**Rocks Around the Clock: Do Zircons Contain Reliable Time Stamps and Early Earth’s Secrets?**

by Dr. Andrew Snelling with Dr. Elizabeth Mitchell February 26, 2014

**Abstract**

Zircon grains are found in rocks all over the earth. Despite debate about the accuracy of the uranium “clocks” they contain, scientists led by University of Wisconsin’s John Valley say they’ve found one grain with a confirmed age of 4.4 billion years. From it they suggest information the secular world finds surprising about hospitable conditions on the early earth. When we examine the assumptions underlying their claims, however, we find their conclusions are built on a wobbly house of cards.

Do zircons—crystals of zirconium silicate—contain clocks you can trust? Crystals of zirconium silicate can be found inside many sorts of rocks in the earth’s crust. Most are small, and they often contain even smaller particles of enormous interest. Trace elements trapped in the crystals may offer clues to the conditions under which the crystals were formed. Oxygen isotopes and atoms of radioactive uranium trapped in the crystals are, many believe, frozen in time.

Confined as they are in these crystals, many scientists believe that the ratio of parent radioactive uranium to daughter lead atoms in zircons can be used to calculate the ages of the crystals. These tiny zirconium silicate crystals can survive seemingly intact despite erosion, changes in environment, and metamorphic conditions that radically alter most rocks. Therefore, the oldest zircons are considered to be the best indicators of what the early earth was like.

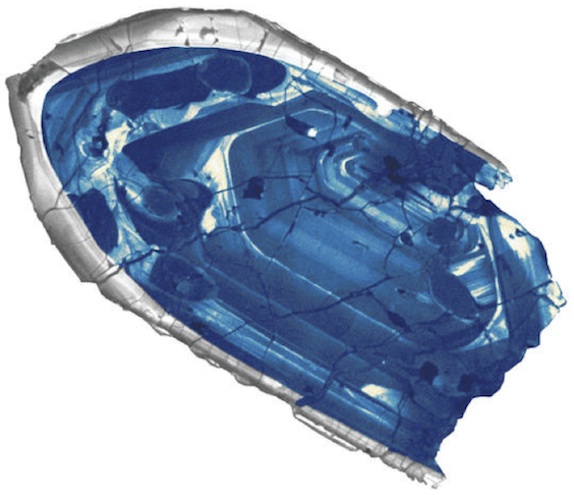
Though apparently impervious to their environmental conditions, zircons can be ravaged from within. Radiation emitted from trapped uranium and thorium atoms can disrupt their crystalline structure. It is possible for the lead atoms—all believed to be the products of radioactive decay—to move. Therefore, many debate the accuracy of these clocks in the rocks.

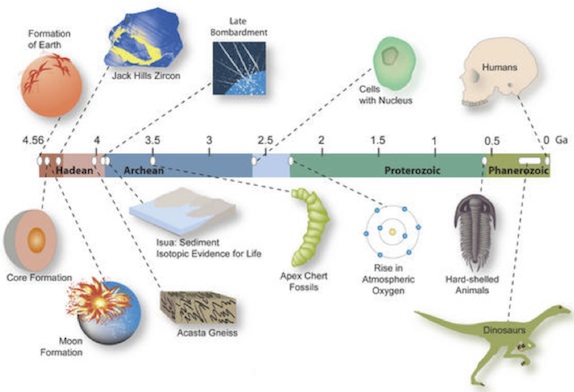
A team led by University of Wisconsin geosciences professor John Valley, writing in the February 23, 2014 issue of *Nature Geosciences*, reports they have pinpointed the location and identity of the individual lead atoms in sub-microscopic sections within one zircon grain from the Jack Hills sandstone north of Perth, Australia. This zircon grain is the width of four human hairs. The research team claims to have confirmed that that the lead atoms in that particular crystal’s clock have not moved significantly since the crystal was formed 4.4 billion years ago.

Confident they have a clock they can trust, Valley’s team also made a surprising discovery about the conditions under which the crystal was formed. Because secular scientists like Valley believe the earth is 4.56 billion years old, they believe this little crystal has a lot to say about the earth shortly after it coalesced into molten rock from matter thrown from a solar nebula. Oxygen isotope ratios in the crystal are consistent with formation in an environment that contained liquid water.

The little crystal Valley’s group analyzed supposedly dates to a time some scientists call the Hadean age. The name is drawn from Hades, the mythological Greek god of the underworld. Even the student unfamiliar with Greek mythology recognizes the hellish implications of the name Hades, reflecting the secular belief that the early earth remained a hot and uninhabitable place for a long time.

Their findings, Valley’s team says, suggest instead that the earth cooled and formed a crust quite quickly, within 100 million years of its fiery beginnings. The oldest known fossils—stromatolites—carry a conventionally assigned age of almost 3.5 billion years, far younger than this zircon. But those surprisingly cool conditions documented in the crystal, presumably only 160 million years after the solar system formed, allowed water to condense on earth and form oceans in which life may well have evolved as early as 4.3 billion years ago.

This is an image of the latest history-making Jack Hills zircon. Though lead (Pb) atoms in the zircon presumably migrated into clusters 3.4 billion years ago under the influence of the grain’s hot environment at that time, researchers assume the atoms haven’t budged since then. Image: John Valley et al./University of Wisconsin-Madison in *Nature Geoscience* through [Yahoo.com](http://news.yahoo.com/confirmed-oldest-fragment-early-earth-4-4-billion-180642066.html)

This is a timeline purporting to display the unwitnessed version of earth’s history created by those who disregard God’s eyewitness account of our origins. It is not possible to accept this version of history, which is built on a host of unverifiable assumptions piled one upon another, without disregarding God’s Word and implying that He is a liar. God’s Word, on the other hand, provides the true history of the world—a world He created in just six days, all ready to be inhabited (Is 45:18). The history in God’s Word fits what we actually observe all around us. Image: John Valley et al./University of Wisconsin-Madison in *Nature Geoscience* through [Yahoo.com](http://news.yahoo.com/confirmed-oldest-fragment-early-earth-4-4-billion-180642066.html)

**Chain of Evidence, or Chain of Assumptions?**

In their paper “Hadean age for a post-magma-ocean zircon confirmed by atom-probe tomography” Valley and colleagues interpret their research results through the lens of multiple levels of assumptions. Each interpretation is built on the assumptions at that level and the interpretation from the previous level. Let’s analyze their chain of arguments very carefully. As we unravel their claims, the discerning reader will see that the whole tapestry Valley has woven falls apart.

**Just the Facts, Please**

What are the observational facts? What did Valley’s team actually see? They examined tiny zircon grains, each measuring about the width of four human hairs. These zircons were extracted from a metamorphosed sandstone layer in a low range of hills called the Jack Hills on a sheep ranch in a remote arid region about 500 miles (800 km) north of Perth, Western Australia. That’s all! From here on Valley’s team makes assumptions to build each level of their interpretation. What they *believe about*the history of these crystals determines the story they believe the crystals are telling.

**History of the Zircons**

First, it is assumed that the particles making up the Jack Hills sandstone in which the zircons were found were eroded from pre-existing rocks and transported by water to be deposited in this layer. And what kind of rock could have produced these zircons in the first place? Since zircon grains initially crystallize at high temperatures (1800°C), the team assumed the zircon grains in this sandstone must have come from a rock crystallized from hot magma. Sometime after the rock cooled, they believe it was eroded and the zircons birthed in it were transported by water to Jack Hills.

This history all sounds reasonable, but *none* of it was observed. This entire scenario is based on inferences about what happened in the distant past, including an assumed naturalistic origin for the earth.

**History of the Earth**

Secular scientists like those on Valley’s team assume that the earth was formed out of a solar nebula as hot matter was thrown out from the sun and coalesced to form a ball. Subsequent meteoric bombardment blasted our moon from the earth, so the story goes, and the energy from that hit “that formed our moon . . . melted and homogenized the earth,”[[1]](#footnote-1) as Valley explains in a news release, leaving its surface an ocean of magma. Thus they assume that the earth formed from the sun after the sun formed, and then only subsequently after the magma ocean cooled enough for water to condense from steam was the earth covered in water. That water, they believe, then eroded the rocks which had crystallized and cooled from the magma ocean, and then transported and deposited the resulting sand and zircon grains in this sandstone layer.

God the Creator of all things is uniquely qualified to give an accurate eyewitness account of the earth’s origins. He was there and, as a holy God, He cannot lie. God has told us in His Word that He made the earth *three days* *before He made the sun.* Furthermore, when He made the earth it was not as a magma ocean that first had to crystallize and cool so that liquid water could condense on it. According to the opening verses of the first chapter of Genesis, the earth God made was *already covered in water*. God the eyewitness trumps the scientists who were not there to see what happened “in the beginning.”

**Tiny Tales of Grand Scope**

The next level of interpretation begins with the U-Th-Pb (uranium-thorium-lead) dating of the tiny zircon grains extracted from the Jack Hills sandstone. Of the hundreds of zircons that were analyzed and dated, *only four* yielded dates greater than 4.3 billion years old. Yet as the writers admit, those four grains have been used to provide “a basis for theories of crustal growth, tectonics, surface conditions and possible habitats for life on early Earth”![[2]](#footnote-2) In other words, from four microscopic mineral grains a whole story has been told about the early history of the earth. That story is based on the assumption that only random natural processes have operated over eons of time with no hint that any Creator was necessary or involved.

Now, of those four tiny grains deemed to be old enough, only *one* grain was selected for this present study. The authors do admit that there has been a lot of “uncertainty about the cumulative effect of un-annealed radiation damage and mobility of radiogenic isotopes [which] has led to questions about the reliability of ages and other geochemical characteristics of these zircons.”2 In fact, it was for these reasons the study of that solitary zircon grain was undertaken.

**The Dates Are Good Except When They Aren’t**

Like other scientists who have previously dated this and the other zircon grains, the authors of this study never question that the U-Th-Pb dating method is anything but reliable in providing absolute ages. While recognizing potential problems owing to the mobility of lead atoms within the zircon grain, they are completely blind to the many other unverifiable, worldview-based assumptions that govern their interpretation of their entire radiometric dating methodology.

They *never* recognize the underlying unprovable assumptions on which the U-Th-Pb system is based. The starting conditions (e.g., the amount of lead present when the crystal formed) can never be known—how do we know that *none* of the daughter lead atoms we measure today were not there in the zircon grain at the beginning? Actually, they do *assume* there were at least some daughter lead atoms at the beginning,*but only* because of what is *believed* to be primordial lead in one iron meteorite, which has no parent uranium atoms but some daughter lead atoms in it! They are therefore constrained by what they believe about that meteorite to concede that some lead atoms could have been present when this zircon grain originally formed, even though lead atoms are thought to not fit into the zircon crystal lattice. But how much “daughter” lead was not derived by uranium decay? Even admitting that some “daughter” lead atoms might have been in the grain to start with does not tell them how much lead *not derived* from uranium decay there might have been.

Next, can we be sure the U and Th have always decayed at the same rates we measure today? No! We have measured U and Th decay for only 100 years, but is it reasonable to assume the decay rates have been constant at today’s rates for 4.5 *billion* years? This is not to suggest that natural laws have changed, only that conditions have not always been the same, and those conditions may have affected the rate at which processes like radioactive decay took place. In fact, this is not idle speculation and conjecture! We have solid evidence that radioactive decay rates *cannot* have been constant. For example, discordant dates have been obtained on the same rocks by the [different radioisotope methods](http://www.answersingenesis.org/articles/aid/v5/n1/precambrian-amphibolite). Discordant dates have been derived from[helium diffusion](http://www.answersingenesis.org/articles/aid/v6/n1/accelerated-nuclear-decay) and U-Pb dates on the same zircon crystals. Coexistent U and Po [radiohalos](http://www.answersingenesis.org/articles/arj/v2/n1/radiohalos-in-yosemite-granites)argue against perpetual uniformity of decay rates. So do grossly discordant [radiocarbon](http://www.answersingenesis.org/articles/aid/v6/n1/fossilized-organic-materials) and radioisotope dates.[[3]](#footnote-3) Given ample evidence observable in the present that decay rates have not been constant throughout the supposed “deep time,” it is not reasonable to assume they have been uniform through unobservable eons.

Finally, how can we be sure there has been no contamination of the relevant trace elements inside these zircons? Such removal or introduction of the “parent” or “daughter” atoms would completely invalidate the clocks in the crystals. Along that same line, migration of the lead atoms within the crystals would also “reset” the dates, rendering the “ages” of the crystals completely inaccurate. How can we be sure there has been no resetting of the dates during the billions of years? To answer this last question was the exact reason for this present study. And while the researchers decided the lead atoms in this little zircon have not moved enough to matter, they have not even begun to address the other unverifiable assumptions on which their methods are based.

**Tunnel Vision**

So how good for this purpose was this one tiny zircon grain? Did their analyses demonstrate that the lead atoms did not move? And if so, what does that do for the trustworthiness of Valley et al.’s conclusions? Actually, even their own published photos—including those in the news releases (see the photo above)—demonstrate conclusively that this grain, like all the others, has a complex internal pattern of concentric crystal zones. They freely admit that these zones are compositionally different. Yet the authors only partially acknowledge this heterogeneity when they mention that there is a *core* that they date at ~4.4 billion years. They analyzed many tiny spots, and they describe an outer overgrowth (clearly visible as gray in the above photo) which they date at ~3.4 billion years, based primarily on the Pb-Pb dates. But in so doing they ignore a Th-Pb date, which they relegated to the supplemental information attached to their paper, that yields a date of only 492 million years!  In fact, even *within*the “~4.4 billion year-old” core, their published images clearly show compositional variations (the core is only the innermost zoned section inside the blue colored area in the photo above). Between this innermost core and the gray overgrowth crust there are clearly additional compositional zones within the blue colored area, including some they label as “disturbed.” *Plus,* there are tiny *quartz* inclusions. Such quartz inclusions are problematical for them because quartz crystallizes at a much lower temperature than zirconium silicate, raising the questions of how quartz inclusions could be there if the zircon crystallized first at high temperatures, and how could they have survived intact if the zircon has been reheated and also weathered through all the time and conditions to which it supposedly has been subjected.

**Zooming in on Lead Atoms**

Finally, we come to the crux of the present study, the *atom-probe tomography analyses of nano-domains*. This new technique purports to count atoms within even tinier regions than those addressed above, much less than a tiny fraction of a hair’s width. Valley’s group shows, and therefore claims, that within the tiny area they scanned there are distinct clusters of atoms with uniform Pb isotope composition correlated with clusters of atoms of the rare element yttrium (Y). They consider the apparently uniform isotopic composition in these clusters combined with the presence of yttrium to be like a fingerprint identifying the migration of those lead atoms into these clusters. They confirmed that the Pb isotope composition in the full volume of these very tiny (sub-microscopic) clusters was the same as that obtained by the standard SIMS (secondary ion mass spectrometry) technique used to date the tiny spots elsewhere within this zircon grain. However, they then admit that the cores of these very tiny clusters yield a Pb isotope composition that equates to a Pb-Pb age for them of ~5.5 billion years, which they quickly add “is significantly older than the age of the Earth and clearly not correct.”2 That of course begs the question as to how do we really know whether any of the other ages are correct? How very convenient to be able to ignore all the data that is impossible within their worldview just as they ignore the Creator God that their worldview will not admit as an eyewitness to the very history they wish to understand!

**How Much Is Too Much?**

Given the great heterogeneity of even the most relevant parts of this zircon grain and the dating aberrancies so casually disregarded, how does Valley’s team conclude that the ~4.4 billion year age is accurate? After all, determining the accuracy of this date was the objective of the study! They admit these very tiny clusters formed as a result of migration of Pb atoms within the crystal after it formed. (Remember, *it is this migration that scientists suspect of resetting the clocks in the zircon and making their times suspect*.)

On their published U-Pb dating diagram, however, the authors project a line representing the Pb isotope composition of the cores of the very tiny clusters from the ~4.4 billion years age (when the zircon grain supposedly crystallized) to where the line “happens” to intersect the U-Pb isotopes growth curve at the ~3.4 billion years age—the presumed age of the zircon’s outer overgrowth (the gray-colored outer zone in the photo above). Because they *assume* that overgrowth resulted from heating of the rock containing the zircon grains, they *assume*the Pb atoms migrated to form these very tiny clusters in the nano-domains within the core during that heating event. Yet if that process—a heating event that metamorphosed the host sandstone—caused the clustering in the first place, why have subsequent events and geologic processes presumably not perturbed those lead atoms further during the subsequent ~3.4 billion years! The ages measured in the relatively larger spots in the crystal core *must* therefore be reliable, they conclude, because only very tiny clusters of migrated lead atoms were created within the much larger spots by the disturbance of outside forces, and so there cannot have been any additional disturbance since then. The clusters of migrated lead atoms *must*have been frozen in time! Why?*Because those who claim to have the key to confirming the age of the world’s oldest rocks need for them to be so*! And all this just goes to confirm, they believe, that the earth must have been covered by a magma ocean prior to the crystallization of this tiny zircon grain ~4.4 billion years ago, a magma ocean caused by the impact that formed the moon!

**Call Your Witnesses**

Interesting story? Were there any human observers of these claimed events? None! So who has the greater faith? The God of the Bible who was there tells a totally different account of His creation. By His command, He called into existence all things in just six ordinary days only 6,000 or so years ago. He said He created the earth before the sun. In the opening verses of Genesis, He describes a world covered in water *when* He created it.

And while God completed the work of creation in just six ordinary days, His involvement with the world He made and the people He created in His own image has never stopped. Despite our sinful nature and rebellion against Him, God wishes us to know not only of His power and holiness but also His great love for us. He has therefore revealed who He is in the person of His Son Jesus Christ. Col 1:16–17, as well as many other passages scattered throughout the Old and New Testaments, let us know that Jesus Christ—the Son of God, our Savior who died on the cross—is none other than the Creator Himself.

During Jesus Christ’s earthly ministry He performed many miracles, including acts of creation, before eyewitnesses. Just think of the feeding of thousands of people from a handful of food, as the Gospel writers report He did more than once. And the greatest of all His miracles was His own resurrection from the dead. Afterward, He showed Himself to be alive by “many infallible proofs” (Acts 1:3). He rose from the dead declaring His divinity (Rom 1:4) and His power over sin, guilt, and death (Rom 4:25). Those who will repent of their rebellion and trust Him can be forever saved.

Our past—humanity’s past and the earth’s past—has only been going on for about 6,000 years. But the supposed billions of years secular scientists insist upon imposing on God’s creation will pale in comparison to the eternity that awaits each and every person, in either one glorious destination or one horrible one much more like the “Hadean” world imagined for the early earth. It only makes sense too see what our Creator, the only eyewitness to earth’s beginnings, has to say in the Bible about our [ultimate destiny](http://www.answersingenesis.org/about/good-news).

**For more information:**

* [#6 Helium in Radioactive Rocks](http://www.answersingenesis.org/articles/am/v7/n4/helium-in-rocks)
* [Ancient Meteorite Said to Harbor Secrets of Watery Martian Past](http://www.answersingenesis.org/articles/2013/12/07/meteorite-watery-past-mars)
* [Implications of Polonium Radiohalos in Nested Plutons of the Tuolumne Intrusive Suite, Yosemite, California](http://www.answersingenesis.org/articles/arj/v2/n1/radiohalos-in-yosemite-granites)
* [Testing the Hydrothermal Fluid Transport Model for Polonium Radiohalo Formation: The Thunderhead Sandstone, Great Smoky Mountains, Tennessee–North Carolina](http://www.answersingenesis.org/articles/arj/v1/n1/testing-radiohalos-model)
* [Radiohalos in the Cooma Metamorphic Complex, New South Wales, Australia](http://www.answersingenesis.org/articles/aid/v4/n1/radiohalos-cooma-complex)
* [Radiohalos in the Shap Granite, Lake District, England](http://www.answersingenesis.org/articles/aid/v4/n1/radiohalos-shap-granite)
* [Radiohalos and Diamonds](http://www.answersingenesis.org/articles/aid/v4/n1/radiohalos-and-diamonds)
* [*News to Note*, July 5, 2008](http://www.answersingenesis.org/articles/2008/07/05/news-to-note-07052008#two)
* [Helium Diffusion Rates Support Accelerated Nuclear Decay](http://www.answersingenesis.org/articles/aid/v6/n1/accelerated-nuclear-decay)
* [Radiohalos—A Tale of Three Granitic Plutons](http://www.answersingenesis.org/articles/aid/v4/n1/radiohalos-three-granitic-plutons)
* [Radioisotopes in the Diabase Sill (Upper Precambrian) at Bass Rapids, Grand Canyon, Arizona](http://www.answersingenesis.org/articles/aid/v5/n1/radioisotopes-in-diabase-sill-at-bassrapids)
* [Significance of Highly Discordant Radioisotope Dates for Precambrian Amphibolites in Grand Canyon, USA](http://www.answersingenesis.org/articles/aid/v5/n1/precambrian-amphibolite)
* [Measurable 14C in Fossilized Organic Materials: Conﬁrming the Young Earth Creation-Flood Model](http://www.answersingenesis.org/articles/aid/v6/n1/fossilized-organic-materials)
* [Radioisotopes and the Age of the Earth](http://www.answersingenesis.org/articles/aid/v6/n1/radioisotopes-and-age-earth)
* [Discordant Potassium-Argon Model and Isochron “Ages” for Cardenas Basalt (Middle Proterozoic) and Associated Diabase of Eastern Grand Canyon, Arizona](http://www.answersingenesis.org/articles/aid/v5/n1/discordant-ages-cardenas-basalt)

<http://www.answersingenesis.org/articles/aid/v9/n1/early-zircon#fnMark_1_2_1>

1. [www.news.wisc.edu/releases/18407](http://www.news.wisc.edu/releases/18407). [↑](#footnote-ref-1)
2. J. Valley et al., “Hadean age for a post-magma-ocean zircon confirmed by atom-probe tomography,” *Nature Geoscience*(2014), doi:10.1038/ngeo2075. [↑](#footnote-ref-2)
3. For more information on radiometric dating and inherent assumptions, see [Doesn’t Carbon-14 Dating Disprove the Bible?](http://www.answersingenesis.org/articles/nab/does-c14-disprove-the-bible), [Carbon-14 in Fossils and Diamonds](http://www.answersingenesis.org/articles/am/v6/n1/carbon-14), [Carbon-14 Dating—Understanding the Basics](http://www.answersingenesis.org/articles/am/v5/n4/carbon-dating), [Radiometric Dating](http://www.answersingenesis.org/articles/am/v5/n2/radiometric-dating), [Radiometric Dating: Making Sense of the Patterns](http://www.answersingenesis.org/articles/am/v5/n1/patterns), [Radiometric Dating: Problems with the Assumptions](http://www.answersingenesis.org/articles/am/v4/n4/assumptions), and [Radiometric Dating: Back to Basics](http://www.answersingenesis.org/articles/am/v4/n3/radiometric-dating). [↑](#footnote-ref-3)