

The Radiometric Dating Game

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Radiometric dating methods estimate the age of rocks using calculations based on the decay rates of radioactive elements such as uranium, strontium, and potassium. On the surface, radiometric dating methods appear to give powerful support to the statement that life has existed on the earth for hundreds of millions, even

billions, of years. We are told that these methods are accurate to a few percent, and that there are many different methods. We are told that of all the radiometric dates that are measured, only a few percent are anomalous. This gives us the impression that all but a small percentage of the dates computed by radiometric methods agree with the assumed ages of the rocks in which they are found, and that all of these various methods almost always give ages that agree with each other to within a few percentage points. Since there doesn't seem to be any systematic error that could cause so many methods to agree with each other so often, it seems that there is no other rational conclusion than to accept these dates as accurate.

However, this causes a problem for those who believe based on the Bible that life has only existed on the earth for a few thousand years, since fossils are found in rocks that are dated to be over 500 million years old by radiometric methods, and some fossils are found in rocks that are dated to be billions of years old. If these dates are correct, this calls the Biblical account of a recent creation of life into question.

After study and discussion of this question, I now believe that the claimed accuracy of radiometric dating methods is a result of a great misunderstanding of the data, and that the various methods hardly ever agree with each other, and often do not agree with the assumed ages of the rocks in which they are found. I believe that there is a great need for this information to be made known, so I am making this article available in the hopes that it will enlighten others who are considering these questions. Even the creationist accounts that I have read do not adequately treat these issues.

At the start, let me clarify that my main concern is not the age of the earth, the moon, or the solar system, but rather the age of life, that is, how long has life existed on earth. Many dating methods seem to give about the same ages on meteorites. Thus radiometric dating methods appear to give evidence that the earth and meteorites are old, if one accepts the fact that decay rates have been constant. However, there may be other explanations for this apparent age. Perhaps the earth was made from older pre-existing matter, or perhaps decay rates were briefly faster for some reason. When one considers the power of God, one sees that any such conclusions are to some extent tentative. For some evidence for a young universe, see <http://users.aol.com/profhilljw/davidspg/snr.htm> and <http://users.aol.com/profhilljw/davidspg/hst.htm>. For some evidence for a young sun, see <http://www.icr.org/pubs/imp/imp->

[276.htm](#). I believe that life was recently created. I also believe that the evidence indicates that the earth has recently undergone a violent catastrophe.

Geologic time is divided up into periods, beginning with the Precambrian, followed by the Cambrian and a number of others, leading up to the present. Some fossils are found in Precambrian rocks, but most of them are found in Cambrian and later periods. We can assume that the Precambrian rocks already existed when life began, and so the ages of the Precambrian rocks are not necessarily related to the question of how long life has existed on earth. The Cambrian period is conventionally assumed to have begun about 550 million years ago. Since Cambrian and later rocks are largely sedimentary and igneous (volcanic) rocks are found in Cambrian and later strata, if these rocks are really 550 million years old, then life must also be at least 550 million years old. Therefore, my main concern is with rocks of the Cambrian periods and later.

How radiometric dating works in general

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Radioactive elements decay gradually into other elements. The original element is called the parent, and the result of the decay process is called the daughter element. Assuming we start out with pure parent, as time passes, more and more daughter will be produced. By measuring the ratio of daughter to parent, we can measure how old the sample is. A ratio of zero means an age of zero. A higher ratio means an older age. A ratio of infinity (that is, all daughter and no parent) means an age of essentially infinity.

Each radioactive element has a half-life, which tells how long it takes for half of the element to decay. For potassium 40, the half-life is about 1.3 billion years. In general, in one half-life, half of the parent will have decayed. In two half-lives, half of the remainder will decay, meaning $3/4$ in all will have decayed. In general, in n half-lives, only $1/(2^n)$ of the original parent material will be left.

Potassium 40 (K40) decays to argon 40, which is an inert gas, and to calcium. Potassium is present in most geological materials, making potassium-argon dating highly useful if it really works. Potassium is about $1/40$ of the earth's crust, and about $1/10,000$ of the potassium is potassium 40. Uranium decays to lead by a complex series of steps. Rubidium decays to strontium. Thus we

obtain K-Ar dating, U-Pb dating, and Rb-Sr dating, three of the most common methods.

When it is stated that these methods are accurate to one or two percent, it does not mean that the computed age is within one or two percent of the correct age. It just means that there is enough accuracy in the measurements to compute t to one or two percentage points of accuracy, where t is the time required to obtain the observed ratio of daughter to parent, assuming no initial daughter product was present at the beginning, and no daughter or parent entered or left the system. For isochrons, which we will discuss later, the conditions are different. If these conditions are not satisfied, the error can be arbitrarily large.

In order to use these methods, we have to start out with a system in which no daughter element is present, or else know how much daughter element was present initially so that it can be subtracted out. We also need to know that no parent or daughter has entered or left the system in the meantime. Radiometric dating is commonly used on igneous rocks (lava), and on some sedimentary minerals. But fossils can generally not be dated directly. When lava is hot, argon escapes, so it is generally assumed that no argon is present when lava cools. Thus we can date lava by K-Ar dating to determine its age. As for the other methods, some minerals when they form exclude daughter products. Zircons exclude lead, for example, so U-Pb dating can be applied to zircon to determine the time since lava cooled. Micas exclude strontium, so Rb-Sr dating can be used on micas to determine the length of time since the mica formed.

I found the following statement in an on-line (non creationist) reference, as follows:

"This is possible in potassium-argon (K-Ar) dating, for example, because most minerals do not take argon into their structures initially. In rubidium-strontium dating, micas exclude strontium when they form, but accept much rubidium. In uranium-lead (U-Pb) dating of zircon, the zircon is found to exclude initial lead almost completely."

[from the Britannica Online, article "Geochronology: The Interpretation and Dating of the Geologic Record."] So because of this, one can do Rb-Sr dating on micas because they exclude strontium when the micas form. Thus one would know that any strontium that is present had to come from the parent rubidium, so

by computing the ratio and knowing the half life, one can compute the age.

In general, when lava cools, various minerals crystallize out at different temperatures, and these minerals preferentially include and exclude various elements in their crystal structures. So one obtains a series of minerals crystallizing out of the lava. Thus the composition of the lava continues to change, and later minerals can form having significantly different compositions than earlier ones. Lava that cools on the surface of the earth is called extrusive. This type of lava cools quickly, leaving little time for crystals to form, and forms basalt. Lava that cools underground cools much more slowly, and can form large crystals. This type of lava typically forms granite or quartz.

A good general introduction to radiometric dating from an evolutionary perspective can be found at <http://asa.calvin.edu/ASA/resources/Wiens.html>.

Why methods in general are inaccurate

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I admit this is a very beautiful theory. This would seem to imply that the problem of radiometric dating has been solved, and that there are no anomalies. So if we take a lava flow and date several minerals for which one knows the daughter element is excluded, we should always get the exact same date, and it should agree with the accepted age of the geological period. Is this true? I doubt it very much. If the radiometric dating problem has been solved in this manner, then why do we need isochrons, which are claimed to be more accurate?

The same question could be asked in general of minerals that are thought to yield good dates. Mica is thought to exclude Sr, so it should yield good Rb-Sr dates. But are dates from mica always accepted, and do they always agree with the age of their geologic period? I suspect not.

Indeed, there are a number of conditions on the reliability of radiometric dating. For example, for K-Ar dating, we have the following requirements:

For this system to work as a clock, the following 4 criteria must be fulfilled:

1. The decay constant and the abundance of K40 must be known accurately.
2. There must have been no incorporation of Ar40 into the mineral at the time of crystallization or a leak of Ar40 from the mineral following crystallization.
3. The system must have remained closed for both K40 and Ar40 since the time of crystallization.
4. The relationship between the data obtained and a specific event must be known.

The requirements for radiometric dating are stated in another way, at the web site <http://hubcap.clemson.edu/spurgeon/books/apology/Chapter7.html>:

"But what about the radiometric dating methods? The earth is supposed to be nearly 5 billion years old, and some of these methods seem to verify ancient dates for many of earth's igneous rocks. The answer is that these methods, are far from infallible and are based on three arbitrary assumptions (a constant rate of decay, an isolated system in which no parent or daughter element can be added or lost, and a known amount of the daughter element present initially)."

Here are more quotes about radiometric dating from http://www.parentcompany.com/handy_dandy/hder12.htm:

"All of the parent and daughter atoms can move through the rocks. Heating and deformation of rocks can cause these atoms to migrate, and water percolating through the rocks can transport these substances and redeposit them. These processes correspond to changing the setting of the clock hands. Not infrequently such resetting of the radiometric clocks is assumed in order to explain disagreements between different measurements of rock ages. The assumed resettings are referred to as 'metamorphic events' or 'second' or 'third events.'"

And again,

"It is also possible that exposure to neutrino, neutron, or cosmic radiation could have greatly changed isotopic ratios or the rates at some time in the past."

It is known that neutrinos interact with atomic nuclei, so a larger density of neutrinos could have sped up radioactive decay and made matter look old in a hurry. Some more quotes from the same source:

a. In the lead-uranium systems both uranium and lead can migrate easily in some rocks, and lead volatilizes and escapes as a vapor at relatively low temperatures. It has been suggested that free neutrons could transform Pb-206 first to Pb-207 and then to Pb-208, thus tending to reset the clocks and throw thorium-lead and uranium-lead clocks completely off, even to the point of wiping out geological time. Furthermore, there is still disagreement of 15 percent between the two preferred values for the U-238 decay constant.

b. In the potassium/argon system argon is a gas which can escape from or migrate through the rocks. Potassium volatilizes easily, is easily leached by water, and can migrate through the rocks under certain conditions. Furthermore, the value of the decay constant is still disputed, although the scientific community seems to be approaching agreement. Historically, the decay constants used for the various radiometric dating systems have been adjusted to obtain agreement between the results obtained. In the potassium/argon system another adjustable "constant" called the branching ratio is also not accurately known and is adjusted to give acceptable results.

Argon-40, the daughter substance, makes up about one percent of the atmosphere, which is therefore a possible source of contamination. This is corrected for by comparing the ratio argon-40/argon-36 in the rock with that in the atmosphere. However, since it is possible for argon-36 to be formed in the rocks by cosmic radiation, the correction may also be in error. Argon from the environment may be trapped in magma by pressure and rapid cooling to give very high erroneous age results. In view of these and other problems it is hardly surprising that the potassium/argon method can yield highly variable results, even among different minerals in the same rock.

c. In the strontium/rubidium system the strontium-87 daughter atoms are very plentiful in the earth's crust. Rubidium-87 parent atoms can be leached out of the rock by water or volatilized by heat.

All of these special problems as well as others can produce contradictory and erroneous results for the various radiometric dating systems.

So we have a number of mechanisms that can introduce errors in radiometric dates. Heating can cause argon to leave a rock and make it look younger. In general, if lava was heated after the initial flow, it can yield an age that is too young. If the minerals in the lava did not melt with the lava, one can obtain an age that is too old. Leaching can also occur; this involves water circulating in rock that can cause parent and daughter elements to enter or leave the rock and change the radiometric age.

Thus it is easy to rationalize any date that is obtained. If a date is too old, one can say that the mineral did not melt with the lava. (Maybe it got included from surrounding rock as the lava flowed upward.) If the date is too young, one can say that there was a later heating event. One can also hypothesize that leaching occurred.

But then it is claimed that we can detect leaching and heating. But how can we know that this claim is true, without knowing the history of rocks and knowing whether they have in fact experienced later heating or leaching?

The problems are compounded because many of the parent and daughter substances are mobile, to some extent. I believe that all parent substances are water soluble, and many of the daughter products as well. A few sources have said that Sr is mobile in rock to some extent. This could cause trouble for Rb-Sr dating. In fact, some sources say that Sr and Ar have similar mobilities in rock, and Ar is very mobile.

Especially the gaseous radiometric decay byproducts such as argon, radon, and helium are mobile in rock. So if a rock has tiny cracks permitting gas to enter or escape or permitting the flow of water, the radiometric ages could be changed substantially even without the rock ever melting or mixing.

For example, suppose that $1/300,000$ of the argon in a rock escapes in one day. Then in 1000 years the rock will have less than $1/(2.7)$ of its original argon. In 5000 years the rock will have less than $1/(2.7^5)$ of its original argon. Now, there is probably not much argon in a rock to start with. So the loss of a tiny amount of argon can have significant effects over long time periods. A loss of argon would make the rock look younger.

In a similar way, argon could enter the rock from the air or from surrounding rocks and make it look older. And this can also happen by water flowing through the rock through tiny cracks, dissolving parent and daughter elements. It would be difficult to measure the tiny changes in concentration that would suffice to make large changes in the radiometric ages over long time periods.

I also question the assertion that argon, for example, is excluded from certain minerals when they crystallize and never enters later on. Geologists often say that ages that are too old are due to excess argon. So it must be possible for that excess argon to get in, even though the crystal is supposed to exclude it. Here is one such reference, although this is to a mineral that does not exclude argon:

"As in all dating systems, the ages calculated can be affected by the presence of inherited daughter products. In a few cases, argon ages older than that of the Earth which violate local relative age patterns have even been determined for the mineral biotite. Such situations occur mainly where old rocks have been locally heated, which released argon-40 into pore spaces at the same time that new minerals grew. Under favourable circumstances the isochron method may be helpful, but tests by other techniques may be required. For example, the rubidium-strontium method would give a valid isotopic age of the biotite sample with inherited argon."

[from the Online Encyclopedia Britannica article, "Geochronology: The Interpretation and Dating of the Geologic Record, Potassium-argon methods."]

Another problem is that the crystal structure typically has imperfections and impurities. For example, different kinds of quartz have different colors due to various impurities that are included but not part of the repetitive unit of the quartz crystal. So even if the crystal excludes the daughter element, it could be present in impurities. Thus crystals, as they form, may have tiny imperfections that accept parent and daughter products in the same ratios as they occur in the lava, so one can inherit ages from the lava into minerals in this way. It is also possible that parent and

daughter elements could be present in boundaries between regular crystal domains. I don't know how we can be sure that a crystal will exclude argon or other daughter substances except by growing it in the laboratory under many conditions.

There can also be argon or other daughter products added from the air or from other rocks. One could say that we can detect whether the daughter is embedded in the crystal structure or not. But this would require an atom by atom analysis, which I do not believe is practical.

Why K-Ar dating is inaccurate

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Since K-Ar (potassium-argon) dating is one of the most prevalent techniques, some special commentary about it is in order. Potassium is about 2.5 percent of the earth's crust. About 1/10,000 of potassium is K40, which decays into Ar40 with a half-life of 1.3 billion years. Actually, only about 1/8 of the potassium 40 decays to argon, and the rest decays to calcium. Thus after n half-lives, $(1/2)^n$ of the original potassium 40 will remain. Of the $1 - (1/2)^n$ which has decayed, about 7/8 will have decayed into calcium, and the remaining 1/8 will have decayed into argon 40. Argon is about 3.6×10^{-6} of the earth's crust. We can assume, then, that the magma is probably about 1/40 potassium and about 1/400,000 K40. After 570 million years, about 26 percent of this potassium will have decayed, so that there will be about 1/3 as much decay product as K40. About 1/8 of the decay product will be Argon 40, so there will be about 1/24 as much argon 40 as K40. Thus we should expect about 1/9,600,000 of a rock having an average concentration of potassium, to be argon, if the rock is really 570 million years old. This is about one ten millionth of the mass of the rock, a very tiny percentage. And yet, with a large amount of argon in the air and also filtering up from rocks below, and with excess argon in lava, with argon and potassium water soluble, and argon mobile in rock, we are still expecting this wisp of argon to tell us how old the rock is! The percentage of Ar40 is even less for younger rocks. For example, it would be about one in 100 million for rocks in the vicinity of 57 million years old.

To get one part in 10 million of argon in a rock in a thousand years, we would only need to get one part in 10 billion entering the rock each year. This would be less than one part in a trillion entering the rock each day, on the average. This would suffice to

give a rock having an average concentration of potassium, a computed potassium-argon age of over 500 million years!

We can also consider the average abundance of argon in the crust. If we assume that a rock has $1/400,000$ K40, that is, 2.5×10^{-6} K40, and 3.6×10^{-6} Ar40, then eight times this much K40 must have decayed, thus about 28.8×10^{-6} parts of K40 have decayed, so there is less than $1/10$ of the original K40 left. This implies a radiometric age of over 4 billion years. So a rock can get a very old radiometric age just by having average amounts of potassium and argon. It seems reasonable to me that the large radiometric ages are simply a consequence of mixing, and not related to ages at all, at least not necessarily the ages of the rocks themselves. The fact that not all of the argon is retained would account for smaller amounts of argon near the surface, as I will explain below. This could happen because of properties of the magma chambers, or because of argon being given off by some rocks and absorbed by others.

I don't see how one can possibly know that there are no tiny cracks in rocks that would permit water and gas to circulate. The rates of exchange that would mess up the dates are very tiny. It seems to me to be a certainty that water and gas will enter rocks through tiny cracks and invalidate almost all radiometric ages.

Let me illustrate the circulation patterns of argon in the earth's crust. About 2.5 percent of the earth's crust is believed to be potassium, and about $1/10,000$ of this is K40 which decays to Ar40 with a half life of 1.3 billion years. So argon is being produced throughout the earth's crust, and in the magma, all the time. In fact, it probably rises to the top of the magma, artificially increasing its concentration there. Now, some rocks in the crust are believed not to hold their argon, so this argon will enter the spaces between the rocks. Leaching also occurs, releasing argon from rocks. Heating of rocks can also release argon. Argon is released from lava as it cools, and probably filters up into the crust from the magma below, along with helium and other radioactive decay products.

All of this argon is being produced and entering the air and water in between the rocks, and gradually filtering up to the atmosphere. But we know that rocks absorb argon, because correction factors are applied for this when using K-Ar dating. So this argon that is being produced will leave some rocks and enter others. The partial pressure of argon should be largest deepest in the earth, and decrease towards the surface. This would result in larger K-Ar ages lower down, but lower ages nearer the surface.

As for K-Ar dating, here is a quote given above:

"As in all dating systems, the ages calculated can be affected by the presence of inherited daughter products. In a few cases, argon ages older than that of the Earth which violate local relative age patterns have even been determined for the mineral biotite. Such situations occur mainly where old rocks have been locally heated, which released argon-40 into pore spaces at the same time that new minerals grew. Under favourable circumstances the isochron method may be helpful, but tests by other techniques may be required. For example, the rubidium-strontium method would give a valid isotopic age of the biotite sample with inherited argon."

So this confirms that argon can travel from rock to rock when one rock is heated. Now, argon is very soluble in magma, which can hold a lot of it:

"Laboratory experiments have been conducted on the solubility of argon in synthetic basaltic melts and their associated minerals.^{31, 32} Minerals and melts were held near 13000C at one atmosphere pressure in a gas stream containing argon. After the material was quenched, the researchers measured up to 0.34 ppm ⁴⁰Ar within synthetic olivine. They noted, 'The solubility of Ar in the minerals is surprisingly high'.³³ Their conclusion is that argon is held primarily in lattice vacancy defects within the minerals."

I note that this concentration of argon, if it were retained in the rock, would suffice to give it a geological age well over 500 million years, assuming an average concentration of potassium. This is from a paper by Austin available at <http://www.icr.org/research/sa/sa-r01.htm>. This paper also discusses Mount St. Helens K-Ar dating, and historic lava flows and their excess argon.

So magma holds tremendous amounts of argon. Now, consider an intrusive flow, which cools within the earth. All its argon will either remain inside and give an old age to the flow, or will travel through surrounding rock, where it can be absorbed by other rocks. If one assumes that the amount of argon in the magma is consistent with an age of 4 billion years, then there should be about 7/8 as much argon ⁴⁰ as potassium ⁴⁰. For a rock 570 million years old, there should be about 1/24 as much argon as potassium ⁴⁰. So magma should have at least 20 times as much argon as a rock 570 million years old by K-Ar dating. In fact, the argon in the magma may well be even higher, as it may concentrate near the top. This amount of argon is enough to raise 20 times the volume of magma

to a K-Ar age of 570 million years, and probably 200 times the volume of the magma to an age of 57 million years. So one sees that there is a tremendous potential for age increases in this way. It is not necessary for this increase in age to happen all at once; many events of this nature can gradually increase the K-Ar ages of rocks. In general, older rocks should have more argon because they have been subject to more exposure to such argon, but their true age is not necessarily related to their K-Ar radiometric age.

We can also consider that most volcanoes and earthquakes occur at boundaries between plates, so if the lava has flowed before, it is likely to flow again nearby, gradually increasing the age. I suppose earthquakes could also allow the release of argon from the magma.

Other mechanisms include dissolving of rock, releasing its argon, fracturing of rock, with release of argon, argon from cooling lava under water entering the water and entering other rocks, and argon from cooling lava entering subterranean water and being transported to other rock. There are so many mechanisms that it is hard to know what pattern to expect, and one does not need to rely on any one of them (such as more argon in the magma in the past) to account for problems in K-Ar dating.

Since even rocks with old K-Ar dates still absorb more argon from the atmosphere in short time periods, it follows that rocks should absorb quite a bit of argon over long time periods, especially at higher pressures. In fact, if a rock can absorb only a ten millionth part of argon, that should be enough to raise its K-Ar age to over 570 million years, assuming an average amount of potassium. It wouldn't require many internal cracks to allow a ten millionth part of argon to enter. Also, as the rock deforms under pressure, more cracks are likely to form and old ones are likely to close up, providing more opportunity for argon (and other gases) to enter.

I mentioned a number of possibilities that could cause K-Ar dates to be much older than the true ages of the rocks. Here is another way that K-Ar dates can be too old: If we assume the earth went through a catastrophe recently, then the crustal plates might have been agitated, permitting lava and argon to escape from the magma. Thus a lot of argon would be filtering up through the crust. As intrusive flows of lava cooled inside the crust, they would have been in an environment highly enriched in argon, and thus would not have gotten rid of much of their argon. Thus they would have hardened with a lot of argon inside. This would make them appear old. The same goes for extrusive flows on the surface, since argon

would be filtering up through the earth and through the lava as it cooled.

The following was sent to me by a friend:

In areas where tremendous tectonic activity has taken place, highly discordant values for the ages are obtained. The difficulties associated are numerous and listed as follows:

1. There seems to be a great deal of question regarding the branching ratio for K^{40} into Ar^{40} and Ca^{40} . The value that has been used for Ar^{40}/Ca^{40} has varied from 0.12 to 0.08. But the value is not really known. The observed value is between 0.11 and 0.126, but in order to match K-Ar ages, which average somewhat higher [lower?] than the U-Th-Pb ages, to the latter ages, the value 0.08 is arbitrarily taken. However, this doesn't remedy the situation and the ages are still too high [low?]. The geochronologists credit this to "argon leakage".

2. There is far too much Ar^{40} in the earth for more than a small fraction of it to have been formed by radioactive decay of K^{40} . This is true even if the earth really is 4.5 billion years old. In the atmosphere of the earth, Ar^{40} constitutes 99.6% of the total argon. This is around 100 times the amount that would be generated by radioactive decay over the age of 4.5 billion years. Certainly this is not produced by an influx from outer space. Thus, a large amount of Ar^{40} was present in the beginning. Since geochronologists assume that errors due to presence of initial Ar^{40} are small, their results are highly questionable.

3. Argon diffuses from mineral to mineral with great ease. It leaks out of rocks very readily and can move from down deep in the earth, where the pressure is large, and accumulate in an abnormally large amount in the surface where rock samples for dating are found. They would all have excess argon due to this movement. This makes them appear older. Rocks from deeper in the crust would show this to a lesser degree. Also, since some rocks hold the Ar^{40} stronger than others, some rocks will have a large apparent age, others smaller ages, though they may actually be the same age. If you were to measure Ar^{40} concentration as function of depth, you would no doubt find more of it near the surface than at deeper points because it migrates more easily from deep in the earth than it does from the earth into the atmosphere. It is easy to see how the huge ages are being obtained by the K^{40} - Ar^{40}

radiometric clock, since surface and near-surface samples will contain argon due to this diffusion effect.

Some geochronologists believe that a possible cause of excess argon is that argon diffuses into mineral progressively with time. Significant quantities of argon may be introduced into a mineral even at pressures as low as one bar.

...

If such [excessive] ages as mentioned above are obtained for pillow lavas, how are those from deep-sea drilling out in the Atlantic where sea-floor spreading is supposed to be occurring?

5. Potassium is found to be very mobile under leaching conditions. As much as 80% of the potassium in a small sample of an iron meteorite was removed by running distilled water over it for 4 and 1/2 hours. This could move the "ages" to tremendously high values. Ground-water and erosional water movements could produce this effect naturally.

6. Rocks in areas having a complex geological history have many large discordances. In a single rock there may be mutually contaminating, potassium-bearing minerals.

7. There is some difficulty in determining the decay constants for the K40-Ar40 system. Geochronologists use the branching ratio as a semi-empirical, adjustable constant which they manipulate instead of using an accurate half-life for K40.

A number of recent lava flows (within the past few hundred years) yield potassium-argon ages in the hundreds of thousands of years range. This indicates that some excess argon is present. Where is it coming from? And how do we know that it could not be a much larger quantity in other cases? If more excess argon were present, then we could get much older ages.

It is true that an age difference in the hundreds of thousands of years is much too small to account for the observed K-Ar ages. But excess argon is commonly invoked by geologists to explain dates that are too old, so I'm not inventing anything new. Second, there may have been a lot more more argon in the magma in the past, and with each eruption, the amount decreased. So there would have been a lot more excess argon in the past, leading to older ages.

For rocks that are being dated, contamination with atmospheric argon is a persistent problem that is mentioned a number of times. Thus it is clear that argon enters rock easily. It is claimed that we can know if a rock has added argon by its spectrum when heated; different temperatures yield different fractions of argon. It is claimed that the argon that enters from the atmosphere or other rocks, is less tightly bound to the crystal lattice, and will leave the rock at a lower temperature. But how do we know what happens over thousands of years? It could be that this argon which is initially loosely bound (if it is so initially) gradually becomes more tightly bound by random thermal vibrations, until it becomes undetectable by the spectrum technique. The fact that rock is often under high pressure might influence this process, as well.

The branching ratio problem

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We now consider in more detail one of the problems with potassium-argon dating, namely, the branching ratio problem. Here is some relevant information that was e-mailed to me.

There are some very serious objections to using the potassium-argon decay family as a radiometric clock. This is harmful to the position of those holding to the theory of sea-floor spreading since their time scale has been calculated using K40/Ar40 dates mainly. About 11% of K40 decays by electron capture and gamma ray emission to Ar40 and the remaining 89% of the K40 decays by B-particle emission to form Ca40. The geochronologist considers the Ca40 of little practical use in radiometric dating since common calcium is such an abundant element and the radiogenic Ca40 has the same atomic mass as common calcium.

"Juggling" is also performed by geochronologists in this K-Ar system. Here the actual observed branching ratio is not used, but rather a small ratio is arbitrarily chosen in an effort to match dates obtained method with U-Th-Pb dates.

The branching ratio that is often used is 0.08, while the true value is probably about 0.12. This means that K-Ar dates computed with the lower branching ratio are a third too large, that is, the actual K-

Ar date should be $2/3$ of the computed date. Thus we have another source of error for K-Ar dating.

How Errors Can Account for the Observed Dates

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Thus there are a number of sources of error. We now consider whether they can explain the observed dates. In general, the dates that are obtained by radiometric methods are in the hundreds of millions of years range. One can understand this by the fact that the clock did not get reset (if one accepts the fact that the magma "looks" old, for whatever reason). That is, we can get both parent and daughter elements from the magma inherited into minerals that crystallize out of lava, making these minerals look old. Since the magma has old radiometric dates, depending on how much the clock gets reset, the crust can end up with a variety of younger dates just by partially inheriting the dates of the magma.

Thus any method based on simple parent to daughter ratios such as Rb-Sr dating is bound to be unreliable, since there would have to be a lot of the daughter product in the magma already. And Harold Coffin's book *Creation by Design* lists a study showing that Rb-Sr dates are often inherited from the magma.

Even the initial ratios of parent and daughter elements in the earth do not necessarily indicate an age as old as 4.5 billion years. Radioactive decay would be faster in the bodies of stars, which is where scientists assume the heavy elements formed. Imagine a uranium nucleus forming by the fusion of smaller nuclei. At the moment of formation, as two nuclei collide, the uranium nucleus will be somewhat unstable, and thus very likely to decay into its daughter element. The same applies to all nuclei, implying that one could get the appearance of age quickly. Of course, the thermonuclear reactions in the star would also speed up radioactive decay. But isochrons might be able to account for pre-existing daughter elements.

Furthermore, some elements in the earth are too abundant to be explained by radioactive decay in 4.5 billion years (such as calcium, argon, and, I believe, strontium). Some are too scarce (such as helium). So it's not clear to me how one can be sure of the 4.5 billion year age, even assuming a constant decay rate.

Why older dates would be found lower in the geologic column especially for K-Ar dating

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In general, potassium-argon dates appear to be older the deeper one goes in the crust of the earth. We now consider possible explanations for this.

There are at least a couple of mechanisms to account for this. In volcano eruptions, a considerable amount of gas is released with the lava. This gas undoubtedly contains a significant amount of argon 40. Volcanos typically have magma chambers under them, from which the eruptions occur. It seems reasonable that gas would collect at the top of these chambers, causing artificially high K-Ar radiometric ages there. In addition, with each successive eruption, some gas would escape, reducing the pressure of the gas and reducing the apparent K-Ar radiometric age. Thus the decreasing K-Ar ages would represent the passage of time, but not necessarily related to their absolute radiometric ages. As a result, lava found in deeper layers, having erupted earlier, would generally appear much older and lava found in higher layers, having erupted later, would appear much younger. This could account for the observed distribution of potassium-argon dates, even if the great sedimentary layers were laid down very recently. In addition, lava emerging later will tend to be hotter, coming from deeper in the earth and through channels that have already been warmed up. This lava will take longer to cool down, giving more opportunity for enclosed argon to escape and leading to younger radiometric ages. A discussion of these mechanisms may be found at [the Geoscience Research Institute site](#).

Another factor is that rocks absorb argon from the air. It is true that this can be accounted for by the fact that argon in the air has Ar36 and Ar40, whereas only Ar40 is produced by K-Ar decay. But for rocks deep in the earth, the mixture of argon in their environment is probably much higher in Ar40, since only Ar40 is produced by radioactive decay. As these rocks absorb argon, their radiometric ages would increase. This would probably have a larger effect lower down, where the pressure of argon would be higher. Or it could be that such a distribution of argon pressures in the rocks occurred at some time in the past. This would also make deeper rocks tend to have older radiometric ages.

Recent lava flows often yield K-Ar ages of about 200,000 years. This shows that they contain some excess argon, and not all of it is escaping. If they contained a hundred times more excess argon, their K-Ar ages would be a hundred times greater, I suppose. And faster cooling could increase the ages by further large factors. I also read of a case where a rock was K-Ar dated at 50 million years, and still susceptible to absorbing argon from the air. This shows that one might get radiometric ages of at least 50 million years in this way by absorbing Ar40 deep in the earth without much Ar36 or Ar38 present. If the pressure of Ar40 were greater, one could obtain even greater ages.

Yet another mechanism that can lead to decreasing K-Ar ages with time is the following, in a flood model: One can assume that at the beginning of the flood, many volcanoes erupted and the waters became enriched in Ar40. Then any lava under water would appear older because its enclosed Ar40 would have more trouble escaping. As time passed, this Ar40 would gradually pass into the atmosphere, reducing this effect and making rocks appear younger. In addition, this would cause a gradient of Ar40 concentrations in the air, with higher concentrations near the ground. This also could make flows on the land appear older than they are, since their Ar40 would also have a harder time escaping.

Do different methods agree with each other on the geologic column?

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Let us consider the question of how much different dating methods agree on the geologic column, and how many measurements are anomalous, since these points are often mentioned as evidences of the reliability of radiometric dating. It takes a long time to penetrate the confusion and find out what is the hard evidence in this area.

In the first place, I am not primarily concerned with dating meteorites, or precambrian rocks. What I am more interested in is the fossil-bearing geologic column of Cambrian and later age.

Now, several factors need to be considered when evaluating how often methods give expected ages on the geologic column. Some of these are taken from John Woodmoreappe's article on the subject, but only when I have reason to believe the statements are also generally believed. First, many igneous formations span many

periods, and so have little constraint on what period they could belong to. The same applies to intrusions. In addition, some kinds of rocks are not considered as suitable for radiometric dating, so these are typically not considered. Furthermore, it is at least possible that anomalies are under-reported in the literature. Finally, the overwhelming majority of measurements on the fossil bearing geologic column are all done using one method, the K-Ar method. (And let me recall that both potassium and argon are water soluble, and argon is mobile in rock.) Thus the agreement found between many dates does not necessarily reflect an agreement between different methods, but rather the agreement of the K-Ar method with itself. For example, if 80 percent of the measurements were done using K-Ar dating, and the other 20 percent gave random results, we still might be able to say that most of the measurements on a given strata agree with one another reasonably well. So to me it seems quite conceivable that there is no correlation at all between the results of different methods on the geologic column, and that they have a purely random relationship to each other.

Let us consider again the claim that radiometric dates for a given geologic period agree with each other. I would like to know what is the exact (or approximate) information content of this assertion, and whether it could be (or has been) tested statistically. It's not as easy as it might sound.

Let's suppose that we have geologic periods $G_1 \dots G_n$. Let's only include rocks whose membership in the geologic period can be discerned independent of radiometric dating methods. Let's also only include rocks which are considered datable by at least one method, since some rocks (I believe limestone) are considered not to hold argon, for example.

Now, we can take a random rock from G_i . We will have to restrict ourselves to places where G_i is exposed, to avoid having to dig deep within the earth. Let's apply all known dating methods to G_i that are thought to apply to this kind of rock, and obtain ages from each one. Then we can average them to get an average age for this rock. We can also compute how much they differ from one another.

Now we have to be careful about lava flows -- which geologic period do they belong to? What about rocks that are thought not to have their clock reset, or to have undergone later heating episodes? Just to make the test unbiased, we will assign altitude limits to each geologic period at each point on the earth's surface (at least in

principle) and include all rocks within these altitude limits within Gi, subject to the condition that they are datable.

The measurements should be done in a double-blind manner to insure lack of unconscious bias.

For each geologic period and each dating method, we will get a distribution of values. We will also get a distribution of averaged values for samples in each period. Now, some claim is being made about these distributions. It is undoubtedly being claimed that the mean values ascend as one goes up the geologic column. It is also being claimed that the standard deviations are not too large. It is also being claimed that the different methods have distributions that are similar to one another on a given geologic period.

The only correlation I know about that has been studied is between K-Ar and Rb-Sr dating on precambrian rock. And even for this one, the results were not very good. This was a reference by Hurley and Rand, cited in Woodmorappe's paper. As far as I know, no study has been done to determine how different methods correlate on the geologic column (excluding precambrian rock).

The reason for my request is that a correlation is not implied by the fact that there are only 10 percent anomalies, or whatever. I showed that the fact that the great majority of dates come from one method (K-Ar) and the fact that many igneous bodies have very wide biostratigraphic limits, where many dates are acceptable, makes the percentage of anomalies irrelevant to the question I am asking. And since this agreement is the strongest argument for the reliability of radiometric dating, such an assumption of agreement appears to be without support so far.

The question of whether different methods correlate on the geologic column is not an easy one to answer for additional reasons. Since the bulk of K-Ar dates are generally accepted as correct, one may say that certain minerals are reliable if they tend to give similar dates, and unreliable otherwise. We can also say that certain formations tend to give reliable dates and others do not, depending on whether the dates agree with K-Ar dates. Thus we can get an apparent correlation of different methods without much of a real correlation in nature. It's also possible for other matter to be incorporated into lava as it rises, without being thoroughly melted, and this matter may inherit all of its old correlated radiometric dates. Coffin mentions that fission tracks can survive transport through lava, for example. It may also be that lava is produced by melting the bottom of continents and successively

different layers are melted with time, or there could be a tendency for lighter isotopes to come to the top of magma chambers, making the lava there appear older. But anyway, I think it is important really to know what patterns appear in the data to try to understand if there is a correlation and what could be causing it. Not knowing if anomalies are always published makes this harder.

It is often mentioned that different methods agree on the K-T boundary, dated at about 65 million years ago. This is when the dinosaurs are assumed to have become extinct. This agreement of different methods is taken as evidence for a correlation between methods on the geologic column. One study found some correlated dates from bentonite that are used to estimate the date of the K-T boundary. I looked up some information on bentonite. It is composed of little glass beads that come from volcanic ash. This is formed when lava is sticky and bubbles of gas in it explode. So these small particles of lava cool very fast. The rapid cooling might mean that any enclosed argon is retained, but if not, the fact that this cooling occurs near the volcano, with a lot of argon coming out, should guarantee that these beads would have excess argon. As the gas bubble explodes, its enclosed argon will be rushing outward along with these tiny bubbles as they cool. This will cause them to retain argon and appear too old. In addition, the rapid cooling and the process of formation means that these beads would have Rb, Sr, U, and Pb concentrations the same as the lava they came from, since there is no chance for crystals to form with such rapid cooling. So to assume that the K-Ar dates, Rb-Sr dates, and U-Pb dates all reflect the age of the lava, one would have to assume that this lava had no Sr, no Pb, and that all the argon escaped when the beads formed. Since the magma generally has old radiometric ages, I don't see how we could have magma without Pb or Sr. In fact, I doubt that there is fresh uncrystallized lava anywhere on earth today that has zero U/Pb and Rb/Sr ages, as would be required if bentonite gave an accurate date for the K-T boundary. So to me it seems to be certain that these ages must be in error.

Furthermore, the question arises whether bentonite always gives correlated ages, and whether these ages always agree with the accepted ages for their geologic period. I believe that bentonite occurs in a number of formations of different geologic periods, so this could be checked. If bentonite does not always give correlate and correct ages, this calls into question its use for dating the K-T boundary.

Possible other sources of correlation

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Note that if there are small pockets in crystals where both parent and daughter product can accumulate from the lava, then one can inherit correlated ages from the lava into minerals. Thus even the existence of correlations is not conclusive evidence that a date is correct.

Anomalies of radiometric dating

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If a date does not agree with the expected age of its geologic period, and no plausible explanation can be found, then the date is called anomalous. But if we really understand what is going on, then we should be able to detect discrepant dates as they are being measured, and not just due to their divergence from other dates.

Geologists often say that the percentage of anomalies is low. But there are quite a number of rather outstanding anomalies in radiometric dating that creationists have collected. These anomalies are reported in the scientific literature. For example, one isochron yielded a date of 10 billion years. A Rb-Sr isochron yielded a date of 34 billion years. K-Ar dates of 7 to 15 billion years have been recorded. It's also not uncommon for two methods to agree and for the date to be discarded anyway. Samples with flat plateaus (which should mean no added argon) can give wrong dates. Samples giving no evidence of being disturbed can give wrong dates. Samples that give evidence of being disturbed can give correct dates. The number of dates that disagree with the expected ages is not insignificant. I don't know what the exact percentage is.

Many dates give values near the accepted ones. But even these often differ from one another by 10 or 20 percent. And quite a few other dates are often much, much farther off. Whatever is making some of these dates inaccurate could be making all of them inaccurate.

It's interesting to note that in a few cases, old radiometric dates are above young ones.

The fact that different methods often give different dates is noted by geologists. Here are some quotes from <http://hubcap.clemson.edu/spurgeon/books/apology/Chapter7.html>:

"It is obvious that radiometric techniques may not be the absolute dating methods that they claimed to be. Age estimates on a given geological stratum by different radiometric methods are often quite different (sometimes by hundreds of millions of years). There is not absolutely reliable long-term radiological "clock". The uncertainties inherent in radiometric dating are disturbing to geologists and evolutionists... [47]

As proof of the unreliability of the radiometric methods consider the fact that in nearly every case dates from recent lava flows have come back excessively large. One example is the rocks from the Kaupulehu Flow, Hualalai Volcano in Hawaii which was known to have erupted in 1800-1801. These rocks were dated by a variety of different methods. Of 12 dates reported the youngest was 140 million years and the oldest was 2.96 billion years. The dates average 1.41 billion years. [48]"

Another source said that about 5 or 6 of the historic lava flows give ages in the hundreds of thousands of years. Geologists explain the Kaupulehu date by the lava being cooled rapidly in deep ocean water and not being able to get rid of its enclosed argon.

Here are some quotes from John Woodmorappe's paper, "Radiometric Geochronology Reappraised," Creation Research Society Quarterly 16(2)102-29, p. 147, September 1979, that indicate that radiometric dates are scattered, and that anomalies are often not reported:

"Improved laboratory techniques and improved constants have not reduced the scatter in recent years. Instead, the uncertainty grows as more and more data is accumulated ... " (Waterhouse).

"In general, dates in the 'correct ball park' are assumed to be correct and are published, but those in disagreement with other data are seldom published nor are discrepancies fully explained." (Mauger)

" ... the thing to do is get a sequence of dates and throw out those that are vastly anomalous." (Curtis et al)

" ... it is usual to obtain a spectrum of discordant dates and to select the concentration of highest values as the correct age." (Armstrong and Besancon).

"In general, strong discordances can be expected among ages deduced by different methods." (Brown and Miller)

Woodmorappe also mentions that very self-contradictory age spreads in the Precambrian era are common.

In addition, Woodmorappe gives over 300 sets of dates "that are in gross conflict with one another and with expected values for their indicated paleontological positions." This table is limited to dates that approach 20% discrepancy, too old or too young. This does not include dates from minerals that are thought to yield bad dates, or from igneous bodies with wide biostratigraphic ranges, where many dates are acceptable. He states that the number of dates within range are less than the number of anomalies, except for the Cenozoic and Cretaceous. When one adds in the fact that many anomalies are unreported, which he gives evidence for, the true distribution is anyone's guess. He also combines evidence from the literature to conclude that "somewhat less than half of all dates agree with 10% of accepted values for their respective biostratigraphic positions." I believe this estimate even includes igneous bodies with very wide biostratigraphic limits, and does not include unpublished anomalies.

There have been criticisms of John Woodmorappe's study, but no one has given any figures from the literature for the true percentage of anomalies, with a definition of an anomaly, or the degree of correlation between methods. Steven Schimmrich's review of this study often concerns itself with John W's presentation of geologists explanation for anomalies, and not with the percentage of anomalies; the later is my main concern.

Here are a couple of more quotes about anomalies:

"Situations for which we have both the carbon-14 and potassium-argon ages for the same event usually indicate that the potassium-argon 'clock' did not get set back to zero. Trees buried in an eruption of Mount Rangotito in the Auckland Bay area of New Zealand provide a prime example. The carbon-14 age of the buried trees is only 225 years, but some of the overlying volcanic material has a 465,000-year potassium-argon age."

[Harold Coffin, *Origin by Design*, page 400.]

A similar situation is reported in the December 1997 issue of *Creation ex nihilo* in which lava with a K-Ar age of about 45 million years overlays wood that was carbon dated by 3 laboratories using AMS dating to about 35,000 years.

Still another evidence for problems with radiometric dating was given in a recent talk I attended by a man who had been an evolutionist and taken a course in radiometric dating. The teacher gave 14 assumptions of radiometric dating and said something like "If creationists got a hold of these, they could cut radiometric dating to pieces."

Another evidence that all is not well with radiometric dating is given in the following quote from Coffin p. 302:

"We find that most primary radioactive ores that have not been exposed to weathering exist in secular equilibrium. Many sedimentary uranium ores are not."

Since equilibrium should be reached in 1 million years, this is a problem for sediments that are assumed to be older than 1 million years.

On another point, if we can detect minerals that were not molten with the lava, as has been claimed, then this is one more reason why there should be no anomalies, and radiometric dating should be a completely solved problem. But that does not appear to be the case, at least (especially) on the geologic column.

I'm not claiming that anomalous results are being hidden, just that the agreement of a mass of results, none of which has much claim to reliability, does not necessarily mean much.

Picking out a few cases where radiometric dates appear to be well-behaved reminds me of evolutionary biologists focusing on a few cases where there may be transitional sequences. It does not answer the overall question. And as I said above, I'm also interested to know how much of the fossil-bearing geologic column can be dated by isochrons, and how the dates so obtained compare to others.

Concerning K-Ar anomalies, here is a quote from Woodmorappe's paper cited above, p. 122:

"K-Ar ages much greater than inferred earth age are also common. Gerling et al called attention to some chlorites yielding K-Ar dates of 7 to 15 b.y. It had been noted that some minerals which yield such dates (as beryl, cordierite, etc.) can be claimed to have trapped excess argon in their channel structures or to have fractionated the Ar isotopes, but none of this can apply to the simple mica-like structures of chlorite. They also pointed out that for the

anomalies to be accounted for by excess argon, unreasonably high partial pressures of Ar during crystallization would have to be required. They concluded by suggesting some unknown nuclear process which no longer operates to have generated the Ar."

This implies that excess argon is coming from somewhere. Here is another quote from Woodmorappe about isochrons, since some people think that mixing scenarios or other age-altering scenarios are unlikely:

"Shafiqullah and Damon said: "The Ar40/Ar36 vs. K40/Ar36 isochrons are valid only when all samples of the system under consideration have the same non-radiogenic argon composition. If this condition does not hold, invalid ages and intercepts are obtained. Models 2-9 yield isochron ages that are too high, too low, or in the future, sometimes by orders of magnitude."

from Woodmorappe, "An Anthology of Matters Significant to Creationism and Diluviology, Report 1," Creation Research Society Quarterly 16(4)209-19, March 1980, p. 218.

The fact that the only "valid" K-Ar isochrons are those for which the concentration of non-radiogenic argon (Ar36) is constant, seems very unusual. This suggests that what is occurring is some kind of a mixing phenomenon, and not an isochron reflecting a true age.

The following quote is from http://www.pathlights.com/ce_encyclopedia/Index.htm:

"Processes of rock alteration may render a volcanic rock useless for potassium-argon dating . . . We have analyzed several devitrified glasses of known age, and all have yielded ages that are too young. Some gave virtually zero ages, although the geologic evidence suggested that devitrification took place shortly after the formation of a deposit." *J.F. Evernden, et. al., "K / A Dates and Cenozoic Mannalian Chronology of North America," in American Journal of Science, February 1964, p. 154.

Why a low anomaly percentage is meaningless

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One of the main arguments in favor of radiometric dating is that so many dates agree with each other, that is, with the date expected for their geologic period. But it's not evident how much support this gives to radiometric dating. If a rock dates too old, one can say that the clock did not get reset. If it dates too young, one can invoke a later heating event. Neither date would necessarily be seen as anomalous. If lava intrudes upon geologic period X, then any date for the lava of X or later will not be seen as anomalous. And even if the date is one or two geologic periods earlier, it may well be close enough to be accepted as non-spurious. If one does not know the geologic period of a rock by other means, then of course one is likely to date it to find out, and then of course the date agrees with the geologic period and this will not be seen as anomalous. So it is difficult to know what would be a reasonable test for whether radiometric dating is reliable or not. The percentage of published dates that are considered as anomalous has little bearing on the question.

The biostratigraphic limits issue

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The issue about igneous bodies may need additional clarification. If a lava flow lies above geologic period A and below B, then allowable ages are anything at least as large as A and no larger than B. This is called the biostratigraphic limit of the flow. Now, according to Woodmorappe's citations, many lava flows have no such limits at all, and most of them have large limits. For example, a flow lying on precambrian rock with nothing on top would have no limits on its dates. And such flows often have a large internal scatter of dates, but these dates are not considered as anomalies because of the unrestricted biostratigraphic limit. Other flows with wide biostratigraphic limits have weak restrictions on allowable dates. This is one reason why just reporting the percentage of anomalies has little meaning.

John W. states that very many igneous bodies have little or no biostratigraphic limits, so just about any age is acceptable. Thus these ages, though they generally have a considerable scatter, are not considered as anomalies. He cites another reference that most igneous bodies have wide biostratigraphic limits. Thus just by chance, many dates will be considered within the acceptable ranges. If the igneous body is constrained to have a date between that of geologic period X1 and X2, with times T1 and T2, and if we regard any date within 20 percent as non-anomalous, then any date between $T1/1.2$ and $T2*1.2$ will be considered as non-

anomalous, and this will include a considerable portion of geologic history. Again, the percentage of anomalies means nothing for the reliability of radiometric dating.

Now, igneous bodies can be of two types, extrusive and intrusive. Extrusive bodies are lava that is deposited on the surface. These cool quickly and have small crystals and form basalt. Intrusive bodies are deposited in the spaces between other rocks. These cool more slowly and have larger crystals, often forming granite. Both of these tend on the average to have wide biostratigraphic limits, meaning that a large spread of ages will be regarded as non-anomalous. And if we recall that most radiometric dating is done of igneous bodies, one sees that the percentage of anomalies is meaningless. Thus we really need some evidence that the different methods agree with each other.

To make the case even stronger, "Many discrepant results from intrusives are rationalized away immediately by accepting the dates but reinterpreting the biostratigraphic bracket," according to John Woodmorappe. This of course means that the result is no longer anomalous, because the geologic period has been modified to fit the date. Finally, the fact that the great majority of dates are from one method means that the general (but not universal) agreement of K-Ar dating with itself is sufficient to explain the small percentage of anomalies (if it is small).

Preponderance of K-Ar dating

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Now, the point about agreement is that whatever figure is given about how often ages agree with the expected age, is consistent with the fact that there is no agreement at all between K-Ar and other methods, since so many measurements are done using K-Ar dating. And one of the strongest arguments for the validity of radiometric dating is that the methods agree. So I'm very interested to know what data there is about how often different methods agree.

So when one combines all of the above figures, the statement that there are only 10 percent anomalies or 5 percent or whatever, does not have any meaning any more. This statement is made so often as evidence for the reliability of radiometric dating, that the simple evidence that it has no meaning, is astounding to me. I don't object to having some hard evidence that there are real agreements between different methods on the geologic column, if someone can

provide it. The precambrian rock is less interesting because it could have a radiometric age older than life, but this is less likely for the rest of the geologic column.

It's not surprising that K-Ar dates often agree with the assumed dates of their geological periods, since the dates of the geological periods were largely inferred from K-Ar dating.

By the way, Ar-Ar dating and K-Ar dating are essentially the same method, so between the two of them we obtain a large fraction of the dates being used.

Some information from an article by Robert H. Brown at [the Geoscience Research Institute site](#) confirms the preponderance of K-Ar dating:

History of the Radioisotope based Geologic Time Scale

Before the discovery of radioactivity in the late nineteenth century, a geological time scale had been developed on the basis of estimates for the rates of geological processes such as erosion and sedimentation, with the assumption that these rates had always been essentially uniform. On the basis of being unacceptably old, many geologists of the time rejected these early twentieth century determinations of rock age from the ratio of daughter to radioactive parent (large). By 1925, increased confidence in radioisotope dating techniques and the demands of evolution theory for vast amounts of time led to the establishment of an expanded geological time scale. With the K-Ar dating techniques developed after World War II, this time scale was refined to the standard Geologic Time Scale adopted in 1964. The construction of this time scale was based on about 380 radioisotope ages that were selected because of their agreement with the presumed fossil and geological sequences found in the rocks. Radioisotope ages that did not meet these requirements were rejected on the basis of presumed chemical and/or physical modifications that made the "ages" unreliable indicators of real time. About 85% of the selections were K-Ar dates, 8% rubidium-strontium dates, and 4% uranium-lead dates. Igneous rocks are particularly suited to K-Ar dating. The crucial determiners are therefore volcanic (extrusive igneous) rocks that are interbedded with sediments, and intrusive igneous rocks that penetrate sediments.

This verifies what I said about almost all of the dates used to define correct ages for geologic periods being K-Ar dates. Also, the uncertainty in the branching ratio of potassium decay might mean that there is a fudge factor in K-Ar ages of up to a third, and that the occasional agreements between K-Ar ages and other ages are open to question.

So the point is that there is now no reason to believe that radiometric dating is valid on the geologic column.

Excuses for anomalies

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Another issue is that sometimes the geologic periods of rocks are revised to agree with the ages computed. This also makes data about percentages of anomalies less meaningful.

It sometimes seems that reasons can always be found for bad dates, especially on the geologic column. If a rock gives a too old date, one says there is excess argon. If it gives a too young date, one says that it was heated recently, or cannot hold its argon. How do we know that maybe all the rocks have excess argon? It looks like geologists are taking the "majority view" of K-Ar dating, but there is no necessary reason why the majority of rocks should give the right date.

The following quote is from the article by Robert H. Brown, cited earlier:

What is a Radioisotope Age?

The relationship of a radioisotope age with real-time must be based on an interpretation. A discussion of rubidium-strontium ages in the Isotope Geoscience Section of the journal, Chemical Geology, specifically states that a radioisotope age determination "does not certainly define a valid age information for a geological system. Any interpretation will reflect the interpreters presuppositions (bias).

Need for a double-blind test

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Concerning the need for a double blind test, it would seem that there are many places where human judgment could influence the distribution of measured radiometric dates. It could increase the percentage of anomalies, if they were regarded as more interesting. It could decrease them, if they were regarded as flukes. Human judgment could determine whether points were collinear enough to form an isochron. It could determine whether a point can justifiably be tossed out and the remaining points used as an isochron. It could determine whether one should accept simple parent-to-daughter K-Ar ratios or whether some treatment needs to be applied first to get better ages. It could influence whether a spectrum is considered as flat, whether a rock is considered to have undergone leaching or heating, whether a rock is porous or not, or whether a sample has been disturbed in some way.

Since one of the main reasons for accepting radiometric dates (at least I keep hearing it) is that they agree with each other, I think that geologists have an obligation to show that they do agree, specifically on the geologic column. Since we do not know whether or how much human judgment is influencing radiometric dating, a double blind study is most reasonable. And it should not be restricted to just one or two well-behaved places, but should be as comprehensive as possible.

Possible changes in the decay rate

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The following information was sent to me by e-mail:

Radiometric dating is predicated on the assumption that throughout the earth's history radioactive decay rates of the various elements have remained constant. Is this a warranted assumption? Has every radioactive nuclide proceeded on a rigid course of decay at a constant rate? This has been challenged by studies involving Carbon (C)-14.

At the temperature or pressure, collisions with stray cosmic rays or the emanations of other atoms may cause changes other than those of normal disintegration. It seems very possible that spontaneous disintegration of radioactive elements are related to the action of cosmic rays and the rate of disintegration varying from century to

century according to the intensity of the rays. The evidence for a strongly increasing change in the cosmic ray influx is most favorable especially in light of the decay of the earth's magnetic field.

Most geochronologists maintain that pleochroic haloes give evidence that decay constants have not changed. Crystals of biotite, for example, and other minerals in igneous or metamorphic rocks commonly enclose minute specks of minerals containing uranium or thorium. The α -(alpha) particles emitted at high velocity by the disintegrating nuclides interact, because of their charge, with electrons of surrounding atoms which slow them down until they finally come to rest in the host material at a distance from their source that depends on their initial kinetic energy and the density and composition of the host. Where they finally stop to produce lattice distortions and defects there generally occurs discoloring or darkening. Each of the 8 α -particles emitted during the disintegration of U238 to Pb206 produces a dark ring in biotite. Each ring has its own characteristic radius in a given mineral (in this case biotite). This radius measures the kinetic energy, hence the probability of emission of the corresponding α -particle and also the half-life of the parent nuclide according to the Geiger-Nuttall law. The Geiger-Nuttall law is an empirical relation between half-life of the α -emitter and the range in air of the emitted α -particles. If the radii of these haloes from the same nuclide vary, this would imply that the decay rates have varied and would invalidate these series as being actual clocks. Are the radii in the rocks constant in size or are there variable sizes?

Most of the early studies of pleochroic haloes were made by Joly and Henderson. Joly concluded that the decay rates have varied on the basis of his finding a variation of the radii for rocks of alleged geological ages. This rather damaging result was explained away saying that enough evidence of correct radii for different geologic periods and sufficient variation in the same period have been obtained that one is forced to look for a different explanation of such variations as were observed by Joly.

Measurements were later made in an excellent collection of samples with haloes. It was found that the extent of the haloes around the inclusions varies over a wide range, even with the same nuclear material in the same matrix, but all sizes fall into definite groups. The measurements are, in microns, 5,7,10,17,20,23,27, and 33.

More recent studies have been made by Robert V. Gentry. Gentry also finds a variation in the haloes leading him to conclude that the decay constants have not been constant in time.

Gentry points out an argument for an instantaneous creation of the earth. He noted from his studies of haloes: "It thus appears that short half-life nuclides of either polonium, bismuth, or lead were incorporated into halo nuclei at the time of mica crystallization and significantly enough existed without the parent nuclides of the uranium series. For the Po218 (half-life of 3 minutes) only a matter of minutes could elapse between the formation of the Po218 and subsequent crystallization of the mica; otherwise the Po218 would have decayed, and no ring would be visible. The occurrence of these halo types is quite widespread, one or more types having been observed in the micas from Canada (Pre-Cambrian), Sweden, and Japan." The argument seems hard to refute.

So, then, careful scientists have measured variations in halo radii and their measurements indicate a variation in decay rates. The radioactive series then would have no value as time clocks.

The following quotation also suggests a cause for a change in the decay rate:

"An earlier increase [in neutrino levels] must have had the peculiar characteristic of resetting all our atomic clocks. This would knock our C-14, potassium-argon, and uranium-lead dating measurements into a cocked hat! The age of prehistoric artifacts, the age of the earth, and that of the universe would be thrown into doubt."

F. Johnson, *J.R. Arnold, and *R.F. Flint, "Radiocarbon Dating," in Science, February 8, 1957, p. 240. This is significant because it is known that neutrinos do interact with the nuclei of atoms, and it is also believed that

much of the energy of supernovae is carried away by neutrinos.

Isochrons

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Isochrons are an attempt to avoid the need for an absence of daughter element initially in computing radiometric ages. The idea is that one has a parent element, X, a daughter element, Y, and another isotope, Z, of the daughter that is not generated by decay. One would assume that initially, the concentration of Z and Y are proportional, since their chemical properties are very similar. Radiometric decay would generate a concentration of Y proportional to X. So we would obtain an equation of the form

$$Y = c1*X + c2*Z$$

By taking enough measurements of the concentrations of X, Y, and Z, we can solve for c1 and c2, and from c1 we can determine the radiometric age of the sample. A good general introduction to isochrons from an evolutionary perspective can be found at <http://www.talkorigins.org/faqs/isochron-dating.html>.

Let's apply this to potassium argon dating, where X is K40, Y is Ar40, and Z is probably Ar36. If the concentration of K varies in a rock, that it is unlikely for the concentration of added argon 40 to vary in a way that will yield an isochron. But if the concentration of K does not vary, then one can still get an isochron if the concentration of the non-radiogenic isotope Ar36 of the daughter product varies. So let's call an isochron a "super-isochron" if the concentration of the parent element varies from one sample to another. Let's call it a "wimpy isochron" otherwise. The question is, what percentage of isochrons are super-isochrons, and how do their dates agree with the conventional dates for their geologic period? I would think that it may be rare to have a super-isochron. If one is dealing with minerals that exclude parent or daughter, then one cannot get an isochron at all. If one is dealing with minerals that do not exclude parent and daughter elements, then most likely the parent element will be evenly distributed everywhere, and one will have a wimpy isochron that cannot detect added daughter product, and thus may give unreliable ages. Whole rock isochrons may also tend to be wimpy, for the same reason. Even super isochrons can yield ages that are too old, due to mixings, however.

False K-Ar isochrons can be produced if a lava flow starts out with a lot of excess Ar40 which becomes well mixed, along with potassium. Then while cooling or afterwards, a mixture of Ar36 and Ar40 can enter the rock, more in some places than others. Other isotopes of argon would work as well. I believe that this will produce a good K-Ar isochron, but the age calculated will be meaningless.

There is another way that false isochrons can be produced. For a wimpy isochron, say a K-Ar isochron, we can assume that initially there is a uniform concentration of K everywhere, and concentrations of Ar40 and Ar36 that form an isochron. Then a lot of Ar40 enters, uniformly, through cracks in the rock or heating. This will retain the isochron property, but will make the isochron look too old.

My reasoning was that if the lava is thoroughly mixed, then the concentration of parent material should be fairly constant. If the concentration of parent substance is not constant, it could indicate that the lava is not thoroughly mixed. Or it could have other explanations. If the lava is not thoroughly mixed, it is possible to obtain an isochron from the mixing of two different sources, in which case the radiometric age is inherited from the sources, and does not necessarily yield the age of the flow.

Someone pointed out to me that many Rb-Sr isochrons are super isochrons. I find this information very interesting, and thank him for it. I'd be curious to know which strata they occur in, as my main interest is the geologic column of Cambrian and above. My impression is that these are not on this part of the geologic column. And how well do the dates correlate with others for the same formation?

There are also mixing scenarios that can produce even super isochrons having invalid ages. And geologists admit in any event that isochrons can sometimes give false ages.

Here is a mixing scenario for false isochrons. Consider this possibility: There are two sources of lava, A and B. Suppose these mix together so that at point 0 we have only A, at point 1 we have only B, and in between we have varying concentrations. Half way between there is a mixture of half A and half B, for example. Suppose X is a parent substance, Y is its daughter, and Z is a non-radiogenic isotope of the daughter. Suppose A has a little X and lots of Y and not much Z, all uniformly distributed, and B has some mixture of Y and Z, all uniformly distributed. Then this

varying mixture of A and B, with all A at 0 and all B at 1, produces a good isochron. There is no way this mixture can be distinguished from a similar case in which A has lots of X and little Y, and B is the same as before, and a lot of time passes.

It is claimed that mixing can often be detected. If this is so, then the question remains, for super isochrons on the geologic column which can be shown not to be caused by mixing, how do they correlate with other methods, and with the expected dates for their geologic period?

My understanding is that isochrons measure the time since a rock was last well mixed. For a lava flow, this could be the time of the flow. Or it could be that several flows all come from the same well-mixed magma, and might yield a joint isochron giving the time of the flow. It seems to me that a single lava flow might not mix well, and thus the age obtained would be that of the magma and not the time of the flow. So this points out another problem with interpretation of isochrons.

I'm also curious to know how much of the geologic column is datable by super isochrons for which no mixing can be shown.

Atlantic sea floor dating

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One often hears about K-Ar dates of the Atlantic Ocean bottom which increase from zero at the mid-Atlantic ridge to about 150 million years at the edges. This is taken as proof that the continents began separating about 150 million years ago. However, this can be explained by assuming that argon rises to the top of the magma, so magma deeper down looks younger. The magma deeper down would have come to the surface later, and thus would be nearer to the mid-Atlantic ridge. Or if the continents split quickly, the observed pattern of dates could be explained by a decreasing concentration of Ar40 in the water. In any event, I don't see how the lava in the center of the Atlantic could have a young age in the conventional view, since it would have cooled rapidly under a lot of water, and would have retained its argon, making it look old.

Dating Meteorites

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We now make some comments about dating the meteorites. Since I have not had as much time to study this, I will just list some points that must be considered. Many parent to daughter ratios for many meteorites give radiometric ages of about 4.5 billion years. This gives support to an ancient age for the meteorites, assuming constant decay rates. However, in interpreting these results, some facts need to be kept in mind. The first is that these results are not obtained by a simple parent to daughter ratio. Instead, some estimate of the amount of daughter initially present in the meteorite has to be made in order to compute a radiometric age. Thus one has a "fudge factor," and in fact, a different fudge factor for each method. So one has to be sure that these fudge factors are properly used, and not simply adjusted in order to obtain an agreement among the dates.

The importance of this is underlined by the fact that these same fudge factors are used to estimate uranium and thorium dates on earth. Thus the estimate of initial concentrations of lead isotopes could also affect the 4.5 billion year age computation for the earth.

We noted above that there also seems to be a fudge-factor built into potassium-argon dating, namely, the branching ratio estimate. This causes the correlation between K-Ar dates and other dates on meteorites to come into question, as well.

Now, at least for uranium-lead dating, a kind of isochron has been observed among five meteorites containing uranium and a number which do not, which gives a rational basis for assuming how much daughter product was present initially. See <http://www.talkorigins.org/faqs/faq-age-of-earth.html>. The obvious question to ask in regards to this is how the meteorites were chosen for this isochron, and whether there are other meteorites and other bodies from the solar system that do not fit. If so, this calls this interpretation into question. In addition, there is just one point on this isochron for all of the meteorites that do not contain uranium. Is this obtained by averaging, or do they all have exactly the same ratio of lead isotopes? If the former, then this could indicate that the points of this isochron have considerable scatter, further calling the age computation into question. A point from the earth is also on this isochron. This is from a sedimentary deposit. But since uranium is much more water soluble than lead, it seems questionable to use this point as representing the ratio of lead isotopes on earth, since it may be impoverished or enriched in uranium. In addition, if other sediments yield different ratios of isotopes, why was only this one chosen? Another question that needs to be asked is whether this isochron could have been

produced by some kind of a mixing process, since such processes can produce isochrons not representing a true age. It also needs to be determined whether the daughter products for methods other than uranium-lead dating also yield isochrons among the different meteorites.

The above discussion concerns dating techniques based on simple parent to daughter ratios. There are other dating techniques such as isochrons and discordia which avoid the need to estimate initial daughter product concentrations. Therefore, it should be determined how many correlations remain in meteorite dating when only such techniques are applied.

Of course, in the traditional view, the matter out of which the solar system was formed would have been very old at the start, in any event, and so the radiometric ages obtained from meteorites or from the earth do not necessarily tell us anything about the age of the solar system or the age of the earth.

My point is not to refute the meteorite dating, since it may be sound, assuming a constant decay rate. However, on seeing the lack of evidence for large-scale evolution, the many problems with radiometric dating on the geologic column, and the many plausible evidences for catastrophe which often seem to be interpreted away by science, I have become somewhat skeptical of any area of science having to do with origins, and so have come to question even the assumptions behind the dating of the meteorites.

Conclusion

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An evolutionist said his experience is that whenever he looks into a creationist source, it blows up on him. My experience is that whenever I look into an evidence for evolution or (now) the reliability of radiometric dating on the geologic column, it blows up on me, too.

I don't deny that there is some degree of plausibility to radiometric dating, although I have to wonder if many field geologists secretly have their doubts about it. My concern is instead to know how much stamina the evidence has against other evidence that may call it into question. My conclusion for the geologic column is, not much.

Gentry's radiohaloes in coalified wood

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Here is some more material from my web site bearing on the question of the age of the geologic column:

It is also of interest in regard to radiometric dating that Robert Gentry claims to have found "squashed" polonium haloes as well as embryonic uranium radiohaloes in coal deposits from many geological layers claimed to be hundreds of millions of years old. (See the Oct. 15, 1976 issue of Science.) These haloes represent particles of polonium and uranium which penetrated into the coal at some point and produced a halo by radioactive decay. The fact that they are squashed indicates that part of the decay process began before the material was compressed, so the polonium had to be present before compression. Since coal is relatively incompressible, Gentry concludes that these particles of uranium and polonium must have entered the deposit before it turned to coal. However, there is a very small amount of lead with the uranium; if the uranium had entered hundreds of millions of years ago, then there should be much more lead. The amount of lead present is consistent with an age of thousands rather than millions of years. It's hard to believe, according to conventional geological time scales, that this coal was compressed any time within the past several thousand or even hundred million years.

Here is a quote from Coffin, page 306, about Gentry's findings:

"Coalified wood from Triassic and Jurassic sediments (225- to 135-million-year conventional geologic age) contains radiohaloes. Published lead-206/uranium-238 ratios for their inclusion centers may be expressed in terms of uranium-lead radioisotope ages ranging between 236 thousand and 2.9 million years. No presently available experimental evidence would exclude the possibility that essentially all the lead-206 in the halo centers was introduced together with the uranium (either directly or as parent polonium-210 or lead-210) and thus did not accumulate from uranium."

In fact, a couple of the haloes have ages consistent with an origin thousands of years ago.

Thus the amount of lead with the uranium is consistent with an age in the hundreds of thousands to millions of years range, much too small for conventional geologic time. And it is reasonable to assume that almost all of this lead came with the uranium, rather than being a result of decay, suggesting that the true age could be much younger than this.

Note that this phenomenon of squashed haloes appears in different coal deposits in different geologic formations, and all give about the same U-Pb ages. The squashing is in the vertical direction, and I can't think of any way this could happen at a time later than the burial of the logs or whatever under a lot of sediment. Coal is not water soluble (at least, coal cars aren't covered, and no one seems to worry about thunderstorms dissolving the coal away), and wood is waterproof, so one would expect that coalified wood would also be waterproof. Coal has small pores. If it had cracks, they would have to be small, since the cell structure is still visible. And if there was a flow of water, it would be more likely to remove soluble uranium than insoluble lead, making the date older. But it is possible that small cracks exist and that uranium could be deposited by a flow of water at some more recent date.

If there were such cracks, we would expect uranium to be entering at regular intervals, and to give a range of ages up to about 225 million years or even higher due to lead being introduced with the uranium. But note that all of the haloes give young ages. The fact that all the ages are so young suggests that the coal is young, too.

It seems most likely that the uranium entered at the same time as the polonium. The fact that so many of the polonium haloes are squashed indicates that the polonium entered before the wood was covered with sediment. I think the most reasonable explanation is that this coal has an age at most a few millions of years old, possibly much younger, and that the geologic time scale is in error. Some of the haloes have ages of 200,000 or 300,000 years, so the true age would have to be this or younger. This applies to several geologic periods. In fact, a couple of the haloes have such low ratios as to imply an age in the thousands of years.

Another possible objection made by an evolutionist is that the radon 222 that results from uranium decay is an inert gas and may have escaped, resulting in little lead being deposited. This would make the observed haloes consistent with an old age for the coal. However, the fact that these uranium haloes are embryonic (very faint) also argues for a young age. In addition, not all of the radon would be on the surface of the particles of uranium. That which

was inside or bordering on coal would likely not be able to escape. Since radon 222 has a half-life of about 4 days, it would not have much time to escape, in any event. Such haloes were also found in shale, with young U/Pb ages as well, and it may be less likely for the radon to escape from shale.

Carbon 14 dating

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The following material is from <http://www.rae.org/ch04tud.html>:
(It looks like C14 dating is the ``bad boy" of radiometric dating.)

Dr. Libby, the discoverer of the C14 method, which won for him a Nobel prize, expressed his shock that human artifacts extended back only 5000 years, a finding totally in conflict with any evolutionary concept. Older dates were found to be very unreliable (CRSQ , 1972, 9:3, p.157). By this time tens of thousands of C14 dates have been published from tests performed by various laboratories around the world. In the annual volumes in which the dates are published, concerns have been expressed about many relatively young dates that violate established geological age notions. One example given was Ice-Age materials that were dated by C14 to fall within the Christian era (CRSQ , 1969, 6:2, p.114). In his book on prehistoric America, Ceram notes a classic case of the difficulties that befall C14 dating. Bones 30,000 years old were found lying above wood dated at 16,000 years (Ceram, 1971, p.257-259).

Another classic C14 problem was noted for Jarmo, a prehistoric village in northern Iraq. Eleven samples were dated from the various strata and showed a 6000-year spread from oldest to most recent. Analysis of all the archaeological evidence, however, showed that the village was occupied no more than 500 years before it was finally abandoned (Custance, 1968, Mortar samples can be given normal C14 tests since mortar absorbs carbon dioxide from the air. Mortar, however, from Oxford Castle in England gave an age of 7,270 years. The castle was built about 800 years ago. The kind of contamination is unclear. Living trees near an airport were dated with C14 as 10,000 years old, because the wood contained contamination from plane exhaust (CRSQ , 1970, 7:2, p.126; 1965, 2:4, p.31). p.19).

[I wouldn't be surprised if these last 2 examples have simple explanations.]

C14 analysis of oil from Gulf of Mexico deposits showed an age measured in thousands of years - not millions. Data produced by the Petroleum Institute at Victoria, New Zealand, showed that petroleum deposits were formed 6,000-7,000 years ago. Textbooks state that petroleum formation took place about 300,000,000 years ago (Velikovsky, 1955, p.287; CRSQ , 1965, 2:4, p.10). Fossil wood was found in an iron mine in Shefferville, Ontario, Canada, that was a Precambrian deposit. Later the wood was described as coming from Late Cretaceous rubble, which made it about 100 million years old instead of more than 600 million years old. Two independent C14 tests showed an age of about 4000 years (Pensee , Fall 1972, 2:3, p.43).

The last major glacial advance in America was long dated at about 25,000 years ago. C14 dates forced a revision down to 11,400 years. The United State Geological Survey carried out studies that gave a C14 date as recent as 3300 years ago, but no text treats such a puzzling find that falls well within historic times (Velikovsky, 1955, p.158-159; CRSQ , 1968, 5:2, p.67). Here is a remarkable example of C14 difficulties in a book published by Stanford University Press. Six C14 ages were determined from a core in an attempt to date the formation of the Bering Land Bridge. The dates ranged from 4390 to 15,500 Before Present.

The first problem was that the results were so disarranged from bottom to top of the core that no two samples were in the correct order. Then the oldest date was discarded because it was 'inconsistent' with other tests elsewhere. Next the remaining dates were assumed to be contaminated by a fixed amount, after which the authors concluded that the delta under study had been formed 12,000 years ago (Hopkins, 1967, p.110-111). ... Even more astonishing is this cynical statement made at a symposium of Nobel Prize winners in Uppsala, Sweden, in 1969: If a C14 date supports our theories, we put it in the main text. If it does not entirely contradict them, we put it in a footnote. And if it is completely 'out of date,' we just drop it (Pensee , Winter 1973, p.44).

As for the contamination issue, someone asserted that any C14 date of 30,000 years or more is due to contamination. If this is so, then why do they say the method is accurate to 50,000 years? If

any C14 date has ever yielded a value over 30,000 years, this implies that such contamination is not ubiquitous. Of course, it could be that older measurement techniques were less accurate. Now, 30,000 years is about 5 half lives of C14, which means that a contamination of 1/32 (slightly less) would be required to achieve this date for a sample of infinite age. This is a substantial contamination.

Anyway, as for C14 dating in general, it seems clear that many, many results are much too young according to the standard view, and that explaining away one or two of them does not appreciably diminish the problem.

Here is another instance of an anomalously young carbon 14 date:

At the 1992 Twin Cities Creation Conference, there was a paper presented called "Direct Dating of Cretaceous-Jurassic Fossils (and Other Evidences for Human-Dinosaur Coexistence)". Among other things, the results of carbon-dating of Acrocanthosaurus bones are given.

The authors noted that dinosaur bones are frequently ("as a rule") found with a black carbon residue of some sort on the bones. The authors speculated that this residue could be the leftovers of the decayed skin and flesh: they quote the Penguin Geology Encyclopedia's definition of "carbonization": "Carbonization; the reduction of organic tissue to a carbon residue. An unusual kind of fossilization in which the tissue is preserved as a carbon film. Plants are commonly preserved in this manner, soft-bodied animals more rarely." Since this material is organic, it can be used to carbon-date the fossils.

The authors describe in detail the measures taken to ensure that no other source of carbon contamination was present inside or outside the bones. When the bones were ground up and carbon-dated, the dates they received from the lab from different methods were 9,890 to 36,500 years BP (before present).

Some have claimed that this bone was covered with shellac, causing the carbon 14 date to be young. Concerning this issue, one individual sent me the following information:

The papers of Miller's that are cited by Lepper are:

Fields, W., H. Miller, J. Whitmore, D. Davis, G. Detwiler, J. Ditmars, R. Whitelaw, and G. Novaez, 1990, "The Paluxy River Footprints Revisited," in *Proceedings of the Second International Conference on Creationism held July 30-August 4, 1990, Volume 2, technical symposium sessions and additional topics*, edited by R.E. Walsh and C.L. Brooks, pp. 155-168, Christian Science Fellowship, Pittsburgh.

and

Dahmer, L., D. Kouznetsov, A. Ivenov, J. Hall, J. Whitmore, G. Detwiler, and H. Miller, 1990, "Report on Chemical Analysis and Further Dating of Dinosaur Bones and Dinosaur Petroglyphs," same proceedings, pp. 371-374.

The above two articles are the ones that purportedly refer to carbon 14 dating of a dinosaur bone covered with shellac. The article I referred to is the following:

"Direct Dating of Cretaceous-Jurassic Fossils (and Other Evidences for Human-Dinosaur Coexistence)" (1992 Twin Cities Creation Conference).

In this paper, the authors describe in detail the measures taken to ensure that no other source of carbon contamination was present inside or outside the bones.

The fact that these are separate papers, and the fact that every attempt was made to avoid contamination, suggests that these are two different incidents. I also received the following information from another person:

As far as I can ascertain from the paper, the researchers responsible specifically mention that the dinosaur bones being dated were not coated with shellac (page 10). Otherwise, the details of the material at your website are as in the paper, and the comment about a black carbon residue around fossilised dinosaur bones is referenced in their paper to a secular source, so it is not simply their observation.

The comments from the Penguin Geology Encyclopedia merely add to their case.

However, of the results they give in their paper, I personally would only be comfortable with the AMS results obtained on the same sample in two different laboratories - the one at 25,750 \pm 280 years BP and the other at 23,760 \pm 270 years BP. The other results were obtained on unspecified equipment or via the less reliable older beta technology and generally appear not to have been cross-checked in another laboratory.

Again I confirm that the claim about the shellac appears to be totally false and merely a smokescreen to avoid the implications of an uncomfortable radiocarbon date.

So, based on all of this information, it looks like there were two separate incidents, and the one I referred to involved a dinosaur bone that was not covered with shellac, but still gave a young carbon 14 date.

Finally, some more quotes about carbon 14 dating from http://www.parentcompany.com/handy_dandy/hder12.htm:

A survey of the 15,000 radiocarbon dates published through the year 1969 in the publication, Radiocarbon, revealed the following significant facts:²⁷ a. Of the dates of 9671 specimens of trees, animals, and man, only 1146 or about 12 percent have radiocarbon ages greater than 12,530 years.

b. Only three of the 15,000 reported ages are listed as "infinite."

c. Some samples of coal, oil, and natural gas, all supposedly many millions of years old, have radiocarbon ages of less than 50,000 years.

d. Deep ocean deposits supposed to contain remains of the most primitive life forms are dated within 40,000 years.

I think it is interesting that so few specimens have old dates, suggesting a rapid increase in the amount of carbon 14 in the atmosphere.

On the same subject, some fossils from the Paluxy River are "anomalous" as well. Carbonized (burnt) wood was discovered in Cretaceous limestone, and dated to 12,800 to 45,000 YBP.

Coffin gives quite a bit of evidence from increases of C14 ages with depth that the concentration of C14 has increased rapidly in recent years, making C14 dates too old, especially after about 4000 years ago. The fact that C14 is still increasing in the atmosphere shows that the earth recently went through some kind of a catastrophe, and this increase is even admitted by some evolutionists.

It has been claimed that Carbon 14 dating was revolutionized in 1969 or so. But it remains to establish how much in error the old dates were. It seems to be a common pattern that when dating methods are revised, we are told how inaccurate the old methods were, but are not told how inaccurate the current methods are.

A number of people requested references for my statements about young carbon 14 dates for coal and oil and fossils. Here is what I found at <http://www.christiananswers.net/q-aig/aig-c007.html>

Consider this: if a specimen is older than 50,000 years, it has been calculated that it would have such a small amount of C14 that for practical purposes it would show an infinite radiocarbon age. So it was expected that most deposits such as coal, gas, etc. would be undatable by this method. In fact, of thousands of dates in the journals Radiocarbon and Science to 1968, only a handful were classed "undatable" - most were of the sort which should have been in this category. This is especially remarkable with samples of coal and gas supposedly produced in the Carboniferous period 300 million years ago! Some examples of dates which contradict orthodox (evolutionary) views:

Coal from Russia from the "Pennsylvanian," supposedly 300 million years old, was dated at 1,680 years. (Radiocarbon, vol. 8, 1966).

Natural gas from Alabama and Mississippi (Cretaceous and Eocene, respectively) should have been 50 million to 135 million

years old, yet C14 gave dates of 30,000 to 34,000 years, respectively. (Radiocarbon, vol. 8, 1966. Many of the earlier radiocarbon dates on objects such as coal and gas, which should be undatable, have been attributed to contamination from, for example, workers' fingerprints, creationist researchers are currently working on the construction of an apparatus, using existing technology, to look for very low levels of C14 activity in, for example, coal after excluding contamination. Such low-level activity would not be expected on the basis of old earth theory, and so is not looked for at present.)

Bones of a sabre-toothed tiger from the LaBrea tar pits (near Los Angeles), supposedly 100,000-one million years old, gave a date of 28,000 years. (Radiocarbon, vol. 10, 1968)

Tree ring chronologies

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Tree ring chronologies are also used to give a history of the earth stretching back over 8000 years. Are these accurate? Here is some information from <http://www.creation-science.com/onlinebook/faq/radiocarbon.shtml> :

One way to infer how the atmospheric concentration of carbon-14 changed in the past is by tree-ring dating. Some types of trees, that grow at high elevations and have a steady supply of moisture, reliably add only one ring each year. In other environments, multiple rings can be added in a year. 4 The thickness of a tree ring depends on the tree's growing conditions, which will naturally vary from year to year. Some rings may even show frost or fire damage. By comparing sequences of ring thicknesses in two different trees, a correspondence can sometimes be shown. Ring patterns will correlate strongly for two trees of the same species that grew near each other at the same time. Weaker correlations (or less confident matches) exist between trees of different species growing simultaneously in different environments. Claims are frequently made that wood growing today can be matched up with some scattered pieces of dead wood so that tree-ring counts can be extended back more than 8,600 years. This may not be true.

These claimed "long chronologies" begin with either living trees or dead wood that can be accurately dated by historical methods. This carries the chronology back perhaps 3,500 years. Then the more questionable links are established based on the judgment of a tree-ring specialist. Standard statistical techniques could establish just how good the dozen or more supposedly overlapping tree-ring sequences are. However, tree-ring specialists refuse to subject their judgments to these statistical tests, and they have not released their data so others can carry out these statistical tests. 5

There are some general problems with constructing a chronology by piecing together records of tree rings from different trees. When trying to find the best solution to a problem like this, there are generally a huge number of possible solutions. So one uses a heuristic program to try to find a good one. There may also be many other solutions that are nearly as good. In fact, there may be others that are even better. So it's not clear to me that there is one clear-cut chronology based on tree ring dating. It was claimed that carbon 14 levels were not considered at all in constructing this chronology. I'd like to have his reference for that. In such a case, one typically defines a goodness function for each solution, and this could incorporate the desire to maintain a nearly constant carbon 14 level in the atmosphere. Add to this the fact that different trees can respond differently to the same climatic condition, and the fact that trees sometimes have more than one ring (especially if there is more than one rainy season per year) and one has even more uncertainty. Without a very thorough examination of the data, it's hard to know how to interpret the result. I'd be interested to know what the authors of this work say about the existence of other chronologies, and how much less of a good fit they are.

In such an optimization problem, it is difficult to know if one has the true solution, so not much weight should be given to the chronology obtained. It's not enough just to eyeball it and say it looks convincing. It should be subjected to several optimization procedures and one should also optimize for shorter chronologies as well to see how much (if any) the quality suffers.

Someone gave me some information about constructing tree ring chronologies by piecing together sub-chronologies. But in a problem like this, sometimes one can get a better solution in the end by taking a sub-optimal choice along the way. So the described procedure will not necessarily find the best chronology.

The following message was sent to me by e mail on February 11, 1998:

As one who has taught dendrochronology, I have a few opinions on this particular subject. Also, one of my graduate students went to work for Ferguson in his lab at U of A, and in fact was the curator of his work after his death, and is presently probably the only one who knows anything about how he [Ferguson] produced the bristlecone chronology. Another of my graduate students gave a seminar to the lab on dendrochronology of fossil trees and had ample opportunity to analyze the procedures there, and to work with Ferguson for a while. I can say on pretty firm grounds that the Bristlecone chronology before 4000bp is fraught with problems and unanswered questions. While Ferguson was alive, he never allowed anyone to analyze his original data or the bases for the many suppositions that went into the establishment of the chronology. Thus the chronology was not subjected to the normal rigors of science. This is regrettable, because I believe he was a careful and sincere scientist. Of course one could always excuse Ferguson for not revealing the bases of his decisions (for example, the most important rings in any chronology are the "missing rings" which have to be added by the investigator). But suffice to say the chronology before 4000bp is entirely dependent on C14 dates of the wood, and is thus tautologous. This does not mean it is meaningless or necessarily wrong, just that I wouldn't base too much on it.

Another article discussing difficulties with tree ring chronologies can be found at http://www.tagnet.org/gri/w/articles/or22_47.htm.

Coral dating

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Some coral formations apparently show a longer year in the past, of about 400 days. This is taken as a confirmation of radiometric dating, since the earth's rotation should be gradually slowing down due to the effect of the moon and tides. Here is some information that was sent to me by a proponent of this method:

How does a flood explain the accuracy of "coral clocks"? The moon is slowly sapping the earth's rotational energy. The earth should have rotated more quickly in the distant past, meaning that a day would have been less than 24 hours, and there would have been more days per year. Corals can be dated by the number of "daily" growth layers per "annual" growth layer. Devonian corals, for example, show nearly 400 days per year. There is an exceedingly strong correlation between the "supposed age" of a widerange of fossils (corals, stromatolites, and a few others -- collected from geologic formations throughout the column and from locations all over the world) and the number of days per year that their growth pattern shows. The agreement between these clocks, and radiometric dating, and the theory of superposition... is a little hard to explain away as the result of a number of unlucky coincidences in a 300-day-long flood.

Clocks tied to the Earth's rotational energy lack the precision of isotopic dating methods, and they are only applicable to a small number of formations which have excellent preservation of fairly small details. However, they do provide an excellent (if rough) confirmation of the isotopic methods' accuracy.

The computation of the slowdown of the earth's rotation is not simple, however. If one extrapolates the current slowdown backwards, one obtains a rate that is too fast. So a correction is applied for resonances of the moon with tides. To me this is rather involved, and not convincing.

Also, if the earth was rotating faster in the past, it was not necessarily due to the elapse of time and the slowdown from tides. The earth could have been rotating faster more recently if there had been some kind of a catastrophe. There was even an article in Science, 25 July 1997, titled "Evidence for a Large-Scale Reorganization of Early Cambrian Continental Masses ..." in which the authors propose that at one time the lithosphere rotated 90 degrees. If we can assume the axis of rotation or crust of the earth are in motion for some reason, this could cause an apparent change in the length of the year. Maybe some event in the core of the earth or some gyroscopic effect or some asteroid impact would cause this. So it's not clear that one can even take a longer year from coral records as confirmation of assumed geologic time.

It is also possible that different lengths of the year in the past are due to unusual patterns of ocean currents or temperature or

availability of nutrients, and not to the length of the year. Just having summer 20 days early one year and 20 days late the next might make the year seem 400 days long. If the axis of the earth were vertical in the past, there would have been no seasons at all, and the apparent years could have been caused by any number of factors.

Here is another scenario that could explain a different period for the year in recent history. Suppose a nearby supernova showered the earth with elementary particles, many of which passed through matter while only weakly interacting with it. But suppose that there were enough such particles to destabilize the nuclei of atoms slightly. This would not have much effect on most nuclei, but it would cause radioactive nuclei to decay. Thus one would have a rapid increase in the decay rate, which would make the matter of the earth and planets appear old very quickly. This would generate a lot of heat, which could lead to many volcano eruptions. It could also lead to convection currents in the core of the earth, redistributing the mass there and causing the rotation of the earth to speed up or slow down dramatically. Of course, this would lead to a major, worldwide catastrophe. In addition, there might be unusual gyroscopic effects. At the same time, the heating effect on another planet could have caused it to explode, producing the asteroids. At any rate, one could get changes in the length of year this way in recent history.

Varves

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Varves are thin repetitive sedimentary layers that are used to argue for a long history of the earth. It is claimed that one varve was deposited each year. But to me, the fact that they show so little evidence of erosion or any kind of activity between the layers is suspicious -- they are all so flat and even. In addition, many well-preserved fossil fish are found in the Green River varves. This is an evidence that these varves were laid down rapidly. (Experiments have shown that if fish are not buried rapidly, the bones fall apart.)

Growth of coral reefs

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It is also often claimed that the growth of coral reefs to their current size would require very long time periods. Coffin shows that coral reefs can grow very fast when they are farther from the surface of the ocean. At the surface, the growth rate slows due to water action and various other factors. So coral reefs are also not an evidence for a long history of the earth since the origin of life.

Evidence for catastrophe in the geologic column

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Here are some quotes from "The Age of the Universe: What Are the Biblical Limits?," 1998, by Gorman Gray, pp. 118 - 119, supporting the idea that the geologic column was laid down catastrophically:

"... deposits above the 'great unconformity' (the boundary between Precambrian and Cambrian) are now thought by most geologists to have been deposited rapidly and catastrophically. ... The evidence is ubiquitous for catastrophic deposits. Evolutionary geologists now acknowledge numerous local catastrophes to account for many different regions while refusing to accept the very simple explanation of one cataclysm responsible for all of them."

"Although the well-informed leadership in geology realizes that catastrophism is evident everywhere, it is not known so well at the university level."

"Even though the basic concept of uniformitarian gradualism for deposited strata has been overthrown, curiously there has been no adjustment in the dates applied to the geologic column. It appears that there are strong forces to hold on to the millions of years concept of geology (in spite of the facts) in order to preserve the supposed time for evolution to occur."

"Evolutionary geologists now hypothesize millions of years of non-activity between formations in order to preserve the evolutionary time schedule. There is no evidence supporting numerous hiatuses. One would think in even a thousand years there would be roots or worm burrows or stream erosion or clam tracks. Instead, most of the interfaces are sharply defined. Evolutionists are saying essentially that no evidence means evidence for long periods of time between formations."

"After these discoveries, geologists began looking at the well-known formations throughout the world and discovered that most of them showed the characteristics of turbidite formation. Over half the depositions on North America have now been identified as turbidities and each year of study yields more which are falling to this concept."

"The latter [sedimentary layers of Cambrian or later age] are worldwide phenomena and many of the formations cover areas of hundreds or thousands of square miles. ... gradual deposition is precluded in the nature of turbidite formations."

I note that turbidities are formed rapidly by flows under water, but have a layered structure. The point of these quotes is that much of the geologic column is now recognized to have been laid down in this manner, now over half of the formations in North America. At present, there is hardly anywhere where this kind of turbidity activity is depositing a significant amount of sediment that will remain for any length of time. River deltas are about as close as one can come, and they are generally not flat like the great sedimentary deposits, and do not cover such a large area. So the evidence is that conditions in the past when these deposits were being laid down were much different than at present. Also, the fact that there is no worldwide unconformity above the Great Unconformity suggests that there was no break in this continuous pattern of deposition, and that the geologic column (up to some point, maybe somewhere in the Mesozoic) was laid down all at once.

There are many evidences of catastrophic conditions in the geologic column, such as polystrate fossils, and fossils giving evidence of rapid burial. For example, a fossil of an 80 to 90 foot baleen whale was found by miners in diatomaceous earth near Lompoc, California. Here is the quote, from Coffin, page 37, about the Baleen whale:

"A recent discovery has caused scientists to begin rethinking the origin of the deposit. Miners found an 80 to 90 foot baleen whale in the white earth. If a long time was required to cover the huge mammal, the bones would not have remained attached together."

He mentions experiments that show that fish bones rapidly separate when the fish die and fall to the bottom, even if predators are kept away. So this really does seem to be an evidence of rapid burial. And this implies also that all of the well-preserved fossils that are found, were buried rapidly.

This casts doubt on the idea that this deposit was laid down gradually. fish fossils are sometimes found in the midst of eating other fish, or giving birth. I realize that geologists say the polystrate fossils (trees extending through many layers) fell into place later on, but these fossils are very common, and a logical corollary of catastrophic deposition.

I think it is interesting that many igneous bodies have wide biostratigraphic limits. This implies that several geological periods are missing, with only a lava flow to show for it. This seems unlikely if these periods were really millions of years long, since there should be some evidence of their passing, but becomes more plausible if these periods were much shorter.

Coffin (and creationists in general) have given many, many evidences of catastrophic conditions in the geologic column. As for Specimen Ridge, which has many layers of upright fossil trees on top of one another, Coffin gives a detailed analysis of this, showing that the assumption of many forests growing on top of one another is not realistic, and gives evidences for the mechanism of rapid transport of trees from somewhere else. He does this as well for the forests of Joggins Petrified Trees of Nova Scotia.

I wish I had time to type in his quotes about the huge volcano eruptions of the past. These are not like anything we know today. Instead, great cracks opened up in the surface of the earth and great quantities of lava just gushed out. No need for a volcano at all! There have been similar eruptions recently, but much more minor. Such an event would of course have the possibility of enriching the atmosphere or water in Ar40 and making the lava appear old just because less Ar40 would escape.

He also mentions that if the Americas and Europe-Africa separated at the assumed slow rate, there would have been enough runoff from erosion to keep the Atlantic Ocean full, so there would not be any Atlantic Ocean at all today.

Now, I want to discuss evidences of erosion between geologic layers. The relative lack of erosion is evidence of rapid deposition and catastrophic conditions in the past. Coffin writes,

"Some geologists estimate that up to 40 percent of the sediments laid down in the past came from turbidity currents." (p. 93)

And according to a later reference, the number has increased since then. Turbidities are associated with rapid deposition.

As for the issue of uniformity, here is a quote from Coffin, page 104:

"Uniformity, however, has become through the years an inflexible and controlling element in geological research, not an hypothesis that one can discard if the facts don't fit. If the results of research don't support uniformity, the research is at fault. The scientist then initiates new research or reinterprets the facts even though he may have to bend or rearrange them unrealistically."

"It is my firm opinion that the concept of uniformity has greatly delayed the advance of geological science. It has stagnated in some areas for years with little progress compared to other sciences. Some geologists have noted the condition but have not recognized the reason why." (page 107)

Coffin notes an increasing tendency to accept catastrophism in geology, however. He mentions Derek Ager's book, "The Nature of the Stratigraphic Record," which supports catastrophism.

As for the degree of erosion between strata and evidence of catastrophism, Coffin writes of the grand canyon region (page 111):

"The strata extend for scores and even hundreds of miles with relatively little change in composition, texture, and thickness. We look in vain to find comparable beds forming today."

"But such erosion and depositional features [gulleys and gorges, deltas etc.] are unknown for some of the beds, and the deposits are massive, quite homogeneous, and not typical of stream and river action."

He mentions giant mud cracks fifteen or more feet high in the geological record.

"However, when we look at the geological record and see thin, flat-lying beds extending sometimes for hundreds of miles, we are at a loss to find their modern counterparts." (page 87)

"The deposits of the past often show essentially no evidence of erosion on their surfaces." (page 88)

"In some places in the world we can trace very thin beds, only an inch or two thick, over hundreds of miles." (page 89)

"Although we do find some erosion between certain beds, usually the amount is small compared to the nature of the earth's surface today." (page 90)

Coffin also gives evidence that the great coal beds were laid down rapidly.

Anyway, I'd encourage readers to consult the book for details: *Origin by Design*, by Harold Coffin, 1983, Review and Herald Publishing Association.

As for fossils, it has been proposed that water with certain unusual chemical compositions or certain kinds of bacteria can cause fossils to be preserved, even if rates of sedimentation are slow. This must be an unusual occurrence, since I don't ever recall seeing the bottom of a lake with zillions of well-preserved dead fish covered with preservative bacteria. In fact, I don't think that there is anywhere in the world today that fossils like those in the fossil record are forming, except possibly as a result of floods and rapid accumulations of sediment. So if the present is the key to the past, we should assume that such rapid accumulations of sediment occurred in the past, too, when all of these fossils formed. Otherwise, we are giving up on uniformitarianism to some extent. And what evidence is there that all of these well-preserved fossils were formed by such unusual conditions, anyway?

Note that since well-preserved fossils imply rapid burial, and many fossils occur together, many creatures must have died at about the same time. Otherwise, their fossils would be widely separated in the rapidly falling sediment. Having many creatures die at once suggests catastrophic conditions.

Someone claimed that Harold Coffin is clueless for promoting a catastrophist view of geology. Those who think that must think that Ager is clueless, too, for promoting a similar view in his book, "The Nature of the Stratigraphic Record." But remember that Ager is not a creationist, and people are generally not so free in their criticism of non-creationists.

We have several evidences for catastrophism in the geologic column: 1.) Turbidities, which some geologists believe are very common. 2) Massive fossil deposits. 3) Geological layers whose boundaries are marked by little erosion or signs of plant or animal life. 4) Massive volcanic eruptions, unmatched by anything known today. All in all, I think the picture is convincing, even though

there may be many other features that are not as easy to understand in this framework.

Concerning the catastrophic nature of the geological record, here are some non-creationist references. This material may be found at <http://members.aol.com/DWR51055/tasc/faqs.htm>, which is a creation FAQ of the Triangle Society for Scientific Creation:

b. "Potentially more important to geological thinking are those unconformities that signal large chunks of geological history are missing, even though the strata on either side of the unconformity are perfectly parallel and show no evidence of erosion. Did millions of years fly by with no discernible effect? A possible though controversial inference is that our geological clocks and stratigraphic concepts need working on." William R. Corliss, *Unknown Earth* (Glen Arm, Maryland: The Sourcebook Project, 1980), p. 219.

RECORD IS CATASTROPHIC, DAVID M. RAUP, Chicago Field Museum, Univ. of Chicago, "A great deal has changed, however, and contemporary geologists and paleontologists now generally accept catastrophe as a 'way of life' although they may avoid the word catastrophe... The periods of relative quiet contribute only a small part of the record. The days are almost gone when a geologist looks at such a sequence, measures its thickness, estimates the total amount of elapsed time, and then divides one by the other to compute the rate of deposition in centimeters per thousand years. The nineteenth century idea of uniformitarianism and gradualism still exist in popular treatments of geology, in some museum exhibits, and in lower level textbooks....one can hardly blame the creationists for having the idea that the conventional wisdom in geology is still a noncatastrophic one." *Field Museum of Natural History Bulletin* (Vol.54, March 1983), p.2 1

CATAclysmic BURIAL, JOHN R. HORNER, "...there were 30 million fossil fragments in that area. At a conservative estimate, we had discovered the tomb of 10,000 dinosaurs ...there was a flood. This was no ordinary spring flood from one of the streams in the area but a catastrophic inundation. ... That's our best explanation. It seems to make the most sense, and on the basis of it we believe that this was a living, breathing group of dinosaurs destroyed in one catastrophic moment." *DICGING DINOSAURS*, 1988, p.131

FOSSIL PROGRESSION?, DAVID M. RAUP, Chicago Field Museum, Prof. of Geology, Univ. of Chicago, "A large number of

well trained scientists outside of evolutionary biology and paleontology have unfortunately gotten the idea that the fossil record is far more Darwinian than it is. This probably comes from the oversimplification inevitable in secondary sources: lowlevel textbooks, semipopular articles, and so on. Also, there is probably some wishful thinking involved. In the years after Darwin, his advocates hoped to find predictable progressions. In general, these have not been found yet the optimism has died hard, and some pure fantasy has crept into textbooks...One of the ironies of the creationevolution debate is that the creationists have accepted the mistaken notion that the fossil record shows a detailed and orderly progression and they have gone to great lengths to accommodate this 'fact' in their Flood Geology." New Scientist, Vol. 90, p.832, 1981

Rates of erosion

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As for the separation of the continents, I found some references about rates of erosion: (This is not a creationist source.)

The span since the Precambrian is long enough, at present rates of erosion, for rivers to have shifted the equivalent of 25 to 30 times the bulk of the existing continental masses, but the rate of erosion and sedimentation is estimated to have increased with time.

...

Such transitory streams, rivers, or creeks are noted for their gullying effects, especially for their rapid rates of erosion, transportation, and deposition. There have been reports of up to 8 feet (2 m) of deposition in 60 years and like amounts of erosion during a single flood event.

...

Roughly contemporaneous with the time of the Aztec Empire, this period was characterized by what O'Hara described as "staggeringly high" environmental impacts and erosion rates of 208 metric tons of soil per hectare (85 tons per acre) per year.

All above quotes are from the online Encyclopedia Britannica, and the first one is from the article "The River System through Time." Anyway, rates of erosion can vary, but one would have to justify that they have been much smaller in the past. In addition, the fact that there are so many evidences of rapid erosion in the geologic column casts doubt on the statement that rates of erosion were slower then.

I wanted to make an additional comment on the separation of the continents. The Americas are thought to have split off about 150 million years ago. Since the precambrian, erosion would have moved about 25 to 30 times the continental masses. Since 150 million years ago, it would be about 10 continental masses. Assuming half goes into the Atlantic and half into the Pacific, it would be about 5 continental masses each way. Now, the average depth of the oceans is less than 5 times the average elevation of the land, so this would be enough erosion to cover an ocean area equal to the combined area of the Americas, Europe, and Africa, which would easily fill the Atlantic Ocean. Of course, as sediment enters the water, the sea level would rise to some extent.

Now, it is possible that this sediment would cause the crust of the earth beneath the Atlantic Ocean to sink to some extent. But since there is a fixed amount of mass beneath the crust, this would mean that the crust would have to rise somewhere else. Where would that be? Since the whole Atlantic would be covered with sediment, it is not likely that any place in the Atlantic would rise. The continents are massive, much more under sea level than above, so it is not likely that they would rise much, either. The oceans near the continents would be receiving erosion just like the Atlantic, so they would not rise much, either. The only place left would be somewhere near the middle of the Pacific Ocean. So, in order for this to rise, the downward force on the Atlantic would have to be transmitted through the 1800 miles of solid rock under the crust, to somewhere in the Pacific Ocean. This seems highly improbable.

In fact, the amount of sediment entering the Atlantic would be even higher than I estimated above, since the mountain chains in the Americas are much closer to the Pacific than the Atlantic. Also, the Ural Mountains are on the eastern border of Europe, and the mountains of Africa are far to the east, having a similar effect.

Of course, so much sediment entering the ocean would cause the sea level to rise, to some extent. This would further lower the level of the continents relative to the ocean, and tend to cause the earth to become flooded.

Coffin mentions that at current rates of erosion, the Gulf of Mexico would fill up in 6 million years, for example. Objections have been raised to this estimate, which I now consider.

It is possible that the crust of the earth would sink to some extent as matter infilled the Gulf of Mexico. But remember that the crust of the earth is about 4 miles thick under the oceans, and about 20 miles thick under the continents. So the thickness under the Gulf of Mexico would probably be in between these limits. In addition, there is 1800 miles of solid rock underneath the crust. The crust moves in plates, implying that it has considerable rigidity and would not bend easily. And note that infilling of sediment would replace water with sediment, so only the difference in density would add to the pressure on the crust. By the time the crust got around to bending, the Gulf would probably be almost full.

Sediments do compact, meaning that more sediment would be required to fill the Gulf. But I believe that the measurement Coffin was referring to already took this fact into account. In addition, shells and bones continually fall to the bottom, and corals grow. Only an inch of accumulation in 100 years would lead to about a mile of sediment in 6 million years, even without erosion. The Gulf of Mexico is about 2 miles deep at its deepest part, except for one place near Mexico, so its average depth may be about a mile. All in all, the filling in of the Gulf of Mexico in 6 million years is not unreasonable. Coffin also notes that the current delta must have formed in at most a few thousand years, assuming the northern border of the Gulf of Mexico was initially straight. Thus one would have to assume that the Mississippi River had a different course, emptying into the Great lakes, as early as 5000 years ago to sustain the current chronology.

Reliability of creationist sources

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The reliability of creationist sources is often questioned because those who write them are not always experts in the areas they write about. But I believe that their message is true, namely, God created the universe, the earth, and all that is in it, God created life on earth recently, and the earth since then has experienced a major catastrophe. If in a few instances creationist discussion of anomalies in radiometric dating is based on a misunderstanding of the literature, there are plenty of other acknowledged anomalies that they could have used just as well. All in all, I would much prefer creationist sources to the talk.origins FAQ and standard

textbook treatments, which gloss over problems that specialists in the fields do not hesitate to admit, and present uniformitarianism, evolution, and radiometric dating as if these were beyond reproach. But I am thankful for the many voices being raised against this triumvirate of confusion, and believe that in the minds of many it is losing credibility, despite the resistance of establishment science. Most people only have time to become familiar with one of these three aspects, and so their doubts are calmed by belief in the evidence from the other two. But all three of them are in confusion.

In general, it's good to read both sides of the story. So I continue to recommend the creation web sites, including the following:

<http://www.rae.org> (This has a good selection of links to other sites)

<http://zim.com/gjlane/science.htm>(Many links)

<http://www.ldolphin.org/URLres.shtml> (More links than you can ever visit.)

[David Plaisted's \(the author's\) Home Page](#)