THE AGE OF OUR WORLD

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In this article I summarise some of the scientific evidence supporting the conclusion that our world is very old.

Evidence for an ancient world is given under the following headings:

1. Continental drift caused by plate tectonics.
2. Distribution of plants and animals around the world.
3. The origin of oxygen in our atmosphere.
4. Coal deposits and coal formation.
5. Speed of mountain erosion and uplift ment.
6. Ice cores drilled in Antarctica.
7. Radiometric dating of rocks.
8. The fossil record shows stages in life complexity over time.

1. CONTINENTAL DRIFT CAUSED BY PLATE TECTONICS

Gondwanaland reconstruction c.400 million years ago

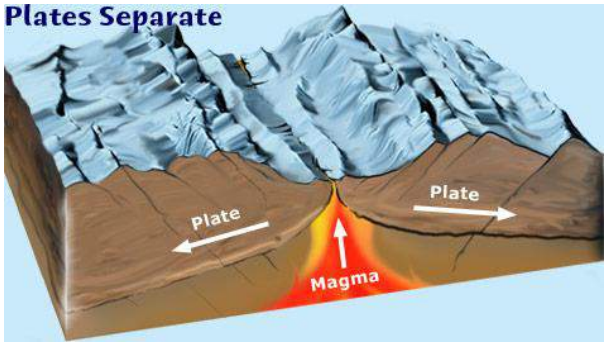
About 400 million years ago all continents were joined together in a similar way as illustrated here. How do we know that this was the case?
One way is to measure the movements of continents that are still taking place.
Satellites have enabled very accurate measurements that show continuing movement of whole continents.

For instance, Africa and South America are moving apart at about 5cm per year. At this rate of movement it would have taken **160 million years** for these two continents to reach their present positions.

It is interesting that the Bible account suggests that all land was initially in one place. We read, *And God said, "Let the waters under the sky be gathered in one place and let dry ground appear"* (Genesis 1:9). Also note that the wording is very suggestive of a process.

Could the continents have moved apart more rapidly than suggested by present speeds of movement? In other words, could they have reached their present positions within thousands of years rather than millions?

Some people have even suggested that the continents very suddenly moved to their present positions. There is no scientific support for this and such a sudden movement of all the continents would have destroyed all higher life through massive earthquakes and tsunamis.



To answer this question about speed of movements, studies of Plate Tectonics have shown the causes of continental drift.
This is caused by molten magma welling up from deep within the earth and then spreading sideways, pushing the continents apart.

At about the mid point between major continents this upwelling of magma has left vast under sea mountain ranges, such as the mid-Atlantic ridge, shown here.

These movements cause earthquakes and for continents to move apart more rapidly the earth would have experienced devastating earthquakes and tsunamis. In other words not the sort of world suitable for plant and animal life.

Evidence for slow continental drift is also shown by a study of animal and plant distribution around the world.

2. DISTRIBUTION OF PLANTS AND ANIMALS AROUND THE WORLD

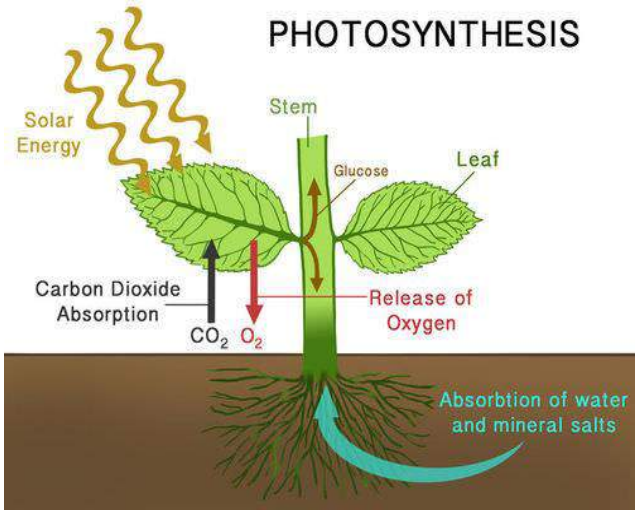
Studies of the distribution of animals and plants reveal distinct regions. Each region has different animals. The most dramatic example is Australia.

According to the studies of continental drift, **Australia broke away from other land masses before the earth contained placental mammals.**

Later in this article we look at how the complexity of life on our world has changed over time. The most ancient rocks contain only single celled creatures. Younger rocks contain multicellular fossils. When we come to warm blooded mammals, the earliest were Marsupials. Only in more recent rocks do we find fossils of placental mammals. Australia has its rich diversity of Marsupial mammals such as kangaroos, because this continent broke away from other land masses before placental mammals were in the world.

3. THE ORIGIN OF OXYGEN IN OUR ATMOSPHERE

The early earth's atmosphere contained very little oxygen. We know that nearly all of the oxygen was created by living organisms using the complex process that we call photosynthesis. This process has been described by some biologists as the most complex known to biology and yet it appeared in early life forms.

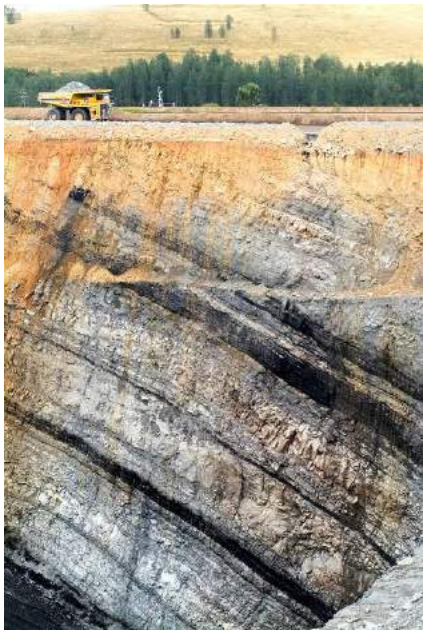


In the illustration we see that sunlight is used as an energy source enabling plants to absorb CO^2 from the atmosphere and in combination with water and mineral salts to create sugars within plants and as a by-product to release oxygen into the air.

We can calculate that, even if the world was totally covered with plants, it would have taken at least **300 million years** for the oxygen to reach the levels needed for sustaining higher life forms such as humans.

4. COAL DEPOSITS AND COAL FORMATION

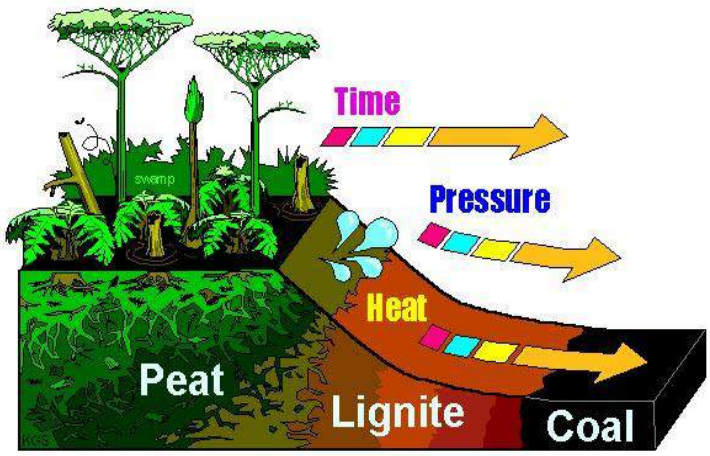
Scientific studies of coal formation and distribution have shown that the vast deposits found in many places, did not all originate from a single catastrophic event.



In these pictures we see a series of coal deposit layers separated by layers of hard rock. Furthermore, chemical analysis of the various coal deposits show that they were formed from vegetation that differed from deposit to deposit.

Some people have suggested that coal deposits were all formed during one vast world-wide flood event. The evidence clearly shows that this was not the case.

In addition, we know that the process of coal formation from dead and compressed vegetation takes long periods of time.



The process of coal formation involves creation of peat from dead vegetation. The early world had vast forests of early types of trees. These forests supported the large dinosaurs that were the dominant land creatures of that time.

When peat layers became covered with other deposits they underwent extensive periods of heating and compression, finally resulting in coal.

Clearly, our coal deposits were formed over a period of millions of years.

5. SPEED OF MOUNTAIN EROSION AND UPLIFTMENT

Our continents are composed of solid materials floating on a molten magma. These solid materials are lighter than the more dense molten magma. In a similar way that boats floating on water have a portion of the hull under the water and a portion above the water, continents show this same characteristic.

In other words, a mountain such as shown here may extend thousands of meters above sea level but below such mountains the continent has a corresponding 'root' extending down into the molten magma.

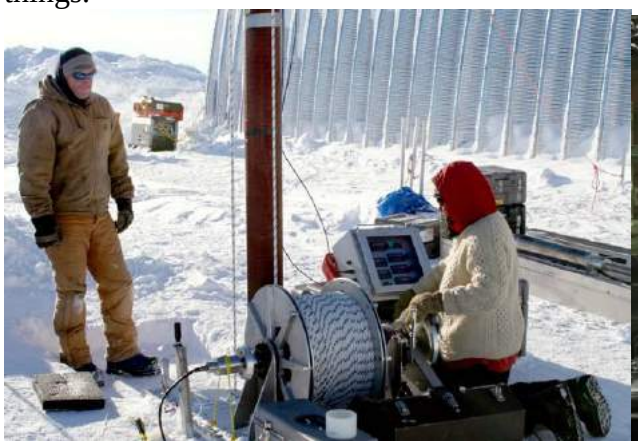
As weather, wind and plant growth slowly wear away the rocks, the mountain rises very slowly, so as to balance the mass above with the mass of the 'root' below.

In addition, continental drift has caused some land masses to collide, such as India hitting Asia and producing the Himalayan mountain range. As a result, some rocks that used to be at sea level have now landed up high above sea level. This is why we can find sea shells and other signs of sea life high up on some mountains.

Another way of looking at these **very slow processes** is to study how soils are formed. Nearly all our soils are the result of a long process of breaking down rocks, so as to release their trapped minerals and so make these available for growth of plants. In other words, even before continents could support the luxuriant growth that led to coal formation, there had to be a long process of soil formation.

6. ICE CORES DRILLED IN ANTARCTICA

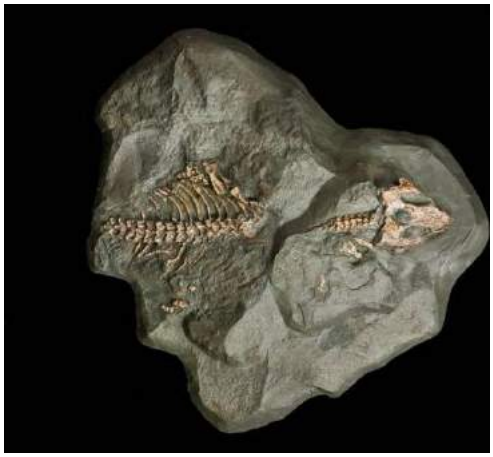
In recent years it has been possible to drill deep into Antarctic ice that has accumulated over many years. Analysis of the ice cores extracted from these boreholes has revealed fascinating things.



This study has shown annual ice deposits going back at least 800,000 years. The deposits of snow from each winter are determined by changes in composition between summer and winter deposits. By counting the number of winter deposits scientists can say how many years are involved.

In addition, we have historical records of major volcanic eruptions in various places and each volcano emits ash with a characteristic mineral composition. This ash becomes distributed worldwide by wind and weather and some reached Antarctica.

Volcanic ash of known age within these ice cores has enabled the scientists to check their analysis of how many years of deposits they are looking at.



This study is not telling us the age of our earth but at least it should be telling us that it is more than a few thousand years old.

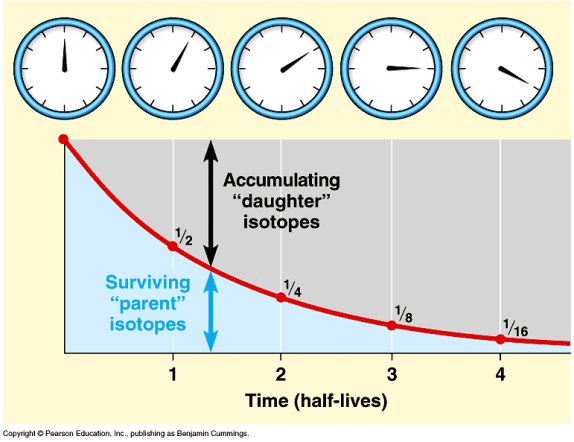
However, below this 800,000 year accumulation of ice we find rocks containing fossils, including amphibians and reptiles, as shown here and also fossilised forests. Forests of the antarctic continent

These Antarctic fossils also tell us that the Antarctic continent used to have a much warmer climate. In other words, these fossils add further evidence to the reality of continental drift.

The whole frozen continent of Antarctica once existed much closer to the equator and enjoyed a mild climate suited for vegetation and animals.

7. RADIOMETRIC DATING OF ROCKS

I have left discussion of radiometric dating to after outlining some of the other evidence for how ancient our world is. This is because those who hold to a theory of a young earth often claim that these dating techniques are faulty. They can point to a very few examples of where the dating was incorrect. However, when the correct methods are used the dating has been shown to be reliable in most cases.



Radiometric dating utilises the fact that radioactive elements (parent isotopes) periodically give off particles of energy as radiation and this changes the structure of the parent isotope.

The rate that this radiation is given off is different for the parent isotopes of different elements and the rates of decay have now been studied in laboratories for over 100 years by generations of physicists.

The time it takes for half of the parent isotope to change to its new form is called the 'half-life' and these half-lives differ for different parent isotopes. By measuring how much change has occurred (shown by the amount of daughter isotopes formed), we can obtain an approximate length of time since the parent isotope was originally formed.

Elements Used in Radioactive Dating

Radioactive Element	Half-Life (years)	Dating Range (years)
Carbon –14	5,770	500-50,000
Potassium – 40	1.3 billion	50,000-4.6 billion
Rubidium –87	48.8 billion	10 mill – 4.6 bill
Thorium – 232	14 billion	10 mill – 4.6 bill
Uranium – 235	713 million	10 mill – 4.6 bill
Uranium – 238	4.5 billion	10 mill – 4.6 bill

The table gives some of the radioactive elements and their 'half life' in millions and billions of years and the dating range suitable for analysis of sample materials. Each method has known margins of error but many rocks can be dated accurately enough to show their great age.

In this way the formation of some of the most ancient rocks has been dated to about 3.5 billion years ago.

These rocks in Greenland have been studied by using five different radiometric dating methods and all the methods gave an age of **about 3.5 billion years.**

Archaeologists use Carbon-14 for dating much younger objects of up to a maximum of 50,000 years old.
(Geologist Dr John Rogers kindly commented on this radiometric dating information)

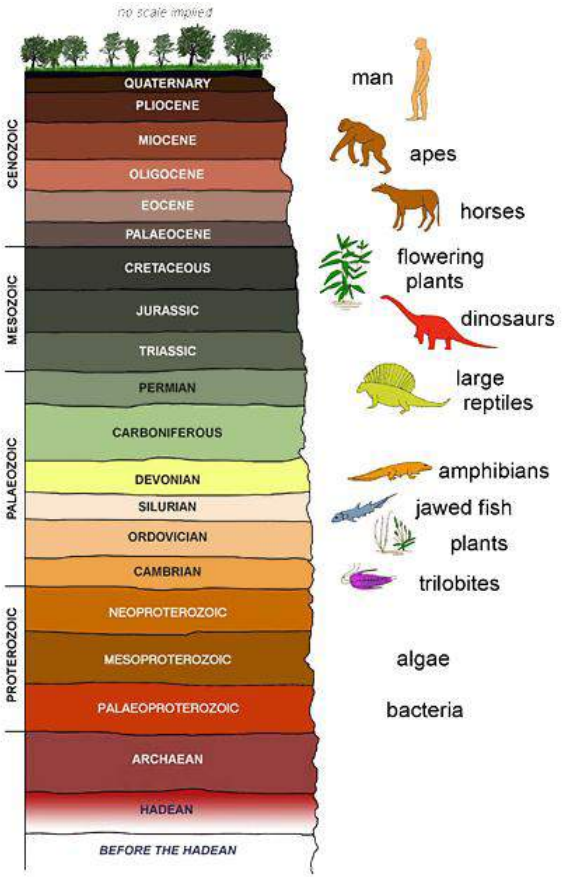
The skeptic may ask how sure are we that the rate of radiometric decay has not changed over time, resulting in us thinking rocks are much older than they are?

To reduce a 3.5 billion year old rock to a mere 6000 years would mean speeding up radiometric decay by at least 500,000 times. Since each decay event gives off radiation and radiation causes heating, such a massive speeding up of radioactive decay would have reduced our earth to a ball of molten rock. This would certainly not be a world suitable for life!

In other words, radiometric dating gives us another major means for studying the great age of our world. **It is billions of years old, not a few thousand!**

8. THE FOSSIL RECORD SHOWS STAGES IN LIFE COMPLEXITY OVER TIME

Once science established that the rocks on our world have varying ages, it became possible for geologists to divide the rocks into layers of differing ages.



We have also discovered that some rocks contain fossils of long dead creatures, many of which no longer exist alive in the world. This in turn has shown us that life forms did not all appear on earth at the same time.

The fossils reveal that the oldest rocks contain only unicellular life forms. A bit later, **some 500 million years ago**, there was suddenly a great variety of multicellular life forms. This period is referred to as the Cambrian Explosion.

However, most of the life forms seen in Cambrian fossils no longer exist alive in the world. More recent rocks contain fossils of creatures and plants with greater complexity.

In other words, **the creation of life in all its diversity did not all take place at the same time. It was spread over millions of years!**

8.

RELATIONSHIP BETWEEN AN ANCIENT WORLD AND THE BIBLE?

Some people who claim the world is only a few thousand years old, do so because they think that the Bible requires them to do so. In my opinion this is very unfortunate for the following main reasons:

1. The Bible is not a scientific textbook and so our interpretations of what it says about Creation should not overrule the evidence from nature of HOW God has created.

2. The Bible says that '*The heavens declare the glory of God'* (Psalm 19 and other passages). It is science that is revealing more about 'how' God operates in his universe. He uses the laws and processes he has created in order to continue his activities and plans.

3. The Bible Genesis account of creation is open to **various legitimate interpretations** that do not conflict with our world being ancient. A link to my own interpretation is given at the end of this article.

4. Some people fear that acceptance of evidence for an ancient world, containing long processes, will conflict with the Christian Gospel message. However, there does not have to be any conflict.

5. When people cling to a 'Young Earth Interpretation' and deny the long processes of creation, this results in the vast majority of our scientifically literate generation rejecting the relevance of the Bible. When the impression is given that the Young Earth Interpretation of Genesis is the only legitimate way of looking at creation, it places an enormous **stumbling block** in the way of reaching our generation with the truth about God, his Creation and the relevance of the Christian Gospel message.

Some previous articles relevant to this one

Amongst the articles most relevant to the age of our Earth and its implication for understanding the Bible: Evidence against a world-wide flood

Reconciling the Genesis creation account with science

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