures on. The list turned out to be comprehensive – the only thing lacking was a ¼ inch drill bit that I was able to purchase at a hardware store near the warehouse. My intuition about getting little help was correct. The atmosphere was cool to adversarial. The dealer, the importer, some art experts and others were all watching as I drilled shavings from the bases of at least 30 sculptures, photographing each with two cameras. The redundancy of cameras turned out to be crucial, because Austin Long inadvertently deleted all the shots taken with his electronic camera. About half of the objects proved to contain more than 100 percent modern carbon (pMC), showing that they had been sculpted from wood that had grown since about 1953, when atmospheric testing of nuclear weapons boosted carbon-14 levels in the atmosphere to more than 100 pMC. I swore to a court deposition to that effect, and the matter was closed for me.

Dating wooden carvings from Mali

The strangest interaction over a set of alleged antique objects came during my last two years on the job. A Mexican gentleman came to my office with a heavy box of artefacts that he said came from central Mexico. I had not seen anything like them before. They were models of human-like heads, surfaced with polygonal slabs of roughly-polished hard stone of different kinds. The man spoke no English, so I did my best to talk about the possibility of dating the objects in Spanish. He and his colleagues evidently believed they were in possession of a valuable set of cultural objects, and wanted to sell them for a great deal of money. I suspect that they themselves had paid a substantial sum for the collection. They had already engaged a laboratory in Europe to identify the surfacing rock-types, and were interested in knowing how old the pieces were. The man identified himself, but would not give more than an email address. Later, I would meet his nephew, who spoke English well. In the meantime, the Mexican gentlemen was most insistent about obtaining some radiocarbon dates. I pointed out that I could see little or no organic carbon on the samples. Over the course of the meeting, he gradually steered me towards the glue that held the eyes in place, while doing his best to make it seem like my idea to date the glue. I wasn't happy about the project, not least because some of the objects had been decorated with small pieces of what looked like five-and-dime cut glass "jewels"; for the moment I was prepared to entertain the possibility that these might have been recent additions. So I drilled out some glue, which looked weathered, but seemed too gummy to be very old, and agreed to look at it. I insisted on payment for an AMS date in advance; it would be all too easy for the disappointed owner of a non-antiquity to refuse to pay.

The glue turned out to contain both carbonate and gummy organic matter. I separated the latter for dating, and obtained a result of more than 5,000 years. The gentleman and his colleagues seemed delighted, despite my pointing out that no sophisticated Meso-American cultures of such age were known. That didn't seem to bother him and his colleagues at all, and they insisted on dating more objects. I agreed to try two more, using the eye-glue as before. This time, one of the dates was more than 10,000 years – and in fact would have stimulated debate on the timing of Native American occupation of North America. The third date was less than 5,000 years. Having three radically

different dates for objects of similar style of manufacture also didn't bother my clients. With three measurements, I was able to compare carbon-14 content with stable carbon isotope compositions. An imperfect correlation emerged, but one sufficient to suggest that the organic part of the glue contained a mixture of a modern organic substance, possibly derived from a C_4 plant such as maize, with a petroleum derivative. This led me to speculate that, by removing the carbonate, I had upset a three-component mixture contrived to yield a particular date.

I reported all of this in writing, with photos of the pieces and a graph showing the isotope correlation, to the clients. I don't believe that the clients had much, if any, understanding of my reasoning. As I wrote out my suspicions about the objects, a final realization came to me – the three heads I had studied had eyes shaped like those of Roswell aliens. The alien eyes were the final straw – I told the clients I wanted nothing more to do with the project.

That was not quite the end of the matter, however. I received an enquiry about my report from a commercial gallery in Vienna, and told them that I had indeed measured such dates, but that the owners of the objects should be asked to produce the entire set of reports. I found it difficult to believe that professional art dealers would countenance a date greater than 10,000 years for sophisticated Meso-American items, but apparently this consideration was not important. Finally, a few weeks later, a gallery in California asked me to look at some small pieces for potential dating. On their arrival, I found that they had clearly been manufactured by the same people who made the three heads I dated. The problem was fast becoming ethical. I could not break confidentiality with the original clients by telling the gallery owner exactly why I did not wish to waste their money on further radiocarbon dates. The best solution was to tell the California gallery that I did not wish to accept further work of that nature, and let them draw their own conclusions.

Late in 2025, the objects came to my attention yet again. An independent researcher in the USA contacted me asking for any insight I might have in interpreting carbon-14 dates from some unusual Mexican antiquities. The description of the objects in question immediately roused my suspicions. It turned out to be the same set of objects, with a similar relationship between radiocarbon content and stable carbon isotopes in a resinous glue. The owners appeared to be exceptionally tenacious in their desire to authenticate and sell the objects.

New Age belief also made a brief appearance in my vicinity. In certain cases, New Age belief seems to start out as partially-digested high-school science, which is subjected to layer upon layer of embroidered speculation tending in the direction of what the new-ager would like to believe. Some of the Geosciences graduate students would shamelessly exploit New Age beliefs about crystals at the Tucson Gem and Mineral Show. My encounter concerned environmental radiation. The reasoning seemed to go something like this: "Radioactivity is bad. Therefore I need to remove it from my drinking water." The timid-sounding caller on the phone wanted to know how he could get spring water that contains no carbon-14. I pointed out that such water existed, but what was the point of seeking it out when food (or at least, wholesome kinds) contains much higher amounts of carbon-14? I also briefly mentioned radioactivity in potassium dissolved in spring water, and tritium in rainwater. Austin Long later told me he had had the same enquiry earlier that day; apparently the person wanted a second opinion.