A physicist's discovery begins an extraordinary odyssey through pride and prejudice in the scientific world.

MYSTERY IN THE ROCKS

By Dennis Crews

The early 1960s was a time of unclouded promise for many American college students. Industry was booming, the infamous war in Indochina had not yet ground itself into public consciousness and civil rights uprisings were the concern of only a principled few. Young professionals ascended by thousands into the American dream, while visions of a home in suburbia, a new car in the driveway and the promise of a comfortable retirement beckoned still more thousands of new graduates into the mainstream.

In this setting, quests for truth and justice seemed the stuff of history and Hollywood hype; the melodrama of moral odyssey paled beside the lure of financial success and professional recognition. But every age is redeemed by its own few who are driven by something other than the urge to get ahead, and Robert Gentry was one of those individuals. Not that he saw himself as any kind of hero—such people never do—but his feet were destined for the high and lonely path where truth and trial intertwine.

Gentry was a graduate student in physics. His analytical mind thrived on certainties. Though he considered himself a Christian he was not much troubled by the strident war between creationists and evolutionists. All through his schooling he had reconciled the seemingly incompatible concepts of science and religion by crediting God as the force behind the big bang, that primal explosion scientists believe started the motor of the universe. Was it really possible to know with any certainty what else might have happened so long ago?

One factor above all others seemed to place the time frame of evolution beyond serious doubt. That factor was radioactive dating—a technique scientists use to determine the age of objects in the natural world. The principle behind radioactive dating is simple. Many rocks contain traces of radioactive elements, which are in the continual process of decaying into lead, a non-radioactive end product. It is possible to measure both the amount of a given radioactive element and the amount of lead resulting from that element in a rock. Scientists correlate the ratio of these two amounts with the known decay rate of that element, to find the period of time that has elapsed since the rock was formed. (Decay rates are calculated by the half-life—the time it takes for half the atoms in a given element to decay.) Many scientists rest their proof of the earth's age upon radioactive dating of rocks that are thought to be associated with the formation of the earth itself.

After acquiring his master's degree in physics Gentry staked out a promising career in the defense industry, working first for Convair (later to become General Dynamics) and then for Martin-Marietta Corporation, researching nuclear weapons effects. By now he was married to an intelligent, pretty math major named Pat, and had a good slice of the American dream within sight. In the summer of 1962 he was awarded a National Science Foundation Fellowship to attend the Oak Ridge Institute of Nuclear Studies in Tennessee. Fall of the same year found him working toward his Ph.D. at Georgia Institute of Technology.

Gentry's fascination with nuclear physics kept bringing one question persistently to his mind. It had always been assumed that decay rates of various radioactive elements had remained constant since the beginning of time—since the big bang, as his fellow scientists believed. Was this a valid assumption? Nobody even knew if physical laws prevailed before that event. Did they spring into existence fully stabilized? His university physics courses treated the uniformity of decay rates as self-evident truth, but nobody had seriously examined that assumption. If the decay rates had ever fluctuated, Gentry realized, the earth might not be as old as scientists believed. Could past uniformity of decay rates be proven?

In graduate school Gentry began studying radioactive dating techniques more closely. As he

reviewed past work in the field, he was fascinated by a specific area of research that once seemed to hold much promise in the field of radioactive dating, but had received little attention for the past two decades. It had begun in the late 1800s when improved microscopes became available. When thin, translucent slices of certain minerals were examined under high magnification, some of them were discovered to have tiny dots imbedded in them, surrounded by concentric, colored rings. Further study revealed that each set of rings was actually the cross-section of a series of spherical shells, like the layers of an onion, surrounding a tiny grain of a different mineral. Scientists first called the rings pleochroic halos, after their property of exhibiting different colors when viewed from different directions by transmitted light.

For a time mineralogists thought that an organic pigment might have been trapped in the rocks when they were formed, eventually diffusing out into the surrounding matter to form the halos. But nobody knew what that pigment might be, or could explain how it formed multiple halos. The phenomenon remained a minor scientific mystery until around the turn of the century, when uranium and certain other elements were discovered to be radioactive.

The man who unlocked the secret of pleochroic halos was Professor John Joly of Trinity College in Dublin. Joly had done extensive study on halos in biotite (a type of mica commonly found in granite), and realized that diffusion of pigments was not adequate to explain the sharply defined edges of the concentric rings, or the regularity of their sizes. In 1907 he began to consider an origin for the halos that could never have been postulated only a few short years before—radioactivity. By that time scientists knew uranium to be the initial member in a series of radioactive elements. Uranium eventually decays into another element (called a daughter element), which in turn decays into another daughter element, and so on down the line until finally only lead remains as a stable end product.

Joly understood that uranium and its radioactive daughter products decay in one of two ways: by emitting either beta particles, which are very light; or alpha particles, which are much heavier. Emitted beta particles harmlessly bounce around the molecular interior of matter like tiny ping-pong balls until they finally come to rest, but the heavier alpha particles blast their way through matter like bullets. A single alpha particle will ionize about 100,000 atoms along its line of travel before being spent, leaving a microscopic damage trail behind it. Single particles firing off from uranium atoms dispersed randomly through a rock would have little discernable effect on it, but billions of atoms clustered in a grain of uranium enclosed within another rock could, Joly realized, leave a distinct signature within the host rock.

Alpha particles emitted from the uranium would all come to rest about the same distance from the center of the inclusion in all directions, Joly believed, producing a spherical damage field. Could this be the cause of pleochroic halos? Several crucial bits of information would resolve the question, and Joly set out to find them. Did the halo sizes correspond to the distances alpha particles would travel in mica?

His research was fruitful, for it demonstrated not only that the sizes were correct, but that the number of rings surrounding certain of the particles corresponded with the number of alpha-emitting members in the uranium series decay chain.

In the years following Joly's discovery many more scientists began studying radiohalos, as they began to be called. Physicists believed they held information that could lead to a better understanding of radioactive phenomena—of decay rates in particular. Geologists studied them in hopes of finding an accurate method by which to determine the age of geologic formations.

Since there seemed to be several distinct halo types, Joly believed radiohalos had ring sizes that varied with age, which implied that radioactive decay rates had once been different from the present rate. Later researchers found that various alpha emitters in the decay chain created rings of different sizes, depending on their alpha energy. Yet many unanswered questions about radiohalos remained. Unfortunately, two world wars and other more pressing kinds of research intervened, sweeping radiohalos off to the periphery of scientific inquiry. For many years they received little further study.

Robert Gentry was destined to pick up the trail of investigation where it had been dropped years before. His interest in the subject of radioactive dating was keen and his training equipped him for the research. Scientists thrive on mysteries, and here was an unsolved one just waiting for somebody to notice it. Certain halos had been found with different characteristics from the others. What was their significance?

After several months of preliminary study on radiohalos Gentry concluded that modern research technology would reveal much more useful information than had been found in the halos years before. They were a well-documented phenomenon, ideally suited to his academic specialty. He discussed the subject with the physics department chairman at Georgia Tech, suggesting that his preliminary study on radiohalos be expanded into a doctoral thesis.

Suddenly Gentry found himself facing a kind of obstacle for which none of his scientific training had prepared him. The department head felt that present dating techniques were beyond question, and held no hope that anything new might be discovered about radiohalos. Furthermore he was not willing even to let Gentry try. The professor finally admitted his fear that if Gentry's research actually succeeded in finding anything which called conventional dating into question, it might bring embarrassment to the university and its faculty. Gentry would have to find a more conventional thesis topic if he planned to continue his doctoral program at Georgia Tech.

The chairman's decision came as a crushing disappointment. It seemed more like a relic of medieval prejudice than an example of academic integrity. However since a year's grace period had been provided for him to finalize his decision, Gentry decided to spend the time doing his own research on radiohalos. That summer he traveled to Dalhousie University in Halifax, Nova Scotia, where the late physicist G.H. Henderson had conducted a decade-long study of radiohalos in the 1930s.

Even though most of Henderson's specimens had been lost over the years, the physics department at Dalhousie was successful in finding a few. In addition, the geology department lent Gentry many fresh specimens of mica from their museum collection for longer-term study. He returned to Atlanta and began to examine the samples.

By the end of the grace year he was more certain than ever that radiohalos held crucial information and must continue to be researched. Unfortunately, the physics department chairman at Georgia Tech was unyielding. Radiohalos would not be considered an acceptable subject for a doctoral thesis. The American dream dwindled on the horizon as Gentry contemplated his alternatives. Would he surrender to pressure from the academic establishment, or pursue his own course? Offsetting his disappointment with the conviction that his research would someday vindicate him, Gentry laid his doctoral program aside and withdrew from the university.

Independent research is costly and difficult apart from the sophisticated laboratory facilities of a modern university, but Gentry was persevering. In a makeshift laboratory at home he began to study all the radiohalo specimens he could find, funding his research by working as a substitute high school math teacher. Patiently and meticulously he gathered data and catalogued the specimens according to type and quality.

Henderson had named the anomalous halo types he had observed A, B, C and D halos. Of all the halo types that had been documented, the ones that commanded Gentry's attention first were the ones most different from the others. The D halos were smaller than the others, with only a single fuzzy disc instead of a series of rings. Gentry split D specimens so that the halo centers were on the surface, then poured a special liquid photographic emulsion over the surface. When the emulsions were developed after a time and inspected microscopically, tiny alpha-emission trails were found radiating from the centers. This demonstrated that the centers were not extinct at all, but still radioactive.

Further research indicated that the D halos were simply uranium halos in early stages of development. It was a previously unknown but rather unsurprising bit of information, since the half-life of uranium-238 is calculated to be 4.5 billion years. Next Gentry turned his attention to the A, B and C halos. Henderson had believed these halos to be caused by alpha radioactivity from three isotopes of the element polonium, all members of the uranium decay chain. He theorized that some time in the past, water or some other solution containing uranium and its daughter elements must have flowed through tiny cracks in the rock and enough polonium had accumulated at certain points along the way to form halos. He had suggested that his hypothesis for this secondary mode of halo origins be tested, but World War II had intervened and the research was dropped.

Gentry's measurements confirmed that the rings were indeed produced by radioactivity from polonium isotopes. But the more he studied the specimens, the greater problems there seemed to be with Henderson's hypothesis for their origin. Close examination revealed many halos in solid areas that were free of any fissures or pathways by which radioactive atoms could have penetrated the rock. Further, there was no discoloration or any other typical evidence of uranium having flowed through the rock previously. Ultra-sensitive testing detected only minute traces of uranium in the surrounding rock—the same amount that existed throughout all mica specimens.

At last, all attempts to confirm Henderson's theory of a secondary origin for the polonium halos failed. Emulsion tests had shown the radioactivity of polonium halo centers to be extinct, which was expected from isotopes with such brief half-lives as polonium. For Henderson this had posed no great problem—but now that he had disproven Henderson's hypothesis, a profound new dilemma appeared. Polonium atoms decayed so rapidly there was no conventional way to account for their having existed in the rock at all.

The longest-lived polonium isotope, polonium-210, has a half-life of 138.4 days. Two beta-emitting

elements precede polonium-210 in the decay chain, the longest lasting of which has a half-life of 22 years. If either of these parent elements were deposited in rock, the halo would begin to form as soon as the beta-emitting parents had decayed into polonium, an alpha-emitter. Polonium-214, which has a half-life of 164 microseconds, is preceded by two beta-emitters with respective half-lives of only 27 and 20 minutes. And polonium-218 has a half-life of just three minutes—with no beta progenitor at all. Thus polonium-218 would have to be deposited inside solid rock the same moment it came into existence, in order to form a halo. Now he clearly saw why Henderson had suggested a secondary mode of origin for polonium halos.

To find radiohalos in granite caused by such short-lived isotopes as polonium was an utter scientific paradox, he realized. Why? Radiohalos can form only in solid rock. Much of the granite encasing the polonium halos was Precambrian, which is believed by most scientists to have taken millions of years to cool from its molten state. Since so few of the rocks which encased the halos had clefts or passages by which polonium atoms could have entered, the polonium had to have existed from the very formation of the rock itself. Yet polonium isotopes have an extremely fleeting existence, and would decay away long before even a small chunk of molten granite could cool and solidify. Was this the kind of discovery the head of the physics department had feared he would make?

All the evidence indicated that the polonium had originated concurrently with the formation of the granite itself. Yet if it had, according to conventional science it quickly would have decayed away, and in the molten primordial mass its telltale halos never would have formed. Was it irresponsible to consider that the tiny radiohalos—a minor, overlooked mystery for so many decades—might be evidence of instantaneous creation locked into the earth's crust? And of crucial importance—was it possible that he had overlooked something that could provide a more conventional explanation for the halos?

The most reliable way to find if there was something he had overlooked, Gentry realized, was to subject his findings to scrutiny by other scientists. By late 1965 he had amassed enough data from his own research to submit the results to *Applied Physics Letters,* a professional journal known for publishing late-breaking physics news. Gentry cautiously tested the waters by first submitting a simple report on some abnormally large halos he had studied. The report passed peer review and was published early in 1966.[1]

Somewhat emboldened by his initial success, Gentry submitted another report to the same journal, this time speaking more freely about polonium halos. Near the end of his manuscript Gentry was candid enough to suggest that conventional science was not adequate to explain their origin in the rocks: "...it is difficult to reconcile these results with current cosmological theories which envision long time periods between nucleosynthesis and the earth's crustal formation. It is suggested these halos are more nearly in accord with a cosmological model which would envision an instantaneous fiat creation of the earth."[2]

Such an obvious reference to special creation was doomed from the start. The manuscript was returned to Gentry, along with a critique by one of the referees on the review panel. The reviewer commended Gentry's workmanship but was offended by his suggestion that instantaneous creation offered a plausible explanation for the halos' presence in the rocks: "...In one blow he implicitly rejects all the carefully accumulated evidence of decades which is in complete conflict with his remarkable conclusion. He is undoubtedly well aware of the findings of the modern science of geochronology. The scientific approach would be to use all these results to his advantage and try to find a possible explanation...I regard the reasoning displayed in this manuscript in its present form as unworthy of publication."[3]

After the blustery rebuke, however, the reviewer tacitly acknowledged the significance of Gentry's research by suggesting that his findings might be appropriate for publication in the prestigious British scientific journal *Nature*—"minus any wild speculation" that would dispute evolutionary cosmology. This was cheering evidence at least that his experimental observations were being taken seriously. It was obvious that all references to instantaneous creation would have to be omitted if Gentry planned to continue publishing papers on his work. Formulating a hypothesis to explain the halos' presence in the rock would be standard practice if the hypothesis were in harmony with popular assumptions, but all Gentry's data pointed to highly unconventional conclusions. Perhaps it would be better to just show the evidence and let his fellow scientists draw their own conclusions.

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[1] Robert V. Gentry, 1966. "Abnormally Long Alpha-Particle Tracks in Biotite (Mica)." *Applied Physics Letters*, Vol. 8, p. 65

[2] Gentry, 1986. *Creation's Tiny Mystery*, Chapter 3. Knoxville: Earth Science Associates

[3] Ibid.

Before revising his manuscript and submitting it to *Nature,* Gentry had the opportunity to present the results of his work on polonium halos to a gathering of scientists at the 1966 annual meeting of the American Geophysical Union in Washington D.C. This event proved to be pivotal for Gentry's future, for through it his work became known to Columbia Union College in nearby Takoma Park, Maryland. An invitation was extended for him to affiliate with the school. Gentry gratefully accepted, and by the summer of 1966 was able to work in a well-equipped laboratory again. Perhaps even more gratifying than the laboratory was the support and encouragement of the science faculty at CUC.

It wasn't long before he had accumulated enough experimental data to revise and expand his first manuscript on polonium halos. By omitting all references to creation, the paper successfully passed peer review. Titled "Extinct Radioactivity and the Discovery of a New Pleochroic Halo," it was published in *Nature* early in 1967.[4] *Earth and Planetary Science Letters*, an international science journal, published a similar paper in Amsterdam.[5]

Gentry's research on polonium halos had such troubling implications for evolutionary chronology that it was necessary to exhaust every possibility of a conventional explanation for their existence. The possibility of a secondary origin for the halos haunted him, and he determined to pursue this line of investigation as far as he could.

A new technique for the examination of alpha-recoil pits in mica had been developed recently which enabled Gentry to conduct another series of experiments. The technique involved etching mica specimens with acid to enlarge the tiny damage pits made by alpha particles, so the pits could be examined by microscope. All mica specimens contain trace amounts of uranium and thus have a low background density of alpha-recoil pits. But if a solution containing uranium had flowed through a rock in amounts sufficient to leave polonium deposits behind, that specimen should have a higher background density of uranium alpha-recoil pits than a specimen which contained no polonium halos.

A long series of experiments using this technique finally showed no difference in the density of background alpha-recoil damage between specimens with polonium halos and specimens with none. This research provided yet another piece of evidence against the secondary origin of polonium halos, and was of sufficient importance to form the basis of another paper which Gentry submitted to the journal *Science.* The first draft of Gentry's report concentrated on the results of his experiments, with little or no mention of any cosmological implications.

One of the two referees who were chosen to evaluate the manuscript approved it for publication, but the other felt Gentry had not provided sufficient explanation for the origin of the halos. This raised a prickly dilemma, for it seemed that speaking truthfully might turn the referees against Gentry. But in a revised manuscript he plainly stated "the experimental evidence indicates the inclusions [centers] of the polonium halos contained the specific alpha emitters responsible for the halos...at the time when the mica crystallized, and as such these particular halos represent extinct natural radioactivity."[6]

The second reviewer objected to this statement, saying that Gentry had proposed a contradictory argument—and rejected the manuscript for publication. Gentry's statement did contradict popular assumptions, but it also happened to be the only explanation possible according to the data his research had uncovered. Since the referee had been unable to fault his experimental data, Gentry was able to request further consideration. After negotiating with the editors of *Science* they agreed to let the manuscript be revised again and assigned two new referees.

By now it seemed Gentry was picking his way through a philosophical minefield. In the next revision he avoided statements that might be seen as a contradiction of prevailing views, and instead veiled the implications of the polonium halos in a series of questions. The third reviewer approved the manuscript for publication, but the canny fourth immediately suspected the final significance of Gentry's research. In his review of the manuscript he wrote, "Does he mean to imply that current cosmological (and geological) theories are possibly so wrong that all of the events leading from galactic, or even protosolar necleosynthesis to the formation of crystalline rock minerals could have taken place in a few minutes?"[7]

Indeed, that was exactly what he meant to imply! He was gratified that the experimental data spoke so plainly the reviewer had not missed its implications. Yet this same reviewer somehow felt that Henderson's hypothesis for a secondary origin of the polonium still must be correct—the alternative was simply too unconventional for him to accept.

[4] Gentry, 1967. "Extinct Radioactivity and the Discovery of a New Pleochroic Halo," *Nature*, Vol. 213, p. 487.
[5] Gentry, 1966. "Alpha Radioactivity of Unknown Origin and Discovery of a New Pleochroic Halo," *Earth and Planetary Science Letters*, Vol. 1, p. 453.
[6] Gentry, 1986. *Creation's Tiny Mystery*, Chapter 3. Knoxville: Earth Science Associates.
[7] Ibid.

Gentry's paper was so carefully written yet the data was so puzzling that finally the reviewer did a highly unusual thing—he broke his anonymity and invited Gentry to contact him personally to discuss the manuscript.

When Gentry telephoned the reviewer, who turned out to be a world-renowned authority on radiometric dating, he cut to the point immediately by asking Gentry's opinion about the origin of polonium halos. Much to his relief the reviewer didn't dismiss him when he candidly admitted believing the halos to be evidence for creation. Instead, the expert plied Gentry with incisive questions. After an hour the reviewer was sufficiently impressed with the evidence to suggest certain experiments that would enable him to further evaluate Gentry's work and its implications.

Though it may have seemed like a temporary setback, this turn of events proved fortuitous. The experiments suggested by the reviewer required research equipment not available at Columbia Union College, and in the search for adequate facilities Gentry contacted a scientist friend, John Boyle, who worked at the Oak Ridge National Laboratory. Through Boyle's intervention Gentry was able to acquire the use of Oak Ridge's facilities for his experimentation. This early work began what would eventually become a long and profitable relationship with the Oak Ridge National Laboratory.

When the experiments were complete and the manuscript revised yet again, Gentry visited the reviewer at his own laboratory. The careful but fair-minded scientist made a thorough study of Gentry's research results and concluded that there was more significance in the polonium halos than first met the eye. He was still mystified by the lack of evidence to support a secondary origin for the polonium halos, but finally approved the manuscript for publication—on the condition that it make no reference to the possibility that the halos originated with primordial polonium. The article, "Fossil Alpha-Recoil Analysis of Variant Radioactive Halos," was finally published in the June 14, 1968 issue of *Science.*[8]

Gentry's research on radiohalos had familiarized him with a number of other unusual halo types for which no specific causative element could be determined. Because of their rarity and unusual sizes it was thought that they might have originated with an unknown type of radioactivity. When the U.S. Atomic Energy commission became aware of Gentry's research on these dwarf and giant halos, he was invited to give seminars on his work at the Lawrence Radiation Laboratory and at Oak Ridge National Laboratory, where scientists were conducting an intensive search for superheavy elements. Eventually he was invited to affiliate with Oak Ridge National Laboratories as a guest scientist. The initial one-year invitation ultimately stretched to thirteen years, and provided incalculable benefits for Gentry's own research as well.

The sophisticated facilities at ORNL greatly accelerated Gentry's study of polonium halos and before long more of his work was in the literature. After a second article in *Science,*[9] a report on his investigation of lunar rock samples was published in *Proceedings of the Second Lunar Science Conference.*[10] Then came another significant finding.

Advanced mass spectrometry techniques enabled Gentry to discover that the tiny radiocenters of polonium halos were composed of a type of lead different from any previously known. The new type of lead, greatly enriched in certain isotopes, could not be accounted for by uranium decay, but only by the decay of polonium. This was another stroke of evidence against secondary origin for the halos, and formed the basis for a third paper published in *Science.*[11] This discovery attracted more attention than any previous report, and soon Gentry was invited to contribute an article on radioactive halos to the 1973 *Annual Review of Nuclear Science.*[12]

About this time a colleague of Gentry's privately suggested that an uncommon isomeric form of radioactivity had caused the polonium halos. Gentry investigated this hypothesis using mass spectrometry techniques and found no experimental evidence to support it. The results were published in *Nature* in August of 1973.[13] By this time Gentry's credibility had been established sufficiently enough for him to suggest there might be cosmological implications in the existence of polonium halos. The *Nature* article carefully stated: "...assuming that Po was incorporated into the halo inclusion at the time of host mineral crystallization meets with severe geological problems: the half lives of the polonium isotopes are too short to permit anything but a rapid

[8] Gentry, 1968. "Fossil Alpha-Recoil Alalysis of Certain Radioactive Halos." *Science*, Vol. 160, p. 1228.

[9] Gentry, 1970. "Giant Radioactive Halos: Indicators of Unknown Radioactivity?" *Science*, Vol. 169, p. 670

[10] Gentry, 1971. "Radioactive Halos and the Lunar Environment." *Proceedings of the Second Lunar Conference*, Vol. 1, p. 167. Cambridge: MIT Press.

[11] Gentry, 1971. "Radiohalos: Some UniquePb Isotope Ratios and Unknown Alpha Radioactivity." *Science*, Vol. 173, p. 727.

[12] Gentry, 1973. "Radioactive Halos." *Annual Review of Nuclear Science*, Vol. 23, p. 347.

[13] Gentry, 1973. "Ion Microprobe Confirmation of Pb Isotope Ratios and Search for Isomer Precursors in Polonum Radiohalos." *Nature*, Vol. 244, No. 5414, p. 282.

mineral crystallization, contrary to accepted theories of magmatic cooling rates."

Suggesting a rapid formation of the earth's oldest rocks, Gentry knew, would be highly provocative to many of his colleagues. Statements like this invited other scientists to refute his research if it could possibly be done. It didn't take long for several to rise to the challenge. In the June 22,1973 issue of *Science* three scientists attempted to put Gentry in his place by suggesting that polonium halos did not really exist at all: "We cannot definitely rule out the existence of polonium halos, but it appears that there is no evidence requiring, or even firmly suggesting, their existence. It was realized very early that their existence would cause apparently insuperable geological problems since the relevant polonium half-life is of the order of minutes. Polonium halos would require that the polonium atoms become part of the inclusion within minutes of the formation of the polonium and that in this very short time the polonium must be so far removed from the parent uranium mass that its presence or location is no longer evident."[14]

The issue was open now for all to see. These scientists had identified the very root of the problem, yet in their haste to protect popular assumptions preferred, ostrich-like, to believe that polonium halos were not really there. Later in a review of another of Gentry's articles *Research Communications Network* noted: 'To date there has been only one effort to dispute Gentry's identification of polonium halos. As it turned out, that effort might better never have been written, the authors having been impelled more by the worry that polonium halos 'would cause apparently insuperable geological problems,' than by a thorough grasp of the evidences..."[15]

Gentry next turned his attention to polonium halos in fluorite, a crystal that occurs in granite. Clear areas in fluorite crystals are even more impermeable to fluid infiltration than those in mica, which has a laminar structure. The halos in fluorite proved virtually identical to those in mica. This discovery fueled another article[16] which was published by *Science* in early 1974 and provided still more evidence against a secondary origin for the polonium halos.

Gentry's position at Oak Ridge permitted him to use a variety of advanced tools and techniques in his experiments, including particle accelerators, mass spectrometers, scanning electron microscopy and x-ray fluorescence analysis. As his research continued to close one door after another on alternative explanations for polonium halos, his articles in various scientific journals became more specific in their suggestion that conventional geologic timetables might need revision.

For several years only a few scientists ventured to challenge the results of Gentry's research. Of those who did, most were unfamiliar with other phases of his work which already answered their objections. Gentry remained his own most tireless critic, carefully exploring every step of his research for new data that would explain polonium halos according to conventional geological and cosmological models. With each ensuing experiment no such data appeared, however. The only apparent explanation for the halos remained the one Gentry had suspected from the very beginning—special creation.

The critics' silence was not to last indefinitely. While many of his colleagues were still trying to divine the significance of his carefully worded conclusions, one sagely prophesied, "Gentry can be sure that, in pressing his own decidedly radical explanations, the sound and fury lie yet before him."[17] It was only a matter of time.

In 1976 Robert Gentry published the results of a new round of research that drew unprecedented attention to the implications of his earlier work. He had long puzzled over the possibility of secondary polonium halos. If any existed, it seemed they would be found in a place where uranium was abundant, and in a substance whose internal structure would permit rapid infiltration and transport of a uranium-rich solution and which contained microscopic capture sites for polonium atoms to accumulate.

No material seemed more ideally suited to the special requirements of secondary halo formation than wood. Gentry was reminded of some specimens of radioactive wood he had heard of a few years earlier. A bit of sleuthing revealed that partially coalified pieces of wood, some as large as logs, had been found in several uranium mines in the western U.S. Gentry was finally able to obtain some samples of the wood and began studying them.

Microscopic examination of prepared specimens revealed an abundance of uranium halos in the wood. The evidence suggested that prior to coalification the wood had been in a water-softened condition, permitting the infiltration of water-borne uranium. Uranium atoms had accumulated in capture sites scattered through the wood and secondary halos had formed around the capture sites. Since enough

[14] C. Moazed, R. M. Spector, R. F. Ward, 1973. "Polonium Halos: an Alternate Interpretation." Science, Vol. 180, p. 1272.

[15] S. L. Talbott, 1977. "Mystery of the Radiohalos." Research Communication Network, Newsletter No. 2.

[16] Gentry 1974. "Radiohalos in Radiochronological and Cosmological Perspective." Science, Vol. 184, p. 62

[17] Talbott, op. cit.

uranium had been deposited in the wood to create halos, Gentry thought, perhaps there would be secondary polonium halos as well.

Gentry's hunch paid off. After painstaking examination, certain of the coalified wood samples revealed polonium halos in even greater numbers than uranium halos. Several unusual facts seemed to stand out, however. First, every polonium halo in the wood was from the isotope ^{210}Po— not a single halo could be found from ^{214}Po or ^{218}Po. Suddenly it made sense. The ^{210}Po isotope had a half-life of 138 days—long enough to be filtered out of the uranium solution and accumulate in the capture sites. The two other polonium isotopes, with half-lives of minutes or less, simply decayed away before they could accumulate in the capture sites.

This was a crucial discovery. Natural circumstances could hardly be more favorable for the formation of secondary halos than they were in the wood specimens. Uranium was abundant, and the porosity of wood afforded ideal opportunity for its infiltration. Even under such optimum conditions, however, only one halo type had been able to form. In contrast, all three halo types were profusely scattered through solid rock—where no significant amounts of uranium existed and where permeability was virtually nil. This was most compelling evidence that the halos in the rock could not be of secondary origin.

The second oddity was that most of the secondary polonium halos found in the wood were not perfectly round, but elliptical. This indicated that the halos were formed while the wood was still in a soft condition, before it was compressed by the weight of overlying sediment. After careful analysis it was found that the elliptical polonium halos in wood specimens taken from three different geological strata—Triassic, Jurassic and Eocene—were virtually identical. Evidence suggested that all the specimens had been infiltrated with the same uranium-bearing solution during a single event.

These findings had disturbing implications for conventional geochronology. The Triassic, Jurassic and Eocene formations are thought by most scientists to have been deposited tens of millions of years apart, but the elliptical halos showed that the wood specimens from each strata had been in a soft, porous condition, uncompressed by overlying sediment, and equally exposed to the elements at the time of infiltration. The simplest scenario to account for their infiltration would be a major flood which uprooted trees, soaking them in water which had absorbed large amounts of uranium from nearby ground deposits, and finally compressing them between layers of sediment. A flood like the one described in the biblical book of Genesis would have done just that.

During his investigation Gentry was puzzled to discover a small number of dual polonium halos in a few of the specimens. In these an elliptical halo was superimposed with a circular one, surrounding the same center. How did the dual halos form? The most likely cause, Gentry realized, was a second infiltration of a uranium-bearing solution occurring soon after the first, while the wood was still soft and porous. The centers of the polonium halos caused by the first infiltration would have an affinity for a uranium daughter, ^{210}Pb, introduced in the second infiltration. This element decays with a half-life of 22 years to ^{210}Po, which in turn would form a second halo.

If the wood remained intact for the duration, both halos would overlap perfectly and appear as one. If the wood were crushed or deformed after 22 years then the overlapping halos would be compressed into an elliptical shape together. But if deformation of the wood happened within just a few years of the second infiltration, then only the first halo, which had already formed, would be compressed. In 22 years the second halo would form a perfect circle around the flattened first halo.

Here was the answer to a question Gentry had not even asked yet: how much time had passed between the formation of the halos and compression of the wood? Geochronology based upon the uniformitarian principle, encompassing tens and even hundreds of millions of years, would be utterly confounded by the brevity of time suggested by the data at hand. The evidence was compelling that only a few years at most had elapsed between the first infiltration of the wood with uranium and the time when it was compressed by overlying sediment. Taken all together, the facts supported no other geological model as strongly as the Genesis flood account.

After amassing this large body of new data Gentry and several colleagues summarized their findings in a collaborative report published by *Science*.[18] The published data showed a clear distinction between the secondary halo type found in coalified wood and the multiple, primordial halo types found in granite. In careful but unmistakable language the report questioned conventional geologic age dating as well as the uniformitarian interpretation of the entire geologic column. It was a challenge that seemed to demand a response from the scientific community.

[18] Robert V. Gentry et al, 1976. "Radiohalos in Coalified Wood: New Evidence Relating to the Time of Uranium Introduction and Coalification." Science, Vol. 194, p.315

Curiously enough, it was an unexpectedly sympathetic figure who first responded to these findings. Soon after publication of the *Science* report Gentry received a letter from Raphael Kazmann, professor of civil engineering at Louisiana State University. He frankly expressed admiration for Gentry's work: "I have been patiently scanning the letters' section of *Science* since the publication by you and your colleagues of your findings on radiohalos. The silence is deafening—I think it can be described as 'stunned silence'.... We are indebted to you and your colleagues for your painstaking observation, the careful wording of your paper, and the courage you have manifested in presenting evidence that contravenes the conventional wisdom of the geological profession."

In a follow-up letter Kazmann informed Gentry of a conference being planned by LSU on the age of the earth. The symposium, which dealt with various aspects of time measurement and the age of geologic formations, was held in April of 1978. Gentry, along with four other speakers, was invited to make a presentation. A report of the proceedings was written by Professor Kazmann and published subsequently in *Geotimes,* a monthly publication of the American Geological Institute,[19] and *EOS,* a weekly publication of the American Geophysical Union.[20] Kazmann's report eloquently summarized both the substance and implications of Gentry's research and brought it before a much larger segment of the geological community than had been aware of it until that time. It also jolted the scientific community out of their "stunned silence."

A letter by the eminent geochronologist Paul Damon, published by EOS, began the rejoinder: "I was dismayed by Raphael G. Kazmann's conclusion...that essentially casts in doubt the entire science of geochronology, on the basis of an absurd interpretation of the origin of 'polonium' halos in minerals observed by Robert Gentry."[21] Damon could not easily argue with the existence or even Gentry's identification of the polonium halos, but objected primarily to his association of the halos with primordial polonium rather than secondarily derived polonium, and to his identification of Precambrian granite as earth's Genesis rocks.

In order for any hypothesis to be considered scientifically tenable Gentry knew that it must theoretically be capable of being falsified; in other words, there must be some objective way to prove, using known physical laws in a controlled experiment, if it is false. Failure to prove a hypothesis false by such a test would not necessarily constitute proof that it was true, but would validate it as a credible hypothesis. One major objection to the concept of special creation had always been that since known physical laws were not adequate to account for the event it was considered unfalsifiable and consequently, unscientific. Since Gentry was suggesting publicly that halos in granite were caused by primordial polonium, it was imperative to establish a practical falsification test for his hypothesis.

It occurred to Gentry that there was a test that could establish the soundness of his hypothesis. If the uniformitarian principle were true, the physical processes that governed the crystallization of ancient granites would operate in the same fashion today. And if they did, it should be possible to duplicate the process of granite formation in a modern scientific laboratory. On this basis, he responded to Damon: "...I would consider my thesis essentially falsified if and when geologists synthesize a hand-sized specimen of a typical biotite-bearing granite and/or a similar size crystal of biotite. I will likewise relinquish any claim for primordial ^{218}Po halos when coercive evidence (not just plausibility arguments) is provided for a conventional origin—and in this respect I will consider my thesis to be doubly falsified by the synthesis of a biotite which contains just one ^{218}Po halo (some of my natural specimens contain more than 10^4 Po halos/cm^3)."[22]

Such a test is reasonable since the basic chemical elements of granite are known, and the temperatures necessary to bring granite to a liquid melt are within the capabilities of a number of laboratories. "Synthetic" rock produced by such a melt has been formed before, but never with the unique coarse-grained texture and crystal structure of a granite. Gentry genuinely hoped that his colleagues would examine his published work in the spirit of scientific inquiry and either respond with contrary evidence, or at least admit the existence of valid scientific evidence for creation. Neither was to happen.

Like the bellicose rumblings of a man awakened from sleep, the reaction of the establishment was neither rational nor sweet. Soon after Gentry's challenge was published another respected geochronologist, Dr. Derek York of the University of Toronto, published a sharply critical article in *EOS.*[23] York produced no experimental data of his own, but he chastised Gentry for not accepting Henderson's

[19] Raphael G. Kazman, 1978. "It's About Time: 4.5 Billion Years." *Geotimes*, Vol. 23, p. 18

[20] Kazman, 1979. "Time: In Full Measure." *EOS Transactions of the American Geophysical Union*, Vol. 60, p.21

[21] Paul E. Damon, 1979. "Time: Measured Responses." *EOS*, Vol. 60 p. 474.

[22] Gentry, 1979. "Polonium Halos," *EOS*, Vol. 60, p. 514

[23] Derek York, 1980. "Polonium Halos and Geochronology." *EOS*, Vol. 61, p. 617

hypothesis of a secondary origin for polonium halos. York's attack was especially troublesome for it failed to address a variety of significant anomalies Gentry's research had uncovered, and made him appear irresponsible and ignorant of past work in the field. In fact Gentry's research and methodology had been scrupulous, and York could hardly have been unaware of this, having also been a participant in the LSU conference.

Appallingly, even after such an unfair attack it took almost a year and much persuasion before the editors of EOS permitted Gentry to respond in print to the specific misrepresentations York's article contained. Suddenly polonium halos seemed to be a hot potato that nobody wanted to touch. The quality of Gentry's research was a matter of public record; now the implications of his work were known also, and had been branded as heresy. To objective observers, the face-off had similar earmarks to a controversy that happened 400 years ago to a man who had observed that the earth orbited the sun, and not vice versa. His name was Galileo, and he had been excommunicated for his efforts.

Gentry was fully prepared for his work to face whatever scrutiny the scientific establishment wished to give it, but in reality it was the objectivity and integrity of the scientific establishment itself which soon would be on trial. Would they fare as well?

During Gentry's tenure as a guest scientist at Oak Ridge, much of his salary had been provided with grant funds from both private sources and the National Science Foundation. In 1979, following customary guidelines, he submitted another proposal to the NSF for further investigation of polonium halos in granite. Enough of his prior research had been published to forcefully defend the relevance of his proposal, so this time he clearly stated the implications of his work with regard to creation. Five of the six scientists who reviewed the proposal gave it a "poor" rating, and it went down in flames. Responding with an emotional vehemence that was most unscientific, these reviewers faulted Gentry for failing "to look for alternative explanations of these halos," calling his interpretation of them "speculative" and "ridiculous." They altogether ignored the ten years he had spent in painstaking search of a conventional explanation for the halos, suggesting that the incongruities he had found might be solved by other researchers "with greater objectivity." Unfortunately no such researchers came forth to tackle the mystery.

The peer reviews also provided a curious snapshot of scientific logic in response to perceived threat. One reviewer launched a baffling non-sequitur by agreeing that Gentry was "probably the world's foremost expert on the observation and measurement of radiohalos. He is remarkably tenacious in the pursuit of certain observations which are difficult to explain. His further work will result in publication. In the past he has seized on several quite new techniques.... However his researches seem to have reached a dead end."[24]

If his further work would result in publication, how could his research have reached a dead end? Was it because he dared to suggest that creation might resolve the mystery in the rocks? Could it be that the reviewer was afraid of what Gentry might publish in the future, and intended to prevent further research by denying him grant funds? Another reviewer rebuked Gentry for not accomplishing the work of generations in constructing an entirely new cosmology, integrating each of the scientific disciplines in detail while he was at it: "[Gentry] does not discuss the enormous amount of conflicting evidence which ascribes a long process of evolution of the universe, the earth, life on earth, etc. to the present state. If he wishes to propose a new framework for cosmology, he should describe it in detail, with all of its supporting evidence, implications, critical observations which could test it against the 'currently accepted cosmological and geological framework....'"[25]

Such criticism served only as a smokescreen for the real issue. The reviewers could find no conventional way to explain the existence of the halos. Without such an explanation the uniformitarian principle, that wonderful philosophical glue that held their own carefully constructed cosmological system together, disappeared. It was not Gentry's responsibility to salvage their belief system; a scientist is an observer of the physical universe, not a philosopher. Scientific theories arise from observation, and when new observations falsify previously held theories those theories must be modified or discarded.

Nevertheless in classic medieval fashion, the establishment showed a preference for hanging the messenger rather than heeding the message. They justified their rejection by calling Gentry's work irrelevant and repetitive, and some critics even impugned his reliability because he had been objective enough to modify his own theories on superheavy elements as his and his colleagues' research had progressed. Despite repeated attempts, Gentry never again received research funding from the National Science Foundation.

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[24] Gentry, 1986. Creation's Tiny Mystery, Chapter 6. Knoxville: Earth Science Associates

[25] Ibid.

In 1981 the Arkansas state legislature passed Act 590, a bill requiring "balanced treatment of creation-science and evolution in public schools." A cry of alarm went up from evolutionists everywhere. They rallied under the banner of the American Civil Liberties Union, which filed a suit challenging the constitutionality of the act. The trial was set for December 7 at the Federal District Court in Little Rock.

Two months before the trail date the Deputy Attorney General called Robert Gentry and asked him to testify as an expert witness for the State of Arkansas. It would be a momentous decision. Gentry realized that his cooperation with the state in this trial would likely sever whatever support remained for him in the scientific establishment. Was the truth about polonium halos important enough to sacrifice whatever was left of his career? His silence, he believed, would only contribute to the suppression of facts, which in turn would rob people of the opportunity to choose intelligently what to believe. He agreed to testify.

An unprecedented media blizzard was generated by various scientific institutions across the country in advance of the trial itself. The loudest voices were virtually unanimous in condemning Act 590, and made dire predictions regarding the advancement of human knowledge if the bill were to pass. Most were ruthless in their characterization of creationists. Almost the entire December issue of *Science 81* was devoted to an attack on creationism, and copies were given to the National Science Teachers' Association for distribution to its members. In an article entitled "Farewell to Newton, Einstein, Darwin...," Allen Hammond and Lynn Margulis summed up the prevailing attitude:

"To argue—as the creationists do—that a theory must be true rather than that the evidence compels one to it as the best choice is antithetical to science. To be unwilling to revise a theory to accommodate observation is to forfeit any claim to be scientific... Creationism is not science. Indeed, creationists do not participate in the scientific enterprise—they do not present papers or publish in scientific journals. And it is precisely because creationists present themselves as 'scientific' that they do most harm to the educational system."

This characterization was the exact reverse of the facts in Gentry's case, but it served the ACLU well. The psychological battle would be won or lost not by facts but by perceptions, and it was clear that the plaintiff would do anything necessary to win. The champions of evolution desired to vanquish creationism so utterly that the issue would never rise again. With a veritable army of over 50 attorneys and paralegals working on their case, including some highly adept volunteers from the prestigious New York law firm of Skadden, Arps, Slate, Meagher and Flom, versus only six which the Arkansas Attorney General's office could muster, the ACLU went to Little Rock with an enormous advantage. No expense was spared in mounting the most aggressive and sophisticated attack possible against the creationists.

Not surprisingly, the trial produced no revelations but generated great news copy. The ACLU team employed the tactic of making witnesses for the state look foolish, using short, hard cross-examinations to discredit them without allowing explanations or scientific discussion that might bolster their credibility. A typical example occurred when theologian Norman Geisler took the stand. Geisler, arguing that in the absence of worship the concept of a creator or first cause does not of itself constitute religion, cited Aristotle's "unmoved mover" as a case in point. From this point attorney Anthony Siano succeeded, step by step, in drawing out Geisler's belief first in God, then in the existence of Satan. Further aggressive questioning laid bare Geisler's belief in the existence of demon possession and UFOs—much to the delight of the plaintiffs—and with no opportunity to place these beliefs in any context the cross-examination was terminated and Geisler was dismissed from the stand.

At various points in the trial testimony for the plaintiff became no less vulnerable, but the strategy of the ACLU lawyers and the vagaries of the court prevented the state from exploiting these weaknesses. Of particular significance was the ACLU's decision to separate the origin of life from the issue of evolution itself. Cross-examination of Yale biophysicist Harold Morowitz, witness for the plaintiff, revealed why. After optimistically asserting that scientists were "getting close" to knowing precisely how life on earth began, Morowitz was forced to concede that leading evolutionists still have only theories. Proper scientific theory uses natural laws to predict physical phenomena and must be validated by experimentation, but Morowitz finally admitted that even after thousands of experiments and intense efforts none of the theories on the origin of biological life had ever worked to produce a living cell.

This incongruity might have led to a more careful examination of the uniformitarian principle had the judge not blocked the state's attorney from proceeding further with the issue. It is doubtful that more than a handful of observers understood what was at stake, and why the plaintiffs did not want the trial complicated by such questions. There are no natural processes that can adequately explain either

the origin of the universe or the genesis of life on earth; both require either the suspension of known physical laws or the intervention of supernatural forces. ACLU strategists knew that evolutionary science could never be shown to rest on a naturalistic base if the discussion wandered into cosmology or origins—both of which, nevertheless, are integral parts of evolutionary science as taught in most high schools and universities. Thus the state lost a significant opportunity to demonstrate the inconsistency of the plaintiff's case.

Geologist G. Brent Dalrymple of the U.S. Geological Survey was the witness for the ACLU who eventually would be addressing Gentry's findings. His initial testimony claimed radiometric dating to be "the only process we know of that is constant through time over billions of years."[26] Under cross-examination, however, several cracks opened in Dalrymple's argument. After close questioning Dalrymple finally admitted that consistent results obtained by different decay schemes today do not prove constant decay rates in the past. He attempted to reduce the impact of this admission by noting that varying decay rates would involve changes in physical laws. Yet his only argument against this possibility was that scientists "presume they have not" changed—at least not since the big bang, upon which he was not anxious to comment since all physical laws become invalid at that point.

Robert Gentry's research had proven this presumption to be an unwarranted convenience for evolution—and one that tended to foster prejudice against the acceptance of any evidence to the contrary. If the testimony of a creation scientist boiled down to a similar presumption, Gentry realized, he would be dismissed with scorn. Should any other scientist be permitted the indulgence of deficient reasoning simply for being on the popular side?

Dalrymple's credibility hung by a slender thread more than once during his cross-examination by state attorney David Williams. At one point Dalrymple emphatically asserted that he would want to look closely at any study which, if true, would call the science of geochronology into question. When Dalrymple was reminded of Gentry's research and the letter his own friend and colleague Paul Damon had published in EOS characterizing Gentry's study as just such work, he accused Damon of engaging in rhetoric. Finally Dalrymple revealed that he had not bothered to read any of Gentry's articles in the refereed scientific journals except for one nearly ten years old. He justified himself with the excuse that publications by creation scientists are not authentic scientific literature.

Dalrymple's unfamiliarity with Robert Gentry's work did not prevent him from having strong opinions about it. Calling Gentry's falsification test "meaningless" and a "technical problem," he characterized polonium halos as "a very tiny mystery" that someday would be resolved according to conventional science. At one point he even suggested that Gentry might be mistaken in his identification of the halos. Since he had done no study on the subject, however, under recross-examination he was forced to admit that his opinions were only speculation. Apparently the ACLU calculated that their witness' ignorance of Gentry's research would be less damaging than having him study the articles before the trial and still not be able to refute them.

A greater irony was to come. Gentry was not called to testify until the end of the trial, after maximum dramatic impact had already been registered by the plaintiff's star witnesses. Many of the media, believing the show to be over, had already evaporated from the scene. Nevertheless in the cross-examination ACLU attorney Bruce Ennis immediately strove to discredit Gentry's integrity as a scientist and diminish the importance of his discoveries. His first questions focused on Gentry's religious beliefs, and then dredged up an insignificant error from his early research he had later corrected in print as a matter of routine years before the trial. Such tactical maneuvers succeeded in keeping the court preoccupied with irrelevancies and diverting attention from Gentry's primary testimony on polonium halos.

When the dust settled few were surprised to learn that the ACLU had won. The trial had been theirs from the beginning. People in attendance had seen primarily what the scientific establishment wanted them to see, and when it was over things stayed pretty much that way. *Discover* magazine's cover story on the trial, Judgment Day For Creationism," was derisively subtitled: "In a showdown in Little Rock, creationists defend their scientific claims—badly" (February 1982). On the day after the trial closed ACLU attorney Bruce Ennis was quoted in the Arkansas Democrat: "The state tried to prove there is scientific evidence for creation. They failed not because of a lack of effort, but because that evidence does not exist." Few readers had any way of knowing how much relevant information had been either deftly discredited by the ACLU strategists or spiked altogether by the media afterward.

[26] S. Smith, 1982. Testimony of G. Brent Dalrymple, *McLean vs. Arkansas State Board of Education.* Little Rock: Official Court Reporter, U.S. District Court.

Judge William Overton's evaluation of Gentry's research was heavily influenced by the testimony of geologist Dalrymple, a witness who had not even studied Gentry's work in the scientific literature. Overton's judicial opinion stated the research to have been "published almost ten years ago and have been the subject of some discussion in the scientific community. The discoveries have not, however, led to the formulation of any scientific hypothesis or theory which would explain a relatively recent inception of the earth or a worldwide flood. Gentry's discovery has been treated as a minor mystery which will eventually be explained. It may deserve further investigation, but the National Science Foundation has not deemed it to be of sufficient import to support further funding."[27]

Judge Overton's opinion inferred that other scientists could find nothing of significance in Gentry's discovery, when in fact his work had such troubling implications that silence was the only weapon they could turn against him effectively. The crowning irony of his opinion was this criticism of creation science: "The methodology employed by creationists is another factor which is indicative that their work is not science. A scientific theory must be tentative and always subject to revision or abandonment in light of facts that are inconsistent with, or falsify, the theory. A theory that is by its own terms dogmatic, absolutist and never subject to revision is not a scientific theory."[28]

This was a most disturbing statement. The simple fact was that Robert Gentry's work exemplified science at its highest level. After discovering a natural phenomenon that seemed to contradict accepted theory, he reserved final judgment and set out with relentless energy to resolve the incongruity. Using the most sophisticated research techniques he methodically exhausted every possible avenue for a conventional explanation of the problem, publishing his results in the open scientific literature for all his colleagues to scrutinize—meanwhile becoming the world's foremost expert in his field. The facts of his discovery continued to confound evolutionary science. No one had ever produced a shred of evidence that contradicted either his findings or his conclusions.

Judge Overton's opinion was far more applicable to the science establishment, whose attitude countered Gentry's with a perverse symmetry. They unequivocally refused to reckon with facts that did not fit the evolutionary model. Indeed, they failed to meet their own criterion of scientific objectivity at its most fundamental level—even going so far as to discredit an honest scientist who brought coercive evidence against evolution to light. They cherished and defended the doctrine of evolution with religious zeal, protecting it from contradiction even at the cost of truth itself.

Retribution for Gentry's participation in the trial was not long in coming. The January 1 and 8 issues of *Science* contained a special report on the trial by reporter Roger Lewin. A careful reading of his article revealed subtle inaccuracies that cast the state's witnesses in an unfavorable light. Omission of key phrases and twisted bits of testimony effectively portrayed Robert Gentry as a person who himself did not consider creation science to be true science, and who admitted that his research conclusions were inspired by the Bible—both serious misrepresentations. The article also contained a number of damaging perversions of the exchange between Gentry and his cross-examiner that could not be verified until four years later, when Gentry finally obtained an audio tape of the proceedings. By then it was far too late.

Lewin's article in *Science* made it imperative for Gentry to respond promptly with an attempt to clarify his position on several critical points. Such rebuttals are customary in scientific journals, particularly when the credibility of individuals hangs in the balance, but this time no such courtesy was extended. The editor simply stated, "While it is understandable that you might have preferred a different emphasis or different details in Lewin's account of your testimony, we do not find that, in this case, his presentation needs clarification." The damage to his reputation would never be undone.

Robert Gentry's research contract with Oak Ridge National Laboratory was terminated later that same year. None of the scientists at Oak Ridge who had been searching for superheavy elements had been successful in their quest, but it was clear that the real reason for Gentry's termination was his now public stand in favor of creationism.

Besides his work on superheavy elements and radiohalos, Gentry's research had provided a wealth of important information relative to the long-term storage of nuclear waste. It was pioneering work that placed him on the cutting edge of a vital energy issue, but suddenly he was treated as if he had never made a single contribution to science. A still more painful disappointment came when the Christian college that had recruited Gentry for his outstanding research quietly let him go. There had been a change of administrations, and with the change came new

[27] William Overton, 1982. *Memorandum Opinion*. Little Rock: U.S. District Court
[28] Ibid.

priorities more in keeping with the mainstream of education. Robert Gentry was a controversial figure, perceived as too much of a liability for the school to retain. Without any affiliation he was no longer eligible for research grants and no other laboratory would open their facilities to him. After the years of plenty, Gentry was thrown back once again on his own.

For the past several years Robert Gentry has continued his research in a sparsely equipped home laboratory. His only funding now comes from private individuals who believe in the importance of his work. The setting is a far cry from the high-tech environs of Oak Ridge National Laboratory, but Gentry is characteristically philosophical about his circumstances. He knew long ago that the decision to pursue truth might lead him into narrow straits. It is a mark of his own integrity that he bears no grudges toward anyone, and still holds many of his evolutionist colleagues in the highest regard. He has no desire to be a crusader; as a scientist he wishes only to seek out facts and make them available to those who wish to know them.

Irresponsible zealots exist on both sides of the creation-evolution fence, just as there are exacting and brilliant researchers on both sides. Surely not everything that calls itself creation science is worthy of the name. But it is important to remember that scientists who openly challenge the tenets of evolution are systematically denied access to grant funds and state-of-the-art facilities that would otherwise enable them to perform quality research. The status quo is fiercely protected by most evolutionists today, who exclude by definition all creationists from their list of "true" scientists.

Robert Gentry enjoyed rare access to research facilities and funds that very few of his creationist colleagues have been able to utilize, and in a few years amassed formidable evidence for creation that remains on the record for all to see. No doubt some of his fellow scientists wish Gentry had never been permitted the opportunity to do his research; certainly they have made it difficult for him to continue in his profession. But at least a few, even among his evolutionist colleagues, remain thankful to him for challenging the status quo and forcing them to think again

Edward Anders, an internationally known geochemist, wrote, "His conclusions are startling and shake the very foundations of radiochemistry and geochemistry. Yet he has been so meticulous in his experimental work, and so restrained in his interpretations, that most people take his work seriously…I think most people believe, as I do, that some unspectacular explanation will eventually be found for the anomalous halos and that orthodoxy will turn out to be right after all. Meanwhile, Gentry should be encouraged to keep rattling this skeleton in our closet for all it is worth."[29]

It is unfortunate that so few of Anders' fellow scientists share his liberal attitude; nevertheless Robert Gentry is still rattling that skeleton. In the basement lab of his modest country home outside Knoxville, Tennessee he daily peers into his well-worn Nikon microscope at thin slices of mica and analyzes other specimens in a small particle spectrometer, while a personal computer churns out data nearby.

It all may seem remarkably unspectacular to the casual observer, yet history is being made. The evidence mounts, and the way Gentry figures it, truth has a way of outlasting all competition. The best thing he can do is to continue his research, even if he finally must do it on the kitchen table while teaching school again to support himself. Someday, like a flash of nuclear fusion, the evidence is liable to attain critical mass and explode into public consciousness. Then the issue of accountability will become unavoidable, and the scientific establishment will be forced to deal with the facts he has uncovered. In the meantime, Robert Gentry simply works and waits.

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[29] Edward Anders, 1977. "Mystery of the Radiohalos." *Research Communications Network*, Newsletter No. 2.

For readers interested in a more comprehensive treatment of this story, Robert Gentry's book, ***Creation's Tiny Mystery****, is available for $22 (U.S.) from Earth Science Associates, P.O. Box 12067, Knoxville, TN 37912-0067*