ON YOUNG EARTH CREATIONISM 2023

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In 2022 I was asked to comment on a lecture to French Christians by a Monsieur Vernaz. I took the opportunity to broaden out my critical response on the whole Young Earth Creationism (YEC) movement and this is a further enlargement of that. This is a reluctant publication: I don't like criticising other Christians and Genesis is not where the heart of the gospel is. Actually, I've spent most of my nearly 50 years as a Christian rather hoping the whole debate would go away. But sadly, it hasn't, and in fact it seems to become even more mainstream. This is curious because, as I frequently mention in this article, over the last 50 years the evidence against any sort of young earth creation has become overwhelming. So for example plate tectonics has clarified the great puzzle of what makes mountains and the work of the geneticists has brought independent testimony in support of the great pattern of existence that is still rather clumsily called 'the tree of life'.

My background

I now live in France and have been heavily involved in environmental work in the last few years with A Rocha France, although the views presented here are entirely my own. Theologically, I am a conventional conservative evangelical with good theological credentials: I've written and edited a vast number of Christian books, a number with the British evangelist J. John.

On a subject where ignorance of science is no barrier to confident pronouncements, my background is relevant. I was converted to Christianity while doing my PhD thesis in Geology in the early 70s when I was working on the Jurassic sequences of southern Tunisia and northwestern Libya at Swansea University, Wales. I spent a considerable time in the field asking myself whether I could explain what I was looking at by any sort of YEC views. I couldn't then and I cannot now.

Nearly 50 years later I can look back on a geological career which has included protracted fieldwork in Tunisia, Libya, Madagascar, Congo, Somalia, Kenya, Lebanon, Jordan, Syria, Papua New Guinea, plus large areas of the UK, France and Spain. I've worked as a research student, as a university lecturer and head of department in Lebanon and I've done 10 years of rigorous oil company consultation which included a lot of fieldwork as well as writing reports on the geology of Mexico, Yemen, New Guinea, Myanmar, Iran Jaya and Morocco. If I'd kept a total of the thicknesses of rock sequences that I've described in detail I'm certain it would run into several tens of kilometres. I've written several major papers on the geology of Lebanon which, if you excuse the absence of modesty, are the standard papers on the structure and stratigraphy of the country and are referred to by everyone writing on the geology of that country or the surrounding area (just Google *Walley*, *Geology*, *Lebanon*). Almost all my work has involved reconstructing ancient history; precisely the area that Young Earth Creationism makes claims about, although very significantly, it doesn't discuss. All that could be condensed into a single blunt phrase: *I know what I'm talking about*.

A few preliminaries

- I very much dislike the use of the word 'creationism' for YEC beliefs. The fact is all Christians – and I presume all believers of other religions – consider that God created the universe. The big issue is a) time scale and b) mechanism.
- It is important to remember that the age of the Earth is a totally different issue to evolution. It's perfectly possible to believe in an old Earth and disbelieve in evolution: I will discuss later exactly what that slippery word *evolution* means. There's a great deal of linguistic naughtiness in trying to make the simple equation 'old earth *equals* evolution *equals* atheism'.
- What YEC believers are proposing is no minor modification to science. What we can call the Standard Geological Model, that which is held by the entire scientific community, states that the Earth formed around 4,600,000 years ago. In contrast Young Earth Creationists would claim that the Earth (and the universe) is only around 6000 years old. Most YEC advocates also try to explain the enormous thicknesses of sedimentary rock on the surface of the earth in terms of catastrophic deposition during Noah's Flood rather than the standard process of generally slow deposition on deserts, beaches, deltas and continental shelves. These are unbelievably large differences and if the YEC view is correct then geology (and much of early history and archaeology) belongs with alchemy in the curiosity cabinet of bizarre theories.
- Although it's easy for the outsider to consider YEC beliefs to be a unity, there is in fact no single model and indeed there are substantial disputes within the various YEC strands. This often results in the frustrating situation that when you offer some critique to a YEC believer you find that they say 'oh *I* don't believe *that*!'
- The YEC position is a curious hybrid of both theological and scientific views. Theologically, there is the YEC interpretation of Genesis – which as we will see later is widely disputed even by those evangelicals who, like myself, believe Scripture is inspired by God. Scientifically, there is the claim that the extraordinary young age for the earth that their interpretation demands is in fact supported by science. A very significant factor that should be noted is that, to my knowledge, no one believes in an earth whose history is measured in just thousands of years unless they have underlying religious beliefs.
- This philosophical 'dual nationality' is important because it maximises the possibility for the promotion of YEC beliefs. In the church, the YEC camp claim to be presenting orthodox Christianity; in the context of the educational system, they claim to be presenting in 'Creation Science' a valid alternative to conventional science. That position in the educational world is strategically very important as it offers both the opportunity to broadcast YEC views and also obtain secular funding.
- One curious feature of YEC publications is that they are less concerned about promoting what they believe than in trying to poke holes in the beliefs of traditional science. There are several reasons for this. First, there is no standard agreed model for earth history among YEC proponents. Second, attempts at expounding any sort of YEC model run the risk of highlighting the innumerable and insurmountable problems it has. Finally, and importantly, in my view, I believe that YEC proponents do not expect to demonstrate the superiority of their model over orthodoxy; they simply want to highlight 'problems' within the orthodox view of geological and cosmic history. The reason is that, in order to gain classroom time and

possibly educational funding, they just want to be able to say that conventional science is sufficiently flawed that an alternative, namely theirs, must be considered.

- The philosophical hybrid status of YEC beliefs gives them a resistance to attack. Frequently I've criticised their science or the lack of it and been told that the problem is my lack of Christian faith. Equally, when you point out impossibilities in the science system you get the appeal to miracles.
- Sadly, it has to be said that in their zeal to propagate their beliefs many YEC advocates have frequently engaged in tactics such as the selective use of data, a distortion of motives and wilful negligence of the real scientific position. So for instance, to call the Standard Geological Model that of 'evolutionary' or 'atheistic' geology is a grotesque falsehood: the fundamentals of orthodox geology predate Darwin and are held today by many people of many faiths.

Again, despite nearly fifty years of reading and talking on Young Earth Creationism it's not something I particularly like discussing. For one thing I prefer my faith to involve making friends not enemies and for another I've lived in hope that this would fade away. I have no objection to what individuals believe personally about origins and Scripture but what I am concerned about is the teaching of things that are untrue and particularly those that could betray younger Christians: Matthew 18:6 may apply here. I've read too many messages from people who say things like 'I gave up Christianity when I did my first geology field trip and realised flood geology was rubbish.'

Enough of an introduction!

Where do YEC earth history views come from?

The narrative given by YEC is almost always along the following lines. For 1800 years Christians believed Genesis to be the authoritative account of the ancient history of the earth with three central elements: a creator God, a brief time scale and a global Flood. However, in the middle of the 19th century Charles Darwin came up with the idea of evolution which allowed the creation of an atheistic alternative and the result was the rise of modern geology and science which denies all three of the original elements. The resulting atheistic, mechanistic evolutionary worldview led to the malaise of modern culture with its rejection of Christianity. The result of this is a simple bipolar view of beliefs: it's God, Christianity and morality versus Darwin, atheism and sin.

Precisely because it is consistently misrepresented by its proponents, I think it's important to know something of the origins of the modern YEC movement. There are many excellent scholarly treatments of YEC views and if details are wanted various works by Ronald Numbers, notably *The Creationists: The Evolution of Scientific Creationism*. (1992, 2006) are helpful. I haven't cross checked every detail but the Wikipedia article on Young Earth Creationism (https://en.wikipedia.org/wiki/Young_Earth_creationism) seems to give a very fair summary of its origins.

a) Before Darwin

YEC proponents like to represent themselves as heroic defenders of traditional Christian beliefs. That's far from the case. Even many of the Church Fathers seem to have viewed Genesis 1-2 as being non-literal. However, until 1800 the majority of Christians probably did understand these first chapters as some sort of historical account of the creation of the universe and with it, the

implication that this was to be measured in thousands of years. (As an aside, the claim that the theory of evolution was responsible for moral decline is historically illiterate. For example 18th century Britain was notorious for its immorality, something brutally portrayed in the drawings of Hogarth https://www.historic-uk.com/CultureUK/William-Hogarth-18th-century-life/ and well documented in the journals of the great evangelists, the Wesleys and Whitfield.)

In terms of geology, even before 1800 those individuals who were starting to look at rocks seriously were beginning to conclude that the earth was very old indeed. See for example the famous quote by James Hutton in 1788 after examining the Scottish rock record: 'The result, therefore, of our present enquiry is, that we find no vestige of a beginning, – no prospect of an end.' There were various attempts to harmonise the scientific/ historical interpretation of Genesis with the rapidly growing science of geology but there was no consensus. Did the days in Genesis represent geological periods? Was there a gap between the first and second verses of Genesis 1? Might the Earth have been created looking old?

Significantly very few geologists, if any, wanted to attribute the entire rock record to deposition by the Flood: even then they knew the impossibilities that this raised. (The whole idea that fossils had been deposited by the Flood was ridiculed by no less than Leonardo da Vinci around 1500: see https://en.wikipedia.org/wiki/Geologic_time_scale. Geologists wryly lament the loss to science caused by Leonardo's hobby of painting pictures.) For some time in the early 19th century, the widespread deposits left by the glaciers that lie on top of underlying rocks in northern Europe were considered to be Flood deposits but by the middle of the century even that view had been abandoned.

What is especially significant is that, in the early part of the 19th century, a sequence of life through time was fairly well established. Geologists were able to correlate rocks on the basis of similar fossils and knew that different types of life occurred at different rock levels, finding, for example no dinosaurs in the oldest rocks and no trilobites in the younger rocks. The recognition of distinctive fossil units proved to be of enormous economic importance because it allowed particular rock units to be identified and traced across a country with the resulting creation of geological maps. If you compare the pioneering geological map of the British Isles by William Smith which is dated to 1815 (https://www.nhm.ac.uk/discover/first-geological-map-of-britain.html) with the modern map (see https://www2.bgs.ac.uk/discoveringGeology/geologyOfBritain/makeamap/map.html) you will see that the occurrences of rock units are largely unchanged.

The fundamental pattern recognised across the world was that life became more and more complex and diverse as you went from older to younger rocks. However, although there were speculations on what the fossil record 'meant', the key interest of geologists was the use of this sequence of life to make correlations across the regions and eventually the world. The result was the beginning of the geological time scale or geological column (https://en.wikipedia.org/wiki/Geologic_time_scale) with such now well-known terms as Jurassic and Cretaceous. The time scale has now become extremely detailed and is summarised in *https://stratigraphy.org/chart#latest-version*. Note that YEC advocates struggle with both the time scale and such maps. All deny the numeric element of the geological time scale and while some pretend that the rock column doesn't exist, others make desperate attempts to explain away the sequence by different unexplained events within the year-

long Flood of Noah. In general though they simply avoid talking about either maps or the geological sequence.

Although in the 19th century there was no assured way of giving numbers to the age of these rocks there seems to have been a widely held belief that the earth's history involved many millions of years. (It was only in the 20th century that radiometric dating allowed the rock units to be given precise numeric dates.)

Let me make two points about the profoundly fertile integration of the geological time scale and geological maps. First, it had nothing at all to do with the theory of evolution and, in all its essentials, predates it. The second is that geology was not driven – and never has been driven – by theory or ideology, let alone any secular or atheistic agenda. It is a practical science based on blunt facts and, often as not, their economic consequences. Even as an infant science, geology was spectacularly successful in explaining the earth's surface as well as revealing such things as buried coal fields. As a result any YEC talk about the 'evolutionist geological time scale' or 'atheistic geological maps' is either deeply ignorant or profoundly dishonest. In fact, in the UK at least, much 19th century geology was done by Christians, some of whom were outspokenly evangelical.

So if we take a snapshot of geological knowledge a few decades *before* Darwin's theory of evolution and half a century *before* radiometric dating we can note three almost universal assumptions.

1) The Earth was already assumed to be at the very least tens of millions of years old.
2) The role of any Flood in depositing rocks was considered as minimal and superficial at best.
3) Life had changed and, in general, became more complex with time.

All three of these facts are commonly ignored by YEC proponents.

b) After Darwin

On The Origin Of Species was published in 1859. Significantly, in terms of practical geology, nothing changed: for the geologist, all Darwin offered was an explanation of the fossil data, not any new data itself.

An often overlooked fact is that a number of Calvinist theologians, holding to the idea that God manages every detail of the universe (see Matthew 10:29 on 'natural selection in sparrows') found themselves in support of Darwin. Others struggled with whether humanity also was a product of a long descent from lower animals. In general, while there was still some discussion on evolution, it's significant that the debate on the age of the earth seems to have faded away during the second half of the 19th century. Even with the founding of the Fundamentalist movement in 1920 there was little opposition to an old earth.

c) The Genesis Flood

This relative tranquillity was changed by the publication in 1961 of *The Genesis Flood* by Whitcomb, and Morris, neither of whom were in any way geologists. To the idea that there had been seven literal days of creation they added the notion that Noah's Flood had created the rock record. This novelty was inspired by the prophetic visions of Ellen White, the founder of Seventh Day Adventism: a very questionable source whom Young Earth Creationists prefer to avoid mentioning. Despite the

fact the book was filled with glaring errors and laughable oversimplifications, it somehow became the standard text for Young Earth Creationism.

With very little modification, apart from the desperate inclusion of cartoonish plate tectonics at unbelievable speeds, that view has remained unchanged. Here's an up-to-date statement from the *Answers in Genesis* website: 'The Flood of Noah's day (2348 BC) was a year-long global catastrophe that destroyed the pre-Flood world, reshaped the continents, buried billions of creatures, and laid down the rock layers.' Two things should be noted. First, that there are bitter disputes within Young Earth Creationists and not all of them would want to give credit to such a date. Second, this sort of date plays havoc not simply with geology but with archaeology and even history as it is routinely assumed today: on a wide range of evidence, well-developed civilizations in many places, such as China, Mesopotamia and Egypt, predate this date. In fact, given that the nations of the world don't start to spread out across the world until *after* the Tower of Babel (Genesis 11:1–9) – an event which YEC believers cannot date much earlier than 2200 BC – they get into very deep problems with things like Chinese history.

The current state of YEC beliefs

I first became aware of the YEC Genesis Flood position sometime in the 60s in my early teens when I was not a Christian. I thought it ridiculous even then and presumed that it would die out. Yet far from dying out it seems to have flourished and is seriously promoted in many elements of the church. It would be fascinating to see detailed sociological research as to why such an implausible and demonstrably false view became so mainstream within certain sectors of Christianity. Let me offer some cautious thoughts.

- YEC views have something of the attraction of many modern conspiracies. It's an exciting, minority belief that whispers '*they* are lying to you', '*scientists* don't know everything' and '*we* can tell you the truth'. YEC sources claims there are 'many' professional geologists who believe in an earth which is just a few thousand years old. On examination of the names offered, these are far fewer than claimed, often have questionable credentials and in general work in specialised aspects of geology such as the description of fossil species or aspects of mineralogy. There are claims in addition that there are YEC believers in the geological community who only pretend to believe in an ancient earth. I've worked with Christian geologists in the oil industry and I've never heard a whisper of secret believers. You would have thought that, on retirement or as they lay on their death bed, some of these people would have produced confessions of their true faith.
- The 'echo chamber' effect of the Internet has allowed every strange and wonderful belief to flourish. Think Flat Earth views.
- It's generally agreed that in the West at least there has been a dumbing down of society. (I love the French equivalent: *la crétinisation.*) There was a time when even ordinary Christians used to seriously engage with science and philosophy. Today's tone is very much shallower. In particular, there is a frailty in popular Christian thinking: too much preaching has become merely the delivery of heart-warming platitudes. One result of this of this is an inability and reluctance to handle complex issues.
- YEC views are linked to a worrying trend where passion becomes combined with ignorance. (As the Irish poet Yeats wrote 'The best lack all conviction, while the worst are full of

passionate intensity.') You hear people speaking out loudly on Genesis who have no idea what the word *genre* means and have not a word of Hebrew. (I had one church pastor say to me, 'I know *nothing* about geology, but you're *wrong*!')

- YEC beliefs offer a simple explanation for church numbers being in decline and society floating adrift from any Christian values: 'Darwin did it'. In addition, YEC holds out the idea that the 'good old gospel' it preaches will put the church and the world back on track.
- Don't overlook the fact that YEC movements are well staffed and funded. In 2021 'Answers In Genesis' employed 364 employees and 'had expenses' of $32.5 million. There are credible rumours this is only the tip of a funding iceberg.
- Despite the extraordinary lack of data supporting their views and the abundance of that which disproves it, YEC movements have an aggressive confidence. (I'm reminded of the comment found scribbled on the sermon notes of a preacher: 'Argument weak: shout loudly!') Along with this, YEC presentations often adopt a knowing, mocking tone which amuses but doesn't inform.
- Although today we all love technology, science itself is something of a minority interest. In one sense this is understandable: everything in every field is now so complex that it's difficult to understand anything but a small segment of science. The science fiction writer Arthur C Clarke wrote 'Any sufficiently advanced technology is indistinguishable from magic.' Clarke overlooked one unfortunate corollary of this: advanced technology (and science) gets *treated* as magic. It's admired but, being no longer understood, is left to the 'magicians'.
- There is something attractive, and indeed reassuring, in the YEC timescale for the universe. With everything only 6000 years old the idea of an imminent Second Coming seems comfortingly probable and imminent. But if you adopt the conventional scientific dating, we find ourselves in a narrative that is suddenly disconcertingly long: we are part of a cosmic drama on a very much larger scale.
- There is also something else and here I tread cautiously. I sense – no more than that – a coming together of various views as a New Christian orthodoxy, primarily in the States but increasingly spreading worldwide. This coalition is relentlessly popularist, demonises anything remotely radical (it hates 'political correctness'/ 'wokeness' in any form), stands against climate change concerns, vaccinations and any manifestation of 'the Big State'. It stands opposed to abortion, is generally supportive for Israel and cautiously believes in some sort of imminent end of the world/Armageddon scenario. It is either linked with, or supportive of, the New Right in American politics. Young Earth Creationism has found itself part of what is, in effect, a package deal.

Scientific problems with YEC beliefs

YEC beliefs are an uneasy marriage of two separate things: a particular biblical interpretation and (allegedly) a science. This gives rise to a tension which comes over in many of the YEC publications. It also grants YEC believers a rather elusive status: if you criticise their views on scientific grounds, they can suddenly claim you are denying the authority of the Word of God. And unlike most scientific theories, when there are problems – and there are *so* many – they can appeal to miracles.

Of note is the fact that although every YEC organisation will claim to be doing 'science', the nature and quality of this work is very suspect. In some cases, the researchers are unqualified or working well outside their training. In most cases those who are doing the science have signed agreements – which go counter to the spirit of science – that they will produce no results that do not fit with the organisation's position on the history of the earth (cf https://en.wikipedia.org/wiki/Answers_in_Genesis). Although there will be a claim in many cases that the work is 'peer reviewed', the peers are a self-selected group from within Young Earth Creationism.

Advocates of a YEC position have a tough task. Although their focus is on the history of the earth rather than of the universe, it's worth noting that the problems extend beyond geology into cosmology where there are profound issues. Given that the speed of light is fixed and that, with reasonable confidence, we can work out the distance of celestial bodies from the earth, we can calculate of how long ago the light left them and began travelling to earth. The figures run into millions and billions of years and pose a very considerable threat to any YEC position.

One popular YEC focus is the 'The Big Bang' origin for the cosmos. Two reasons make it an attractive thing to preach against. For one thing, the unfortunate and pejorative title 'Big Bang' with its overtones of chaos and randomness unsettles many Christians. (In fact, in my view, it's an event that could be much more sympathetically described as the 'flowering' of the cosmos.) For another, astrophysics is an easy field to mount an attack for a *popular* audience because it's not hard to sound convincing with a few graphs, some obscure symbols and lots of big numbers: you can be very confident that aImost no one in your audience will be able to comment with authority. I personally take the view that the YEC preoccupation with the origins of the universe is something of a diversionary tactic: YEC advocates would prefer to speak of an intangible and mysterious astronomy rather than tangible and relatively simple geology because virtually every cliff and every quarry speaks of vast amounts of time. My simple response to most YEC claims is simply this: 'get up and go look at some rocks!'

The challenge for a YEC view in geology is even more problematic. Here the discrepancy between YEC views and the Standard Geological Model of orthodox science is extraordinary. The view, held by I'd guess more than 99.9999% of the earth science scientific community – which of course includes many Christians – could be defined as a consensus resting on three foundations: a) an earth history involving billions of years, b) the predominance of uniformitarian processes during that history and c) the continuous operation of plate tectonics. Let me expand on these.

In terms of age, it is believed on the Standard Geological Model that the Earth formed around 4,600,000 years ago. It should be noted that here radiometric dating has merely given numbers to what was already largely inferred. So in the late 19th century there were great debates on the age of the earth and all the questions revolved around how *many* tens of millions of years were involved. No one was pitching for an age of anything less than 10 or 20 million years. This problem for YEC views cannot be overstated. Although they can find ways of 'stretching' the chronology of Genesis, it's difficult to get it supporting an age much beyond 10,000 years for the origin of the universe. And that, compared to what science claims, would be still utterly and laughably insignificant. The compression required is equivalent to revising history so that, in reality, the six momentous years of

the Second World War only took three minutes! It's been commented, with justice, that the Young Earth Creationism should be renamed as the Effectively Instantaneous Earth Creationism.

In terms of rock forming processes, the principle of uniformitarianism (simply, if simplistically, stated as 'the present is the key to the past') still holds in orthodox geology but with important modifications. Uniformitarianism implies that in any interpretation of ancient rocks, an initial starting point for interpretation is to assume that they were a) formed by processes similar to today and b) at more or less the same rate. So for instance in the past there are many rocks whose features allow them to be identified as having been deposited in delta, beach and desert sedimentary environments similar to today. Perversely, by seeking to demonstrate that particular rock levels are indeed flood deposits, Young Earth Creationists adopt a uniformitarian point of view.

Now, contrary to what is claimed by many YEC advocates, the use of uniformitarianism by geology is not a cast-iron rule. Two exceptions are widely accepted. The first is that geologists recognise that in many ways the past *was* different and the further back you go the more different that past was. So it is now assumed that the composition of the atmosphere and marine water often differed from that of the present-day world and in the first few billion years of earth history things were probably very different. The second exception is the universal acceptance of the possibility that a limited range of catastrophic events have occurred. The most noted example here is the recognition that, on limited occasions, in the past the earth has been struck by sizeable comets or meteorites. The results of these are easily recognisable and limited. None of these catastrophes gives support in any way to any sort of YEC global catastrophism. One frequently repeated denigration is that 'evolutionary geology' is not prepared to accept the possibility of catastrophes. In fact, the recognition and acceptance of catastrophic events among scientists gives the lie to the claim that orthodox geology is unprepared to consider non-uniformitarian events. As with so much YEC thinking this is utter nonsense. Geologists know what catastrophic flood deposits look like, they have been widely recognised and they have been recognised on Mars where they are attributed to that part of Mars Rock record which – with irony – is termed the 'Noachian Period'.[1] On earth, flood deposits occur in only a tiny part of the rock record.

In terms of plate tectonics, the assumption in the Standard Geological Model is that the slow, steady movement of tectonic plates around the surface of the earth has operated for billions of years. In fact it is quite common for geologists to recognise early events that have involved the destruction of oceans and the creation of mountain ranges. So the Appalachian Mountains in North America are considered to be a continuation of the metamorphic and igneous rocks found in the uplands of Brittany, the Massif Central of France and the Iberian Massif and were caused by the closure of the long gone Rheic Ocean around 300 million years ago.

The slow rate of plate movement – the maximum is around 10 centimetres a year – demands a geological history of many millions, if not billions of years. With modern GPS techniques this movement of the plates is now easily demonstrated. So Iceland for example is getting 2.5 centimetres wider a year. Significantly there's a close match with the geological record. So for instance if you look at the rock record you find that Europe and America began to split, giving the North Atlantic, in the early Jurassic, around 200 million years ago. If you divide the distance across

[1] Heydari, E., Schroeder, J.F., Calef, F.J. et al. Deposits from giant floods in Gale crater and their implications for the climate of early Mars. Sci Rep 10, 19099 (2020). https://doi.org/10.1038/s41598-020-75665-7

the modern Atlantic by the rate at which the North Atlantic is spreading in Iceland today you get an early Jurassic date.

Because plate tectonics is undeniable – it's a been an accepted and demonstrable fact for fifty years – YEC advocates are faced with a problem. Attempts to harmonise YEC beliefs with plate tectonics have these hundred km thick plates accelerating from zero, moving at up to 2 metres a second and then decelerating again and all during the flood year. The amount of heating involved in accelerating and braking such slabs is enough to render the surface of the earth molten!

Ultimately, in order to overturn the views of orthodox science YEC believers need to successfully complete two tasks. The first task is to demonstrate that the Standard Geological Model is utterly and completely wrong. The second task is to demonstrate that their own model fits the data better.

Task 1: Disproving the Standard Geological Model

One of the greatest successes of geology, and indeed science, is the creation of the geological map which describes the rocks found at the Earth's surface in a particular area. It is particularly powerful in the case of sedimentary rocks where, normally on the basis of fossils, rocks can be assigned to a particular geological age, such as Cambrian, Silurian, Jurassic and Cretaceous. As noted earlier, with increasing precision these units have been recognised and correlated across the world. Gaining geometric information about the direction and amount of any alignment ('dip') of sedimentary rocks allows the prediction of what lies beneath the surface. So, in the UK, if Permian rocks are found at the surface, a prediction can be made that below them are likely to be Carboniferous rocks with coal deposits. It's a predictive ability which is now well over 200 years old and has been enormously successful across the world.

Very early on in the history of geology as a science the study of sedimentary rocks at the surface and the cross correlation across regions saw the creation of the geological column; that expression of the of the geological time scale that traditionally begins with the Precambrian and which continues up through ten or so periods to the present day. As this is often attacked, some comments are relevant.

- It is sometimes claimed that the complete geological column is rarely found. In fact, there are some cases of continuous sequences of sediments of several time periods but actually any local expression of the geological column will often contain gaps, which generally represent periods of non-deposition or of erosion. The fact remains however that a complete sequence can be pieced together relatively easily. Even in the small area of the British Isles almost every geological period is well represented.
- Locally or regionally, the geological column is normally very thick and generally very complex. In any given continental area there's a strong likelihood that what you have is between 5 to 15 kilometres of sediments of many different types formed under a variety of environments at a various times. Within that sequence there may well be volcanic units, evidence of erosion, tilting and folding.
- As noted earlier the idea that the geological column is a 'evolutionary model' is refuted by the fact that this existed in a form close to its modern one, 30 years or more before Darwin published his theory of evolution.
- Radiometric dating using isotopes is commonly treated as worthless by YEC advocates. This is of course very surprising because all geological organisations who have got the money,

whether academic or industrial, use it regularly. If it didn't work – it's a costly technique – then they would be the first to reject it. I've had samples dated by radiometric dating using isotopes on several occasions and never had cause for complaint. One interesting case study was a sequence of Late Jurassic sedimentary rocks in Madagascar in which there were a series of, I think, six separate lavas. I sampled them, brought them back to the UK and, in standard scientific procedure, gave them random numbers and sent them off to the lab for dating. When I got the results back two things were striking. First of all, the results were all with more or less within the range that they should have been for Late Jurassic, around 160-150 million years old. Secondly the order of the individual sample dates was consistent with their position in the rock record; the lower lavas were given older dates than the younger lavas.

- One recent claim that rocks are actually astonishingly young is based on a discovery that some soft tissues are preserved in some dinosaur fossils. Interestingly, the discover of this is a keen Christian, Mary Schweitzer, who believes in the Standard Geological Model, but who has been exasperated by the fact that YEC people claim her data in support of their views. She is quoted as saying of YEC proponents "They treat you really bad. They twist your words and they manipulate your data.'[2] The fact that on *very* rare occasions preserved cells and dinosaur tissue occur remains an oddity, but is now beginning to be understood.
- There are claims of 'out of sequence' fossils; fossils that occur in the wrong level of the geological column. The most (in)famous of these are the now discredited human footprints with dinosaur prints at Paluxy River in Texas: see Wikipedia: https://en.wikipedia.org/wiki/Paluxy_River. In connexion with such 'out of sequence' fossils, let me make two points. First, if the rocks were deposited by the chaos of the Flood, then fossils ought to be hopelessly mixed up and 'out of sequence' fossils ought to be the norm. In fact, although I haven't examined every claim, I'm unaware of *any* that can be substantiated. My own testimony here should be noted. In the course of my career I must have carefully examined, and in many cases described in detail, well over 10 kilometres thicknesses of sedimentary rocks across the world. I know my fossils and always try to identify them and I can honestly say I've never come across any that were not where they ought to be in the geological column. The second is that if such 'out of sequence' fossils did occur they would have been described. So, for instance, science has long assumed that no ammonite survived the end of the Cretaceous: an event we now know was marked by a global catastrophe. Were a geologist to discover ammonites in younger, post Cretaceous rocks and it to be demonstrated that they had actually lived *after* the Cretaceous, then that would be a discovery that would make headlines and guarantee a scientific career. The fact is that science is fundamentally self-checking. There is no conspiracy of silence!
- Nothing exemplifies the ability of the YEC groups to manufacture the popular geological equipment of the 'urban myth' more than their claims that dinosaurs and human beings coexisted. That is quite simply no evidence whatsoever for this: indeed there is no trace of any dinosaur having existed after the end of the Cretaceous around 65 million years ago.
- Another area of attack is to point out that rocks can be deposited rapidly. The standard example here is Mount Saint Helens, where as a result of the catastrophic eruption of 1980, tens of metres of rocks were laid down rapidly locally. The fact is that these are instantly

[2] https://www.smithsonianmag.com/science-nature/dinosaur-shocker-115306469/

> recognisable as volcanic derived material which bears no resemblance to anything other than the very tiniest proportion of the rock record. In the middle of the oceans, sediments accumulate only 0.1 mm per 1,000 years while along the continental margins the rate may be as fast as a metre a year.

In attempting to undermine the concept of the geological column and to demolish the Standard Geological Model, YEC proponents have trawled through the literature to find the difficulties, discrepancies and anomalies that occur in every area of life, taken them as evidence of a failure of the model and highlighted them. In doing so they have often ignored the context and completely overlooked the perfectly consistent results that occur in the overwhelming majority of geological papers. What is frequently not appreciated outside the geological community is the sheer volume of geological data, accumulated over two centuries, from cliffs, quarries, excavations, boreholes and mines that, were it to be brought together, would fill the largest public libraries of any city. Yet, despite the desperate search for anomalous data, the number of reported cases reported is tiny. If the geological record were fundamentally in error, then anomalies would be the norm, not a rare exception. In fact the presence of anomalies in science is perfectly normal and is often something that draws the attention of researchers. In most cases, after study it is resolved with some modification of the existing model. Very early on in my geological career I was thrown a puzzle, where what seemed to be superficially Cretaceous fossil brachiopods appeared to be present in much older rocks, Ordovician. I looked very closely at the brachiopod and did some careful work on its internal structure and it turned out to belong to a very different and older group altogether.

The overall impact of YEC criticisms on scientific geology is utterly minimal. I have never come across any serious discussion amongst geologists, even Christian ones, in which someone raised the possibility that the YEC interpretation of geology might be correct. The claim is similar to someone saying that, on the basis of a couple of contradictory dates found in soldiers' memoirs, that the Napoleonic Wars never happened.

What the non-geologist does not easily appreciate is how, in unravelling the ancient past, all sorts of multidisciplinary data interlock. So, for instance, in studies of the opening of some ocean such as the North Atlantic we have a wide range of data. Geophysics allows us to determine the amounts of movement of the tectonic plates, radiometric dating of igneous lavas gives absolute dates for continental separation, fossil studies linked to the geological column show marine fossils spreading up between the gap and increasingly different fossil types occurring on either side of the new ocean as the ocean grows. In the vast majority of cases the data fits and can be cross correlated. Where it doesn't fit, the work generally explains some unexpected complexity or other.

The robustness of the Standard Geological Model is striking. Historians of science have described what can be considered as the symptoms of a 'theory in trouble'. There is a widespread sense of unease with the old model, abundant anomalous data that just doesn't fit, unanswered questions etc, speculations on alternatives etc. It happened in the models of mountain building before plate tectonics and explains why plate tectonics was so widely accepted: it solved many problems and resolved discrepancies and curiosities. None of these symptoms apply to the Standard Geological Model. It works, and within orthodox science no one is expressing discontent or unease with it.

Task 2: Providing an alternative model for Earth History

If advocates of YEC have failed to undermine the existing science model, they have failed even more profoundly with any attempt to create an alternative. There are only the sketchiest models for any sort of replacement within the YEC world and these are widely (and acrimoniously) disputed even with the YEC believers. Consider for example the very basic question: where did the quantities of water sufficient to cover the highest mountains come from? Some YEC advocates believe that the water came from inside the Earth, as the 'fountains of the great deep' that burst out on the day of the flood (Genesis 7:11). Others believe that the water came from the collapse of a water vapor canopy that surrounded the Earth before the flood, and that collapsed as part of the 'windows of heaven' that opened on the same day (Genesis 7:11). There are similar – and equally contradictory issues – as to where the water went to afterwards

Perhaps the most telling argument against YEC beliefs is that the only people who believe them already hold some sort of commitment to one particular interpretation of Genesis. Whereas there are secular, atheistic cosmologists who disagree with the Big Bang, you will find no secular believers in a 6000-year-old earth.

In brief any YEC model, particularly one involving flood geology, must overcome enormous difficulties. Let me briefly list them.

- As noted above one of the greatest successes of science is the creation of the geological column and the geological map with its delineation of units such as Cambrian, Silurian Jurassic and Cretaceous etc. All YEC models fail to explain that. There are no flood geological maps based on flood geology.
- The universally recognised sequence of life over time makes perfect sense under some sort of development, whether evolutionary or not, but none at all if all the rocks were simply deposited by some astonishingly chaotic and catastrophic flood.
- The environments of formation of many rocks can be fairly precisely identified. In terms of sedimentary rocks we can recognise the following phenomena:
    - sediments that are reliably interpreted as being deposited by wind.
    - evident ancient soil horizons complete with roots.
    - coral reefs, including stacked sequences up to several kilometres thick.
    - vast numbers of surfaces in sedimentary rocks that have burrows and trails across them reflecting the activity of animals going about the ordinary business of life.
    - numerous levels with mudcracks; a sure indication of exposure to the sun.
    - Dinosaur footprints and even nests with eggs.
    - Sequences often over a kilometre thick of salt deposits: something that cannot form underwater.
    - Buried forests.
    - Many sedimentary sequences contain lavas and frequently ones that are clearly weathered and eroded.

All these reflect the presence of time, frequently, the presence of exposure above water and the total absence of anything like the presumably chaotic inundation of a global flood. In addition, in many areas there are vast accumulations of fossils, whether vertebrate or invertebrate, that are far too numerous to have all been alive at the same time. A particular telling challenge for YEC views

here is the famous English Chalk which is up to 1,500 meters thick and is made up entirely of the skeletons of microscopic planktonic algae that must have formed in clear, mud-free, shallow water. Science considers that it was formed over a period of around 30 million years, consistent with that fact that equivalent modern sediments accumulate at between 10 millimetres and 100 millimetres per 1000 years. It's hard to speed that rate up.

One other feature of note is the widespread occurrence, particularly in the Jurassic and Cretaceous of thick (often several kilometres or more) pale and often white limestones: these cover a large part of the southern UK and France and elsewhere. They contain virtually no sand, silt or clay and speak powerfully of slow quiet deposition in shallow, clear water seas. Take a few kilos of these rocks, dissolve the limestone away in dilute acid and you will be left with only a few grains of sand and a smear of clay. Anything less like a flood deposit would be hard to imagine.

I have no particular expertise in igneous or metamorphic rocks but simple physics applies with things like granite intrusions. We know what temperature the magma must have been to be molten and so, given the volume of the intrusion and thermal properties of any insulating surrounding rock, we can work out how long it must have taken for the magma to cool to the point of solidifying. For most granite bodies the figures are of the order of several million years.

It should be noted that the geological column now extends well into the rocks before the Cambrian which are still widely termed Precambrian. Here we have a very thick and very complex sequence of rocks that are generally metamorphosed and which are interpreted by orthodox science as being due to a long succession of deposition, erosion and plate collisions over more than 3 billion years. The challenge of the Precambrian to YEC proponents is so overwhelming that they are often reduced to resorting to the desperate expedient that God created these rocks looking old. This raises the question as to why other parts of the geological record might not also have an apparent age and brings with it the denial of the fundamental basis of science: what we see is reality.

It should also be noted that numerous cores have been made of ice caps and within them yearly alternations which allows for counting of years. Continuous ice sequences have been recovered now for up 130,000 years in Greenland, and 800,000 years in Antarctica.

A literalistic interpretation of the Flood narrative which sees it as a global event poses many problems in terms of what is called biogeography. The idea that animals of all types are gathered from across the whole world *in our sense* into the Ark is difficult to conceive. It is typical of the bizarre world of YEC belief that it is widely proposed that rather than every species being gathered into the Ark, Noah simply received representatives of particular 'kinds', which after the flood, evolved rapidly over 4,000 to 5000 years into many different species.

If the devastated earth was repopulated after a global flood a few millennia ago from an Ark then there are innumerable curiosities that demand an explanation: why is the fauna of Australia with its marsupials so unique? Did koala bears walk there all the way from Mount Ararat in 4000 years? Why does only Madagascar have lemurs? Why are there still strong zoological and botanical links between areas that orthodox geology considers were once part of the same supercontinent of Gondwana? The difficulties of deriving the entire human race from a handful of survivors on Mount Ararat around 4000 years ago are obvious.

It also needs to be pointed out that Flood geology goes against Scripture. So we are told in Genesis 2:14 that two of the rivers that define the garden of Eden are the Tigris and Euphrates. Although in existence before the Flood, they lie on many thousands of metres of sediment and so in flood geology terms must post date the flood. We are also told the flood waters rose over the mountains (Genesis 7:19) implying that the mountains must have pre-existed before the Flood.

Significantly too there are a few allusions in Scripture which imply an old earth.

- Job 15:7 “Are you the first man ever born? Were you brought forth before the hills?”
- Psalm 90:2-6: “Lord, you have been our dwelling place throughout all generations. Before the mountains were born or you brought forth the earth and the world, from everlasting to everlasting you are God.”
- Micah 6:2: “Hear, O mountains, the Lord’s accusation; listen, you everlasting foundations of the earth.”
- Habakkuk 3:6: “[God] stood, and shook the earth; he looked, and made the nations. The ancient mountains crumbled and the age-old hills collapsed. His ways are eternal.”

The commonly stated verdict on ‘creation science’, Young Earth Creationism and flood geology is that they belong in the category of *pseudoscience*. I have no wish to disagree.

But what about ‘Evolution’?

One of the many debating tricks used by YEC proponents is to either explicitly or implicitly suggest that to accept orthodox geology is to accept evolution and therefore atheism. Here it's worth noting a recurrent pattern in the YEC argument: the idea that there are just two beliefs and it's a matter of either one or the other. Everything is seen in black and white, without any possibility of uncertainty or nuance.

A key question here, which can only be tackled briefly, is exactly what is meant by ‘evolution’. Forty years ago I was taught a clarification of the term which has served me well in an enormous number of settings. It is to recognise that that are three definitions of evolution, each very different and each requiring a different reaction from Christians. Let me call them Evolution 1, 2 and 3. Although they can be refined and modified, I believe that these three divisions are valid.

Evolution Definition 1:

‘The small-scale genetic shift of organisms’

This is microevolution, has been observed in both the laboratory and nature in everything from viruses to birds. It is plainly scientific and is a proven fact. It has no conceivable conflict with any form of religion.

Evolution Definition 2:

‘The gradual origin of all living things in an unbroken succession from one or more common ancestors over several billion years.’

There could be a discussion here about whether all the changes are gradual, but it doesn't alter the fundamental definition. This is 'geological' or 'historical' evolution: the idea that over countless generations something like algae or bacteria have progressively evolved into complex multicellular plants or animals. It is still scientific but it is not 'observational science': it happened in the past and cannot be tested in the lab. So, for example, we cannot be *absolutely* certain that in the Devonian two members of species A mated to give the novel gene combination that is Species B. Increasingly however, analysis of DNA of living organisms allows us to reconstruct highly probable relationships and suggest approximately when such events might have occurred.

Is there a conflict with religion? In theory, no. If you take the view, generally associated with Calvinism but in fact thoroughly biblical, that God oversees every event in the universe, then this is simply the process that he works through. A view that this is how God works could be termed either *Theistic Evolution* or *Continuous Creation*. The obvious issue for Christians who believe the Bible is the extent to which Evolution 2 conflicts with Genesis. Here assumptions have to be made about what scientific information is being conveyed by those passages. Many Christians would also probably want to suggest that human beings were specially created. I comment on these below.

Is Evolution 2 likely? Personally, I acknowledge the evidence for it and think it likely, but I retain some reservations. Put crudely I have no problem with 'the survival of the fittest' but rather with the notion of 'the arrival of the fittest'. Some living things seem to me to have structures which are so complicated and have such interlocked and interdependent physical structures and biochemical elements that I struggle to see how they evolve by gradual chance. The idea that God lies behind every mutation and extinction that has driven the development of life seems to me perfectly reasonable. On this view Evolution 2 exists but it is in fact a directed and supervised evolution.

Evolution Definition 3:

'Evolution is the only creating force in the universe. It is the mechanism through which all things have come into being. There is no supernatural God, gods or higher powers, only evolution.'

Although this is rarely put so starkly, it is what underlies much usage of the word *evolution*; here normally capitalised as Evolution. What we have here is a philosophical view of the purpose, or lack of it, behind the universe. Precisely because it pronounces – negatively – on the existence of God, it is actually a religious or theological opinion and as such is based on faith. It hardly needs stating that this is in total opposition to Christianity or indeed any other religion.

The key point is that a belief in the first or even the second type of evolution does not lead you to the last one. Note too that the age of the Earth is actually an irrelevant issue here. It is possible to believe in an old earth and reject any idea of gradual change.

But what about Genesis?

There's an awful lot could be written about this, so here is just a brief and somewhat personal sketch.

- One very curious aspect of the interpretation of Genesis is that many people, particularly YEC advocates, seem to read this as a 19th, 20th or even 21st century document written in

quasi-scientific language for a western culture. Genesis was presumably written for its pre-scientific culture but has spoken to many other cultures over its history of several thousand years. Paradoxically, for all their attack on secular science, one of the chief problems with YEC views is that they are *too* respectful of science. By trying to straitjacket Genesis 1 into scientific language they lose sight of what the text is saying. Can we let Genesis please be Genesis?

- Given the difficulties of matching Young Earth Creationism into any geological model, a more honest interpretation might quite simply be to ascribe the first eleven chapters of Genesis to a real earth which was miraculously destroyed and replaced at the end of the Flood. Given that the Flood is portrayed as some sort of destruction and recreation of the world this isn't actually quite as unrealistic as it sounds. It would of course remove the early chapters of Genesis from any geological verification.
- The days of creation in Genesis 1 have been variously interpreted. Superficially, they seem to recount a series of 24 hour days but there is no clarity what a 'day' represents. In the Hebrew, Genesis 2:4 talks about 'the day' (*yom*) in which the Lord made the heavens and the earth': a clear indication that day is not to be rigidly seen as 24 hours.
- There is a widely noted and striking parallelism between days 1 to 3 and days 4 to 6. in summary the first three days seemed to represent what you might call 'realms' and the next three days seem to refer to the 'inhabitants' or 'rulers' of these realms. If so, then this suggests that Genesis 1 is not so much chronological as ceremonial or legal, bearing within it the widespread Old Testament phenomenon of covenants, their gifts and responsibilities.
- Other possible suggestions have been made for Genesis 1.
    - Might it be predominantly poetic? It certainly has what has been called a hymn-like framework.
    - Might it be liturgical? That is to say, a framework for worship, perhaps in some festival.
    - Might it be polemical? Addressed to attack prevailing misunderstandings of the universe.
    - Might it actually be a combination of several genres?
- The existence of a second account in Genesis 2 but from a different perspective seems to flag up the fact that Genesis 1 is not to be interpreted literally.
- Theologians talk about the early chapters of Genesis as 'proto-history'. It's certainly hard to see how they can be historical, when there were no human historians to account for events. Indeed it's difficult to see how God could have given someone like Moses an account of the universe according to modern science when so much of the language of science and the fundamental concepts would have been alien to him and his culture.
- The idea that God might have actually given the human race in the Bible a detailed historical picture of the creation is actually rather curious: it doesn't apply to astronomy, geography, anatomy or biology. Part of the challenge and privilege of being made in God's image is surely that we humans are supposed to find out the truth about the world for ourselves.
- With respect to the Flood, again there are different interpretations. Certainly, there is no evidence of a worldwide flood event covering every mountain. Nevertheless, there is the possibility that the flood account deals with some sort of local historic event. It's important to remember at behind the phrase 'covered the whole earth' is the Hebrew 'eretz' that could equally well be translated as 'covered the whole *land*.' A local area would certainly

make more sense of gathering of animals. In terms of the event itself it's worth remembering that around 10,000 BC the climate shifted rapidly from the Ice Age to the Holocene Climatic Optimum which was marked by warmer and more stable climates. Was that shift marked by worldwide climatic catastrophes? *Perhaps*. One good rule is 'insufficient data: mind open, mouth closed.'

- I have long had the personal opinion that Genesis 1 to 11 is, in film language, a 'soft focus' prologue. It's hard to be precise on dates and details; it is perhaps somewhere on the boundary between fact and fiction. Yet when we are introduced to Abraham in Genesis 12, the image sharpens up into focus remarkably. We know exactly where we are, Ur of the Chaldees, and, fairly precisely, when, around 2000 BC.
- The fact that these early chapters are not history as we know it does not minimise the ethical aspects.

On who we are as humans

Genesis appears to teach that human beings were specifically and separately created and made in God's image. YEC believers claim that only they defend this truth. Yet, as with so much of the relationship between Genesis and science, it isn't that simple. The fact of the matter is the links between humanity and the animal world are undeniable. In terms of physical make-up we share an enormous commonality of organs, tissues and even genetic material with the great apes, to the extent that we have something like 95-99% of our DNA in common with chimpanzees. There are even some marked behavioural similarities. At the same time however, it is worth pointing out that the gulf between humanity and even the highest apes remains remarkable. We alone have the ability for complex language with its use of symbols, have analytical thought, make complex tools, have intricate social structures and engage in rituals. We are also rare amongst apes in having monogamous relationships. Biologically, many of these changes are to do with the very much larger and more developed human brain capacity.

A recurrent image that I have used in teaching and which bears repeating is a computing one. My current desktop computer looks superficially similar to one I had twenty years ago and has much in it that is the same, but its power and potential is enormously more. Human beings can be considered like that: although we have similar 'hardware' to other apes, God has installed on it very different 'software'. Cautiously, I think there is potential in thinking of the creation of Adam and Eve as the divine installation of a 'major software upgrade'.

Some concluding thoughts

1) In one sense YEC beliefs are harmless. It is doubtful whether a belief in a 6000-year-old earth shaped by a global flood is damaging spiritually to any individual. The problem comes however where it is taught and even imposed as Christian orthodoxy.
    - It encourages the dismissal of data as 'uncomfortable facts' which can, and should be, ignored.
    - It belittles and denies science as a method and, in doing so, sets an unhealthy pattern. It brings with it an anti-science attitude which spills over into vaccinations and climate change.

One YEC site has criticised the James Webb Telescope on the grounds that Scripture tells you all you need to know about the universe!

2) In an area that Christianity has always found complex, it advocates narrow and simplistic thinking. With its conspiracy mindset, YEC beliefs are producing something akin to a cult.
3) Particularly frustrating is the way that YEC advocates enjoy in talking up a 'warfare' type conflict with every secular views. One YEC writer has said 'If the earth is old, then Christianity is wrong. These concepts are not just incompatible, they are opposites. They are mutually exclusive! Christianity makes no sense at all if the earth is old.' This of course plays into the hands of the hard-line 'New Atheists'. The reality is that faced with the beauty and complexity of the natural world many people outside the Christian faith quietly reject a naturalistic explanation of the universe. As in so many areas, bridge building is better than trench digging.
4) I'm probably not alone in being troubled by an ugly, belligerent and litigious aspect to YEC beliefs even when towards fellow Christians. Whatever happened to gracious dialogue?
5) Isn't it better to maintain an open mind than confidently adopt wrong views?
6) There is a real sense in which the advocacy of YEC beliefs dilutes the gospel. The focus increasingly falls on how the universe was created in the past rather than how it was redeemed at Calvary or will be restored at Christ's return. God becomes primarily the great architect of the universe rather than also its redeemer and restorer and also the potential father of those who choose to believe. In fact, Christ often gets a poor deal in YEC thinking: the spotlight falls elsewhere. Linked with this have been some rather curious and somewhat covert links between American Young Earth Creationism and Islamic groups, particularly in Turkey.
7) Paradoxically, YEC views eliminates one of the strongest and most challenging lines of evidence for the Christian God who creates, sustains and redeems. This is the fact that geology teaches that life has existed on this planet from at least 3.6 to 3.8 billion years ago. Yet the biosphere in which life exists is no more than around 20 kilometres thick. On an earth of 12,700 km diameter that corresponds to nothing more than the equivalent of a sheet of paper around a basketball. Yet orthodox geology reveals that the biosphere, which demands liquid water, has existed intact for nearly 4 billion years. Given that even only ten kilometres above us the environment is freezing cold, getting close to being a vacuum and full of radiation, there are only two possible explanations for this. One is that earth is incredibly lucky and has won the 'planetary lottery' of survival, time after time. The other is that, as Jesus says, God is a heavenly father looking after his creation.

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