Top 10 REASONS

Why the Universe, the Sun, Earth, and Life are NOT 6000 years old: *A Primer*

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DEFCON

There are many and varied ways that modern science has confirmed the history of the Universe, the Solar System, The Earth, and Life on Earth. All of these methods, while independent, are in agreement and they ALL tell us that Life, the Earth, and the Universe are many orders of magnitude older than 6000 years old. There is no scientific room for errors of this many orders of magnitude. It would be like measuring the distance between New York and Los Angeles, and determining it was less than 1 inch. In order to agree with a Young Earth Creationist picture, essentially every facet of modern science—on which we base every aspect of modern technology, our vehicles, our society—would have to be completely incorrect, implying almost everything we base our modern lives on would not work as it does.

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THE UNIVERSE: THE BIG BANG REALLY HAPPENED

The Big Bang is not an unsubstantiated theoretical speculation. Last year's Nobel Prize was given for observations of the cosmic microwave background radiation that has been traveling for over 14 billion years before being received by NASA's Cosmic Background Explore Satellite. This thermal radiation bath, whose temperature is measured more accurately than any other known existing system, has a temperature that is in precise agreement with the predicted value if the Universe has been expanding for 14.3 billion years since the big bang. Moreover, the small temperature deviations observed across the sky agree exactly with what are predicted if gravity worked over the course of several billion to create all of the 400 billion observed galaxies in the universe. Moreover, observations of the primordial background radiation are in exact independent agreement with the predictions of a hot big bang that produced precisely the observed abundance of light elements, hydrogen, deuterium, helium, and lithium, at a time when the universe was 1 second old and had a temperature of 10 billion degrees.

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STARS AND GALAXIES

When we look out at the universe we see galaxies much like our own… billions of them. The stars in these galaxies shine just like the stars in our own galaxies. They are made of hydrogen gas, and we can measure the brightness of hydrogen gas in the laboratory, and the brightness of our Sun, so we know how bright many of these stars are as well. The nearby Andromeda galaxy looks virtually identical to our own Milky Way galaxy. We can measure the size of these galaxies and compare them to our own, and get good agreement. The size of the disk of our galaxy is about 100,000 light years across, which means it takes light about 100,000 years to travel the distance across our galaxy. When we observe the Andromeda galaxy we observe it to be 2 million light years away, meaning the light took 2 million years to get to us. There are many ways we can determine the distance to this galaxy. With large telescopes we can resolve almost all of the stars in the galaxy. Counting them up, we get about 100 billion stars. If it were not 2 million light years away, it would outshine anything else in the night sky. If this many stars were located within a distance of 6000 light years, the distance light can travel in 6000 years, our galaxy would be overwhelmed with stars. Moreover, we can observe galaxies that have collided. The time it takes for two galaxies to collide is over 200 million years. The evidence goes on and on and on.

Stars, too, give us a very good handle on the age of the universe. We know precisely the physical processes that power stars; we have recreated them here in laboratories on earth with nuclear fusion and fission. As a result, we can use the known laws of physics as measured here on earth to predict the rate at which stars evolve, and the temperature density profile inside stars such as our Sun. We can then measure these properties by observing the light coming from the sun, and they agree precisely with our predictions. We can even measure particles called neutrinos coming from the center of the sun that are produced in nuclear reactions in the sun's core, and their energy distribution and the number of neutrinos emitted agrees precisely with our calculations. Based on such predictions we know precisely that the Sun, for example, is 4.55 billion years old (more on this later). We can also determine the ages of other stars in this way, and the ages of stars in our galaxy tell us that our galaxy is about 11-13 billion years old, precisely in agreement with the number we get from measuring the cosmic microwave background radiation as described above.

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RADIOACTIVITY

Radioactive dating is a popular method to determine the age of various living systems. Radiocarbon dating, for example, is a technique for which the Nobel Prize was awarded in 1960 that can be used to date the age of living things because while they are alive they exchange carbon with the atmosphere, where small amounts of radioactive carbon-14 are created due to cosmic rays, but when they die they stop exchanging carbon with the atmosphere. By counting the percentage of carbon-14 in the tissue of the material and comparing it with the percentage of carbon-14 in living systems, they can see how many carbon-14 nuclei have decayed. Since carbon-14 decays on average with a half-life of 5730 years (meaning that after 5730 years half of the carbon-14 nuclei will have decayed, and after another 5730 half of the remaining carbon-14 atoms will have decayed etc), using knowledge of the abundance of carbon-14 in the atmosphere as a function of time, based on cosmic ray intensities, the earth's magnetic field, and also on the rate at which old carbon from rocks is diluting carbon in water, etc, we can use this technique to reliably date living systems back to about 60,000 years. The ages obtained from this measurement technique are in agreement with other age determinations based on geology, etc.

We can use other forms of radioactivity to make measurements of systems that are much older, however. For example potassium-40 has a half life of 1.3 billion years, uranium-238 has a half life of about 4.47 billion years, and thorium-232 has a half life of 14 billion years. Since these materials are created inside the fiery cores of stars by nuclear burning, we can measure the abundance of these parent-nuclei compared to the abundance of the daughter nuclei into which they decay to determine the age of old rocks, as well as the ages of some stars in which the abundance of these heavy elements can be measured. And not surprisingly, the ages we get all are consistent with other age determinations. The age of the earth, when determined this way, agrees well with the age of the sun, i.e. about 4.5 billion years. The ages of the oldest systems in our galaxy comes out to be about 10-13 billion years, in agreement with stellar evolution estimates, etc.

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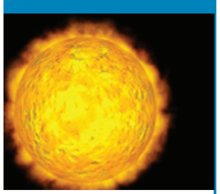

SUPERNOVA 1987a

Stars explode in brilliant fireworks displays called supernova about once per hundred years per galaxy. The last supernova to have been observed in our galaxy was observed by Johannes Kepler about 400 years ago. By observing many different galaxies in the universe on a given night, however, we can actually observe many stars exploding throughout the universe on even a single night. We were lucky on February 23, 1987 to have observed a star exploding on the edge of our galaxy, about 150,000 light years away from us. How do we know it is that far? First, the distance to the star had been determined by measuring how bright it was before the star exploded. But even more remarkably, the laws of physics that govern how stars like the star that observed to explode in 1987 actually explode is generally understood, and we can predict how much energy is released, not just in light, but in the particles called neutrinos that are emitted in nuclear reactions. It is amazing that we were actually able to measure the neutrinos coming to us from this distant star, and from this we were able to independently confirm that the star was 150,000 light years away. Therefore, the star exploded 150,000 years ago, telling us that our galaxy, at least, is older than 150,000 years old.

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THE SUN SHINES

When you look at the sun, you might imagine that you are seeing light that was emitted very close to the time you observe it. In fact, it takes light about 8 minutes to get from the Sun. That isn't very long. But you may be more surprised to learn how long the light takes to get from the center of the Sun to the outside. Remember that we can measure both the nuclear reactions taking place in the center of the Sun using neutrinos, and we can also determine the density profile and temperature of the interior of the Sun by measuring the way the Sun vibrates, just like we can determine the density profile in the Earth using seismology, as we hunt for oil, etc. Using known laws of physics that predict exactly not only the density profile of the sun, and its temperature, and also the rate of nuclear reactions in the sun's core, we find that it takes almost 1 million years for energy emitted in the center to make its way to the surface, where we can then see it! If the Sun was 6000 years old, it would not be shining as it does. In fact, we can see stars that are just forming and are only thousands of years old, and exactly as we predict, they have not settled down to burn evenly and uniformly as our Sun does. If the Sun were only 6000 years old, its brightness would be such that life on Earth would be burnt to a crisp, and its brightness would also vary greatly over the course of human history.

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CONTINENTAL DRIFT

Scientists had noted for hundreds of years that the shapes of the continents, in particular those on either side of the Atlantic Ocean are such that they look like they could fit together. Moreover, rocks and fossils found on the facing shores of the different continents were remarkably similar. We now understand this, not just theoretically, but experimentally, by recognizing that the continents are indeed drifting apart. Using satellite data we can measure that South America and Africa are moving apart at an average rate of 5.7 centimeters per year, about the same rate at which your fingernails grow.

This spreading apart of the continents is now understood because material is measured to be moving up to the surface from deep in the earth at the mid-ocean ridges. Our understanding of the Earth's dynamics is completely consistent with this observation, and using the present observed rate of ocean spreading we can determine that the observed continents were part of a single land mass about 250 million years ago.

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ROCK STRATA, ICE CORES, AND ALL THAT

The Geological time scale of the Earth has been accurately known for perhaps 150 years. The principle is simple, as rock layers are laid down on the surface of the Earth in succession over time. While the layers are often eroded and distorted, they can have different appearances in different areas. Over the course of 2 centuries geologists have pieced together a completely consistent history of the planet that agrees with the 4.5 billion-year-age estimate determined by other means, from radioactive dating, astrophysical arguments, and biological analyses. Moreover, the different epochs determined by geologists have associated with them different fossil species that not only document the evolution of the diversity of life on Earth, but also demonstrate widely varying climates over periods of millions and billions of years. During these periods there are observed to be layers where there are mass extinctions, when up to 95 percent of life on Earth became extinct. One such mass extinction period occurred 65 million years ago, and coincides with the independently determined extinction era for dinosaur species. This time is well before the earliest hominids were known to be arising out of Africa, some 3-5 million years ago. The physical processes responsible for the generation of these layers and the patterning of the rock are well understood, and could not have been created in a single worldwide flood 6000 years ago, or 65 million years ago.

On a shorter time scale there are other direct measures of the age of the Earth. Most notable are deep ice cores taken in Antarctica, Greenland, and elsewhere. These all provide a consistent record of climate variations over the earth over the past 400,000 to 800,000 years. As the Earth's temperature varies, the isotopic abundance of gases, such as deuterium in water that condenses, will be different. By extracting deep ice cores, and measuring the isotopic abundance ratios of the gases in the trapped bubbles in the ice, climatologists can determine much about the earth's history. Layers are separated by the amount of annual snowfall. As the temperature varies over the year, separate layers are distinguishable, just like tree rings, and ages of the ice as a function of thickness are determinable. In this way one can determine that the deepest ice cores reflect a history in excess of 500,000 years reflecting dramatic variations in temperature, carbon-dioxide abundance, sea levels, etc. In fact, there have been numerous times over the past 400,000 years when global sea levels rose by more than 40 meters, but no time in the past 6000 years has this happened.

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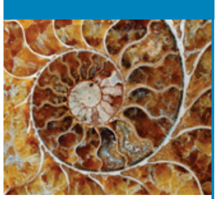

FOSSILS

The fossil record on earth is amazingly rich, painting a vivid picture of the rise and fall of various species. Over 99% of all species that have ever existed on earth are now extinct. The presence of this fossil record not only supports the evolutionary picture of the change of speciation with time, but it also provides an independent tool to determine the age of various systems by what is called biostratigraphy. Fossils such as ammonites and trilobites exist all around the world and reveal not only the changing nature of life, but also provide an independent confirmation of geological ages, at least for life forms that existed many millions of years ago.

Dinosaurs, for which there is great interest and great misinformation in the Creation museum, lived during the period ranging from 250 million years ago until about 65.5 million years ago, when they rapidly died off in an event that is known as the K-T extinction event. During this period, evidence from geological strata obtained all over the world overwhelmingly demonstrate a global disruption of vegetation. The K-T geological boundary layer contains an abundance of iridium that is hundreds of times larger than normal, and is consistent with the iridium abundance measured in meteorites and asteroids. The idea that this mass extinction was associated with a large meteorite impact is supported by the existence of a 100 mile wide crater at Chicxulub on the coast of Yucutan Mexico.

Many fossils of hominid species predating Homo Sapiens exist going back millions of years. Until recently one of the most complete skeletons belonged to a young female, named "Lucy" by her discovers. Found in Ethiopia in 1974, Lucy dates back 3.2 million years and is one of the earlier of the transitional fossils common to both chimpanzees and modern humans.

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EVOLUTION

Darwin's remarkable realization that the diversity of life on Earth changes over time has now been tested in many different ways using many different types of science, from radiometric dating of fossils to the science of genetics. Evolution provides a remarkable framework within which the current diversity of life on earth can be understood. It is supported by every piece of data in modern biology and geology. The fossil record is replete with transitional fossils of all sorts, including a continuous record of evolution from sea to land animals, and a remarkably complete record, containing hundreds of examples of the transition of hominid species to modern humans over a period of 5 million years.

The age determination of different human fossils is supported by a wealth of data, including radioactive dating, geological dating, and more recently genetic dating. Modern genetics, the study of DNA as the repository of information that is the basis for reproduction of life forms, allows detailed comparisons between species to be performed. The close genetic relationship between the human genome and that of great apes is one of the many pieces of data that imply that they are our closest genetic cousins on earth. Because mutation rates of various parts of the DNA sequence has been determined, one can use these as "molecular clocks" to determine how long it has taken for divergence between humans and great apes. It has been determined that the human-chimp divergence began around 4.5-5 million years ago, while the divergence between humans and gorillas (and chimps) occurred around 7 million years ago.

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THE DOCUMENTARY RECORD

Finally, humans, or at least our immediate ancestors, have left us a documentary record of their own existence, demonstrating in many different ways that they have been around for far longer than 6000 years. Ancient Egyptian civilization, for example, began along the Nile river about 13,000 years ago, where stone tools dating from this period have been discovered, and analyses of ancient pollen found at archaeological sites indicate farming of wheat and barley . Evidence for large building construction in Egypt also goes back at least 8000 years.

In Europe, humans as well as other hominid species living over the past 100,000 years have left us a documentary record in different forms. Neanderthals, for example, who lived in Europe from 100,000 years ago till about 24,000 years ago have left not only many fossil skeletons, but sophisticated toolkits consisting of hand axes and spears. There is clear evidence that Neanderthals buried their dead, as well as constructed complex shelters.

Perhaps most remarkable, humans themselves have left a clear documentary record of their existence going back at least 30,000 years. This comes from artwork found in caves, particularly those found in modern France and Germany. These beautiful images of bison, horses, and deer tell us not only that these early humans were capable of an artistic appreciation of the world around them, but it also tells us what animals were cohabiting with humans at the time. These are dated by not only geological methods, but also by radiocarbon dating of the pigments in the paintings themselves. A foot-tall lion-headed human figure carved from mammoth ivory was found in a cave in Germany dating back 32,000 years.

It is interesting to note that of all the drawings and writings of early humans, not a single drawing or text indicates any animals that resemble dinosaurs. There is no documentary evidence, geological evidence, or biological evidence of any cohabitation, which is completely consistent with the knowledge that dinosaurs disappeared around 65 million years ago.

Some of the most interesting sets of paintings include tracings of human hands, over 10,000 years old (some as ancient as 27,000 years old), demonstrating that perhaps these early humans wanted to leave a permanent record of their own existence. Happily, the messages they have left us in this form have survived to the present time. We should celebrate this wonderful gift of our ancient ancestors to the modern world.

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