JOURNAL OF CREATION
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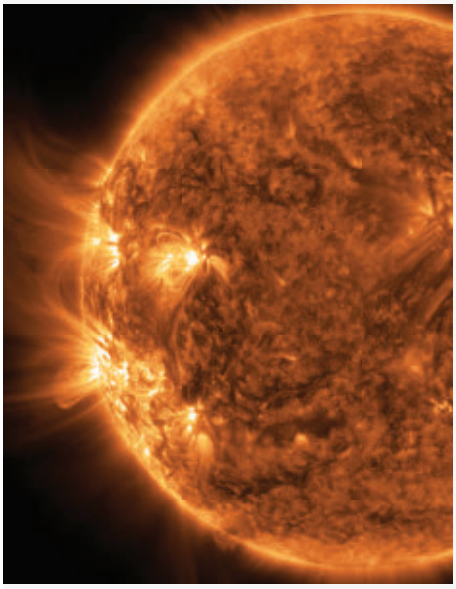
SUPERSYMMETRY
NO SOLUTION FOR
'DARK MATTER'

SULFUR-CYCLING BACTERIA
UNCHANGED IN
'1.8 BILLION' YEARS

SUPERFLARES
AND THE ORIGIN OF LIFE

MILANKOVITCH 'CLIMATE-CHANGE' SUPPORT WANING

FLOOD PROCESSES INTO THE LATE CENOZOIC?



JOURNAL OF CREATION

An international journal devoted to the presentation and discussion of technical aspects of the sciences such as geology, biology, astronomy, etc., and also geography, archaeology, biblical history, philosophy, etc., as they relate to the study of biblical creation and Noah's Flood.

COVER: Close-up image captured by NASA's Solar Dynamics Observatory (SDO) showing the July 6, 2012 X-class flare captured in the 171 Angstrom wavelength.

IMAGE: © NASA/SDO/ALA

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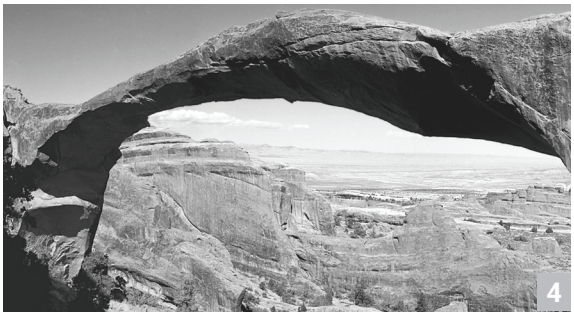

Did large free-standing arches form quickly during the Recessional Stage of the Flood?

The Surprise Canyon Formation's length, depths, and base fill are consistent with mass flow scouring, and do not demand long periods of time.

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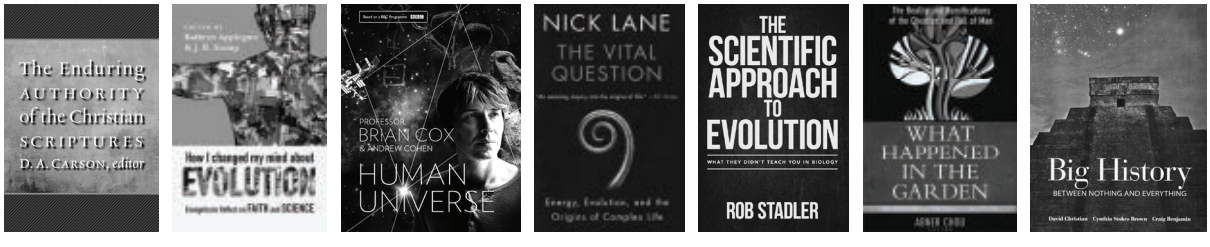
LETTERS



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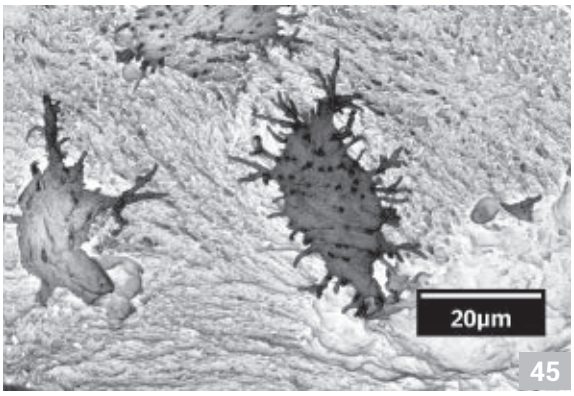
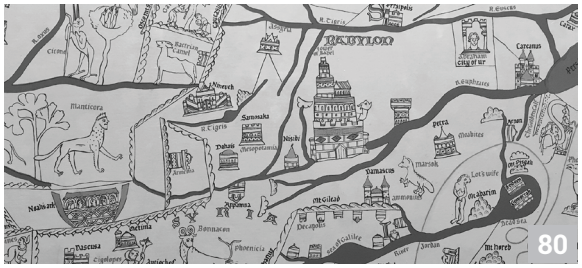


Could stunningly preserved osteocytes from a Triceratops *horn have survived for several hundred million years?*

VIEWPOINT

PAPERS



The date of the Babel event is relevant to questions about the timing of post-Flood climatic changes and human migration.

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Creation Ministries International Ltd. is an independent, non-profit, non-denominational organization, controlled by Christians in the fields of science and education, committed to researching, developing, and promoting Christian creationist materials, and Christian school texts and aids. Our work is based on acceptance of:

» The Bible is the written Word of God. It is divinely inspired and inerrant throughout.

» The final guide to the interpretation of Scripture is Scripture itself.

» The account of origins presented in Genesis is a simple but factual presentation of actual events and therefore provides a reliable framework for scientific research into the question of the origin and history of life, mankind, the earth and the universe.

» Scripture teaches a recent origin for man and the whole creation.

» The great Flood of Genesis was an actual historic event, worldwide (global) in its extent and effect.

» The special creation of Adam (as one man) and Eve (as one woman) and their subsequent fall into sin, is the basis for the necessity of salvation for mankind (and thus for the Gospel of Jesus Christ).

» The scientific aspects of creation are important, but are secondary in importance to the proclamation of the Gospel of Jesus Christ as Sovereign, Creator, Redeemer and Judge.

Please note that in all of this, we openly proclaim that our work is centred around Jesus Christ. We are convinced that the real needs of men and women can only be met by reconciliation to God through faith in and commitment to Jesus Christ the Creator, as Lord and Saviour.

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The problem of the wet Sahara

Michael J. Oard

Both creation and secular geologists agree the earth's deserts and semi-arid areas were once well watered.[1] Creation scientists attribute this to the ponding of water in enclosed basins during the run-off stage of the Flood and greater Ice Age precipitation. During this time the Great Salt Lake in Utah, USA, was about 12 times its current area and about 330 m deeper[2]. Measuring the ancient shorelines in Death Valley, California, USA (figure 1), shows a lake once filled Death Valley 170 m deep.[2] Today it is one of the hottest, driest places on Earth.

The Sahara Desert was also well watered

Today the Sahara Desert is also one of the hottest and driest places on Earth, but field and satellite pictures record evidence of ancient large lakes and rivers.[3–5] Paleolake Chad was much larger than today at 340,000 km^2 in area.[6] Countless Neolithic artefacts and fossils of aquatic animals, such as the hippopotamus, indicate comparatively recent climate change.[7] Dwarf Nile River crocodiles have been found as recently as the early 20th century in isolated Sahara oases.[8] Judging by the thousands of rock petroglyphs, the population of the Sahara was quite large. James Wellard states:

> "The Sahara is a veritable art gallery of prehistoric paintings. … The evidence is enough to show that the Sahara was one of the well-populated areas of the prehistoric world. … Yet there is his work, in the most inaccessible corners of the desert, literally thousands of figures of tropical and aquatic animals, enormous herds of cattle, hunters armed with bows and boomerangs, and even 'domestic' scenes of women and children and the circular huts in which they lived."[9]

Others corroborate:

> "Occupation is clearly testified in the frequent rock engravings that are scattered throughout the upland regions of the desert, illustrating a lush environment with Sahelian and riverine fauna and scenes of large-game hunting, livestock herding and religious ceremony… ."[10]

This period of time is called the African Humid Period (AHP).

Timing of the African Humid Period

The timing of the AHP has been debated, but secular researchers generally believe it started about 15,000 years ago.[11,12] Based on 3,287 carbon-14 dates from 1,011 Neolithic archeological sites, they surmise that humans were in northern Africa 5,500–10,500 years ago. So, the AHP is inferred to have likely ended about 5,500 years ago in the uniformitarian timescale. This corresponds to the very late Pleistocene, during deglaciation, and the early to mid-Holocene, after the biblical Ice Age.

That the wet period in the south-west United States occurred during the Ice Age or shortly afterwards is corroborated by high shorelines cut into end moraines. For instance, a shoreline from pluvial Mono Lake in the Owens Valley, about 242 m higher than the 1975 level of Mono Lake, was cut in the most extended end moraine that had formed east of the Sierra Nevada Mountains, California, USA.[2] Since this end moraine was not deformed after the shoreline was carved, the ice must either have been melting at the time or had totally melted from the Sierra Nevada Mountains. The highest point of the lake could not have occurred long after the Ice Age because the Ice Age climate was very wet with strong drying afterwards.[1] The heavy Sierra snow should generally coincide with the high levels of pluvial lakes.

The timing of the wet period in the Sahara Desert and the south-west U.S. partly coincide. It is claimed to have been dry in North Africa from the last glacial maximum to 15,000 years ago[12] and the south-west USA

Figure 1. Shorelines in southern Death Valley, California, USA, from an Ice Age lake 180 m deep

pluvial lakes dried out rapidly in the Holocene. The difference in timing, if real, could simply be due to the difference in latitudes.

Cause of the African Humid Period

Secular scientists really do not know why the AHP occurred. It is assumed the intertropical convergence zone (ITCZ) that causes an east-west heavy rain band and tropical forests through central Africa somehow moved up to 600 km north. The ITCZ is related to the current general circulation of the atmosphere, and scientists do not know how or why it could be farther north during the AHP.[13,14] Some models claim modest success in moving the ITCZ a little farther northward due to Milankovitch fluctuations and the increase in greenhouse gases.[12] One wonders how slight changes in Earth radiation balance caused by the Milankovitch mechanism[15] and an increase in carbon dioxide after the Ice Age would produce an ITCZ significantly farther north than today. Carbon dioxide is significantly higher today than right after the Ice Age, and the ITCZ remains stable in its central African location, since it is *locked* to its average location by the general circulation. Creation scientists do not have an explanation for the AHP either, except the post-Flood Ice Age has more potential to explain it, with much more precipitation caused by the warm oceans after the Flood.[16]

References

1. Oard, M.J., *Frozen in Time: Woolly Mammoths, the Ice Age, and the Biblical Key to Their Secrets*, Master Books, Green Forest, AR, pp. 41–44, 2004.
2. Smith, G.I. and Street-Perrott, F.A., Pluvial lakes in the western United States; in: Wright, Jr., H.E. (Ed.), *Late-Quaternary Environments of the United States*, University of Minnesota Press, Minneapolis, MN, pp. 190–212, 1983.
3. Pachur, H.-J. and Kröpelin, S., Wadi Howar: paleoclimatic evidence from an extinct river system in the southeastern Sahara, *Science* **237**: 298–300, 1987.
4. Paillou, P., Schuster, M., Tooth, S. *et al.*, Mapping of the major paleodrainage system in eastern Libya using orbital imaging radar: the Kufrah River, *Earth and Planetary Science Letters* **277**: 327–333, 2009.
5. Chorowicz, J. and Fabre, J., Organization of drainage networks from space imagery in the Tanezrouft plateau (Western Sahara): implications for recent intracratonic deformations, *Geomorphology* **21**:139–151, 1997.
6. Hoelzmann, P., Kruse, H.-J. and Rottinger, F., Precipitation estimates for the eastern Saharan palaeomonsoon based on a water balance model of the West Nubian palaeolake basin, *Global and Planetary Change* **26**:105–120, 2000.
7. Kröpelin, S. and Soulié-Märsche, I., Charophyte remains from Wadi Howar as evidence for deep mid-Holocene freshwater lakes in the eastern Sahara of Northwest Sudan, *Quaternary Research* **36**:210–223, 1991.
8. Drake, N.A., Blench, R.M., Armitage, S.J., Bristow, C.S. and White, K.H., Ancient watercourses and biogeography of the Sahara explain the peopling of the desert, *Proceedings of the National Academy of Science* **108**(2): 458–462, 2011.
9. Wellard, J., *The Great Sahara*, E.P. Duggon & Co., New York, NY, pp. 33–34, 1964.
10. Manning, K. and Timpson, A., The demographic response to Holocene climate change in the Sahara, *Quaternary Science Reviews* **101**: 28–35, 2014.
11. Lécuyer, C., Lézine, A.-M., Fourel, F. *et al.*, I-n-Atei paleolake documents past environmental changes in central Sahara at the time of the "Green Sahara": Charchola, carbon isotope and diatom records, *Palaeogeography, Palaeoclimatology, Palaeoecology* **441**:834–844, 2016.
12. Otto-Bliesner, B.L., Russell, J.M., Clark, P.U. *et al.*, Coherent changes of southeastern equatorial and northern African rainfall during the last deglaciation, *Science* **346**:1223–1227, 2014.
13. Braconnot, P., Joussaume, S., de Noblet, N. and Ramstein, G., Mid-Holocene and Last Glacial Maximum African monsoon changes as simulated within the Paleoclimate Modelling Intercomparison Project, *Global and Planetary Change* **26**:51–66, 2000.
14. Notaro, M., Wang, Y., Liu, Z., Gallimore, R. and Levis, S., Combined statistical and dynamical assessment of simulated vegetation-rainfall interactions in North Africa during the mid-Holocene, *Global Change Biology* **14**: 347–368, 2008.
15. Oard, M.J., *The Frozen Record: Examining the Ice Core History of the Greenland and Antarctic Ice Sheets*, Institute for Creation Research, Dallas, TX, 2005.
16. Oard, ref. 1, pp. 1–217.

A new mechanism to form free-standing arches questionable

Michael J. Oard

Free-standing arches are the most amazing features. Sometimes an arch is long and high with just a thin strip of rock connected at the top, such as Landscape Arch in Arches National Park, Utah, USA (figure 1). It is the second-longest arch in the world and spans 88 m (290 ft). Arches and natural bridges are similar, but a natural bridge is one in which a flow of water, like a stream, is obviously associated with its origin.[1] There is no obvious stream associated with an arch. Instead arches are commonly found on ridges or the sides of a ridge.

Origin of arches enigmatic

The conventional explanation of how rock arches formed requires long periods of time of slow erosion by physical and chemical weathering. To form an arch, significant amounts of the rock must weather and erode without eroding the arch itself. Geologists estimate that it would have taken 70,000 years of water, frost, and wind opera ting in a dry climate to form the isolated Delicate Arch in Arches National Park.[2] It is important to note free-standing arches are not forming today but are being destroyed, as evidenced by the collapse of Wall Arch in Arches National Park.[3] This presents a challenge for a uniformitarian explanation of their origins:

> "Arch formation cannot be due solely to weathering and erosion, however, because these processes are not restricted to the sites of

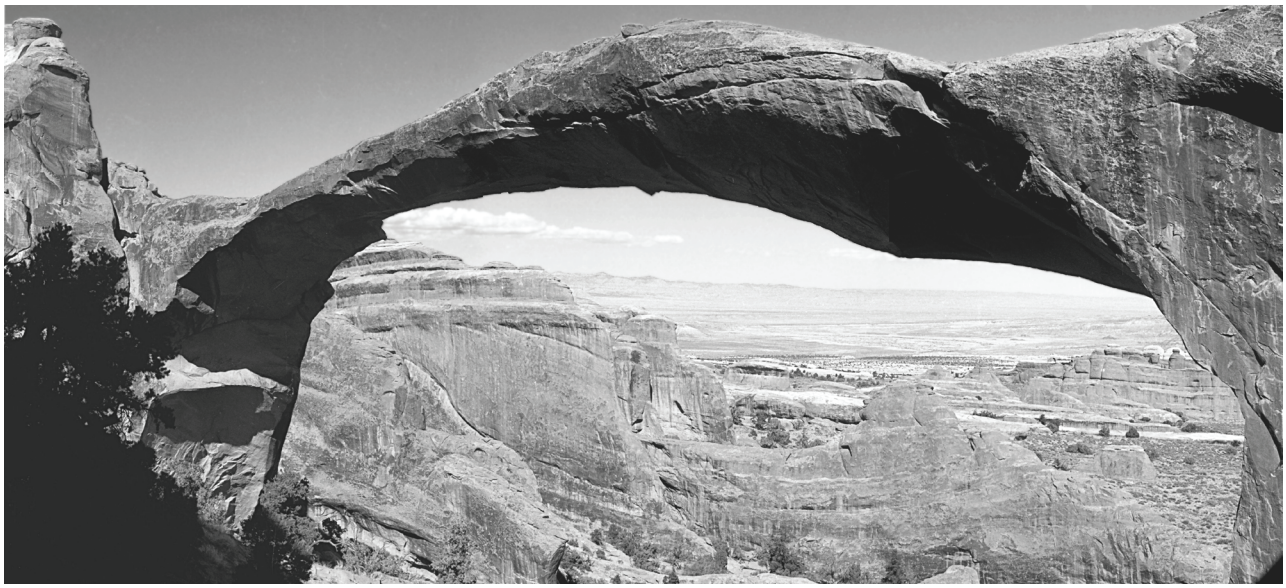


Figure 1. Landscape Arch, Arches National Park, Utah, USA

arches in rock fins.[4] There must be some factor that locally enhances the effects of erosion within a rather small part of a rock fin to produce an arch. How erosion is localized within a rock fin to form an arch is enigmatic."[5]

A new speculative hypothesis

A new hypothesis proposes that arches and other sandstone landforms are formed by differential stress that locks the sand grains during erosion.[6,7] The researchers submerged 10 cm cubes of sand with weights on top. As erosion occurred, differential vertical stress caused the locking of sand grains that resisted further erosion. In nature the eroding agent can be wind or water.

Unfortunately, the experiments really do not apply all that well to natural arches. The researchers used unique sand from a quarry in the Czech Republic that has angular sand grains. It is the angular sand grains that can especially be locked when the vertical stress increases due to differential erosion. Moreover, in order to form an arch, the researchers had to start with a cut at the base of the sandstone block. They assume natural sandstone has a planar discontinuity that would weather faster. So, it appears a little arch had to form first before differential stress would increase its size and preserve it.

These experiments, along with their numerical analyses, are artificial. Arches National Park is a good location to test this new hypothesis. It has over 2,000 arches that are mostly developed in the Entrada Sandstone.[8] The vast majority of the arches in Arches National Park are made of fairly homogenous sandstone that is considered to be lithified desert sand. The sand grains are generally rounded. It is unlikely that spherical sand grains would lock enough to cause differential erosion even under pressure.

A possible Flood mechanism

Large free-standing arches in sandstone are not forming today, but are being destroyed. It does not seem possible that they were formed by present processes. The only possibility appears to be quick formation during a rapid erosion event. The final draining of floodwater during the Recessional Stage of the Flood[9] would cause the rapid erosion. Reconstructing exactly how any one free-standing arch formed may be extremely difficult, or even impossible, but it is possible that turbulent eddies or cavitation first eroded the joints into fins followed by greater erosion at the base of a fin, which rapidly carved an arch

References

1. www.naturalarches.org/archinfo/faq.htm#bridge.
2. Harris, A.G., Tuttle, E. and Tuttle, S.D., *Geology of National Parks*, 5th edn, Kendall/Hunt Publishing, Dubuque, IA, p. 83, 1990.
3. Oard, M.J., Many arches and natural bridges likely from the Flood, *J. Creation* **23**(1):115–118, 2009.
4. A rock fin is a narrow, strip of rock with a vertical wall produced from the weathering and erosion of joints and expansion cracks in the rock.
5. Cruikshank, K.M. and Aydin, A., Role of fracture localization in arch formation, Arches National Park, UT, *GSA Bulletin* **106**:879–891, 1994; p. 879.
6. Bruthans, J., Soukup, J., Vaculikova, J. *et al.*, Sandstone landforms shaped by negative feedback between stress and erosion, *Nature Geoscience* **7**:597–601, 2014.
7. Paola, C., Emergent sculpture, *Nature Geoscience* **7**:552–553, 2014.
8. Arches National Park, www.desertusa.com/arches/du_arc_desc.html, accessed 4 July 2016.
9. Walker, T., A biblical geological model; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, PA, pp. 581–592, 1994.

SUSY is not the solution to the dark matter crisis

John G. Hartnett

On 19 August 2016, the 'SUSY Bet' event took place in Copenhagen at the conference on Current Themes in High Energy Physics and Cosmology at the Niels Bohr International Academy. An adjudication of the wager on supersymmetry (SUSY) first made in 2000 was given. The detail of the wager is explained in figure 1.

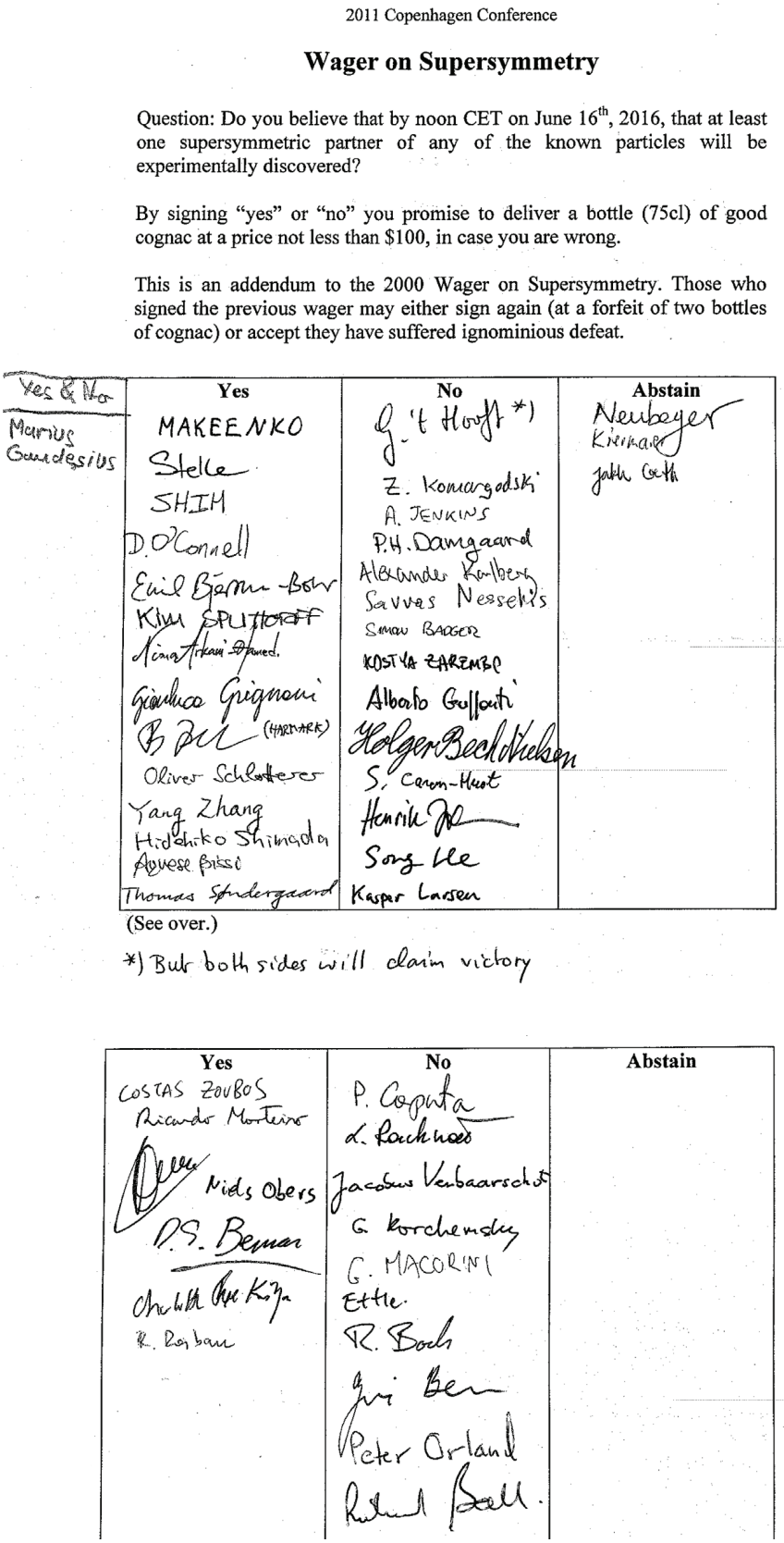
Supersymmetry

What is supersymmetry? In particle physics, supersymmetry is a proposed type of spacetime symmetry that relates two basic classes of elementary particles: bosons, which have an integer-valued spin, and fermions, which have a half-integer spin. Each particle from one group is associated with a particle from the other, known as its superpartner. It has been these supersymmetric partner particles that have been sought in high energy particle experiments.[1]

The bet involved two aspects of supersymmetry theory:

1. That after 10 years (from 2000) the Large Hadron Collider (LHC) would have collected enough experimental data to confirm or deny the existence of the supersymmetric particles that the theoretical physicists were thinking about at that time.
2. That supersymmetric particles with sufficiently low masses would be discovered like "sitting ducks" (as Gerard 't Hooft put it).

At the event the 'Yes' side of the bet, who believed the particles would be detected, conceded the loss of the



2011 Copenhagen Conference

Wager on Supersymmetry

Question: Do you believe that by noon CET on June 16th, 2016, that at least one supersymmetric partner of any of the known particles will be experimentally discovered?

By signing "yes" or "no" you promise to deliver a bottle (75cl) of good cognac at a price not less than $100, in case you are wrong.

This is an addendum to the 2000 Wager on Supersymmetry. Those who signed the previous wager may either sign again (at a forfeit of two bottles of cognac) or accept they have suffered ignominious defeat.

Yes & No	Yes	No	Abstain
Marius Gaudesius	MAKEENKO	G. 't Hooft *)	Neubeyer
	Stelle	Z. Komargodski	Kiriman
	SHIM	A. JENKINS	John Ellis
	D. O'Connell	P.H. Damgaard	
	Emil Bjarne Bohr	Alexander Kamberg	
	Kim SPILLHOFF	Savvas Nesseris	
	Nima Arkani-Hamed	Simon BADGER	
	Gianluca Grignani	KOSTYA ZAREMBO	
	(HARVARD)	Alberto Guffanti	
	Oliver Schlotterer	Holger Bech Nielsen	
	Yang Zhang	S. Caron-Huot	
	Hidehiko Shimada	Henrik	
	Alvise Bissi	Sang Lee	
	Thomas Søndergaard	Kasper Larsen	

(See over.)

*) But both sides will claim victory

Yes	No	Abstain
COSTAS ZOUBOS	P. Copeta	
Ricardo Monteiro	L. Rachmeed	
Mads Obers	Jacobus Verbaarschot	
P.S. Bernar	G. Korchemsky	
	G. MACORINI	
R. Roiban	Ettle.	
	R. Boels	
	Yuri Ben	
	Peter Orland	
	Richard Ball.	

Figure 1. Details of the famous SUSY Bet, adjudicated on 16 August 2016

bet to the 'No' side. The bet was meant to be decided on 16 June 2016, if no SUSY particle was detected after effectively 10 years of operation of the LHC. The adjudication of the bet was extended by the 'No' side by an additional six years due to delays in getting the LHC online, which included a two-year delay due to an explosion.

On the larger question of the significance of the negative LHC results, a recorded video statement by Nobel Laureate Gerard 't Hooft (who had bet against SUSY) can be viewed online,[2] and a statement by Stephen Hawking (not in on the bet, but in the audience) claimed that if arguments for SUSY were correct, the LHC should have seen something, so they think nature has spoken and there's something wrong with the idea.

The losers of the bet who spoke at the event—Nima Arkani-Hamed, David Gross and David Shih—demonstrated the lesson about science that supersymmetry and superstring theory have taught us: particle theorists backing these ideas won't give up on them, no matter what. They all took the position that they still weren't giving up on SUSY, despite losing the bet.

Gerard't Hooft commented that all evidence so far has been circumstantial at best. No direct evidence has ever been found in support of supersymmetry and hence string theory, because SUSY would be an essential element in string theory.[3] String theory does not have any experimental support and SUSY has not fulfilled its promise, therefore it does not help us trust in such a theory. Therefore he found the 'No' side won the bet.

Dark matter

We all know that the Higgs boson—the so-called God particle—was discovered after the LHC became fully operational, but SUSY has not been established. And the Higgs discovery has meant some very important restrictions on the type of fields the universe might have undergone in the alleged cosmic inflation epoch.[4] However there is one more ramification.

It was hoped that the lowest mass SUSY particle would turn out to be a dark matter candidate. Now that observations have ruled out MACHOs[5] as possible candidates for dark matter, WIMPs (or Weakly Interacting Massive Particles) are the only remaining contender. They comprise an entirely new class of fundamental particles that has emerged from supersymmetry theory.[6]

Supersymmetry is a theoretical idea where known elementary particles have supersymmetric partner particles.[1] This is not part of the highly successful, and experimental tested, standard model of particle physics, but is an untested theoretical extension beyond the standard model. In the so-called Minimal Supersymmetric Standard Model (MSSM), which was hypothesized to explain the hierarchy problem (which is, why elementary particles have the various masses they do), *the lightest stable supersymmetric particle is the neutralino. And the neutralino is the WIMP, the best hope for a dark matter particle*.[6]

Conclusion

With the non-detection of any SUSY particles and the essential demise of string theory (that is how good experimental physics should work) it also does not bode well for dark matter. The dark matter crisis has just gotten into a bigger crisis. The best candidate has been experimentally shown now to be extremely improbable. Where does that leave dark matter and the standard model of particle physics? Where does that leave the standard big bang model and big bang nucleosynthesis? In big, big trouble. It is a failed paradigm and should be discarded.

References

1. According to the theory, each particle from one group is associated with a particle from the other, known as its superpartner, the spin of which differs by a half-integer. In a theory with perfectly 'unbroken' supersymmetry, each pair of superpartners would share the same mass and internal quantum numbers besides spin. For example, there would be a 'selectron' (superpartner electron), a bosonic version of the electron with the same mass as the electron, that would be easy to find in a laboratory. Thus, since no superpartners have been observed, if supersymmetry exists it must be a spontaneously broken symmetry so that superpartners may differ in mass. Spontaneously broken supersymmetry could solve many mysterious problems in particle physics including the hierarchy problem. The simplest realization of spontaneously broken supersymmetry, the so-called Minimal Supersymmetric Standard Model, is one of the best studied candidates for physics beyond the Standard Model.
2. SUSY Bet 2016, youtube/As9raVaTFGA.
3. Superstring theory is an attempt to explain all of the particles and fundamental forces of nature in one theory by modelling them as vibrations of tiny supersymmetric strings. 'Superstring theory' is a shorthand for supersymmetric string theory because unlike bosonic string theory, it is the version of string theory that accounts for fermions and incorporates supersymmetry. Since the second superstring revolution, the five superstring theories are regarded as different limits of a single theory tentatively called M-theory, or simply string theory.
4. Hartnett, J.G., Inflation—all in the 'Dark', The Higgs boson messes with cosmic inflation, creation.com/ inflation-all-in-the-dark, July 2014.
5. MACHO = Massive Compact Halo Objects, which some believe are brown dwarf stars. But if they are, too few were found in searches for them to have any bearing on the dark matter crisis.
6. Cold Dark Matter and Experimental Searches for WIMPs, www.astro.umd.edu/~ssm/darkmatter/WIMPexperiments.html, accessed on 2 September 2016.

Sulfur-cycling bacteria 1.8 billion years old the same as today

Michael J. Oard

Natural selection has been redefined from 'survival of the fittest' to differential reproduction. Accordingly, the organism with the most offspring is more fit and should evolve faster than those with few. If this were true, rapidly multiplying bacteria should have evolved far faster than the branch that led from amphibians to humans, which by comparison have few offspring.

Bacteria that do not change with time

In spite of evolutionary expectations some bacteria have not changed for billions of years. A formation in Western Australia claimed to be 1.8 Ga old contains fossilized sulfur-cycling bacteria.[1] These bacteria metabolically are fueled by seawater sulfate, meaning they can live in an anoxic zone. They are very similar to those found in another formation that is dated 2.3 Ga old. Contrary to evolutionary theory the sulfur-cycling bacteria are essentially *identical* with modern types:

> "An ancient deep-sea mud-inhabiting 1,800-million-year-old sulfur-cycling microbial community from Western Australia is essentially identical both to a fossil community 500 million years older and to modern microbial biotas discovered off the coast of South America in 2007."[2]

Claims of similarity are based on morphology, community structure, habitat features, and physiology inferred from the characteristics of the mineral deposits. This presents a conundrum for evolution. Why have the bacteria "remained fundamentally unchanged over billions of years?"[3] Little or no change has also been noted with Precambrian cyanobacteria supposedly over billions of years.[4]

The researchers suggest that the stasis is because the environment had remained unchanged:

> "Once subseafloor sulfur-cycling microbial communities had become established, however, there appears to have been little or no stimulus for them to adapt to changing conditions."[5]

How likely is it that the environment remained the same for a few billion years? More to the point, how would the researchers know the environment did not change?

A confirmation of Darwin's null hypothesis?

This stasis is supposedly a 'confirmation' of Darwin's null hypothesis that environments must change for evolution to take place. The authors admit that, "Although logically required, this aspect of evolutionary theory has yet to be established."[6] The authors then go on to admit the tenuous nature of their arguments by pointing out that evidence based on morphology does not say anything about relatedness at the genomic level.

Stasis is evidence for creation

Stasis of course is no surprise to creation scientists, even in a 'changing environment'. Creation scientists would expect kinds to remain unchanged although variety within each kind would exist. In a recent book, Michael Denton states that the supposed evolution of at least 100,000 unique biological features had to occur rapidly. This is based on the fossil record in which the features suddenly appear with no ancestors. Then the fossil record shows amazing stasis once the feature has 'evolved'.[7] This is an interpretation with no evidence. Evolution is hypothetical while the real evidence shows supports creation with burial in the Flood and not evolution.

References

1. Schopf, J.W., Kudryavtsev, A.B., Walter, M.R., Van Kranendonk, M.J., Williford, K.H., Kozdon, R., Valley, J.W., Gallardo, V.A., Espinoza, C. and Flannery, D.T., Sulfur-cycling fossil bacteria from the 1.8-Ga Duck Creek Formation provides promising evidence of evolution's null hypothesis, *Proceedings of the National Academy of Science* **112**(7):2087–2092, 2015.
2. Schopf *et al*., ref. 1, p. 2087.
3. Schopf *et al*., ref. 1, p. 2090.
4. Schopf, J.W., Disparate rates, different fates: tempo and mode of evolution changed from the Precambrian to the Phanerozoic, *Proceedings of the National Academy of Science* **91**(15): 6735–6742, 1994.
5. Schopf *et al*., ref. 1, pp. 2090–2091.
6. Schopf *et al*., ref. 1, p. 2091.
7. Denton, M., *Evolution: Still a Theory in Crisis*, Discovery Institute Press, Seattle, WA, 2016.

Did the Mediterranean Sea desiccate numerous times?

Michael J. Oard

The Mediterranean Sea is underlain by a thick 'evaporite' which is overlain by hundreds of metres of sediment. The evaporite averages about 1 km thick and covers an area of 2.5 million km^2. It is locally exposed by uplifts in Italy and other areas around the Mediterranean Sea. 'Evaporite' is the name given to a water-soluble mineral sediment that is assumed to form from the concentration and crystallization of a body of water, such as sea water, when it evaporates. Because of the thickness and lateral extent of the evaporite, Hsü and colleagues conclude that the Mediterranean Sea must have evaporated numerous times in the past.[1,2] It was calculated that one drying of the Mediterranean Sea would produce only 60 m of evaporites, so to collect 1 km, the sea had to have dried out completely and be refilled 17 times. This period of drying-out is called the 'Messinian salinity crisis' and is 'dated' between 5.97 and 5.33 Ma ago—a period of only 650,000 years within the uniformitarian timescale. The desiccation of the Mediterranean Sea is generally accepted by uniformitarian scientists today, although this article will show that the idea is essentially an 'outrageous hypothesis'.

Desiccating Mediterranean Sea challenged

Although criticism has largely been ignored, it seems more scientists are becoming skeptical of the repetitive desiccation of the Mediterranean Sea.[3–5] There are various alternative scenarios proposed for the Messinian salinity crisis, including no drawdown of sea level, partial evaporation, and complete evaporation forming a basin 2,000–2,900 m below sea level. However, the evidence from the deposits is equivocal.[5,6] After re-examining all the deep-sea cores that have penetrated the top of the evaporate,[7] Lugli and colleagues claim that the Mediterranean Sea was never desiccated.[8] They add that the vertical sequence of the evaporites is not what is expected from desiccation, as some of the bacteria fossils in the deposits are considered to be marine and not just from brackish water. Lugli and colleagues agree with other researchers that the 'desiccation cracks' are tectonic, and further state that the supposed stromatolites in the carbonates below the evaporites are really the result of subaqueous gravity flows.[9] The interpretation that some of the interbeds are eolian deposits is disputed. Lugli and colleagues conclude:

> "The major portion of the evaporites collected by ODP and DSDP cruises are clastic or cumulate deposits that cannot provide clear bathymetric indications but do help us to exclude shallow-water and supratidal depositional environments and a total basinal desiccation."[10]

The evidence for the Messinian salinity crisis was not only the physical properties of evaporites that suggested desiccation, but also the canyons cut along the continental margin of the Mediterranean Sea. These canyons sometimes extend inland and are filled. They were believed by some to have been carved by river erosion through the continental shelf and slope during drawdown as the Mediterranean Sea dried out. The inland canyons are then believed to have been filled by a sea level rise during the Pliocene. Others now reinterpret these canyons as submarine canyons that did not need a river to erode them.[11] The infilled canyons, for instance in the Nile River Valley, more than 1,000 km inland, are not necessarily marine or dated Pliocene:

> "However, a careful reading of Chumakov's original paper (1967) reveals that the supposed marine origin and the Pliocene age of these infilling deposits were based only on the presence of a poor ostracod assemblage, actually consisting of non-marine taxa with wide age ranges."[12]

A new hypothesis

Some researchers, who believe the Mediterranean Sea was deep during the Messinian salinity crisis, have proposed a new hypothesis.[11] They suggest that the cascading of hypersaline continental shelf water down the continental slope resulted in an increase in deep-water salinity that precipitated out the salt and gypsum. There are modern analogs around the Mediterranean Sea and Persian Gulf. The hypothesis also is supposed to account for the mysterious erosion surfaces seen along the continental slope in seismic reflection profiles that have been used as evidence of subaerial erosion. The downslope cascading by sheet flow supposedly carved these widespread erosion surfaces.

However, these modern analogs are extensively smaller than what is needed to cause the huge evaporate deposit and the widespread erosion surfaces. Moreover, a numerical model showed that the hypersaline water would tend to converge and cascade down the submarine canyons, assuming they existed at the time, rather than down the slope as sheet flow.[11] These flows continued to erode the submarine canyons. One would expect more terrigenous deposits than salt or gypsum, which does not appear to be the case.

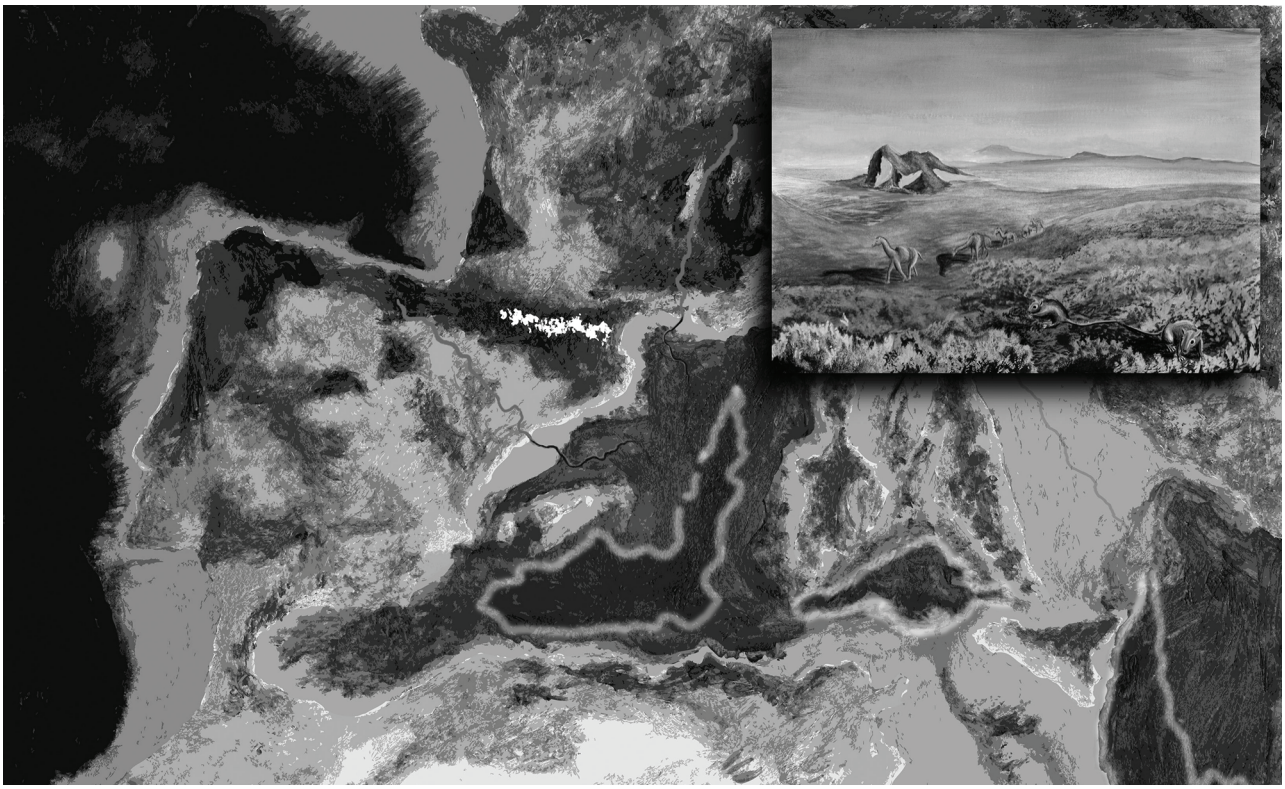


Figure 1. Artist's depiction of the nearly dry Mediterranean Sea after disconnecting from the Atlantic Ocean Rivers shows the deep canyons carved, and (now) extinct animals roaming the area.

Creation science implications

The controversy over the Messinian salinity crisis shows that the previous interpretations that the Mediterranean Sea desiccated numerous times was based on simplistic interpretations of presentday evaporites. It is interesting how researchers can appear to have much evidence in support of a claim which turns out equivocal on close inspection. As creation researchers, it is important to be skeptical of uniformitarian interpretations when it pertains to geological and paleontological features. This should especially be the case for the numerous paleoenvironmental deductions in secular geological literature.[13] I have commonly found that when examining a feature that appears to be contrary to the biblical worldview, the feature often contains contradictions to uniformitarianism and is supportive of an alternative mechanism.

The creation science explanation of such a huge deposit is that the 'evaporites' are actually precipitates. It's a model that needs further work. The area and volume of these deposits imply a catastrophic mechanism typical of a global Flood. The thick layer of precipitates would place the Flood/post-Flood boundary in this area in the very late Cenozoic. Noah's Flood is the only mechanism that could produce such a huge, thick deposit in a short time, not to speak of many of the other 'evaporites' worldwide.

References

1. Hsü, K.J., Ryan, W.B.F. and Cita, M.B., Late Miocene desiccation of the Mediterranean, *Nature* **242**:240–244, 1973.
2. Hsü, K.J., Montadert, L., Bernoulli, D. *et al.*, History of the Mediterranean salinity crisis, *Nature* **267**:399–403, 1977.
3. Roveri, M. *et al.*, The Messinian Salinity crisis: past and future of a great challenge for marine sciences, *Marine Geology* **352**:25–58, 2014.
4. Christeleit, E.C., Brandon, M.T. and Zhuang, G., Evidence for deep-water deposition of abyssal Mediterranean evaporites during the Messinian salinity crisis, *Earth and Planetary Science Letters* **427**:226–235, 2015.
5. Hardie, L.A. and Lowenstein, T.K., Did the Mediterranean Sea dry out during the Miocene? A reassessment of the evaporite evidence from DSDP legs 13 and 42A cores, *J. Sedimentary Research* **74**(4):453, 2004.
6. Oard, M.J., The Messinian salinity crisis questioned, *J. Creation* **19**(1):11–13, 2005.
7. None of the cores have penetrated more than the top of the evaporite.
8. Lugli, S., Manzi, v., Roveri, M. and Schreiber, B.C., The deep record of the Messinian salinity crisis: evidence of a non-desiccating Mediterranean Sea, *Palaeogeography, Palaeoclimatology, Palaeoecology* **433**:201–218, 2015.
9. Manzi, V., Lugli, S., Roveri, M. *et al.*, The Messinian salinity crisis in Cyprus, a further step towards a new stratigraphic framework for Eastern Mediterranean, *Basin Research* **28**:207–236, 2016.
10. Lugli *et al.*, ref. 8, p. 217.
11. Roveri, M., Manzi, V., Bergamasco, A. *et al.*, Dense shelf water cascading and Messinian canyons: a new scenario for the Mediterranean salinity crisis, *American J. Science* **314**:751–784, 2014.
12. Roveri *et al.*, ref. 11, p. 754.
13. Oard, M.J., Beware of paleoenvironmental deductions, *J. Creation* **13**(2):13, 1999.

Surprises in Surprise Canyon

J.N. Caldwell

John Woodmorappe's critical review of *The Grand Canyon: Monument to an Ancient Earth*[1] provided a good summary critique of the arguments the authors used to try to undermine Flood geology. Nonetheless, as Woodmorappe stated: "I … need to strongly stress the fact that it would require a full-length book to address all the fallacies of this pro-uniformitarian compromising evangelical missive."[2] A few remarks expanding on some of Woodmorappe's points are thus germane.

Surprise Canyon

My main comment addresses a sedimentary layer within the Canyon walls called the Surprise Canyon Formation (figure 1). Hill *et al.* place strong emphasis upon their interpretation of a subaerial fluvial environment for this formation, claiming it as evidence for a prolonged period of erosion, and asserting that creationists have largely ignored the age implications of this evidence.[3]

The published research on the Surprise Canyon Formation, however, reveals some surprising information. First, the formation is a relatively recent discovery, being undefined before 1984 because of its discontinuous and patchy nature and generally inaccessible outcrops.[4] It consists mainly of highly fossiliferous channel fill with conglomerates at its base. It incises through the top two members of the Redwall Limestone, and thickens from east to west. As a result of these characteristics, the Surprise Canyon Formation has been interpreted to have been formed by a dendritic river system flowing across the top of the underlying Redwall Limestone during a time of subaerial exposure—hence the interpretation of a subaerial fluvial environment.

However, since Hill *et al.* place great emphasis on uniformitarian methodology, using the present as the key to the past, their interpretation of the Surprise Canyon should be judged by that standard as well.

Surprise canyon and sedimentary fill

One of the most interesting aspects of the Surprise Canyon Formation is the depth of the channel fills, which range from an average of 50–98 m (164–323 ft) in the west, to 45 m (144 ft) in the central area, to no more than 25 m (82 ft) in the eastern exposures, with the deepest channel fill being 122 m (400 ft). The total length of the formation is estimated at 112 km (70 mi).[5] From a uniformitarian perspective, therefore, it would be instructive to compare the dimensions of Surprise Canyon with those of the ten deepest rivers in the world today (table 1).

According to Hill *et al.*, therefore, the Surprise Canyon river system, which was only 112 km (70 mi) long, was deeper than all of the world's currently existing river systems, except for three rivers which are 25–56 times longer than the Surprise Canyon system's estimated total length! (table 1).

Table 1. Ten deepest rivers in the world, along with their lengths, with the Surprise Canyon at the bottom[6]

River	Length (km)	Maximum Depth (m)
Mississippi	3,730	61
St. Lawrence	1,200	65
Hudson	507	66
Yellow	5,460	80
Amazon	6,990	91
Mekong	4,350	100
Zambezi	2,570	116
Danube	2,860	178
Yangtze	6,300	200
Congo	4,700	250
Surprise	*112*	*122*

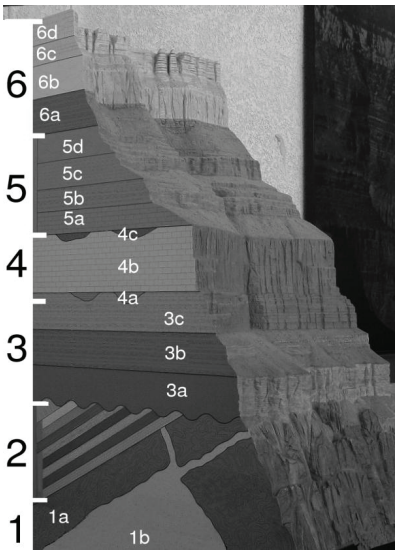


Figure 1. Geologic column of the Grand Canyon. Surprise Canyon Formation (4c) is shown incising into Redwall Limestone (4b).

Surprise canyon and karst

Moreover, the river that carved Surprise Canyon was supposed to have developed on a karst surface, for which Hill *et al.* use Yucatan as a modern-day analogy. The problem from a uniformitarian perspective, however, is that the Yucatan has no major rivers running through it because of its karst topography. This happens on the Kaibab Plateau, as well, where water drains *through* the surface and exits as waterfalls from the cliffs. So the question must be asked, how was a river system as short and deep as that proposed for the Surprise Canyon Formation supposed to have developed on a karst surface?

Additionally, the photos I've seen of Surprise Canyon outcrops appear to show draped fill layers within the channels, not the stacks of multiple channel fills which are common in modern rivers.[7,8] Drape fill is more

consistent with *one* episode of scouring.

In conclusion, the Surprise Canyon Formation's short length, anomalous depths, and conglomeratic base fill are not consistent with modern drainage networks developed on karst surfaces. They are, however, consistent with mass flow scouring, which may have been subaerial or subaqueous, but in either case, does not demand a long period of time.

Grand Canyon and geomorphology

My second comment upon the book is that the authors point out the flaws with the many scenarios given by both creationists and secular geologists for the carving of the canyon, but do not address the solutions proposed by Michael Oard in his book, *A Grand Origin for the Grand Canyon*.[9] Oard offers the most detailed analysis available from a creationist standpoint of the geomorphological features of the Grand Canyon, and I highly recommend it to all interested readers.

A call for caution

Lastly, although the book is about geology, Noah's Flood, and biblical creation, the authors apparently cannot imagine that creation scientists who study the Grand Canyon could be anything besides deluded or acting on blind faith. The authors imply that their perspective on science is the only correct one. However, they do not realize, or are unwilling to concede, that science is a tool, not a philosophy, and much of the scientific evidence cited in their book can be interpreted in different ways, depending upon the assumptions of the scientist.

The book itself ends with the words, "Truth always matters". Creationists could not agree more, but unfortunately, when it comes to the origin and age of the Grand Canyon, the full truth will not be known until we meet the One who created the world and all that is in it. Until then, He has revealed enough truth in His word for us to know the age of the earth, the reality of the global Flood, and the resurrection of Christ. So a measure of caution would be well-advised for Christian scientists who claim that science invalidates a literal interpretation of the book of Genesis, while presumably accepting a literal interpretation of the New Testament's decidedly unscientific assertions that a man was born of a virgin and rose from the dead.

References

1. Woodmorappe, J., review of *The Grand Canyon: Monument to an Ancient Earth* by Hill *et al.*, *J. Creation* **30**(3):17–21, 2016.
2. Woodmorappe, ref. 1, p. 17.
3. Hill, C., Davidson, G., Ranney, W. and Helble, T., *The Grand Canyon, Monument to an Ancient Earth: Can Noah's Flood Explain the Grand Canyon?* Kregel Publications, Grand Rapids, MI, p. 200, 2016.
4. Beus, S.S., A geologic surprise in the Grand Canyon, *Fieldnotes, Arizona Geological Survey* **16**(3):1–4, 1986.
5. Billingsley, G.H. and Beus, S.S., The Surprise Canyon Formation, an Upper Mississippian and Lower Pennsylvanian (?) rock unit in the Grand Canyon, Arizona, *US Geological Survey Bulletin A* **1605**:A27–A33, 1985.
6. Merrow, B., 2009 Day 8 Sept 20 166.5-213 from National Canyon to Pumpkin Spring bmerrow.blogspot.com, 1 January 2009.
7. McCann, M., Mike the Geologist: Science and the Bible (Lesson 5), www.internetmonk.com, 19 May 2016.
8. Oard, M.J., *A Grand Origin for the Grand Canyon*, CRS books, Chino Valley, AZ, 2016.
9. Oard, M.J., *A Grand Origin for the Grand Canyon*, CRS books, Chino Valley, AZ, 2016.

Errata

J. Creation **30**(3)

- Timothy Clarey's reply under the letter by Ralph Bazley (p. 47), and his reply under the letter by Carl Froede Jr and Jerry Akridge (p. 52) should be exchanged.
- The Hebrew words on pp. 105 and 106 should read as follows: נָטָה (natah), רָקַע (raqa), מָתַח (mathach), and עוֹלָם (`owlam).

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Evangelical scholars still misinformed about creation

The Enduring Authority of the Christian Scriptures
D.A. Carson (Ed.)
Eerdmans, Grand Rapids, MI, 2016

Lita Cosner

The Enduring Authority of the Christian Scriptures is a significant contribution to evangelical scholarship. Edited by one of the foremost living Bible scholars with essays contributed from well-respected scholars from across historical, biblical, and theological specialties, this over-1,000-page book is weighty both in terms of its bulk and the level of its argumentation. There are many positive things that one can say about this book, which makes it all the more disappointing how it treats biblical creation.

Genesis: the lowest common denominator?

D.A. Carson makes the first comments in the book about creation vs evolution. He begins by contrasting Richard Dawkins and the new atheists with theist John Polkinghorne and pantheist Arthur Peacocke, the latter being "scientists who reject the philosophical naturalism of the new atheists, and find ways to think about the integration of scientific learning and fundamental Christian claims, including supernatural claims" (p. 34).

He continues on to note the need for "cautious skepticism" regarding scientific claims: "Not that many decades ago, phrenology and eugenics were both almost universally espoused and commonly practiced. They were, after all, 'scientific'. Today they are equally universally dismissed" (p. 35).

However,

> "… this stance does not sanction arrogant dismissal; it mandates respect, careful listening, evaluation, and sometimes patient uncertainty, as we refuse to be intimidated by the overconfident claims of some scientists or by the popularity of some nearly universally adopted theories" (p. 35).

So far so good. But he criticizes Christians who "appear to be utterly certain about how to read every line of Genesis 1–11", and counsels:

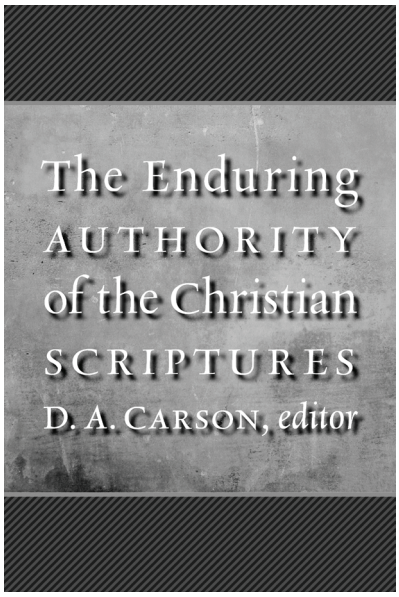
> "Frankly, in the light of the complexity of the hermeneutical issues raised by these opening chapters of Scripture, the question posed by Francis A. Schaeffer forty years ago is still the most pertinent one: What is the least that Genesis 1–11 must be saying in order for the book of Genesis, and the rest of the Bible, to be coherent and true?" (pp. 35–36).

However, it is difficult to imagine Carson arguing for this sort of least-common-denominator theology in regard to the Trinity or the Resurrection, but in fact the doctrine of creation is every bit as foundational for the Christian faith.[1]

That Augustine quote!

Another author, Glenn S. Sunshine, in his essay, "Accommodation Historically Considered", quotes Augustine's famous statement in *On the Literal Meaning of Genesis* to the effect that

> "… it is a disgraceful and dangerous thing for an infidel to hear a Christian, presumably giving the meaning of Holy Scripture, talking non-sense on these topics; and we should take all means to prevent such an embarrassing situation, in which people show up vast ignorance in a Christian and laugh it to scorn" (p. 245).



Sunshine says: "Augustine's comments in *On the Literal Meaning of Genesis* are among the first to address the typical modern question of the relationship between the Bible and science" (p. 246). However, this quote is *misused* when people use it to argue against young-earth creation, because evolution does not meet Augustine's definition of 'fact' in that quote, and he was himself a young-earth creationist.[2]

Science and Scripture

Kirsten Birkett in her essay "Science and Scripture" helpfully, accurately, and surprisingly explains the case of Galileo's persecution as an instance of the church of the day being overly *pro-science*, i.e. pro-Aristotelian science. While there were very good reasons at the time for being cautious of accepting Galileo's theory (Newtonian physics, which is critical for making sense of heliocentrism, was still in the future, for one). There is very little to dispute in this retelling,

and one hopes its appearance in such a substantial collection of scholarship will help to debunk the false religion-vs-science narrative.

Sadly, there is much less to celebrate in her discussion of chronology, the age of the earth, and the days of Genesis (p. 956ff). She notes that certain Jewish and Christian interpreters had non-literal understandings of the days in Genesis, but fails to examine the text of Genesis 1 to see if the grammar itself allows for such a non-literal view. She also does not mention that a literal view of the creation days was the majority view throughout church history.

Birkett helpfully recounts the history beginning from the Renaissance of the attempts to create a chronology of the world, and the calendrical problems of the period that complicated things. However, disappointingly the conclusion was that "the Bible could not stand alone" (p. 960).

She also cites Isaac La Peyrère as an example of questioning whether Adam was the real historical first person (p. 960). His goal in interpreting Adam figuratively was to reconcile "Bible chronology with the longer ones of the ancient pagans, the American Indians, and the Chinese" (p. 961). This supports the idea that "church scholars were quite aware of claims to a long history of the earth and to various degrees were prepared to accept it" (p. 961). However, the example of La Peyrère shows that there *were* people who were *not* prepared to accept it; as she says:

> "… as the ideas spread, they attracted violent criticism. ... Calvinist Holland and Catholic France alike condemned it. La Peyrère was arrested by the Inquisition in Brussels. His master Conde secured his release at a price of his conversion to Catholicism. He had to publish a retraction and died a pauper" (p. 961).

Is creationism 'Scripture against science'?

Birkett discusses and dismisses young-earth creation without citing one prominent young-earth theologian or scientist (and while citing their critics exclusively). It is not a fair or a scholarly way to critique someone, so the kindest thing I can say about this part of her essay is that she needs to inform herself about the actual arguments creationists use—she seems unaware, for instance, that creationists have various ways of accounting for predatory structures (discussed on p. 968).

The bias in her examination of young-earth creation is even more apparent when compared to her analysis and criticism of John Polkinghorne, which cites many of his own writings. If Birkett had similarly cited biblical creationist scholars, one might have still *disagreed* with her analysis, but there would be less grounds for criticizing the bias of it.

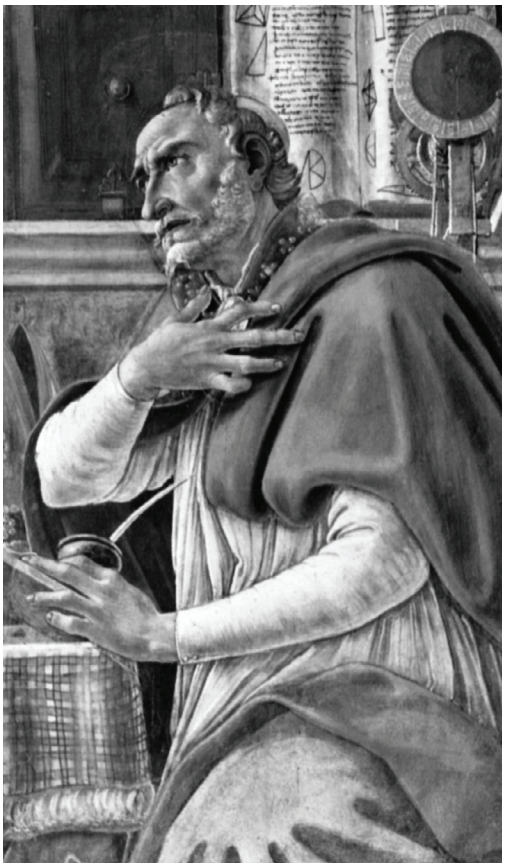


Figure 1. Augustine is misquoted to criticize young-earth creation.

Positive points

It is a shame that the book is so weak overall when it comes to the doctrine of creation, because in other respects it is quite good and contains a lot of worthwhile information. For instance, the historical chapters contain a lot of evidence that inerrancy is not a modern invention, but can be found as far back as the Patristic period, through the Reformation, and in every strain of Protestant thought.

Among the biblical/theological topics, Craig Blomberg's "Reflections on Jesus' view of the Old Testament" was notable. He asserts:

> "When it comes to the inspiration, truthfulness, authority, and relevance of the Bible of his world, Jesus could scarcely have held to higher views. ... He acknowledged Scripture's divine origin as God's word and words. He quoted from the Bible extensively and intensively. He affirmed the inviolability of its contents down to the smallest details. To whatever degree the contents of the Hebrew canon had solidified by his day, Jesus affirmed their unity but also their tripartite division. He interpreted the historical narratives in ways that suggest he believed that at least most (and probably all) of the events narrated really happened" (p. 696).

This necessarily has implications for the Christian's view of Scripture:

> "If we are followers of Jesus, we will want to adopt his view

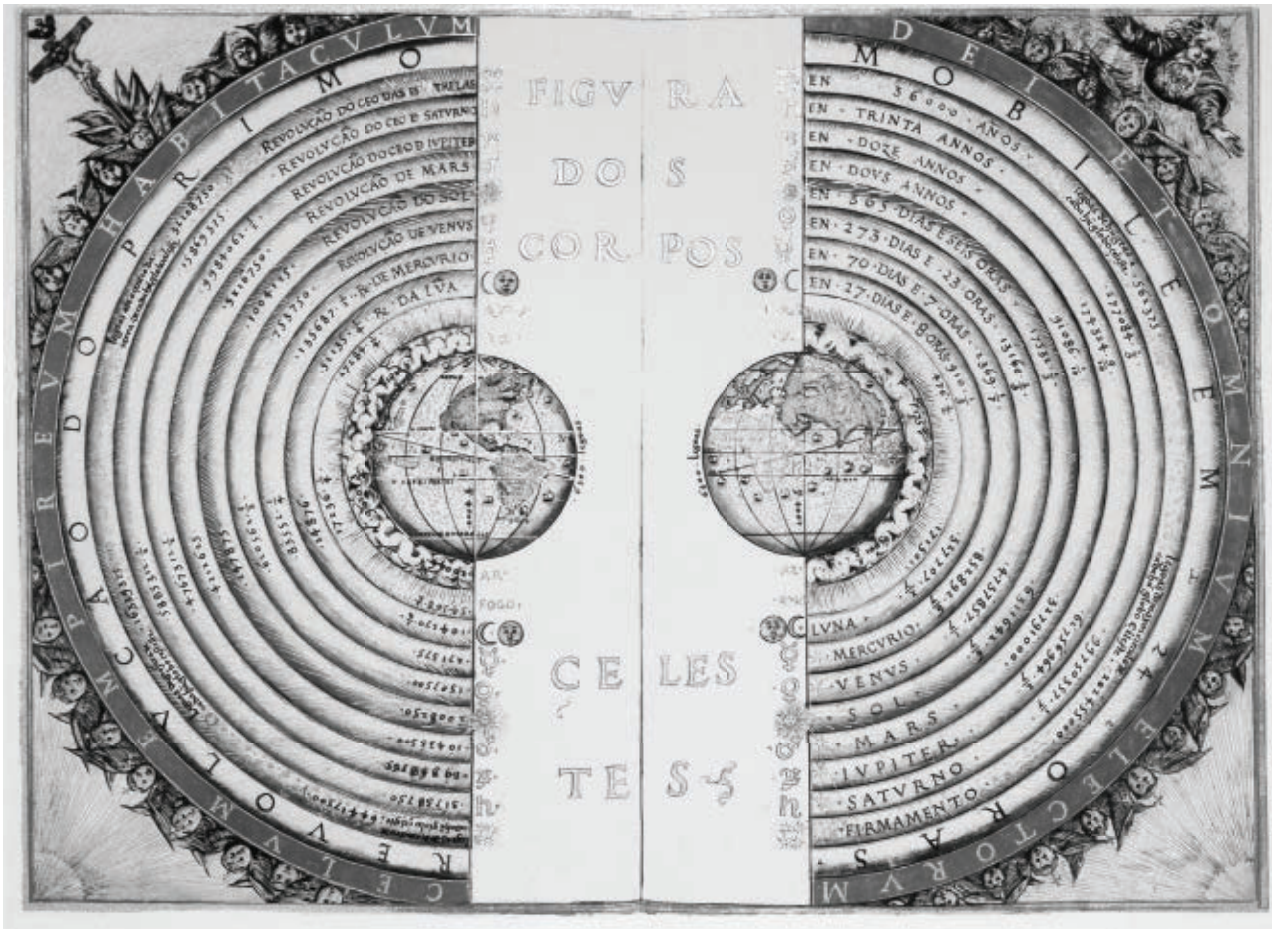


Figure 2. Galileo's conflict with the Aristotelian academy of his day was an instance of the church being too wedded to a scientific theory.

of the Scriptures. He believed in their fully divine origin, reliability, and authority. Therefore, our view of the Old Testament should accept their complete God-given trustworthiness and claims on our lives as well. And just as nothing in the humanity of a person requires that a given writing of theirs contain errors, nothing in the humanity of Scripture logically compels us to find mistakes in it" (p. 699).

This, at least, is something with which biblical creationists can wholeheartedly agree!

There are also sections on philosophy and comparative religions, with which some readers will doubtless disagree (one may question the wisdom, for instance, of seeing the Buddhist *sutras* as a possible gateway to evangelism), but which are nonetheless informative and interesting.

Conclusion

A review of a work like *The Enduring Authority of the Christian Scriptures* will necessarily fail to address the whole book, so one is forced to cover the topics most interesting to the readers of a given review. Unfortunately, this may give an unbalanced view of the book in that on the topic of creation, it is very disappointing for young-earth creationists to find that we have once again been misrepresented. But in other ways the book is very useful and contains arguments that are of use to young-earth creationists. Because of this potential usefulness, we shouldn't completely reject books like *The Enduring Authority of the Christian Scriptures,* even if we wish the authors were a bit more well-informed about creation. The very academic and densely argued nature, however, makes it most suitable for specialists.

References

1. See a critique of the same sort of argumentation in a popular-level article at Cosner, L., Timescale and theology, creation.com/timescale-theology, 28 June 2016.
2. See Cosner, L. and Sarfati, J., Non-Christian philosopher clears up myths about Augustine and the term 'literal', *J. Creation* **27**(2):9–10, 2013; creation.com/augustine-myths-debunked.

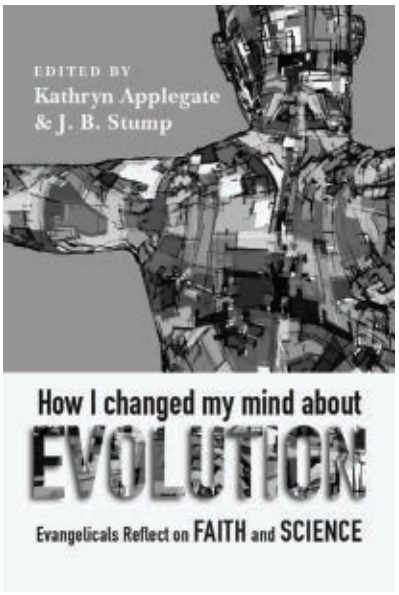
Evangelicals needlessly cave on evolution

How I Changed My Mind About Evolution: Evangelicals reflect on faith and science

Kathryn Applegate and J.B. Stump (Eds.)

InterVarsity Press, Downers Grove, IL, 2016

Keaton Halley



How I Changed My Mind About Evolution is a regrettable, 200-page survey of theological abdication. Editors Applegate and Stump[1] are both staff scientists at the Templeton-funded organization BioLogos, whose mission is to persuade people that microbes-to-man evolution is both true and compatible with Christianity (p. 16).[2] This book is intended as a means toward that end, but it does not attempt to reach its goal by setting out a purely rational case that resolves the conflicts. Instead, it presents personal stories—twenty-five short testimonies from people who claim to have reconciled evolution and faith to their own satisfaction.

While *How I Changed My Mind* will likely be persuasive to some, it ultimately fails to show that theistic evolution is an acceptable option for Bible believers. The book's attempts at reconciliation are inadequate, and there are several severe problems for theistic evolution which the book's contributors largely ignore.

Common themes

What persuades the contributors to merge their faith with evolution? A variety of influences are discussed, but certain themes come up repeatedly, so the most common ones are evaluated below.

"Bad arguments for young-earth creationism (YEC) turned me off"

Many contributors recount their exposure to arguments they rightly recognize as fallacious. These include such claims as: dinosaurs are fake / Satan buried dinosaur bones (pp. 30, 140), although no mainstream creationist organization has ever taught this; the Paluxy riverbed contains dinosaur and human footprints (p. 110); God created with apparent age (pp. 125, 169), ignoring the correct view of creation with functional maturity; entropy began at the Fall (p. 126); the Bible contains advanced scientific insights (pp. 106, 119, 146, 148, 171); mammoths were snap frozen (p. 36); there is too little dust on the moon (p. 175); the speed of light is slowing down (p. 175); and there are no transitional fossils (pp. 149, 175), downplaying the fact that there are still only a handful of debatable forms compared to the huge numbers Darwin expected. Also, one chapter mentions a pastor who claimed to embrace evolution but, hypocritically, "would never say that from the pulpit" (p. 37).

Respectable creationists have long distanced themselves from such things.[3] But the authors show little familiarity with the best creationist arguments, and instead repeatedly tear down the worst.

"All truth is God's truth"

The authors often use this phrase, or note that God wouldn't deceive us, and assert that we have nothing to fear from an honest exploration of the scientific evidence (pp. 65, 79, 115, 129, 156). Agreed, but all this begs the question as to whether evolution is true. Beginning with the assumption that evolution is fact and insisting, on that basis, that it *must* be compatible with Christianity is backwards. The same reasoning could be used to justify all manner of theological errors, like condoning homosexuality because one first 'knows' it is morally right, and 'all morality is God's morality'.

"The scientific community operates in an open, objective, self-correcting manner"

Many of the book's contributors display a naïve view of how the scientific community operates when it comes to the origins debate (pp. 23, 37, 53, 67, 83, 125, 171). They lump evolution together with technological breakthroughs, ignoring the important distinction between operational and historical science (pp. 67, 171). And they fail to critically analyze the many assumptions that underpin evolutionary conclusions, e.g. methodological naturalism. For some, the only alternatives are that evolution is a fact or that evolutionists are lying conspirators (p. 140).

Figure 1. No mainstream creationist ministry has ever taught that dinosaur bones are fake, yet several contributors cite bad arguments like this as among their reasons for embracing evolution.

In reality, this is a false dichotomy since scientists are real people who, although typically sincere, are not necessarily dispassionate and objective—they are susceptible to groupthink and confirmation bias. Many honest evolutionists recognize that philosophical assumptions, politics, and personal agendas play significant roles in the scientific enterprise.[4,5] In general, although various evolutionary models and mechanisms are debated, the overarching evolutionary paradigm itself is taken as a given and *not* open to question.[6] Also, in academia and other arenas, there is tremendous persecution of those who doubt evolution, as has been thoroughly documented.[7]

"We can't take all of the Bible literally"

There is a tendency to (mis) characterize the YEC hermeneutic as a strictly literalistic interpretation, and then to defeat this straw man by pointing out that nobody believes "the sun is literally rising" (pp. 67, 118, 177). This is an inexcusable distortion, and completely fails to interact with the thoughtful exegetical arguments that creationists have been making for decades. We abide by objective rules for determining the meaning of any given text, so there is no inconsistency or arbitrariness when we regard some passages as making literal, historical claims and others as employing figurative language.

"Genesis does not describe *how* God created"

A moment's reflection would falsify this assertion, but it is endlessly repeated by theistic evolutionists nonetheless (pp. 43, 50, 93, 171). One must wonder why so much detail is given in Genesis chapters 1 and 2 if God is totally unconcerned about communicating something of the manner in which He made things. On the contrary, the text gives readers time markers and an order of events; it mentions the raw materials from which God fashioned Adam and Eve; and more. So on what basis do theistic evolutionists reject these statements? Jesus and the New Testament authors affirmed these details about *how* God created, but the contributors fail to engage with the relevant NT texts.[8,9]

"God accommodated ancient Near Eastern (ANE) science"

This claim is a veiled denial of inerrancy, since it asserts that the Bible contains affirmations about the natural world which are false (pp. 43, 50, 102, 146, 148). Several contributors appeal to John Walton, in particular, who teaches that Genesis, along with other ANE documents, is not even describing the origins of material things (pp. 33, 93, 116, 118). With a nod to Richard Dawkins' famous quip about Darwin and atheism,[10] one writer goes so far as to say, "Walton's book helped me become a biblically fulfilled evolutionary creationist" (p. 118). But Walton's interpretation is preposterous on its face, and has been shown to thoroughly contradict Scripture.[11,12]

More faulty arguments

"YEC is a late theological innovation"

James K.A. Smith's essay repeats the old nonsense that Ronald Numbers' book, *The Creationists*, "demonstrates the utter novelty of young-earth creationism as a biblical hermeneutic" (p. 25). Smith completely ignores documentation proving that YEC has been the dominant view throughout church history, held by the NT authors, the Early-Church Fathers, medieval theologians, the Reformers, and the 19th-century Scriptural Geologists—all predating the birth of the modern creationist movement.[13–15]

"Conflict with evolution is primarily an American hang-up"

N.T. Wright's essay argues that Americans, as a result of their unique social and political history, attach more significance to the evolution debate, and conduct it with more polarization, than the rest of the world. Even if this is so, it does nothing to demonstrate that the American perspective is the wrong one, nor does it commend evolution as compatible with Christianity. It also ignores the fact that many leading creationists come from Australia and elsewhere. This issue is about truth, which transcends American concerns.

"God is slow"

The award for the most superficial theological argument in this book goes to Richard J. Mouw for his claim that "God is slow" and therefore we need not insist on six literal days (pp. 192–193). To be sure, God *may* work slowly, like when He delayed fulfillment of his promise to give Abraham a son until Abraham was very old. But other times He works quickly, like when Jesus turned water to wine instantaneously. So the question of how long God took to create cannot be decided by appealing to a half-truth masquerading as a profound insight. God revealed how long He took to create in Genesis, so that is what Christians ought to believe.

"If you were convinced YEC was wrong, would you give up Jesus too?"

Denis Lamoureux was impacted by this booby-trapped question, which apparently helped to convince him that YEC is not foundational or terribly important (p. 146). But such conclusions do not follow. Lamoureux's hypothetical question pits two truths against each other by *stipulating* that one is incorrect, even though, in the actual world, there's no need to choose between them.

To give a parallel, Christians believe rape is wrong because it violates God's character. But atheists sometimes ask, "If you became convinced that God did not exist, would you then feel free to commit rape?" The question is meant to disconnect moral evil from God's existence. It can be rhetorically effective, because nobody wants to say that rape might turn out to be okay. People have a strong intuitive conviction that rape is wrong even if they haven't deduced this from a belief in God. But does this mean the wrongness of rape can be disentangled from God's existence? No! Moral truths are grounded in the *nature* of God, even if we can recognize them without *belief* in God. In the same way, we may personally be convinced of the Gospel for reasons distinct from biblical creation, but this does not mean that the Gospel can be logically disentangled from biblical creation.

Lamoureux is baiting YECs with a "what if …" game that is rigged in his favour. But there's no need for us to bite, because he's presenting us with a fictitious world that forces an unnecessary choice. Regardless of which answer we give, the strength of the case for YEC remains exactly the same in the *actual* world.

Serious challenges largely ignored

One significant weakness of this book is that major biblical arguments against evolution are passed over in silence or with hasty dismissals. The contributors do not take seriously enough the numerous theological and exegetical difficulties for their position. There is very little wrestling with the text of Scripture or interacting with thoughtful creationist arguments.

Here are a few of the neglected issues.

God's involvement

In the Bible, God claims responsibility for nature. He is the Creator of living things, even of specific parts, like human eyes, ears, and mouths (Exodus 4:11; Proverbs 20:12). Thus, we can identify God's handiwork in "the things that have been made" (Romans 1:20). But many theistic evolutionists oppose the claim that living things were intelligently designed (ID), or that God's hand can be detected through science (pp. 53, 73). In fact, they often use dysteleological arguments in an effort to prove that God was *not* directing the origin of various biological systems.

One contributor does make a muddled attempt within one short paragraph to reconcile "divine sovereignty and 'purposeless chance'" (p. 67). But he conflates true randomness with apparent randomness, and fails to address the deeper incoherence in the typical theistic evolutionist's anti-ID position.[16] One can't say that, on a 'macro level', chance washes out and God retains control, unless one admits that teleology is present. Unfortunately, many theistic evolutionists are unwilling to accept that. They seem to want a God who directs an undirected process—but not even God can accomplish the logically impossible.[17]

God's rest

Genesis teaches that God *ceased* from His creative activity on the seventh day (Genesis 2:2), so the work of creation was finished from that time. Since then, God has been *sustaining* the universe, not actively creating (Colossians 1:17), although certain miracles might be thought of as exceptions to this general pattern. But theistic evolutionists commonly believe that God's creative *modus operandi*—the evolution of stars, planets, and living things by natural processes—is still operative now.[18] So, is creation finished or a work

in progress? This problem is never discussed.

Historical Adam and Eve

Several contributors allude to the fact that Adam and Eve have increasingly come under fire as theistic evolutionists have worked out the implications of their position over time (pp. 49, 51, 184, 189). They recognize that this raises significant theological questions, but they offer little in the way of resolution. About the only biblical justification given for the Adam-and-Eve rethink is the old canard about irreconcilable differences between Genesis 1 and 2 (p. 51).[19] They don't exegete the Scriptures to prove that the Bible is ambiguous on whether Adam and Eve were historical, supernaturally created, the first people, or the parents of all humanity. They hardly discuss how to deal with the many important doctrines linked to Adam and Eve, like marriage, gender roles, the image of God, and the Fall. Their only comments on these vital doctrines are simple admissions that they must be radically revised. For instance: "Evolutionary creation contends that humans evolved from prehuman ancestors, and that the image of God and human sin were gradually and mysteriously manifested" (p. 153).

Furthermore, the essayists do not deal with how to reinterpret the connections between Adam and the Gospel in places like Romans 5 and 1 Corinthians 15. This leads to a final concern.

Death before sin

One of the most significant biblical objections creationists raise against evolution is that it requires the death of both animals and human beings before the Fall.[20,21] This is contrary to the Bible's clear teachings that "by a man came death" (1 Corinthians 15:21) and that "the creation was subjected to futility" (Romans 8:20). Yet, most of the contributors to *How I Changed My Mind* sidestep this issue. Only two of the twenty-five authors even address the problem. The first is Richard Dahlstrom, who simply dismisses the YEC perspective as a 'literal reading' (pp. 176–177). The other is Kathryn Applegate, who offers several responses. First, she seemingly trumps the Bible with her evolutionary starting point, saying, "as the fossil record makes clear, physical death has been around since the dawn of life" (p. 185). Next, she claims that humanity's mandate to subdue the earth implies that some "disorder existed in the beginning" (p. 185). But, even if we accept that debatable assertion, disorder doesn't imply death. Unfallen humans might have cultivated pre-Fall gardens, trained beasts of burden, harnessed fire, and more—imposing order where it was previously lacking, even in a death-free world. Third, Applegate points out that God uses death and suffering "for redemptive ends" and that Christ's death was "ordained from the beginning" (p. 185). True, but irrelevant. The fact that God uses evil for good doesn't mean that He might have created it directly. Death and suffering are the results of original sin.

Conclusion

It is a serious concern that this book might persuade even more evangelicals to embrace evolution. Since these are well-crafted, engaging stories, it is easy to connect emotionally with the intelligent, and apparently genuine, people involved. Also, there are many kernels of truth sprinkled throughout. In the end, however, these personal testimonies are being used to teach error. Therefore, one should not read this book without also becoming familiar with the arguments for biblical creation. Once these testimonies are subjected to an informed cross-examination, the case for theistic evolution falls apart.

References

1. Compare Price, P., Stumped by biblical creation: BioLogos takes a cheap shot at biblical creation … and misses, 24 November 2015, creation.com/stump.
2. Cosner, L., Evolutionary syncretism: a critique of BioLogos, 7 September 2010, creation.com/biologos.
3. Arguments we think creationists should NOT use, creation.com/dontuse.
4. Sarfati, J., *Refuting Evolution*, Chapter 1: Evolution and creation, science and religion, facts and bias, creation.com/refutingch1.
5. Wieland, C., Can they *all* be wrong? *Creation* **10**(2): 29–33, March 1988, creation.com/can-they-all-be-wrong.
6. Wieland, C., The rules of the game, *Creation* **11**(1): 47–50, December 1988, creation.com/rules.
7. To, L., If you can't beat them, ban them: A review of *Slaughter of the Dissidents* by Jerry Bergman, *J. Creation* **23**(2):37–40, April 2009, creation.com/slaughter.
8. Wieland, C., Jesus on the age of the earth, *Creation* **34**(2):51–54, April 2012, creation.com/jesus-age.
9. Sarfati, J., Genesis: Bible authors believed it to be history, *Creation* **28**(2):21–23, March 2006, creation.com/gen-hist.
10. Dawkins, R., *The Blind Watchmaker*, Penguin Books, London, p. 6, 1991.
11. Statham, D., Dubious and dangerous exposition: A review of *The Lost World of Genesis One*, *J. Creation* **24**(3):24–26, 2010, creation.com/genlostworld.
12. Halley, K., John Walton reimagines Adam and Eve: A review of *The Lost World of Adam and Eve* by John Walton, *J. Creation* **29**(2):47–51, 2015, creation.com/images/walton.
13. Sarfati, J., Genesis: Bible authors believed it to be history, *Creation* **28**(2):21–23, March 2006, creation.com/gen-hist.
14. Batten, D., Old-earth or young-earth belief: Which belief is the recent aberration? *Creation* **21**(1):24–27, December 2001, creation.com/old-young.
15. Mortenson, T., *The Great Turning Point*, Master Books, Green Forest, AR, 2004.
16. Cosner, L. and Halley, K., Did God create an 'open' universe? Theistic evolutionists take God out of the driver's seat, 2 June 2015, creation.com/open-theism-evolution.
17. Sarfati, J., If God can do anything, then can He make a being more powerful than Himself? 12 January 2008, creation.com/omnipotence.
18. Halley, K., God's rest—A problem for theistic evolution, 25 August 2016, creation.com/gods-rest.
19. But, see: creation.com/genesis-contradictions.
20. Cosner, L. and Bates, G., Did God create over billions of years? And why is it important? 6 October 2011, creation.com/billions.
21. Sarfati, J., The Fall: a cosmic catastrophe: Hugh Ross's blunders on plant death in the Bible, *Creation* **19**(3):60–64, 2005; creation.com/plant_death.

An overhyped book that drifts from subject to subject

Human Universe
Brian Cox and Andrew Cohen
ISI Books, Delaware, 2014

John Woodmorappe

Author Brian Cox is identified as a particle physicist and professor at the University of Manchester. He performs experiments at the Large Hadron Collider in Switzerland, and also is a science broadcaster. He pairs up with Andrew Cohen, who is Head of the BBC (British Broadcasting Corporation) Science Unit.

My own fields of science are geology and biology, not astronomy or physics. For this reason, I write this review from the viewpoint of an outsider, and make no attempt to evaluate the veracity, or otherwise, of the authors' technical points in astronomy or physics. However, it should also be stressed that this book is geared to the non-specialist (except for the fairly technical ending), and that most of the content of this book is unrelated to astronomy and physics. In fact, it includes discussion of subjects as diverse as UFOs, the search for extraterrestrial life, dinosaur extinction, manned spaceflight, Earth-crossing asteroids, nuclear war, supposed man-caused global warming, organic evolution, human evolution, the significance of culture and writing in human cultural evolution, and more.

This work includes some interesting and seldom-known information. For instance, against those who had argued that the U.S. Apollo manned lunar exploration program had been a waste of money, the authors point out that each dollar spent has been returned sevenfold into the economy (p. 237). This came from the new technologies that had been created and the trained personnel whose skills became applicable to fields outside of manned lunar flight.

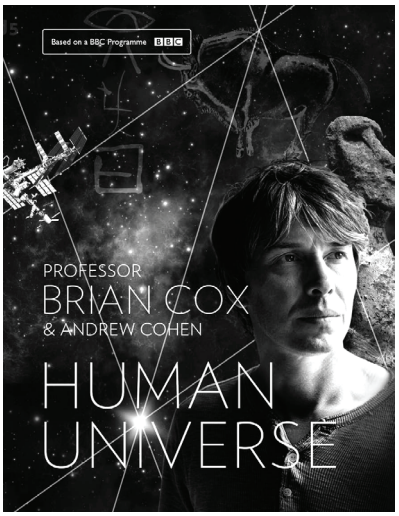
Unfortunately, this book comes across as a hodge-podge of disparate contents. In fact, the sheer variety of subjects brought up in this book makes it almost seem as if the authors are inventing things, to write about, on the fly. This also makes it difficult to summarize the contents of the book.

What about God?

Cox and Cohen hardly ever mention God or religion. They treat the idea, of Stephen Jay Gould, on science and religion being non-overlapping magisteria, as a controversial one (p. 52), but do not elaborate. However, they reveal their disdain for religion as they talk about, "The division into hundreds of countries whose borders and interests are defined by imagined local differences and arbitrary religious dogma …" (p. 114). This shows a gross ignorance of religions and the basis for the differences between them. In addition, their attitudes smack of extreme internationalism. Do I hear, from the authors, an endorsement for a New World Order?

The authors present a contrived dichotomy between theology and astronomy, saying that the latter means less terror but zero comfort. They prefer what they consider the elation of the latter (p. 3), as if religion could not be a source of elation.

What about God as the First Cause? The authors seem to be ambivalent about that. On one hand, they brush off the "fine-tuned universe" consideration as not needing a



God-of-gaps explanation, owing to the (presumed) existence of multiple universes (p. 199). They support an ongoing inflationary expansion of the universe, that is constantly creating new universes. Ironically, this concept does, in some sense, allow for a First Cause of our universe, though not necessarily one that involves God. They ask:

> "Did the whole universe have a beginning, an essential, external cause in the spirit of Leibniz's God? We still don't know. Possibly there was a 'mother of Big Bangs', and, if so, we will certainly need a quantum theory of gravity to say anything more. What does this mean? The wonderful thing for me is that nobody knows, because the philosophical and indeed theological consequences of eternal inflation have not been widely debated and discussed" (p. 207).

The authors spend much time discussing SETI, which involves an attempt to decipher intelligent signals from some advanced extraterrestrial civilization. In common with most evolutionists, the authors fail to see the delicious irony of attempting to ferret out intelligent design in distant signals, while ignoring the intelligent design that is so obvious in the living things in front of their faces.

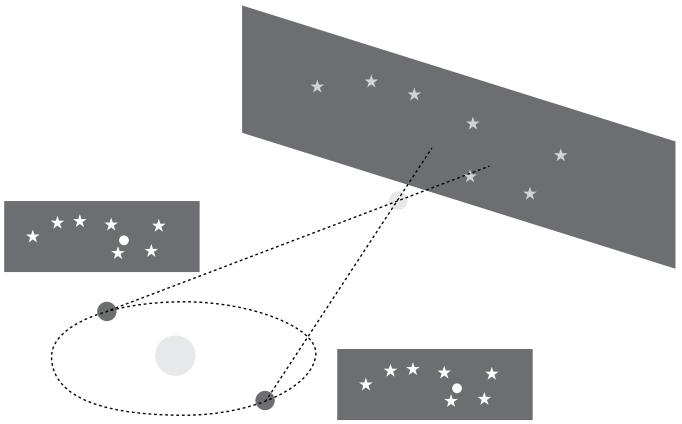


Figure 1. The stellar parallax provided conclusive proof that Earth indeed does move in space. Its discovery came centuries after Galileo.

Revealingly, Cox and Cohen adopt a rather nihilistic view of everyday existence. They note how improbable it is that a particular sperm and particular egg combined to form us as the specific individuals that we are. However, they would have us believe that our individual uniqueness is no more significant than the fact that each snowflake is unique, and probably unlike any other snowflake.

The authors' condescending attitudes

Some of what the authors write can easily alienate the reader. Consider two examples.

Cox and Cohen indulge in a form of chronological snobbery. They refer to the prevalent thinking, before Galileo, as "centuries of autocratic idiocy" (p. 39). This, if nothing else, shows an abysmal ignorance of the scientific achievement and learning that took place during the Middle Ages. Besides, it does not consider the *really* "autocratic idiocy" of modern totalitarian movements, all of which were non-religious or anti-religious.

The authors express their disdain for those who question man-caused global warming, by stating that perhaps the flooding of Miami and Norwich by rising sea levels would silence them (p. 114). Ironic to their supercilious and rather arrogant verbalization, there is no consensus regarding the degree of inferred sea-level rise, even if human-caused global warming is true, much less that it would be anywhere near extreme enough to flood coastal cities!

The Galileo affair: not black and white

The authors part ways with those who would unilaterally paint the church as the bad guy and Galileo as the courageous, persecuted independent thinker. First of all, they point out that the church did not consider Copernicanism itself heretical even in 1600, which was 30 years before Galileo (p. 5).

Cox and Cohen realize that the antagonism stemmed not so much from what Galileo said, but the way he presented it—as a frontal attack on the church. They comment:

> "Galileo, in what was certainly an ill-judged move, decided to move beyond reporting his scientific observations and instead champion a particular theological and philosophical interpretation of the data—namely that the church was wrong and that the earth was most definitely not the center of the universe. This he seems to have done because he wanted to be famous, and famous he became … . Many historians characterize Galileo as a bit of an egoistic social climber who brought it all on himself, which is partly true and yet also desperately unfair. He was undoubtedly a great scientist and a supremely talented astronomical observer" (p. 39).

Given the knowledge of the time, the matter was not nearly as cut-and-dried as Galileo used in his invectives against the church. If Galileo was unreservedly a great scientist, should he not, of all people, have been the *first* to be aware of the limitations of the evidence? Every good scientist does exactly that.

Consider Tycho Brahe, whom the authors describe as the greatest astronomical observer before the invention of the telescope. He did not unreservedly accept the sun-centred solar system owing to the fact that he found the evidence for Earth being in motion, unconvincing—particularly the (apparent) fact that the stars never changed their positions relative to Earth (pp. 9, 20). It was not until the 19th century—some 300 years *after* Galileo—that it was discovered that Earth does move, relative to the stars, in what is known as stellar parallax (figure 1). The movements were not discovered earlier because they are extremely small—measured in arcseconds (1/3600 of a degree)—owing to the great distances of stars from Earth (p. 22).

The standard evolutionary storytelling

The authors go on an imaginative excursion as they write:

> "The first population of living things whose descendants survived to the present day is commonly known as LUCA—the Last Universal Common Ancestor. … LUCA may have been unrecognizable when compared to today's life—they may not even have been cellular in nature, but rather a collection of biochemical reactions involving proteins and self-replicating molecules, possibly contained inside

rocky chambers around deep-sea hydrothermal vents" (p. 104).

In the eye of evolutionary imagination, anything is possible.

Cox and Cohen then repeat the serial endosymbiosis scenario. In fact, they embellish it by dramatizing it as a saga: "Somewhere in some primordial ocean, this simple prokaryote managed to swallow a bacterium—a trick that neither cell possessed before—and against terrific odds the pair survived and multiplied" (p. 110). Brave little fellow! And it lived happily ever after, and so have its descendants—us.

The remainder of the author's recounting of evolution merely repeats the standard accounts about how it supposedly happened. There is, of course, not a glimmering of questioning it. However, to their credit, when the authors discuss the australopithecine Lucy, they are candid about the fact that not all scientists believe that it was bipedal (pp. 130–131).

The authors focus on the origins of human agriculture and human writing. They believe that such events were decisive in allowing the emergence of modern thinking. Agriculture facilitated a relatively stable society and a relatively constant food supply. Writing made it possible for the wisdom or discoveries of one individual to be recorded and used by others, including those who lived long after the contributor had passed away.

Conclusions

This book presents a fairly good history of astronomy, notably the discovery of stellar parallax. It also raises an astonishing variety of subjects, making it quite disjointed. For this reason, it may not hold the reader's interest.

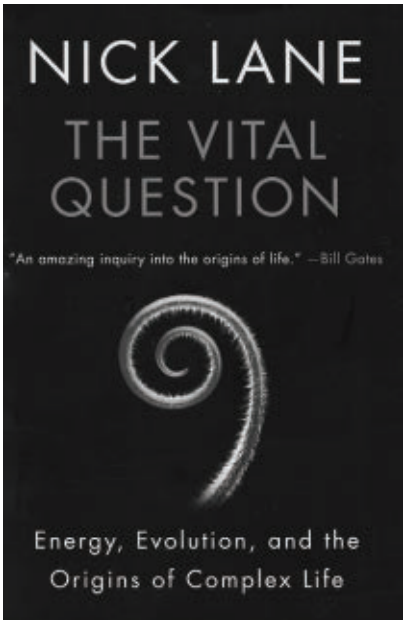
Otherwise, this work is much the same standard evolutionary fare. It does not even begin to do justice to the implications of religion in general and the Christian faith in particular.

The glaring discontinuities among even 'simple' life forms

The Vital Question: Energy, evolution, and the origins of complex life

Nick Lane

W.W. Norton & Company, New York, 2015



John Woodmorappe

The author is a biochemist at University College London. He is the winner of the 2015 Biochemical Society Award for his contributions to the molecular life sciences. He has written a number of books, including *Life Ascending*.[1]

This work is significantly more technical than most other evolutionary works intended for a general readership. It emphasizes biochemistry. The first part of this book examines different evolutionary origin-of-life hypotheses, and the remainder is a rather arcane presentation of the structure and capabilities of prokaryotes and eukaryotes.

Discredited evolutionistic origin-of-life hypotheses

Those readers who were in school decades ago can recall how they were taught, as fact, that the earth once had a reducing atmosphere and that life arose in a chemical soup in this Jupiter-like atmosphere. This notion was consonant with the famous Urey–Miller experiment of 1953, which showed that simple organic compounds (such as amino acids) could be generated from hydrogen, methane, and ammonia (p. 95).

As so many other things once taught as 'fact' by evolutionists, this, too, has been abandoned. The atmosphere of the early earth is no longer thought to ever have been Jupiter-like. Instead, it may have been dominated by volcanic gases, especially nitrogen and carbon dioxide. This eliminates the possibility of life having originated from a chemical soup.

In addition to all this, the 'chemical soup' hypothesis is chemically and geologically implausible (p. 104). In taking this position, Lane is merely repeating what creationist biochemist Duane T. Gish had said decades ago.

The author rejects panspermia—that life originated elsewhere. The reason is straightforward. Panspermia simply relocates the problem. It does not explain how life arose from non-life in the first place.

Some evolutionists have toyed with the idea that clay minerals could have served as the first replicators of what eventually became life. Lane dismisses this idea, pointing to the superficial capabilities of clay minerals, "Yet that solves little, because minerals are too physically clumsy to *encode* anything that approached an RNA-world level of complexity, although they are valuable catalysts [emphasis in original]" (p. 97).

The author touches on some of the problems of the RNA-world hypothesis, not the least of which is the fact that it is already quite a leap, from 'dumb' chemicals to RNA itself:

> "Today, life uses proteins—enzymes—but RNA also has some catalytic capabilities. The trouble here is that RNA is already a sophisticated polymer, as we have seen. It is composed of multiple nucleotide building blocks, each of which must be synthesized and activated to join together in a long chain. Before that happened, RNA could hardly have been the catalyst. … The idea that RNA somehow invented metabolism by itself is absurd, even if RNA did play a key role in the origins of replication and protein synthesis" (p. 100).

Lane revives the work of Ilya Prigogine on dissipative structures, such as the convection currents in a kettle of boiling water. However, he does not explain to the reader what substantive relevance such dissipative structures had for the putative spontaneous origin of life.

The author tacitly admits that Prigogine's dissipative structures do not, at least by themselves, explain how life originated from non-life, as he critiques the hypothesis that life originated in the black smokers of deep-sea hydrothermal vents:

> "Organics either remain bound to the surface, in which case everything eventually gums up, or they dissociate, in which case they are flushed out into the open oceans with unseemly haste, through the billowing chimneys of the vents. … While they are truly far-from-equilibrium dissipative structures, and certainly solve some of the problems of soup, these volcanic systems are too extreme and unstable to nurture the gentle carbon chemistry needed for the origin of life" (p. 106).

Life originating at alkaline hydrothermal vents?

The author is enamored with the idea of life originating in the relatively placid alkaline hydrothermal vent systems. He has done simulation experiments, on their supposed capabilities, at University College London (p. 111). Probably the best known of alkaline hydrothermal systems is the one at Lost City, in the mid-Atlantic Ocean (figure 1).

So what can alkaline hydrothermal vents do? Lane answers:

> "Very few natural environments meet the requirements of life—a continuous, high flux of carbon and usable energy across mineral catalysts, constrained in a naturally microcompartmentalised system, capable of concentrating products and venting waste. While there may be other environments that meet these criteria, alkaline hydrothermal vents most certainly do, and such vents are likely to be common on wet rocky planets across the universe" (p. 287).

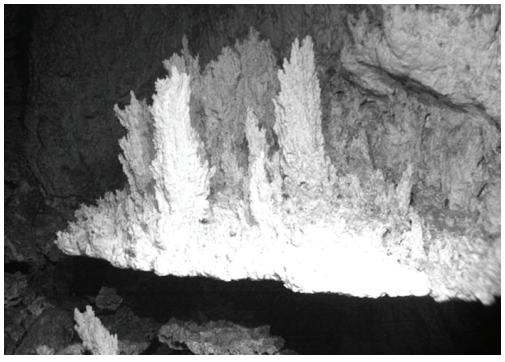


Figure 1. The Lost City alkaline hydrothermal vent. The author excitedly thinks that vents such as this 'solve' the problem of the evolutionary origin of life.

On a chemical level, Lane proposed that the seawater was acidic from dissolved CO_2 on the early earth, while alkaline water flowed through the vents and was separated by pores. This would have supposedly acted like an electric battery. So can he even demonstrate that any voltage or current can turn CO_2 and H_2 into even simple organic molecules?

Let us elaborate on the mechanisms which are supposed to make the origin of life especially likely at alkaline hydrothermal vents. The mechanisms, in and of themselves, are of a largely speculative nature. Lane quips:

> "The serious problem is that these vents are rich in hydrogen gas, but hydrogen will not react with CO_2 to form organics. The beautiful answer is that the physical structure of alkaline vents—natural proton gradients across thin semiconducting walls—will (*theoretically*) drive the formation of organics. And then concentrate them. To my mind, at least, all this makes a great deal of sense [emphasis added]" (p. 120).

Then we should see some evidence that any voltage or current can turn CO_2 and H_2 into even simple organic molecules. None has been forthcoming.

Lane adds, "Organics such as nucleotides can *theoretically* concentrate up to more than 1,000 times their starting concentration by thermophoresis, driven by convection currents and thermal diffusion in the vent pores [emphasis added]…" (p. 287). Notice Lane's repetitive use of the word *theoretically*! From a physico-chemical perspective, thermoporesis is more likely to sort by molecular mass. That would mean it would concentrate

molecules of similar mass. But that would enable destructive cross-reactions, a major nemesis of all chemical evolutionary theories.

Lane adds that "Such vents constrain cells to make use of natural proton gradients, and ultimately to generate their own" (p. 154). Notice Lane's fast-and-loose, in fact, magical, thinking. He would have us believe that the natural proton gradients at alkaline hydrothermal vents somehow became self-functioning entities that either gave rise to life or became incorporated in the earliest forms of life. But in one of his original co-authored papers, he is forced to admit in the abstract:

> "How such gradients could have powered carbon reduction or energy flux before the advent of organic protocells with genes and proteins is unknown."[2]

The alkaline-hydrothermal-vent hypothesis, like all previously proposed evolutionary origin-of-life hypotheses, suffers from this fatal flaw: it does not explain how the specified complexity, necessary for life, originated spontaneously. Rather, Lane is drawn to this as a desperate expedient because all the other theories are so bad, as the above paper stated:

> "Over the last 70 years, prebiotic chemists have been very successful in synthesizing the molecules of life, from amino acids to nucleotides. Yet there is strikingly little resemblance between much of this chemistry and the metabolic pathways of cells, in terms of substrates, catalysts, and synthetic pathways."

Overall, like most chemical evolutionists, when it comes to origin of life, Lane is confusing *necessary* conditions with *sufficient* conditions.

Almighty natural selection—not God

Author Nick Lane's attitudes towards a designer are unambiguous. In describing the ATP synthase, which is driven by the proton-motive force embedded in the cell membrane, he sees the evidence for a Creator, but walks away from it. He calls the ATP synthase "the most impressive protein nanomachine of them all", and adds:

> "This is precise nanoengineering of the highest order, a magical device, and the more we learn about it the more marvelous it becomes. Some see in it proof for the existence of God. I don't. I see the wonder of natural selection. But it is undoubtedly a wondrous machine" (p. 73). (In reading this, I could not help but think of Romans 1:19–20.)

On another subject, the author adheres to endosymbiosis theory, whereby the mitochondria were once stand-alone cells that became engulfed by, and a functional part of, another cell. He believes that most mitochrondrial genes were lost or transferred to the nucleus of the host cell, but that some remained in the mitochondrion, not as vestiges of the mitochondria's onetime status as a separate cell, but as a means of essential local control of the enormous electrical potential of the mitochrondrial membrane (p. 243). Without this local control, the mitochondrion would probably destroy itself before corrective commands arrived from the distant nucleus. Lane, even while recognizing the fact that the genes in the mitochondria are not vestigial, cannot escape getting caught up in his boundless faith in natural selection:

> "This is the basis of our mosaic respiration chains—blind selection. It works. I doubt that an intelligent engineer would have designed it that way; but this was, I hazard, the only way that natural selection could fashion a complex cell, given the requirement for an endosymbiosis between bacteria" (pp. 244–234).

Note that, unlike some other evolutionists, Lane does not even bother to tell the reader why he supposes that the system he describes is 'bad design'. Instead, his reasoning appears to be completely flippant.

Survival of the fittest does not imply arrival of the fittest

Throughout this work, Nick Lane stresses that evolution occurs because of 'first principles', which includes the premise that alternative solutions to those seen in nature would not work. However, showing that alternatives do not work is not synonymous with explaining how they came into existence in the first place! It is like merely pointing out the obvious—that automobile motors have oil because oil-less motors would overheat from friction and soon destroy themselves. However, this elementary fact hardly explains how a putative spontaneous, non-intelligent process could give rise to an automobile motor in the first place.

The flaw with the author's reasoning is clear, and is quite common to evolutionists. He is confusing survival of the fittest with the *arrival* of the fittest. For example, the ATP synthase seems to be necessary for a self-reproducing cell to exist, and, without reproduction, there is no natural selection. The same objection applies to his idea of "evolution of active ion pumping" to explain the first living cells.

The *ad hoc* nature of the author's reasoning is evident in his taking both sides of the question as to whether the outcomes of evolution are governed by constraint, or if they are governed by contingency. Regarding the former, he conjectures that extraterrestrial life would probably be similar to that on Earth, because all forms of life have to resist the gravity of the planet they live on, and because life may necessarily have to be cellular in order to function. As for contingency, Lane suggests that, were the Cambrian explosion to be re-run, the world's

land masses could today be dominated by giant terrestrial octopuses.

The notion of 'structural constraints' soon degenerates into evolutionary speculation and storytelling. This is obvious from Lane's following statements:

> "There is something about the physical structure of eukaryotes that is fundamentally different from both the bacteria and archaea. Overcoming this structural constraint enabled the eukaryotes alone to explore the realm of morphological variation …. There is nothing radical about the idea of structural constraints, *but of course there is no consensus on what those constraints might be* [emphasis added]" (p. 158).

Unicellular and multicellular life: a series of chasms

As we have seen, there is still no evidence that life could come from non-life. The forms of life known to us are of no help to evolutionary theory either. Lane 'gives away the store', at the very beginning of this book, as he lays out the situation:

> "Indeed, bacteria have remained simple in their morphology (but not their biochemistry) throughout 4 billion years. In stark contrast, all morphological complex organisms—all plants, animals, fungi, seaweeds, and singled-celled 'protists' such as amoeba—descended from that singular ancestor about 1.1–2.0 billion years ago. This ancestor was recognizably a 'modern' cell, with an exquisite internal structure and unprecedented molecular dynamism, all driven by sophisticated nanomachines encoded by thousands of new genes that are largely unknown in bacteria. There are no surviving evolutionary intermediates, no 'missing links' to give any indication of how or why these complex traits arose, just an unexplained void between the morphological simplicity of bacteria and the awesome complexity of everything else. An evolutionary black hole" (p. 2).

Let us elaborate. The author follows Eugene Koonin in the division of eukaryotes into five 'supergroups': the Chromalveolates, Plantae, Excavates, Rhizaria, and Unikonts. The hypothetical 'missing link' was LECA (the last eukaryotic common ancestor), shown in the diagram in the book (p. 41) as a black hole. Lane quips:

> "I like the symbolic black hole at the centre. LECA had already evolved all the common eukaryotic traits, but phylogenetics gives little insight into how any of these arose from bacteria or archaea—an evolutionary black hole" (p. 41).

Here are some of the specifics of the suddenly appearing eukaryotic traits:

> "The last common ancestor of eukaryotes was a complex cell that already had straight chromosomes, a membrane-bound nucleus, mitochondria, various specialized 'organelles' and other membrane structures, a dynamic cytoskeleton, and traits like sex. It was recognizably a 'modern' eukaryotic cell. None of these traits exist in bacteria in anything resembling the eukaryotic state. This phylogenetic 'event horizon' means that the evolution of eukaryotic traits can't be traced back in time beyond the last eukaryotic common ancestor" (p. 160).

Unicellular and multicellular life—a violation of all evolutionistic nested hierarchies

There is no evolutionary connection between even 'simple' forms of unicellular life. The author rejects what he calls the "famous but misleading" three-domain tree of life, which sorted out the relative origins of bacteria, archaea, and eukaryotes (p. 124). In actuality, the genes between the three groups deploy in an inconsistent fashion.

Let us elaborate. Lane frankly acknowledges:

> "Around three quarters of eukaryotic genes that have prokaryotic homologues apparently have bacterial ancestry, whereas the remaining quarter seem to derive from archaea. … That much is incontestable. What it means is bitterly contested. Eukaryotic 'signature' genes, for example, do not share sequence similarities with prokaryotic genes. Why not? Well, they could be ancient, dating back to the origin of life—what we might call the venerable eukaryotic hypothesis. These genes diverged from a common ancestor so long ago that any resemblance has been lost in the mists of time. If that were the case, then eukaryotes must have picked up various prokaryotic genes much more recently, for example when they acquired mitochondria. This hoary old idea retains an emotional appeal to those who venerate eukaryotes. *Emotions and personality play a surprisingly big role in science* [emphasis added]" (p. 162).

Lane then brings up other explanations to explain (or explain away) these incongruities. He conjectures that eukaryotic genes evolved faster than other genes, thus losing the similarities with their putative ancestors. He points to the fact that the 'bacterial' genes in eukaryotes join with different bacterial groups (p. 163), and then struggles to account for the pattern that has emerged. He first entertains gene transfer, but then realizes that the pattern is inconsistent with an ongoing transfer of genes.

This is what Lane suggests:

> "A simpler and more realistic explanation is that there was a single endosymbiosis between and archaeon and a bacterium, neither

of which had a genome equivalent to any modern group; and subsequent lateral gene [transfer] between the descendants of these cells and other prokaryotes gave rise to modern groups with an assortment of genes" (p. 165).

Elaborating on the origin of eukaryotes, Lane invokes a complex pattern of bacterial endosymbiosis and a onetime episode of lateral gene transfer, calling it a 'possible scenario' (p. 167). His choice of words is appropriate.

'Ecological spectra' should not be confused with evolutionary transitions

The author uses the term 'ecological spectrum' to refer to all the different kinds and sophistications of organismal systems found in nature, and tacitly recognizes (as long noted by creationists) that an ecological spectrum is not the same as a series of evolutionary transitions. (p. 45). To make this even clearer, Lane comments:

"An ecological intermediate is not a true missing link but it proves that a certain niche, a way of life, is viable. A flying squirrel is not closely related to other flying vertebrates such as birds and bats, but it demonstrates that gliding flight between trees is possible without full-fledged wings. That means it's not pure make-believe to suggest that powered flight could have started this way" (p. 48).

The evolutionary storytelling may not be pure make-believe, but it is close enough.

'Advanced' eukaryotes did not originate from 'primitive' eukaryotes

Let us now apply the distinction, between evolutionary transitions and ecological intermediates, to the presumed evolution within eukaryota. Lane writes:

"More significantly, there is very strong evidence that the intermediates were not, in fact, outcompeted to extinction by more sophisticated eukaryotes. They still exist. We met them already—the 'archezoa', that large group of primitive eukaryotes that were once mistaken for a missing link. They are not true *evolutionary* intermediates, but they are real *ecological* intermediates. They occupy the same niche [emphasis added]" (pp. 47–48).

No evidentiary basis for the evolutionary origin of the human eye

Although this book is not about the evolution of organs and organ systems, the author briefly mentions some of them in the context of ecological intermediates which, as we have noted, should not be confused with evolutionary intermediates. Author Nick Lane repeats the standard scenario of the vertebrate eye evolving, step-by-step, to its presently seen complexity. He then 'gives away the store' by admitting that there is no evidence that the eye did (or could) evolve step-by-step (or, for that matter, via 'hopeful monsters'). He writes, "*We do not see the historical steps in the evolution of eyes*, but we do see an ecological spectrum [emphasis added]" (p. 45).

The author conjectures that we do not see transitional forms of vertebrate eyes because these have been driven to extinction by their currently existing successors. All we can see now is the 'survival of the survivors'. Evolution has (conveniently) obliterated the very evidence of its occurrence. Moreover, given the fact that evolutionary theory accepts the premise that a less-derived state *can* co-exist with a more derived state, the evolutionary copout is nothing more than *ad hoc* reasoning to save the theory. In any case, the prima facie evidence is unambiguous: There is no proof that the vertebrate eye did, or could, evolve from pre-existing ever-simpler forms of eyes.

Conclusion

The author is obviously an enthusiastic evolutionist. While freely acknowledging the flaws of all previous evolutionistic origin-of-life theory, he fails to provide convincing evidence that his pet theory—alkaline hydrothermal vents—in any way accounts for the spontaneous origin of specified complexity.

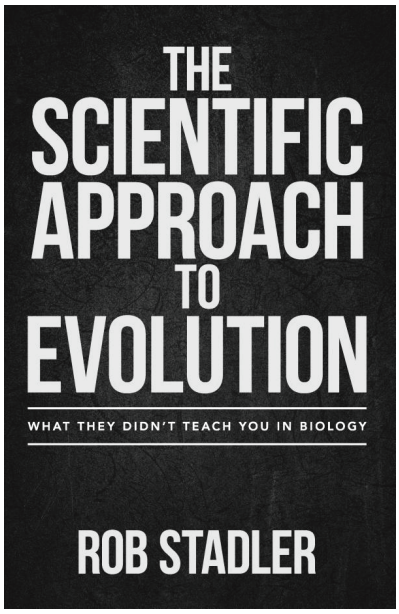
Both prokaryotes and eukaryotes show huge gaps between them, and a contradictory pattern of potential nested hierarchies. The reader who is willing to 'think outside the box' is well-founded to doubt the fact of evolution entirely.

References

1. See review, Woodmorappe, J., Evolutionary speculations, yet no 'badly designed' vertebrate eye, *J. Creation* **29**(3):23–27, 2015.
2. Sojo, V., Herschy, B., Whicher, A., Camprubí, E. and Lane, N., The Origin of Life in Alkaline Hydrothermal Vents, *Astrobiology* **16**(2):181–197, February 2016 | doi:10.1089/ast.2015.1406.

Strict science procedures evaluate evolution

The Scientific Approach to Evolution: What They Didn't Teach You in Biology
Rob Stadler
CreateSpace, North Charleston, SC, 2016



Brian Thomas

Did evolution really happen? An answer would depend on what one means by 'evolution'. It will also depend on the design of experiments used to test evolution. Rob Stadler's first book evaluates evolutionary ideas using a fresh and clear technique. I know of no other written work that has taken his approach, which supplies readers a new tool to evaluate fuzzy thinking that often muddies origins discussions.

The author has a master's degree in electrical engineering from MIT, a Ph.D. in biomedical engineering from Harvard, 17 technical publications and medical device patents related to heart health. He has almost as much expertise as is humanly possible on the subject of his book, a subject that begins with six criteria for 'high-confidence science'.

Theoretically, anyone willing to practise applying them should be able to begin ranking the confidence level that science can answer any given research question. Without despoiling the book's core content, those criteria include: 1) procedural repeatability versus non-repeatability; 2) measurement directly or indirectly; and 3) analysis prospectively versus retrospectively.

What should the reader expect from this book? First, its 201 pages do not reveal what the author believes about origins. Its tone should thus appeal as much to an atheistic evolutionist as to a biblical creationist, and any stripe in between, provided they like logic and are willing to let science confront beliefs. Tastefully selected bold text emphasizes certain main points. Two helpful appendixes flesh out the six criteria and handle objections. And the book's 10 chapters come packed with examples, and include several helpful 'figures', which are basically illustrations that simplify some of the concepts. Further, one need not have much technical background to understand its contents. When he discusses numbers, he illustrates them first. Before discussing mutations, he explains in just a few pages how DNA works.

Six criteria for 'high-confidence' science

Stadler quickly tutors his readers, using both real and hypothetical research questions, how to apply the six criteria. For example: "How fast would a bowling ball fall 5,000 years ago?" Without a time machine, this question fails the repeatability criterion. However, by introducing assumptions, science could at least take a stab at its answer. Science cannot answer this directly, but only indirectly. Even taking someone's blood pressure with a sphygmomanometer is an indirect measurement, and yet close enough to be practical.

The author builds a case, aided in greater detail for the über-interested by an appendix, that the qualitative degrees to which a particular question meets the six criteria reveal the confidence one should expect in experimental science's ability to test that question. The author uses as a high-confidence science example a study of aspirin's effects on potential blood clotting in 39,876 women (p. 20). It was repeatable, very directly measurable, and removed bias, among other qualities. The reader quickly begins to feel confidence in evaluating all kinds of research questions in light of how confidently science can answer them. With this training in place, the author rigorously evaluates origins questions like creation versus evolution.

He clearly defines evolution, perhaps in ways that biblical creationists do not prefer, but in ways that should appeal to evolution-leaning readers. 'Generalized evolution' basically means any change, 'microevolution' means minor changes, 'macroevolution' means major changes, and 'grand evolution' makes no distinction between micro and macro versions. This way, Stadler sets up future chapters to evaluate research questions that fit each definition. Microevolution, mostly including 'speciation', research questions meet very-high-confidence science, macroevolution research questions meet very-low-confidence

science criteria, and toward the end of the book Stadler graciously but firmly leads the reader to evaluate 'grand evolution'.

Evaluating experiments on evolution

He considers Lenski's ongoing study of 'evolution' in *E. coli*. How does it stack up on the six criteria? It basically asks the question: "How much evolutionary change can occur in *E. coli* under a restricted diet in lab conditions?" The 30-year exercise remains extremely repeatable. It uses very direct measurements, even to the level of analyzing time-stamped, freeze-dried bacterial genomes from generations long past. Its prospective analysis designed the experiment in advance and controls all the pertinent variables along the way. I'll let the reader discover how the remaining criteria apply.

Meanwhile, the author clearly shows that 'microevolution' occurred in these bacteria, but that it took 33,000 generations and about 10 trillion individual bacteria in order to merely duplicate one gene and damage another. That's how the bacteria grow in their particular restricted diet.[1] At the end of the book, Stadler brings this and several other examples back around to show that the very science that demonstrates microevolution refutes macroevolution.

However, the book directly tackles the main pillars of macroevolution, too, including vestigial organs, homology, biogeography, and fossils. Each one topples under the weight of its abject failure to meet any of the six criteria of high-confidence science. Perhaps to make this section more palatable to evolutionary readers, the author states the situation positively. For example he describes how the homology research question "Are similarities between life forms a result of macroevolution?" *meets* all six criteria of *low*-confidence science.

Macroevolution is not repeatable. Without directly observing the process that produced the creature, a scientist cannot make direct measurements. And the only practically available data to test this question comes from fossils, which permit only retrospective analyses. Same for the remaining three criteria. The author summarizes each key research question in an easy-to-read, two-column table. Point-by-point, question-by-question, each icon of macroevolution falls into the category of non-science.

Chimpanzees and Lucy

Stadler applies the six criteria of high-confidence science, or the opposite criteria of low-confidence science as the case may be, to King Tut, malaria, orphan genes, Lucy, and human-chimp ancestry. These last two seem particularly relevant for general readers, who typically show more interest in their own human origins than in less familiar subjects like biogeography. In an extreme understatement of the total failure of macroevolution to meet any vestige of any of his six criteria, Stadler writes: "All of this high-confidence evidence speaks to microevolution, not macroevolution" (118). Using language like this, the book gently permits the scientific criteria to violently punch topics like human-chimp common ancestry right in the face.

Speaking of human-chimp origins, the book quotes evolutionary technical literature that admits to huge DNA differences between humans and chimpanzees.[2] Tidy features like this quote list reveal that the author knows his subject and uses that knowledge appropriately. Meanwhile, like repeated body blows, the quiet quotes promise to purge the air right out of the metaphorical lungs of those committed to the false statistic of 99% genetic identity.

Then at just the right time, Stadler recalls studies from his prior chapters which demonstrated the many generations and individuals were required to make just the *handful* of DNA mutations to enable *E. coli* to consume citrate and malaria to resist drugs. This high-confidence microbe research demonstrates the folly of calling upon mutations to explain how a minimum of *75 million* DNA bases changed between chimp and human over evolution's long-held scenario of six million years. In other words, high-confidence experiments expose just how incredibly non-scientific, and therefore faith-based, are claims like human-chimp common ancestry.

Potential for the six criteria

The final chapter calls for sweeping cultural changes in light of the clarity that these six criteria bring to research questions. Public school curricula should clearly state why science cannot directly address chemical evolution ('abiogenesis') instead of current wording that asserts science has demonstrated life from non-life. Museum placards should describe how research questions like, "Did modern humans evolve from Lucy?" meet all six criteria for *low*-confidence science instead of current wording that leads viewers to believe that science has shown we all came from Lucy.

Well, more scientists and thinkers of every origins persuasion equip themselves to better evaluate the scientific credibility of research questions, but Stadler probably asks too much. If people actually ran on good logic, his changes would have a better chance of taking hold. But people run on all kinds of motivations—not the least of which is an intense desire to avoid God and therefore avoid the clearly seen evidence for creation, an inexcusable but common crime against our Creator (Romans 1:18–32).

Even scientists who merely ask basic operational questions instead of more challenging origins questions have proven their motivation. They want to produce publications more than they want to ensure scientifically determined findings. For this very reason, Smaldino and McElreath wrote: "Therefore, when researchers are rewarded [by career advancement] primarily for publishing, then habits which promote publication are naturally selected. Unfortunately, such habits can directly undermine scientific progress", leading to "an increase in false discoveries".[3] So, yes, if scientists were motivated by logic and a sense that they ought to do good science, then they might make the changes for which Stadler calls. But I won't hold my breath.

The Scientific Approach to Evolution explains in an accessible way how six criteria for high-confidence science can expose exactly what's scientifically wrong with our culture's overconfident, pro-evolution answers to origins questions. Along the way, it gives confidence to those willing to let science do only and exactly what it can do. Stadler's stark logic and gracious tone might just turn the tables on what his readers thought they knew about the limits of science and the scientific merits and demerits of evolution. So, can science tell us if evolution happened? After reading this book, you'll know. And you'll know exactly why you know.

References

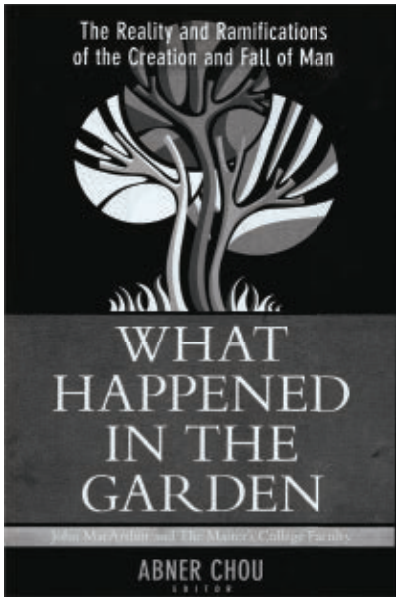
1. Thomas, B., Evolution's Top Example Topples, *Acts & Facts* **44**(10), 2015; icr.org.
2. See also Bergman, J. and Tomkins, J., Is the human genome nearly identical to chimpanzee?—a reassessment of the literature, *J. Creation* **26**(1):54–60, 2012; creation.com/chimp-dna-lit.
3. Smaldino, P.E. and McElreath, R., The natural selection of bad science, *Royal Society Open Science* **3**:160384, 21 September 2016 | doi:10.1098/rsos.160384.

The historical Adam and what he means for us

What Happened in the Garden: The reality and ramifications of the creation and fall of man

Abner Chou (Ed.)

Kregel, Grand Rapids, MI, 2016



Shaun Doyle

Many ostensibly evangelical voices have arisen to question the reality and/or significance of the historical Adam and Eve in the last decade or so. Books such as Peter Enns' *The Evolution of Adam*[1] and John Walton's *The Lost World of Adam and Eve*[2] have lead the charge. Much of the controversy goes back to claims made by the founder of *BioLogos*, Dr Francis Collins, in his 2006 book *The Language of God*.[3] He claimed that, since population genetics implies that modern humans are descended from a population of c. 10,000 people around 100–150 thousand years ago, Adam and Eve could not be historical individuals.[3]

These claims have not gone unchallenged. Many articles and books have been written in response.[4] Nonetheless, few books have had creation biologists address the biological objections Collins and others have advanced against the historical Adam.[5] Moreover, few books have explored the ramifications the historical reality of Adam has for matters beyond biblical reliability and Paul's soteriology.

What Happened in the Garden? provides the first major attempt explicitly by biblical creationists to address these wider questions in book form. It is a collection of essays organized by The Master's College and edited by Abner Chou, Professor of Bible at The Master's College. As the subtitle points out, the book explores "*The Reality and Ramifications of the Creation and Fall of Man*". It consists of three main parts: part 1 explores the historical reality of Genesis 1–3, part 2 explores the theological ramifications of the reality of Genesis 1–3, and part 3 explores several wider worldview ramifications.

Part 1: Adam and history

History actualizes theology

Abner Chou's chapter on the interpretive issues of Genesis 1–3 in relation to the historical Adam is perhaps the best contribution of the volume. He addresses two main challenges to the historical reading of Genesis 2–3.

First, Chou shows that the Bible does not work as if it contains God's inerrant 'spiritual message'

supposedly packaged in the ancient authors' culturally conditioned assumptions. Rather, the Bible starts from authorial intent, and grounds theology in history from creation to consummation.

Second, Chou shows that more is made of certain Ancient Near Eastern (ANE) literature discovered in the last 150 years than deserves to be made. If there are parallels, they are usually used in the ANE literature in different ways for different purposes than is found in Genesis. Chou argues that the interplay of parallels and differences is best explained if Genesis is myth-*busting* polemic grounded in history. I wonder if Noel Weeks' more skeptical approach to the significance of ANE literary parallels is more compelling,[6,7] but Chou shows very cogently that the traditional interpretation of Genesis 1–3 fits well into the ANE context.

Adam and evolution

Evolution presents a massive challenge to the biblical understanding of Adam (figure 1). Can the patterns of similarity we observe in fossils and genetics be explained from a biblical perspective? Ph.D. creation biologists Todd Wood and Joseph Francis set out to answer those questions.

Wood and Francis basically accept the patterns of similarity evolutionists cite as evidence for common ancestry. However, they say it is by no means clear that these patterns admit of only evolutionary explanations. Regarding the fossils, many evolutionary methods of analysing the data *assume* evolution, and so cannot detect discontinuity. Creationists have instead developed their own methods for detecting discontinuity, such as *statistical baraminology*,[8] which has revealed discontinuity between humans and apes.[9]

Wood and Francis are much less sanguine about our interpretive grasp of the genetic data. The data is often ambiguous, so that evolutionists often overstate their case. Though at present underdeveloped, there are also many potentially fruitful avenues of explanation in the biblical framework.

They also present some intriguing genetic data that may suggest discontinuity between humans and other apes:

> "Creationist research has shown that when we compare human DNA to other human DNA, we find a characteristic ratio of transversions[10] to transitions[11] (about ten transitions for every one transversion), but when we compare human and chimpanzee DNA, the ratio is significantly different (about fifteen to one)" (p. 68).

Wood and Francis do not aim to refute evolution. Rather they try to show that evolutionists do not have a monopoly on explaining the data. This method has weaknesses—a direct challenge to evolution provides powerful intellectual permission to explore other options. Moreover, many creationists question their acceptance of certain arguments, and the tentativeness of some of their explanations.[12] Nonetheless, they successfully convey a need for epistemic humility to *both* evolutionary and biblical approaches to the data.

Adam and human genetics

Evolutionists have claimed that *modern human* genetic diversity implies humans could not have arisen from a single pair less than 10,000 years ago.[13] Wood and Francis respond by examining whether the Bible can potentially explain the data.

Wood and Francis outline the basics of genetics, and the basic rationale behind evolutionary claims about human genetic diversity. They concede the power of the reasoning, but also say "there is still evidence in our own genomes that indicates that we did not come from a single pair of individuals" (p. 82). Why would biblical creationists say there is "evidence for" ideas contrary to Scripture? They likely meant that there is data consistent with us coming from more than a single pair.[14] But will the average reader understand this?

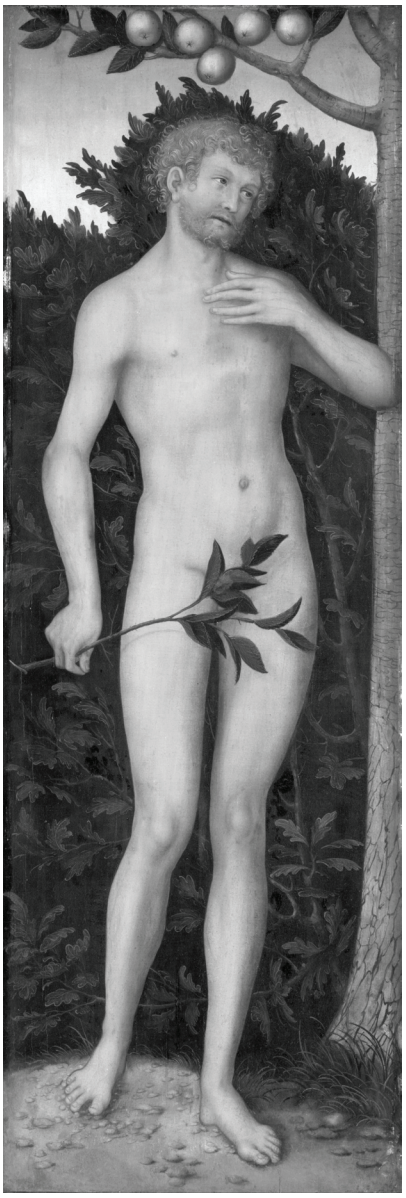


Figure 1. Evolutionists have claimed that evolution and genetics contradict the historicity of Adam. However, this reveals more about the biases of evolutionists than it does about the reality of Adam.

Next, Wood and Francis point out that creationists come to the human genetic diversity data with different assumptions. They point out estimates of the original population size from

modern human genetic diversity are not relevant to *total* genetic diversity. The estimates do not account for Neandertals or Denisovans, which have been shown by both genetics and baraminology to be human. This creates a special problem for Hugh Ross's ideas on human origins, which rest on the idea that humanity arose from a single pair around 50,000–70,000 years ago that *excluded* Neandertals and Denisovans. Nonetheless, it is an open question as to whether this affects the evolutionary argument.

Moreover, population growth estimates are consistent with biblical timeframe:

> "For now, we can definitely emphasize that ancient population size estimates support a rapid population growth within less than one thousand generations. That would be less than twenty thousand years ago, which indicates that even under the conventional population genetics model, most of the genetic variation in the human population is very recent" (p. 89).

Wood and Francis note some important observations that help us see why the creationist need not think the Bible is inconsistent with the data. However, the critique of the objections is considerably milder than even the previous chapter. Showing that the Bible is not inconsistent with the data does not show that it can offer a *probable* explanation of the data. However, there is more to be said positively for the biblical framework, and against the evolutionary framework, than Wood and Francis say.[15] Their method is also a dangerous apologetic gambit. If the creationist reader knows that the objections they are struggling with have problems, they will be less tempted to embrace them. By not engaging in the 'evolution vs creation' slugging match, the authors blunt the effectiveness of their apologetic for the average creationist reader.

The Fall and fallen reading

Grant Horner, Associate Professor of English at The Master's College, reflects on the literary nature of Genesis 3, and why people often misread it. Genesis and the whole historical Creation-Fall-Redemption plotline of Scripture evince a clear historical intent. A metaphorical Adam makes for a meaningless Jesus. As such, the only ethical way to read Genesis 3 is as history.

But if Genesis 3 is so clear, why is it that "no amount of evidence will convince someone predetermined to consider this unsophisticated" (p. 106)? Genesis 3 points out that we're not ethical. We're fallen. Horner argues that Genesis 3 becomes the explanation for people's tendency to misread it—a literal Fall is too simple and sobering for sinners to see.

Detractors could easily see this chapter as diagnosing a problem that doesn't exist. That however would ignore the previous three chapters. Horner helpfully stresses the pastoral and devotional significance of reading Genesis right, and reading the science in light of Genesis.

Figure 2. The Fall is an integral part of the redemptive *historical* narrative of Scripture. Without it, Jesus' death is meaningless.

Part 2: Adam and theology

Adam and Original Sin

The church has historically seen Adam's role as the originator of sin, death, and suffering in creation as the bad news that makes the good news of Jesus good (figure 2). Former Professor of Theology at The Master's College Paul Thorsell reviews the doctrine of Original Sin, and explores whether Scripture and church have rested so much theological weight on the historical Adam.

First, Thorsell overviews the history of the doctrine of Original Sin. He shows that there was in even the earliest church fathers the notion of racial solidarity in Adam, and that his sin resulted in us having corrupt natures and being subject to death. East and West parted ways over the issue of inherited guilt. However, in their own ways both East and West undoubtedly retained the importance of Adam as the historical reason why sin and death reign over us all. Only in the last few centuries, because of Enlightenment thinking, has there been a significant movement away from Original Sin.

Second, Thorsell evaluates the evidence from Paul. He shows that Paul views Adam as the head of humanity, and the ultimate historical reason why Christ came. Paul's arguments are not simply about the benefits of Christ; they are about how Christ provides the historical solution to the historical problem of sin introduced by Adam's first sin.

Third, Thorsell looks at Genesis 3 to see whether Paul's 'Original Sin' reading of it is tenable. Genesis 3 explains so

much of the tragedy in the rest of the narrative. And while it is rarely brought to the fore, Genesis 3 casts its shadow over the evil and futility of the fallen world in the rest of Scripture.

This chapter was one of the best in the book. Thorsell does a very good job summarizing the theological importance of the historical Adam—without a historical Adam, the historical Jesus is meaningless for our salvation.

Adam and prophecy

William Varner offers a defence of Genesis 3:15 as messianic prophecy. His exegetical defence, and his appeals to canonical context that show Genesis 3:15 is a divine word to Satan, and not simply to a snake (cf. John 8:44, Revelation 12:9), are relatively standard. He does, however, call into question an implicit reference to the virginal conception (p. 165).

However, I was left wondering why this chapter mattered. Varner says the significance is largely in the need to avoid separating theology and history (p. 168). But Genesis 3:15 can be history whether it's a messianic prophecy or not. Indeed, some Christian biblical creationists have doubted a messianic reading of Genesis 3:15 without rejecting its historicity.[16] Moreover, if it's not a messianic prophecy, Adam was still historical and the historical cause of the bad news that makes the good news of Jesus good.

Part 3: Adam and worldview

Adam and human enterprise

Professor of Business Administration R.W. Mackey offers a helpful exploration of how we would expect the historical Fall to impact human enterprise. First, the Fall introduced distortion into our communication, making it harder to understand each other because we're corrupted in a corrupted environment. Mixed signals, and deceptive signals, are common. Second, economic scarcity: man would work hard and compete for an uncertain yield that would deteriorate over time. Third, management became about damage control and holding people accountable. And this is of course what we face all the time in the fallen world of human enterprise.

Adam and thermodynamics

How was physics impacted by the Fall? This has been a source of much speculation for creationists. Taylor Jones (late Professor of Chemistry) helpfully moves away from older notions that the 2nd Law of Thermodynamics (2LT) started at the Fall. Rather he draws a distinction between 'functional entropy' and 'destructive/dissipative entropy' which produces 'waste'.

In some respects, this captures helpful distinctions. However, it also creates manifest oddities, e.g. that no cell died before the Fall (p. 201), or Adam and Eve didn't urinate or defecate before the Fall (pp. 203–204). The problem is that the Bible describes *situation-specific* differences between the pre- and post-Fall worlds in terms of *value* rather than *general* differences in terms of *calculable physics*. While there were physical differences, we have no way of parsing that difference out in terms of calculable physics. The best we can probably say is that God removed some of His sustaining power.

Adam and the law

Lawyer George Crawford offers a helpful perspective on how the Fall shapes and impacts our understanding of law. The fundamental aspects of law—indictment, investigation, due process, the punishment fitting the crime, etc.—are reflected in Genesis 3, and develop because of it. Their pervasiveness is consistent with the historical reality of Genesis 3. We distort natural law and pervert natural justice because of the effects of the Fall, necessitating a formal legal tradition. Though our fallen state means that even the formal attempt to understand justice can be perverted, and when it is, many dreadful woes result. This also means that Christians have a legitimate role to play in the legal and political spheres; we must remind men of their fallen condition, and thus their need of the Saviour.

Adam and the psyche

Professor of Biblical Counselling Ernie Baker helpfully explores the ramifications of the historical Adam and the Fall for the human psyche. He notes that a right diagnosis is crucial to being able to work towards proper solutions. He overviews and evaluates numerous recent attempts to address the issue: getting our thinking straight, or reducing our psychological issues down to the effects of causes beyond us, like biology or our background. They all have important things to say, but they all ultimately fail.

Rather, Adam and Genesis 1–3 provide an important key in understanding mental problems and the human psyche. Sin as deviation from the proper moral order of Genesis 1. The Fall is the descent into sin, and slavery to sin. The result is that our whole cognitive framework (physical and spiritual) is in slavery to an idolatry problem. A key aspect of the solution is the Gospel.

Addressing the issue of mental illness, Baker strikes a good middle ground. We cannot take the notion for granted, because it came out of a non-biblical framework. However, the Fall affected our bodies as well as our souls, and so mental issues can have a significant neurobiological basis. But it's a spectrum, not a spiritual/physical either/or picture. And the Gospel is always central to addressing the issue.

Adam and the evangelical gender debate

Associate Professor of English Jo Suzuki argues that gender, distinguished from biological sex, is socially constructed and not innate. He says the Bible does not ground gender relations in essential differences between 'masculinity' and 'femininity'. Rather, he says gender relations are grounded in the creation order of Genesis 2, and in God's specific commands. He also says gender relations reflect the essential unity and authority/submission relational structure among the divine persons as a ramification of being made in God's Triune image.

This means, Suzuki argues, that we cannot extrapolate biblical commands on gender roles beyond their limits, i.e. outside marriage and the church, and beyond death. Suzuki also argues that this means women are called to submit in marriage and the church by God's command, not because they are inferior to men.

However, at several points Suzuki's argument seems to create more problems than it solves. First, Suzuki relies on a questionable model of distinguishing the divine persons.[17] Second, drawing an analogy from the model of personal distinctions within the Trinity, which Suzuki uses, plausibly undercuts his rejection of innate gender differences, and his warrant for the implications he says arise from it.[18] Third, Suzuki's rejection of innate gender differences seems to push him to reject the reality of biological sex differences in the resurrection (p. 258). This conflicts with the physical fact of Jesus' male resurrection body. If Jesus was raised biologically male, then we will also retain our biological sex in the resurrection.[19]

Suzuki's attempts to address gender that go behind creation to the Trinity and forward from creation to the eschaton seem to create more problems than solutions. Nonetheless, he is absolutely right to ground our understanding of gender relations in the historical facts of Genesis 1–3.

Adam and education

Alexander Granados, president of Southeastern Bible College, provides a helpful look at the importance of Adam for education. He argues that the modern West has taken in the fallacy that education is a panacea for social ills. Rather, "Higher education's ultimate purpose became career training for self-promotion" (p. 278).

As Granados says, it's Genesis 3 all over again. We live in a *fallen* world, where we reject God and exalt ourselves as if we know better than God. However, God would not have set up the world to run in the way it runs now. And this is exactly what Genesis 1–3 teaches.

As such, removing the historical Adam from our understanding of wisdom will distort our endeavours to gain wisdom. Removing the Bible from the centre of gaining wisdom results in making 'under the sun' pursuits central to gaining wisdom, which is ultimately futile. Education can only point to the One who can set the world right through the transforming power of the Gospel. And the Gospel is the only answer to the problem of Adam's original sin.

Adam and us

John MacArthur, president of The Master's College, closes out the individual chapters with a poignant reflection on the importance of the historical Adam. Original sin and the historical Adam are twin keystones in the biblical Creation-Fall-Redemption schema. If original sin is not true, corporate redemption in Christ is impossible. Why? Adam is the fountainhead of a coherent biblical narrative from Genesis to Revelation, in which there is no room for evolution and deep time. Relegating Adam to fiction rather than fact means the biblical story is no longer *our* story.

Assessment

As often happens with collections of essays from different authors, the quality of the contributions is uneven. There are some brilliant contributions, both at the scholarly (Chou and Thorsell) and pastoral (John Macarthur) levels. Most of the chapters provide a helpful look into a particular area, and all provided helpful information. However, some chapters possessed significant errors (Taylor's chapter on the physics of the Fall), and others had some argumentative shortcomings (e.g. Wood and Francis on Adam and human genetics). Moreover, there are no indexes, either for Scripture references, subjects, or authors, which makes it unhelpful to search the book.

Nonetheless, *What Happened in the Garden?* is an important contribution to the literature on the historical Adam, and to the creationist literature. All the writers provide a clear testimony to biblical creation, and there is a lot of useful information in this book. It is also refreshing to see issues of genetics tackled by creation biologists (even as I demur at certain points from their arguments). Among biologists, theistic evolutionists have dominated the conversation about Adam in the books, so thoughtful responses from creation biologists are needed in that medium. Overall, *What Happened in the Garden?* poses a powerful challenge to those who would say that the historical Adam has no reality or relevance, and powerful impetus for biblical creationists to think clearly and deeply about why the reality of the Creation and Fall of man is so important.

References

1. Enns, P., *The Evolution of Adam*, Baker Publishing Group, Grand Rapids, MI, 2012.
2. Walton, J.H., *The Lost World of Adam and Eve*, IVP, Downers Grove, IL, 2015; reviewed by Halley, K., John Walton reimagines Adam and Eve, *J. Creation* **29**(2):47–51, 2015.
3. Collins, F.S., *The Language of God*, Free Press, New York, pp. 126, 206–210, 2006, reviewed by Weinberger, L., Harmony and discord, *J. Creation* **21**(1):33–37, 2007.
4. Book length treatments include VanDoodewaard, W., *The Quest for the Historical Adam: Genesis, Hermeneutics, and Human Origins*, Reformation Heritage Books, Grand Rapids, MI, 2015 (reviewed by Carter, R., Finally setting the record straight—Christian views on the historicity of Adam through the ages, *J. Creation* **29**(2):36–40, 2015); and Madueme, H. and Reeves, M. (Eds.), *Adam, the Fall, and Original Sin: Theological, Biblical, and Scientific Perspectives*, Baker Academic, Grand Rapids, MI, 2014 (reviewed by Cosner, L., The vital importance of the historical Adam, *J. Creation* **29**(3):19–22, 2015).
5. Some articles have addressed this topic, however. For instance, Carter, R.W., The Non-Mythical Adam and Eve! Refuting errors by Francis Collins and *BioLogos*, creation.com/historical-adam-biologos, 20 August 2011; Sanford, J.C. and Carter R.W., In Light Of Genetics … Adam, Eve, And The Creation/Fall, *Christian Apologetics J.* **12**(2), 2014; Carter, R.W. and Hardy, C., Modelling biblical human population growth, *J. Creation* **29**(1):72–79, 2015; Jeanson, N. and Lisle, J., On the Origin of Eukaryotic Species' Genotypic and Phenotypic Diversity: Genetic Clocks, Population Growth Curves, and Comparative Nuclear Genome Analyses Suggest Created Heterozygosity in Combination with Natural Processes as a Major Mechanism, *Answers Research J.* **9**:81–122, 2016; Carter, R.W. and Powell, M., The genetic effects of the population bottleneck associated with the Genesis Flood, *J. Creation* **30**(2):102–111, 2016.
6. Weeks, N.K., The ambiguity of biblical 'background', *Westminster Theological J.* **72**:219–236, 2010.
7. Weeks, N.K., The Bible and the 'universal' ancient world: a critique of John Walton, *Westminster Theological J.* **78**:1–28, 2016.
8. Wood, T.C., A baraminology tutorial with examples from the grasses, *J. Creation* **16**(1): 15–25, 2002.
9. Wood, T.C., Baraminological analysis places *Homo habilis*, *Homo rudolfensis*, and *Australopithecus sediba* in the human holobaramin, *Answers Research J.* **3**:71–90, 2010. Wood's study cut against both evolutionary and creationist consensus on the identification of *A. sediba*, and provoked numerous responses from creationists: e.g. DeWitt, D., Habermehl, A. and Menton, D., Baraminological analysis places *Homo habilis*, *Homo rudolfensis,* and *Australopithecus sediba* in the human holobaramin: Discussion, *Answers Research J.* **3**:153–158, 2010. Many were incensed that he included *Australopithecus sediba* in the human holobaramin, even raising questions about the theological propriety of doing so. The methodological and evidentiary issues require further discussion beyond what is possible here, but the theological objection of Wood's critics is faulty. Wood was clearly not saying that *A sediba* is less than human. He said it was a full-blooded child of Adam, period—regardless of how strange it looked. This conclusion only sounds odd because the original discoverer Lee Berger labelled the find *Australopithecus sediba*. Had it been labelled *Homo sediba* it's unlikely creationists would have cared about Wood's conclusions as much. At worst, Wood's conclusions were based on skewed data or a faulty method. Whether true or false, though, Wood's study should remind us that evolutionary 'species' and 'genus' labels have limited heuristic value for discerning the limits of the biblical kinds, *even with respect to humans*. Evolutionists do not operate with Adam in mind, so we should not expect their classification of paleoanthropological finds to reflect the biblical picture.
10. Transversions are mutational interchanges of nucleotide bases of different shape (i.e. of a one-ring purine (A or G) for a two-ring pyrimidine (C or T) or vice versa). This entails an exchange of one-ring and two-ring structures.
11. Transitions are mutational interchanges of nucleotide bases of similar shape; i.e. an exchange of one-ring pyrimidines (C T), or of two-ring purines (A G).
12. For instance, on issues such as '95–98% genetic similarity between chimps and humans', see Tomkins, J. and Bergman, J., Genomic monkey business—estimates of nearly identical human–chimp DNA similarity re-evaluated using omitted data, *J. Creation* **26**(1):94–100, 2012.
13. Venema, D.R., Genesis and the genome: genomics evidence for human-ape common ancestry and ancestral hominid population sizes, *Perspectives on Science and the Christian Faith* **62**(3):166–178, 2010.
14. One of the authors, Dr Wood, caused a stir on his blog in 2009 by claiming: "There *is* evidence for evolution, gobs and gobs of it [emphasis original]." Wood, T.C., The truth about evolution, toddcwood.blogspot.com, 30 September 2009. He later clarified what he meant by 'evidence': "A good explanation corresponds to lots of data (which we call 'evidence'), but it still might have inconsistencies, or pieces of data that correspond poorly to the explanation. Despite the presence of these inconsistencies, it's still quite reasonable to call something 'good science' if it corresponds to lots of data (i.e. has a lot of evidence)." Wood, T.C., The nature of science, toddcwood.blogspot.com, 6 October 2009. Wood used 'evidence' as synonymous with 'data', and he does not equate 'good science' with truth, or even the best explanation of all the relevant data.
15. One biblical assumption Wood and Francis did not mention that helps mitigate the explanatory challenge is that some human genetic diversity is *created* diversity—it doesn't all have to be explained by mutation. This drastically drops the number of *mutations* creationists need to account for, so the age and population estimates also drop. See Carter, R.W., The Non-Mythical Adam and Eve! Refuting errors by Francis Collins and *BioLogos*, creation.com/historical-adam-biologos, 20 August 2011; and Carter, R.W. and Powell, M., The genetic effect of the population bottleneck associated with the Genesis Flood, *J. Creation* **30**(2):102–111, 2016.
16. Kulikovsky, A.S., *Creation, Fall, Restoration*, Mentor, Fearn, Scotland, pp. 217–218, 2009.
17. Suzuki relies on Wayne Grudem's idea that the Father's authority and the Son's submission are primary factors that distinguish them as persons (see e.g. Grudem's *Systematic Theology*, Zondervan, Grand Rapids, MI, pp. 251–257, 2000). However, this is not how the church has historically distinguished the Father and the Son in the immanent Trinity. Rather, it has differentiated them through relations of personal origin; i.e. the Father is the Father because He begets the person (not the essence) of the Son, and the Son is the Son because He is begotten by the Father. This is commonly called *eternal generation*. Relations of authority and submission are ancillary and contingent matters that may be fitting outworkings of these relations of origin in creation and salvation, but do not define the distinction between the Father and the Son. For a helpful guide through this, see Sanders, F., 18 Theses on the Father and the Son, scriptoriumdaily.com/18-theses-on-the-father-and-the-son, 13 June 2016. Note also that Grudem has since retracted his side-lining of eternal generation, and has been convinced that relations of authority and submission between the Father and the Son are grounded in eternal generation: Grudem, W., Why a denial of the Son's eternal submission threatens both the Trinity and the Bible, waynegrudem.com/wp-content/uploads/2016/11/ETS-Presentation-on-Trinity-11-15-16.pdf, 15 November 2016.
18. Suzuki would disagree: "If indeed the male headship mirrors the role relationship within the Godhead, then it certainly is not based on the essence of the Persons within Trinity, because, as one being, the three persons' essence is the same" (p. 260). However, this confuses different uses of 'essence'. When we say the divine persons 'share the same essence', we mean they subsist in one 'what' like a chair is one 'what'. Still, there are ways to define 'Father' and 'Son' to distinguish them as persons. Those defining factors that distinguish Father and Son we can call 'essential' or 'intrinsic' to their distinct personhood. From this, we need to ask: does submission to the Father define divine Sonship? If so, submission defines the Son as a distinct divine person. If women are held to be analogous to the Son in this way, it seems to mandate that 'submission' is part of what defines 'womanhood'. This essentializes gender and seems to universalize the authority men should have over women, which Suzuki wants to avoid.
19. Suzuki calls this argument "weak" because "It is inconceivable for me that we continue to retain the biological function no longer needed throughout eternity" (p. 258). This is just personal incredulity. All that says is that Suzuki hasn't grasped just how radical an affirmation of human sexuality Jesus' resurrection is. It shows that *the value of sexual distinction goes deeper than reproductive function*.

Bad History

Big History: Between Nothing and Everything

David Christian, Cynthia Stokes Brown, and Craig Benjamin

McGraw Hill Education, New York, 2014

Andrew Kulikovsky

Big History is a reference text for universities across the United States and around the world. David Christian (D.Phil., Oxford University) is a lecturer in history at Macquarie University Sydney Australia. In 2010, he founded the 'Big History Project' with Bill Gates. Cynthia Stokes Brown (Ph.D., Johns Hopkins University) has written extensively on civil rights history. She is also the author of *Big History: From the Big Bang to the Present* (2007). Craig Benjamin (Ph.D., Macquarie University) is an Associate Professor of history at Grand Valley State University in Michigan.

These authors boast that "this is the first modern text on big history" (p. 4), and claim to have created a new vision of the past that draws from many different scientific disciplines including history, geology, biology, and cosmology. These alleged insights in our understanding of the past have occurred largely since the middle of the 20th century, and partly as a result of what they call the Chronometric Revolution. At the centre of this Chronometric Revolution is a series of new techniques for dating past events. Because historical studies traditionally relied on written documentary evidence, historical studies have therefore been constrained to the events of human history, so there is no way of knowing events that happened before the advent of humans.

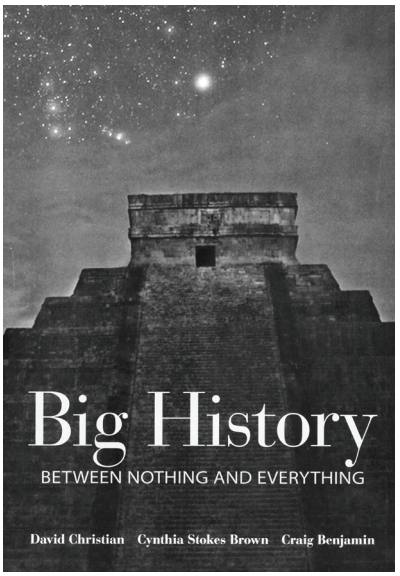
These supposed new ways of dating past events have allegedly made it possible to assign 'absolute dates' to events not mentioned in any documents, including the origin of life and origin of the universe. The authors are speaking, of course, about radiometric dating (including carbon-14 dating and uranium-lead dating) in which they place great faith and confidence—although even scientists who are ardent defenders of the accuracy of radiometric dating would never claim that it produces absolute dates.

The authors summarily dismiss the notion of divine revelation, describing it as merely "whispered words of divine beings or inner voices" (p. 6).

What is big history?

The authors claim to have formulated a new secular and materialistic origin story to replace religious origin stories—especially the biblical account of creation. To them, origin stories such as the Genesis account are "naive and simplistic" (p. 12), and the miraculous birth and death of Christ are dismissed as being merely great stories with "almost magical power" (p. 12). In fact, they assert that it is a mistake to take origin stories such as the Genesis account too literally, and that those who told them did not themselves always treat the stories as the literal truth.

The authors assert that there is no objectively verifiable evidence to support the creationist view and no way of testing it. Therefore, scientists regard supernatural creation as a matter of belief or as a metaphor. Instead, scientists look for naturalistic explanations that can be supported by objective evidence. The authors seem blind to the fact that big bang



cosmology and biological evolution are mere forensic reconstructions that have no direct evidence and there is no way of testing them.

Indeed, the authors describe big history as an attempt "to reconstruct the history of the whole of time … based on the conclusions of modern scientific scholarship" (p. 3). Big history, then, is a modern, universal, scientific, origin story.

The authors claim there is a single thread that runs through the whole story: the emergence of more and more complex things over time. It is clear from their statements that they presuppose chemical evolution operating in a materialistic universe. Again, the authors claim that big history is based on the best knowledge available to us—in other words, knowledge derived from modern science. For them, modern science is the dominant form of knowledge in the modern world, because it is global in its reach, and employs what they believe is the rigorous use of carefully tested evidence.

Big history and 'science'

The authors follow the standard big bang model as the modern scientific

explanation of the origin of the universe, claiming that the universe 'appeared' 13.8 billion years ago. So where was it before it appeared? Was it hidden? When did it actually come into existence? The authors don't say.

The authors speak of 'flows of energy'. But where are these flows of energy, and where did they come from? Indeed, what is energy? How does a materialist explain it? This sounds like new age drivel rather than science!

Biological evolution is presented as another 'just-so' story: "for a period of over 3 billion years, single-cell organisms floating in the ocean evolved to acquire the ability to *photosynthesise* …" (p. 45). How did these single-cell organisms 'acquire' this capability? What chemical or biological processes caused this?

There is of course the mandatory reference to the supposed 'Tree of Life.' For evolutionists, this means that humans are closely related to apes, rather than being a special creation of God made in His image:

> "Worse yet for traditional Christian believers, Darwin's theory clearly implies that if repeated over millions of years, blind processes alone are able to produce exquisitely complex organisms; a creator God is not necessary to explain the huge variety on earth" (pp. 59–60).

How can the authors possibly know that blind processes can create complexity? They offer no scientific justification or actual examples. Again, this is just plain wishful thinking! It is a mere assertion with no basis at all in fact.[1]

The authors even make reference to Ernst Haeckel's discredited and fraudulent theory of embryos: "In its early stages, a human embryo has traits found in fish, amphibians, and reptiles before developing its mammalian characteristics" (p. 61).[2]

Assertion as fact

The authors constantly present assertions and assumptions as simple fact. But despite the authors' absolute insistence that evolution is true, their language often betrays them with phrases like "*the most likely*", "the question that has *yet to be answered fully*, the *gap in our understanding*", "*how life emerged remains a mystery*", and "*no one can explain* this". Indeed, baseless and fantastic assertions permeate the entire book.

Human history

Regarding the loss of body hair in the story of human evolution, the authors suggest that "females selected males with little hair because they could feel certain that such males had fewer parasites" (p. 86). But how could a dumb chimp possibly know what a parasite was and that they lived in a potential mate's body hair?

The authors state that human history began when our ancestors began to collaborate in new ways. This assertion is a bit of a stretch given that collaboration is generally limited to within particular communities or cultures. History is littered with wars between different clans, tribes, and cultures, and there have been numerous genocides—some of which have been justified on evolutionary grounds.

According to the authors:

> "... most of human history has taken place in this paleolithic era … the period during which we became who we are and began to realise our species' potential physically, socially, technologically, and linguistically. Examining this period helps provide answers to the fundamental question of what it means to be human" (p. 93).

Not surprisingly, the alleged transition from hunter-gatherer societies to agrarian, agricultural societies is explained in terms of *social evolution*. By agrarian societies, the authors mean civilisations that have developed agriculture, cities, states, specialisation and a division of labour, armies, writing, and tributes.

Note that the Bible presents both Cain and Abel as agrarian agriculturalists (Gen 4:2), and Cain built a city (Gen 4:17), so humans had agrarian characteristics right back in the beginning.

The authors use the world of social insects (termites, and bees and wasps) to explain the emergence of power:

> "There is a close parallel between the social world of termites and evolving human societies in the Early Agrarian Era. … In the same way that social insects adapted genetically to living in large colonies, humans adapted culturally to the new realities of sedentary, communal, interdependent living that emerged following the transition to agriculture" (p. 121).

They go on to assert that early leaders in the agrarian period were appointed by consent and had not yet learned to impose their will by force. But how could they possibly know this? It appears they are simply reading their preconceived ideas of social evolution into world history. Indeed, they argue that the process of more complex social arrangements emerging out of less complex ones is "similar to the evolution of multicellular organisms: entities that were once independent become linked into larger unities" (p. 128). They continue: "around the world a similar process of increasing complexity occurs, no matter what the environment, whenever the human population reaches a certain density" (p. 148). "Just as the DNA of modern humans produces individuals who are very similar to each other despite some interesting differences, so too agrarian civilisations seem to be generated by a sort of social and historical DNA that ensured they were quite alike" (p. 153).

In any case, their assumption of social evolution leads to an incorrect chronology. The Bible makes it clear agrarian civilisations existed at the beginning before stone age cultures. Stone age cultures emerged after the dispersion at Babel because the resulting isolation of certain people groups led to a loss of technology.

The authors also make the following curious comment: "Virtually all of our knowledge of ancient Hebrew history comes from the Old Testament of the Hebrew Bible, although much of this has yet to be substantiated by archaeologists" (p. 158). This is complete rubbish! Biblical history has an incredible record of archaeological confirmation.[3]

Regarding the rapid decline of some agrarian civilisations (e.g. the Mayan civilisation in South America), the authors suggest the cause was overpopulation and a deteriorating agricultural landscape, which produced famine, disease, population movements, frequent wars, and a loss of confidence in rulers. Of course, they do not consider spiritual decline as a cause, despite history repeatedly demonstrating that ungodly and perverse societies have never flourished and do not last.

Their comments regarding Australian Aborigines are just as fantastic: "it is tempting to think that if the region's history had played out for a few more centuries without European interference, we might have seen developments similar to those in Mesopotamia at the time of the first appearance of agriculture" (p. 211). Again, this is nonsense and a complete fantasy. If Aborigines had been in Australia 60,000 years prior to European colonisation, as most anthropologists now claim, then why hadn't they already discovered agriculture? The truth is that they would never have discovered agriculture because it goes against their traditional animistic beliefs about nature and the land. Their faith in social evolution has blinded them to what more objective historians have previously pointed out.[4]

The modern revolution

The authors note that "the technologies and social structures that enabled humans to increase their control over resources arose from the ancient process of innovation through the sharing of information" and then ask "why should the pace and synergy of collective learning have accelerated so sharply in the modern era? And why did rates of change vary so greatly from region to region?" (p. 216). However, you will not find credible answers to these question in this book. Readers should consult the works of Thomas Sowell and Rodney Stark who answer them in great detail.[5]

The authors assert that societies have been generally hostile to "new ideas, new ways of doing things, new religions and technologies, and innovations in general" (p. 217). They contend that conservatism has been the rule in most societies, although some individuals have been willing to go against the grain and searched for new knowledge and new ways of doing things. But their assessment is grossly simplistic. While Christian societies have been morally and socially conservative, they have also sought and highly valued new knowledge. Indeed, they were instrumental in creating centres of learning, including universities, not to mention the scientific revolution.

Anti-Western sentiment

European colonisers and traders are routinely presented as bad guys and a negative influence on more primitive societies. According to the authors, the Dutch and English used "brutal tactics" and instituted "short and brutal campaigns" (p. 234). They add:

> "The Spanish had a political edge insofar as they operated under the brutal military and political rules of Europe's constantly warring states, and felt free from the moral constraints of the societies they were invading. Both Herman Cortes [*sic*] in Mexico and Passaro [*sic*] in Peru succeeded in part by capturing and massacring the leaders of their opponents, breaking all the diplomatic and moral rules of the societies they had entered. Finally, and perhaps most important of all, Europeans succeeded because they brought with them new diseases, to which the populations of the Americas lacked immunity" (p. 234).

Of course, no one back then knew that diseases were caused by microscopic organisms. Also, both the Aztecs and Incas were brutal regimes, and it wasn't hard for the Conquistadors to gain allies among the peoples oppressed by the regimes.

Their description of the African slave trade makes it sound like it was all created and sustained by Europeans, but that is not even close to the truth. Blacks enslaved other blacks and sold them to Arabs, who in turn sold them into Europe. Europeans, then, brought them to the USA. In fact, slavery was a global phenomenon. Blacks enslaved other blacks; blacks enslaved whites; whites enslaved blacks; and whites enslaved other whites. What the authors fail to acknowledge is that it was Europeans (Catholics and British Christians) who were chiefly responsible for the abolition of slavery.[6]

European colonials are generally presented as rapers and pillagers of the environment. Indeed, there is a very strong pro-environmentalism, anti-development, anti-capitalist, and anti-human sentiment throughout the book. No attention is given to the positive

aspects of British colonisation in both Africa and South-East Asia.

Islam, on the other hand, is presented in a more positive (yet distorted) light, despite the fact that Islam has always been a parasite on other societies and has spread primarily through conquest.

The authors suggest that Europeans had an inflated opinion of themselves and saw themselves as unlocking the secrets of nature, while amassing great wealth and military power, all at the expense of other regions:

> "[T]hey judged other peoples and cultures as inferior and took on the arrogance of believing themselves superior to all others. In many cases, this belief was added to their already existing belief in the superiority of their religion, Christianity" (p. 257).

Yet, the reality is that Europeans were entirely justified in thinking this way. Indeed, their greater power, greater wealth, and greater freedom, not to mention their technological superiority, was proof enough of their cultural superiority. Of course, European elites also believed that their cultural superiority was due to them being more 'highly evolved' than those from other cultures—a point that the authors once again fail to acknowledge.

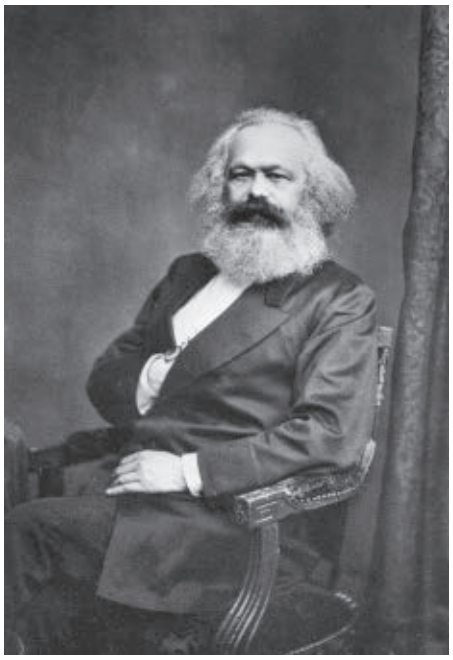


Figure 1. *Big History*, like many other modern education texts, reflects Karl Marx's ideas about social evolution and his anti-capitalist, anti-western, and anti-Christian sentiments.

Their contempt for Europeans, however, does not stop them from painting hagiographic portraits of both Marx and Engels and their socialist program. But you won't find any reference to Magna Carta, the Reformation, or the Westminster system of government despite their monumental impact on both European and world history.

Politics and economics

In regard to international relations and global politics, they note that the post-WWI League of Nations (and related institutions) were the first formal structures of world government but they were too weak to keep the peace. The same could be said for the post-WWII United Nations.

According to the authors, communists saw themselves as the leaders of the oppressed classes throughout the world, the workers and peasants, and were prepared to use coercive methods (i.e. violence and brutality) in their attempt to build a better society. They attempted to build a modern industrial economy without capitalism's motivational forces, because they viewed capitalism as the source of exploitation and inequality. In order to do this effectively, the state had to exercise great unilateral power and had to be willing to rule brutally when faced with opposition.

In the authors' estimation, "the Soviet Union offered a tempting alternative to the capitalist societies of the West" (p. 273). Russia had, through violent struggle, escaped the grip of the capitalist world and built a powerful modern economy against the odds. The Soviet Union also gave economic, technical and sometimes military, support to its allies, including Cuba, Nigeria, and Egypt. They claim that some of the results were spectacular: "In China, in North Korea, and in parts of Eastern Europe the methods of the Soviet Union were used to build the foundations of modern industrial economies" (p. 273). On this point, the authors are delusional! The only things the Soviet methods brought were equally distributed poverty, oppression, suffering and death! The Soviets and their allies were responsible for all the greatest of human slaughters in history—Communist dictatorships murdered hundreds of millions of their own people.[7]

The authors later claim that the Industrial Revolution raised the wealth of Europe and North America but led to a sharp decline in the relative wealth of East Asia. There is a subtle implication here that East Asia's sharp decline is the fault of Europe and North America, presumably because they plundered and exploited East Asia! But nothing could be further from the truth. Firstly, Europe's rise was not uniform. Not every European nation had the same economic success and rise in wealth. Secondly, those that did see economic gains were the beneficiaries of their own technological innovations that were encouraged and embraced.

Environmentalism and climate change

The authors go on to suggest that humans are unfairly dominating and exploiting the earth:

> "[T]he big story of the twentieth century is how one species suddenly began to dominate the energy and resources of the biosphere as a whole.

> What was 'growth' for humans was experienced by many other species as a decline in available land, food, and habitat. Human activity also began to destabilize nonliving geological and meteorological systems, such as the movement of water and patterns of climate change or the ancient biochemical cycles of carbon and nitrogen. Can humans keep extracting more and more resources from the biosphere? Or is growth beginning to threaten the ecological foundations on which modern societies depend?" (p. 283).

This is typical of the modern anti-human, 'equal consideration' ecological ethics espoused by Peter Singer. Humans are supposedly a parasite consuming the world's resources and destroying the planet in the process. In reality, there is still plenty of available land, modern technology has improved water quality and prevented damaging floods, and the planet is not burning up.

Nevertheless, the authors' catastrophic view of climate change shines through, claiming that "[w]ithin a few decades many of the world's great aquifers will dry up…" (p. 284) and "we are now beginning to transform the atmosphere in ways that are likely to have a profound impact on global climates and ocean levels in the next century" (pp. 284–285). Climate change alarmists such as Tim Flannery have been saying as much for years yet none of their dire predictions have come even remotely true.

In fact, there is a real deep green Gaia streak in this book. The authors assert:

> "... we cannot regard the biosphere as a passive object: it is, rather, a complex, evolving super organism that will react to the actions of humans in ways that may not always please us. It will, to put it anthropomorphically, defend itself against us if that is necessary" (p. 285).

Regarding population growth, the authors claim that the human footprint likely surpassed Earth's carrying capacity some years ago. So what do they propose? A global reduction in standard of living? A rationing of food and medicine? Culling by means of forced abortion and euthanasia?

Unsurprisingly, the authors speak favourably of all the standard Green Left policies including doing something about climate change, slowing population growth, reducing CO2 emissions, taxing fossil fuels, establishing green belts and animal migration corridors, reducing consumption, and having fewer children.

There is also some sci-fi dreaming about humans using terraforming on planets such as Mars in order to set up habitable human colonies. They imagine that

> "... isolated populations of humans will almost certainly evolve and change in different star systems. Eventually, our species will divide into numerous subspecies… . That piece of speculation is a reminder that our species, like all others, evolves. Whether or not we start steering our evolution through genetic manipulation, we will change, and there will eventually come a point where it will no longer be clear…whether our descendants count as humans or not" (p. 302).

Conclusion

This book is ultimately a new secular and materialistic origin story intended to replace religious origin stories—especially the biblical creation account.

It seeks to present Darwinism and social evolution as verified and hard scientific fact supported by a conclusive array of incontrovertible evidence. But because this is meant to be a history book, none of the actual science is explained or justified. There are no detailed footnotes to academic works, although there are a few reference works listed in a further reading section at the end of each chapter. The text simply tells the currently accepted materialistic and naturalistic story of the beginnings of the universe in narrative prose as if it was unquestionably true. The words 'emerge' and 'emergent properties' permeate the whole book. What does this actually mean? Where do things emerge from? What caused them to emerge? The authors never say.

Moreover, there is no mention of the implicit racism in Darwin's theories and writings.

This book is not a true work of history. It is merely a propaganda tool for the indoctrination of students with a materialist and, indeed, Marxist, worldview. Students who want serious, well-researched and documented works of history, should consult the book of Genesis, Geoffrey Blainey's *A Short History of the World*[8], any work by Rodney Stark[9] and Thomas Sowell's *Conquests and Cultures*, *Wealth, Poverty and Politics*, *Migrations and Cultures*.

References

1. See Wells, J., *Icons of Evolution: Science or Myth?*, Regnery, Washington, DC, pp. 29–58, 2000.
2. See van Niekerk, E., Countering revisionism—part 1: Ernst Haeckel, fraud is proven, *J. Creation* **25**(3):89–95, 2011; and Wells, ref. 1, pp. 81–110.
3. See Kitchen, K.A., *On the Reliability of the Old Testament*, Eerdmans, Grand Rapids, MI, 2003.
4. See Sowell, T., *Wealth, Poverty and Politics: An international perspective*, Basic Books, New York, 2015.
5. Stark R., *How the West Won: The Neglected Story of the Triumph of Modernity*, ISI Books, Wilmington, DE, 2014.
6. See Thomas, H., *The Slave Trade: The story of the Atlantic slave trade 1440–1870*, Touchstone, New York, 1997.
7. Rummel, R.J., *Death by Government*, Transaction Publishers, New Brunswick, NJ, 1994.
8. Apart from the first few paragraphs, which assume an evolutionary origin of human beings, this work is an outstanding summary of world history.
9. See especially *The Rise of Christianity*, *The Triumph of Christianity*, *The Victory of Reason*, and *How the West Won*.

Our eternal universe

In response to John Hartnett's *Our eternal universe* (**30**(3):104–109), one is reminded of the danger of approaching the biblical text on terms other than the text's own. Dr Hartnett has approached the text from a cosmological rather than eschatological viewpoint and has reached conclusions that are not substantiated by an analysis of all the relevant texts.

First, Hartnett has not consulted qualified Hebrew experts regarding the usage of the Hebrew words he cites. He has also not interacted with how his definition of these words has implications for creation cosmology, and only thrown out a vague accusation of eisegesis towards people who hold a definition with which he disagrees. One would hope for a more substantial argument.

Second, the burning bush has nothing to do with eschatology as such, so to use whatever is happening regarding entropy in that passage to argue for an eschatological position is flawed. I would argue that speaking about a miracle in scientific terms may be a definitional exercise in confusing categories, and then to import questionable conclusions from this miracle to *eschatology* makes another gigantic, unsubstantiated (in the most literal sense—he does not justify it at all) leap. Of *course* God can reverse entropy; God can do anything. The question is: what does the Scripture teach God *will* do regarding the New Heavens and Earth?

Third, *ōlām* does not always mean 'forever'. While it may *sometimes* hold this meaning, its more-common meaning is "long time, duration".[1] No one would argue that Ecclesiastes 1:3–11 says that the earth is infinitely old, yet *ōlām* is used for the length of the past duration of the earth in that passage.[2] It is also a problem to use *poetic* passages to interpret *didactic*; sound exegesis demands we do the opposite.

Fourth, his misuse of the New Testament shows that Hartnett has not consulted even the most basic scholarly sources; in fact, he does not even pretend to have done so. His opinion ("I say" ... "My claim" ... "I would take it") is presented as definitive, even when it disagrees with the vast majority of NT scholarship. For instance, he interprets Matthew 24:35 as "Jesus is not actually saying heaven and earth will pass away, but that it would be easier for them to do so than it would be for God's words to fail". But that is *precisely* the opposite of the point that Matthew is making. The vast majority of New Testament scholarship realizes that Jesus is saying that even the things that seem most permanent—the heavens and earth—will pass away, but in contrast God's Word will never pass away.[3–6] Furthermore, the Greek word translated "will pass away" is in the future indicative, meaning Jesus is communicating it *will* happen (as opposed to it being stated in more hypothetical terms). It is egregious to appeal to Luke to negate the clear contrast present in Matthew, because Luke records Jesus making a *similar* (not identical) statement in a much *different* context, as anyone can see who bothers to read the surrounding context.

Then he makes the leap from subjective argumentation based on personal opinion to the *assumption* that these are accurate to form the basis of his next level of argumentation: "Once we accept the fact [!] of the eternal preservation of the heavens ... ." This question-begging is not how scholarship should be done.

Fifth, the idea of the destruction and restoration of the universe, and its parallel with death and resurrection of believers, is so pervasive throughout Scripture. Therefore, to assert that this restoration amounts to a simple reversing of entropy and to interpret all the destruction passages figuratively is simplistic and disrespectful to the text. The word limit does not allow me to draw out the theme here, but my forthcoming book, *From Creation to Salvation* (CBP, 2017), traces the 'uncreation' theme and its importance to a biblical creationist view.

There can tend to be a distrust of biblical studies as a discipline because of its liberal wing, and perhaps this is why Hartnett neglected to cite even one expert. But we cannot afford to do scholarship in a vacuum. Hartnett's paper would have benefitted from outside expertise; the lack of it means that his paper suffers from several flaws the reader must try to overlook before even weighing the merits of his position.

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References

1. HALOT.
2. Sarfati, J., *Refuting Compromise*, 2nd edn, CBP, Powder Springs, GA, p. 320, 2011.
3. Morris, L., *The Gospel According to Matthew*, Pillar New Testament Commentary, Eerdmans, Grand Rapids, MI, p. 613, 1992.
4. Blomberg, C., *Matthew: The New American Commentary*, Broadman & Holman, Nashville, TN, p. 364, 1992.
5. Keener, C., *The Gospel of Matthew: A socio-rhetorical commentary*, Eerdmans, Grand Rapids, MI, p. 590, 2009.
6. Lenski, R.C.H., *The Interpretation of the Gospel of St. Matthew*, Augsburg Fortress, Minneapolis, MN, pp. 953–954, 2008.

» John Hartnett replies:

My article is an essay exploring the idea that the universe—the total sum of all that exists including all stars and galaxies—may, in fact, be eternal. As I pointed out there are scriptures in Psalms 89 and 148 that support such a notion. I admit that I have taken a different eschatological viewpoint to what has been promoted

by many in creation ministries up to this time. But biblical eschatology and biblical creation historical narrative are not the same thing. My friend Russ Humphreys takes exception with my approach also, saying that I am inconsistent, by taking a literal reading of narrative texts in Genesis but not in Revelation and other prophetical texts. I disagree, as I do also with Cosner here, and with many so-called authorities on eschatology. I don't believe biblical history and eschatology have the same standing. One is known and the other is not.

In regards to the Hebrew words (natah, raqa, and mathach) Cosner seems to be referring to, as mentioned in the text, I have discussed their use before (my ref. 12) in *J. Creation* without much comment. I suggest they do not support an expanding universe, as in the rubber sheet analogy of standard big bang cosmology, and as such cannot be used to support such a notion. This has at least one impact on creation cosmology, which Russ Humphreys has acknowledged. It caused him to modify his approach in his own cosmology to looking at a static universe rather than an expanding one.[1]

In my ref. 13, I comment on others' interpretations, or what I would call misinterpretations, of some of those verses used to make claims of science well beyond the possible meanings of the Hebrew texts, but I do not make any "vague accusation of eisegesis". I simply state that "I believe that eisegesis is used". There's nothing vague about that and I am not being accusative but stating a problem that I also have been guilty of, i.e. reading into scriptures something I want them to say.

On Cosner's point about the burning bush, I disagree. The burning bush tells us about the created world. It tells us something about the physics of the universe. Williams and I wrote about this in our book *Dismantling the Big Bang*.[2] There we wrote that it was the sustaining power of God that maintained the bush burning—essentially reversing entropy—and when the Creator removed that sustaining power the bush then burnt away. In like manner the processes of increase in entropy in the universe result in decay. God's sustaining power is capable of maintaining the physical systems and He has chosen on occasion to demonstrate this to us. The link to eschatology may be seen in the link to the future state of the universe, which is what I put forward in this article.

I agree that *ōlām* has a range of meanings, and one of those meanings is 'forever'. The question then is, do the stars and galaxies remain eternally or not? It seems Cosner is arguing that in these passages because they are poetry they cannot be relied upon to mean what they apparently say. I disagree. The verses cited are not allegorical and have a straightforward meaning. But the passage in Luke 16 I may have misstated as an equivalent verse to that in Matthew 24. I was not meaning to imply it was the same context but rather equivalent in meaning. There Jesus makes the same statement and hence I used Luke 16:17 to interpret Matthew 24:35.

In regards to this article, a reader wrote to me stating the following:

> "Just a note to say I agree with your conclusion that the universe as promised by God is eternal. Unfortunately, many Christians read scripture and are unaware of the obvious 'Hebraisms'. So scriptures are misunderstood ... and can seem contradictory. The verse Matthew 24:35 is written in a very common style ... used in the Talmud as well. Like saying that 'salt which has lost its taste' ... salt doesn't lose its taste. You were very wise to look to other verses where God states that the universe is eternal. So, in conclusion, we have assurance of God's Word being eternal because we know that the universe is eternal."

The discussion in my article is really about the way one interprets the various scriptures I have cited. The standard position of many in biblical creationist circles has been that the New Heavens and New Earth are totally recreated—the old ones being totally wiped out. But even Cosner's statement of "the idea of the destruction and restoration of the universe, and its parallel with death and resurrection of believers, is so pervasive throughout Scripture" is not an argument in favour of total destruction and recreation but of renewal. The believers are not totally recreated again but renewed (or changed, 1 Corinthians 15:51–54) in the New Heaven and the New Earth. Christ was observed in a new resurrection body that bore the marks of His crucifixion. A vestige of the past body was still there. Eschatologically, I argue (my ref. 15) that it is the earth and the atmospheric heavens that are renewed, i.e. refurbished, and not the annihilation and destruction of the whole physical universe, which God created.

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References

1. Hartnett, J.G., Tension, not extension in creation cosmology, creation.com/tension-not-extension-in-creation-cosmology, 12 August 2014.
2. Williams, A. and Hartnett, J.G., *Dismantling the Big Bang*, Master Books, Green Forrest, AR, 2015.

Our eternal universe

I appreciate the insights John Hartnett provides in his writings (e.g. *Starlight, time and the New Physics*, *Dismantling the Big Bang*, and various articles in the creationist journals). I also agree with him when he says, in *Our eternal universe,*[1] that "Only the eternal God, the Creator of all, can preserve that which has a natural tendency to decay." There will be no net increase in entropy in the 'new heavens and earth' because God will continually, and perpetually, maintain a zero-sum balance for increases/decreases in entropy. However, I believe that Dr Hartnett has overstated his claim that this *present* universe will be eternal. He quotes from Psalms 148:6 and 89:37 to substantiate his claim. He says:

> "These verses from the Psalms are not prophetic, nor are they intended as allegory, or just poetry but are stating facts regarding God's creation. That is, that the sun, the moon, and the stars in the cosmos are to be there forever. The Hebrew word used in both Psalms 89:37 and 148:6 is מָלוֹע [sic] ('owlam), which generally has the meaning of 'timeout of mind (past or future)', but practically means 'eternity' and is frequently translated as 'always'."

Brown-Driver-Briggs[2] indicates that עוֹלָם can mean 'long duration' and does not necessarily have to mean 'endless' or 'eternal' time into the future, as Hartnett suggests: "So my argument here is that based on Psalms 148:6 and 89.37 God will preserve the starry heavens forever, i.e. for an eternity." The Hebrew word עוֹלָם can mean 'always' in a time-bound context—i.e., as long as the applicable time-based circumstances continue (e.g. Exodus 19:9; Isaiah 14:20, 34:10, 47:7; Ezekiel 37:25 etc.).

Hartnett says that Psalm 148:6: "… is a clear reference to a created yet an eternally existing universe. That is, a universe that was created in the finite past yet exists eternally, never to vanish or be eviscerated. The sun, moon, and stars are specifically mentioned, that they will exist, 'for ever and ever'. It is by decree of the Creator and that decree will never be cancelled."

However, we should interpret Psalm 148:6 and Psalm 89:37 in the context of what Peter says:

> "But the day of the Lord will come like a thief, and then the *heavens will pass away* with a roar, and the *heavenly bodies will be burned up and dissolved*, and the earth and the works that are done on it will be exposed. Since *all these things are thus to be dissolved*, what sort of people ought you to be in lives of holiness and godliness, waiting for and hastening the coming of the day of God, because of which *the heavens will be set on fire and dissolved, and the heavenly bodies will melt as they burn!* But according to his promise we are waiting for new heavens and a new earth in which righteousness dwells [emphasis added]."[3]

Peter states explicitly that this current universe is not eternal and will be consumed at the consummation of this current age. As one commentator stated regarding Psalm 148:6, "He hath also stablished them for ever and ever" (comp. Psalm 89:37). The expression, 'for ever and ever', must not be pressed. It means 'for all *time*'—while heaven and earth endure—but does not imply an absolute perpetuity.[4]

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References

1. Hartnett, J.G., Our eternal universe, *J. Creation* **30**(3):104–109, 2016.
2. Brown, F., Driver, S.R. and Briggs, C.A., *Enhanced Brown-Driver-Briggs Hebrew and English Lexicon*, Clarendon Press, Oxford, pp. 761–763, 1977.
3. *The Holy Bible: English Standard Version*
4. Spence-Jones, H.D.M. (Ed.), *Psalms*, vol. 3, Funk & Wagnalls, London, p. 407, 1909.

» John Hartnett replies:

The main criticism here is that Hughes contends that I must use 2 Peter 3:10–13 to interpret the meaning of the Hebrew word עוֹלָם (`owlam), translated 'forever' in English in Psalms 148:6 and 89:37. However, I disagree.

I do not interpret 2 Peter 3:10–13 as literal melting of the elements of creation itself as do many others. Like other passages used to support a literal destruction of the starry heavens (Revelation 6:14 and Isaiah 34:4) I take a different approach to interpreting their meaning, which leads to a refurbishment of the earth and the heavens around the planet but not to the total destruction of all stars in the universe and planet Earth. In reference to 2 Peter 3:10, I wrote in the article:

> "The 'elements' there are not subatomic particles but *the fundamental principles* upon which the earth has been governed to this point in time. At the *day of the Lord,* when Christ returns (here's where eschatology comes in), God destroys the 'old order' bringing in His rule not only in heaven but in earth. The passage "*the earth also and its works will not be found*" makes no sense interpreted literally. The 'earth' symbolizes earthlings, inhabitants of the earth, not the planet itself. This is evident because the 'earth' has 'works' and only people can have works. It is true that the works include mankind's creations, and I believe that that is one reason

> God will refurbish the earth. But when God judges those works by fire at the *great white throne judgment* (Revelation 20:11) it is people He will judge and those people not found in the *book of life*—i.e. not saved—will be cast into the *lake of fire*" (Revelation 20:13–15).
>
> Now looking at Revelation 6:14: "And *the heaven departed as a scroll when it is rolled together*; and every mountain and island were moved out of their places [emphasis added]."

It cannot mean the destruction of the starry heavens either. From the second part, it could signify the refurbishment of the atmospheric heavens because it seems to indicate from "every mountain and island were moved" that the earth's surface is reworked. This argument is strengthened by Revelation 21:1 itself which concludes with "there was no more sea". So *if this has a literal fulfilment* it must occur with the refurbishment of the earth surface, thus the earth survives but the surface is remade. Then why not "heaven" also, meaning the atmospheric heaven around the earth?

The preceding verse Revelation 6:13:

> "And *the stars of heaven fell to the earth*, even as a fig tree casts her untimely figs, when she is shaken of a mighty wind [emphasis added]."

The stars of heaven cannot *literally fall* to the earth. Under the historical interpretation of biblical prophecy Revelation 6:13 is interpreted to mean the dethroning of earthly rulers. It is *symbolic language*. Therefore, these verses probably have no literal fulfilment.

Similarly with Isaiah 34:4:

> "And all *the host of heaven shall be dissolved, and the heavens shall be rolled together as a scroll*: and all their host shall fall down, as the leaf falls off from the vine, and as a falling fig from the fig tree [emphasis added]."

(Note Revelation 6:13–14 is a reference to Isaiah 34:4.)

Chapter 34 of Isaiah describes God's judgments on the wicked. If verse 3, "the mountains shall be melted with their blood", cannot be literal, then why assume that the following "And all the host of heaven shall be dissolved ..." (verse 4) to be literal?

Of Isaiah 34:4, John Gill[1] wrote:

> "*And all the hosts of heaven shall be dissolved*. 'Pine away', as with sickness, grow languid, become obscure, lose their light, and be turned into blood and darkness; this figure is used to express the horror of this calamity, as if the very heavens themselves, and the sun, and moon, and stars, were affected with it; see (Isaiah 13:10) *and the heavens shall be rolled together as a scroll*; a book, or volume, which when rolled up, one letter of it could not be read; and it was the manner formerly of making and writing books in the form of a roll; hence the word volume; and here it signifies that there should be such a change in the heavens, as that not a star should be seen, much less the sun or moon; and may signify the utter removal and abolition of all dignities and offices, supreme and subordinate, civil and ecclesiastical, in the whole Roman jurisdiction; thus the destruction of Rome Pagan is described in (Revelation 6:14) ... from whence the language seems to be borrowed: *and all their host shall fall down, as the leaf falleth off from the vine, and as a falling fig from the fig tree*; that is, the stars should fall down: by whom may be meant persons in office, that made a considerable figure; who shall fall from their stations, in which they shone with much splendour and grandeur, as leaves fall from trees in autumn, particularly the vine; or as unripe and rotten figs fall from the fig tree when shaken by a violent wind; the same metaphor is used in (Revelation 6:13) [underlined emphasis added]."

On the following verse, Isaiah 34:5, John Gill wrote:

> "*For my sword shall be bathed in heaven* ... That is, the sword of the Lord, as it is called in the next verse (Isaiah 34:6), and it is he that is speaking; it designs the vengeance of the Lord, the punishment he will inflict on the wicked, said to be 'bathed in heaven', because determined and prepared there; the allusion may be to the bathing of swords in some sort of liquor, to harden or brighten them, and so fit them for use. Kimchi renders it, 'my sword' which is 'in heaven shall be bathed', that is, in the blood of the slain; 'heaven' may denote ... the whole Roman Pagan empire in (Revelation 12:7) and may design the principal men in it, those that are in the highest places and offices, in whom the sword of the Lord shall be first drenched, and be as it were satiated and inebriated with the blood of them ... ."

John Gill understood this verse as a metaphorical description of the removal of those in power; *nothing to do with a literal heaven and stars falling or dissolving.*

Therefore 2 Peter 3:10–13, Revelation 6:14 and Isaiah 34:4 cannot be used to straightjacket a literal interpretation on the destruction of the whole starry universe, and thus it follows one does not interpret the Hebrew word עוֹלָם (`owlam) in Psalms 148:6 and 89:37, translated 'forever', as not meaning 'eternal' because of a prior commitment to a certain eschatology.

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References

1. John Gill's Exposition on the Entire Bible, www.biblestudytools.com/commentaries/gills-exposition-of-the-bible/.

Utterly preserved cells are not remnants—a critique of *Dinosaur Blood and the Age of the Earth*

Mark Armitage

Soft sheets of fibrillar bone and stunningly preserved osteocytes recovered from a *Triceratops* horn at Hell Creek, Montana, cannot be explained by the interpretations tendered by Dr Fazale Rana in his book *Dinosaur Blood and the Age of the Earth*. Rana's obvious misunderstanding and mischaracterization of the *Triceratops* horn soft tissues are examined and corrected herein. Simply parroting the talking points of evolutionary scientists on dinosaur soft cells does not explain their presence, therefore careful work must be done to explain them.

The book *Dinosaur Blood and the Age of the Earth* by Fazale Rana, Ph.D.,[1] is essentially a recitation of the arguments presented by secular scientists to 'explain' the presence of stunningly preserved dinosaur soft cells via previously unknown 'mechanisms'. It follows then that an invalidation of these proposed 'mechanisms' should silence the secular community and put the onus on them to do more careful work in trying to explain why these cells are here.

The presence of endogenous molecules, proteins, sheets of fibrillar bone, intact blood vessels, and stunningly preserved dinosaur bone cells (osteocytes) is problematic for Dr Fazale Rana and his followers. After all, the life experience of the average person tells them intuitively that such findings are incompatible with long ages. Dinosaur bones are 'so old' and been subject to so much weathering, scavenging, and other processes that *must* have accompanied the many millions of years of their existence, that the average person 'knows' that this is impossible.

Rana must assure his followers that there is nothing to be alarmed about regarding dinosaur soft tissues. He and Hugh Ross have built their ministry on the antibiblical and antiscientific assumptions that the earth is billions of years old. So now he must explain to his followers that it is not unusual at all to recover such soft tissues from animals that died so very long ago.

As if to downplay the glaringly obvious, Rana writes, "few people in the scientific community are impressed with this latest scientific argument" (introduction, p. 11), i.e. that the presence of soft tissues means these remains are young. I can certainly tell you that biologists at California State University were impressed with the implied argument that soft tissues found in a cracked-open, water-filled *Triceratops* horn are detrimental to the deep-time paradigm! My lawsuit against the State of California now shows that the very day my paper on soft tissues in a *Triceratops* horn was published on the online website, several powerful professors in the Biology Department met and decided to terminate my position where I ran a million-dollar microscopy suite. Moreover, *very few* scientists are working in the dinosaur soft-tissue area, primarily because it is a career killer, so. So, contrary to what Rana says, many people in the scientific community see the obvious implications to the presence of dinosaur soft cells and tissues.

Rana claims that the purpose of his book is to help Christians understand why it makes sense from a "biochemist's standpoint" (p. 12) that soft tissue remains can be preserved in fossils which date to several hundred million years in age (p. 12). He claims that he understands the "structure, function and *stability* of molecules" [emphasis his], so he feels qualified to help prevent well-meaning (but perhaps ignorant) believers from "making a scientifically questionable argument for a young earth" (p. 12). He also writes that a secondary goal of the book is to help Christians "overcome unnecessary obstacles to old earth creationism" (p. 13). That, in fact, is the *real* purpose of the book because of the prevalent and almost daily discoveries of soft tissue in supposedly ancient remains.

Regrettably, due to space I can only supply a cursory review of Rana's book. However, the complete review is available by email (micromark@juno.com). There are works in the literature that show Rana's position to be wrong when it comes to Scripture.[2]

To say this is a decidedly anti-young-earth creationist (YEC) book is an understatement. Rana chides and belittles YECs at regular intervals, making it clear that we represent the greatest opposition to his need to keep the faithful in line lest they begin to question his teaching on a very old earth. In fact, the introduction, every chapter,

the conclusion, and even the appendix include arguments directed specifically at those of us who hold to a young earth.

Barely five paragraphs into the introduction, Rana launches his attack on young-earth creationists. Initially he begins his treatment of YEC teaching by pitting it against "true science" and characterizing YECs as having "only a line of reasoning" in the face of "true scientific fact".

It is not surprising that I am the first young-earth creationist that Rana names (in the very paragraph following his opening salvo against YECs). To his credit, Rana does correctly report that I published original scientific findings on soft tissue, being the first to report on soft tissue in a *Triceratops* horn.[3] However, as you will note in my review of chapter 4 below, Rana exposes his ignorance of the true significance of that work.

A glaring example of this lack of understanding is seen when Rana uses the phrase "soft tissue remnants" (eleven times in the introduction alone). By doing so, he illustrates a conspicuous disregard of the stunning and copious numbers of fantastically preserved bone cells (osteocytes) I have found not only in *Triceratops* but also in *Nanotyrannus* vertebra and metatarsals (figures 1 and 2). *Nanotyrannus* is a recently erected genus related to *T. rex*.

Radiometric dating

Chapter 3 of the book is a review of the radiometric dating methods. There are many fine resources available that discuss and expose this topic from a YEC and biblical point of view.[4] However, Rana must mount a vigorous reinforcement of radiometric dating at this juncture, because stunning dinosaur soft cells appear to throw these other dating methods 'under the bus'. Rana even writes, on page 12: "The goal of chapter three is to demonstrate why radiometric dating *is* trustworthy [emphasis in the original]." That's a curious statement if radiometric dating is unquestioned.

Nevertheless, Rana dives into radiometric dating methods in chapter 3 with a thorough enough review. He devotes significant time to the intricacies and technicalities of the methods, and that it requires the use of "experts who have spent years working with these techniques" (chapter 3, p. 44) to understand it, and "geochemists who possess a good understanding" to get it right (p. 45). He mentions in passing, however, that it can be "tricky" and that "rare exceptions do exist where chemical and physical processes do alter the radioactive decay rate" (p. 41). It is a shame that he misses the opportunity to share with his readers that there has been an observed solar influence on some nuclear decay rates.[5,6] If we are just now discovering influences on some decay rates such as these solar ones, who knows what other influences that we know nothing about might also alter these 'constant' rates?

It is in this chapter, however, that Rana must be corrected on two very important misrepresentations. The first is his conspicuous misunderstanding that

> "Armitage … uncovered soft, flexible brown sheets about 8 inches by 4 inches [20 cm x 10 cm] in size from the *Triceratops* fossilized horn *after* soaking pieces of it in a mild acid bath for a month [emphasis added]" (chapter 3, p. 50).

The *Triceratops* horn,[7] was not fossilized (permineralized). It responded to and was decalcified by the very weak acid EDTA that is used in pathology labs daily to decalcify bone (essentially EDTA serves to remove

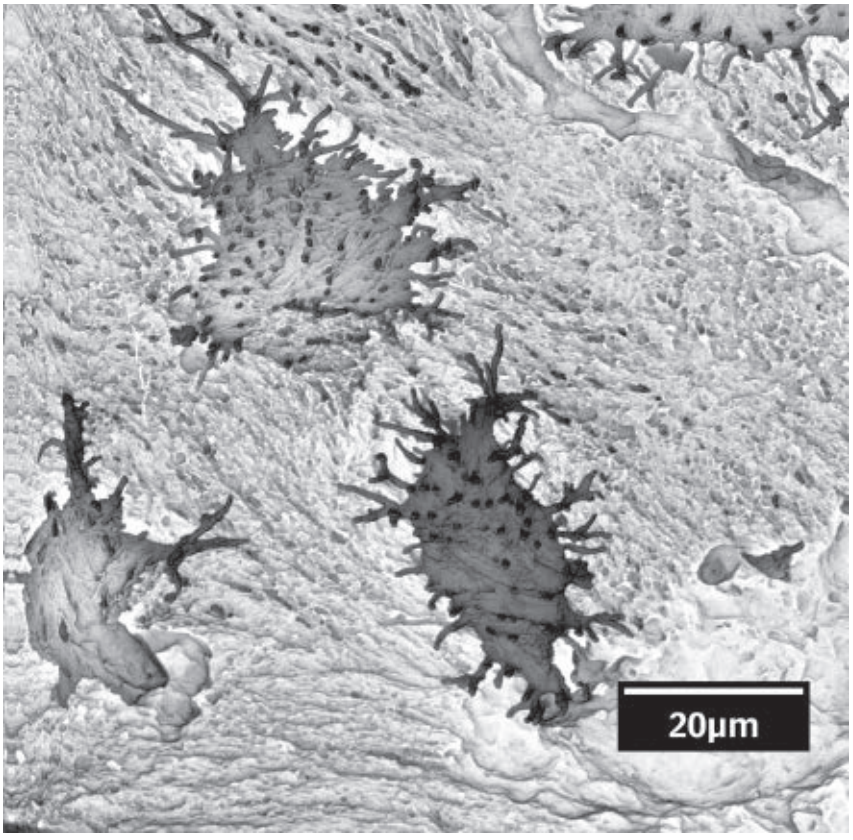

Figure 1. Osteocytes recovered from *Nanotyrannus* vertebra

calcium from the bone apatite lattice). Next, he needed only to read the second sentence of the abstract of that paper to realize how wrong he is about the soaking of the bone in that acid and the "soft, flexible brown sheets"! Or he might have simply read the caption of figure 5, which reads: "Light micrograph, flap of fixed soft tissue (white arrow) slightly peeled away from *undecalcified Triceratops* bone specimen (black arrow) [emphasis mine]." Regardless, my paper states on page 604: "Large strips of thin, light brown, soft material (20 cm by 10 cm) were recovered from the innermost sections of other fixed and unfixed, *non-decalcified* horn bone pieces [emphasis added]." In other words, the "soft, flexible brown sheets" that Rana refers to were found in *unsoaked* bone. There was no need to soak the bone in anything to get to them—they were simply lying there against hard bone.

Secondly, Rana assumes that pieces of the horn containing these "soft, flexible brown sheets" were submitted to ^{14}C dating, the results of which were reported by Thomas and Nelson.[8] This is simply not the case. I know what was submitted and what was not submitted for radiocarbon dating.

Based on this error, Rana builds a faulty argument supporting his contention that YECs make it "impossible that the ^{14}C they detected was endogenous to (produced within) the soft tissue". He contends that "that amount of (soft, flexible brown) material should have easily produced a strong ^{14}C signal" and that "It is impossible to reconcile the data reported with any scenario that would treat the flexible sheets of soft tissue as only 3,000 to 6,000 years old" (p. 50).

The piece of the *Triceratops* horn that was subjected (in this *initial* ^{14}C testing) was not from the centre of the bone where the "soft, flexible brown sheets" of fibrillar bone were found. I sent a chunk of the outer, weathered and fractured part of the 25 -cm (10 inch))-diameter horn. It is not surprising then that "older than expected" dates were received from the test because the specimen submitted was found upside down in the soil with all of its vascular elements facing up and exposed to rain, roots, microbes, insects etc, all of which might have degraded soft tissue in the outer bone.

The soft sheets have not been tested for ^{14}C. Rana did not know this fact regarding what was submitted for testing at the time he wrote his book, but he could have asked.

Therefore, his arguments with respect to the 'older' than expected ^{14}C age for the "soft, flexible brown sheets" of fibrillar bone, which should have had "a strong ^{14}C signal" (pp. 50–51), are invalidated. He also ignores the well-documented existence in the literature of strong ^{14}C signals in fossil shells and bones, oils, coals, and diamonds supposedly millions and billions of years old.[9]

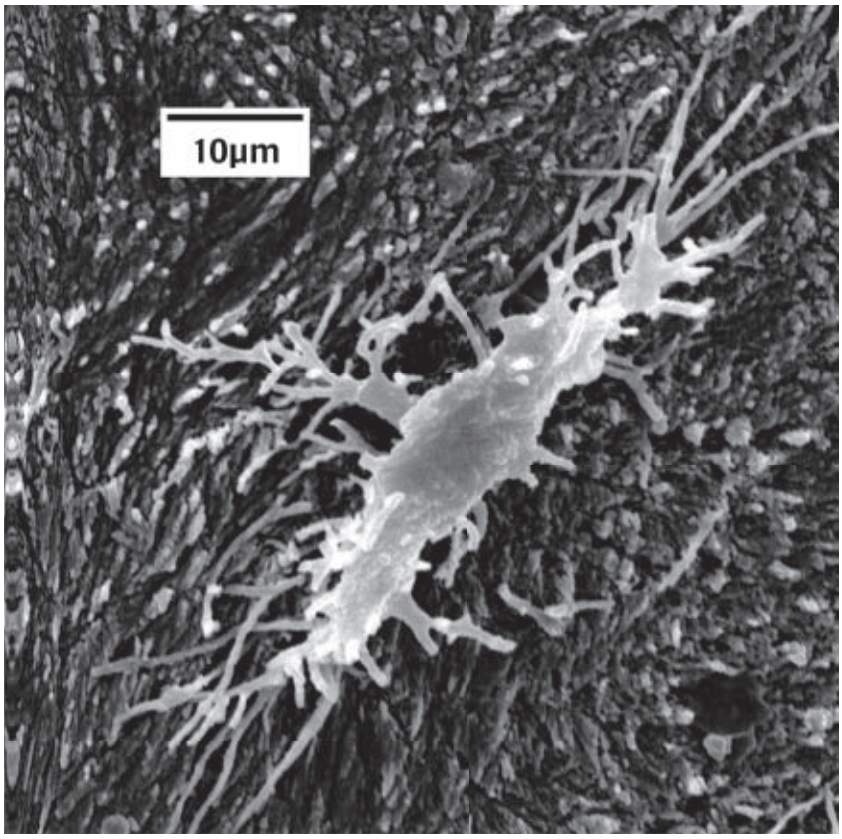

Figure 2. Osteocyte collected from *Nanotyrannus* metatarsal

The next chapter, chapter 4 of Rana's book, is his undoing, especially with respect to the soft fibrillar sheets of bone that have been discussed in the 2013 *Acta Histochemica* paper.[7] Rana contends: "most of the biomolecules that survived in the fossil remains of dinosaurs are made up of molecules with one of two properties:

(1) an extensive cross linking, or

(2) a chemical makeup similar to graphite".

He is not incorrect that collagen does feature a great deal of cross-linking, but the graphite comment could mislead some folks. Many biological tissues are characterized by the connecting together of many repeated polymer subunits. Graphite could be considered to have a more complex construction than do

biological tissues because of its far stronger bonds, but it is not itself biological. What is more, osteocytes are not collagen. They are delicate cells with no cross-linking in their structure. For that matter, neither is DNA, with no cross-linking whatsoever. Nevertheless, Rana proceeds to describe seven 'durable' chemical biological structures as potential reasons for the ongoing presence of dinosaur tissues in bone graveyards after millions of years of exposure in their shallow graves.

I note that little discussion is made here of the highly destructive actions of water molecules and oxidants (like those produced by the action of free iron) on once-living biological tissue systems. What is more, none of the seven 'durable' chemical structures have anything to do with the membranes of cells, like the thousands of osteocyte cells that I have recovered from dinosaur remains. The phospholipid bilayer membrane of every osteocyte cell is extremely vulnerable to the action of water and oxidants, which bring about massive decay.[10]

What is curious, however, is that Rana goes into some detail describing the durability of the heme molecule, and concludes: "the porphyrin ring [*which locks the iron molecule tightly to its centre*] is an extremely stable compound, which helps explain its presence in fossilized dinosaur bones [emphasis added]" (p. 61). Rana is actually making a very good argument here contradicting Dr Schweitzer's hypothesis that 'free' iron molecules work through Fenton chemistry reactions to produce hydroxyls and peroxyls (oxidants) which somehow 'fix' the soft tissues (like formaldehyde). If the heme molecule is 'extremely stable', then how is the iron liberated? Additionally, how do these liberated iron molecules 'fix' tissues with the dangerous hydroxyl oxidants *before* they can destroy the very tissues they are 'fixing'? None of this is explained by Schweitzer *et al.*[11] or Rana. [12]

On page 62, Rana confesses that he only has half an explanation at this point, as "durability alone is not sufficient to account for the survival of soft tissues in fossil remains for upwards of hundreds of millions of years". He then qualifies the importance of what he is about to tell us: "Many other conditions *must* also be met simultaneously." None of the nine stabilizing conditions he outlines (that *must* be met) relate to the *Triceratops* horn we recovered.

Necessary stabilizing conditions

Let us consider these nine 'stabilizing conditions':

1. "During fossilization [I think he means per-mineralization], mineral-rich water infuses the remains … the original minerals in the bone (and other parts) are replaced with minerals from the environment" (p. 62). In the case of the *Triceratops* horn, only the vessels that were open to the environment (and mineral-rich water) were hardened into stone. That is why they did not respond to decalcification. The bone, however, is still bone. One can see this clearly in figures 14 and 15 of my paper.[13] It responded to the same decalcification protocol that every pathology laboratory in the country employs to examine soft tissues in human bone. It is still bone. Therefore #1 is invalidated.
2. "Burial conditions also appear to be important … presumably water more readily drains away from animal remains … creating drier conditions, removing microbes and environmental enzymes" (p. 62). In the case of the horn, my paper stated clearly: "the horn was not desiccated when recovered and actually had a muddy matrix deeply embedded within it" (p. 606). There were "drier conditions" associated with the deposit, but it was not so in the horn. We described in several places in our paper that the horn was wet; therefore, it would have certainly been perfused with bacteria, microbes and environmental enzymes. Therefore #2 is invalidated.
3. For the third qualification, Rana discusses "Dry, anhydrous conditions", which we have just dealt with above, but here he seems to now argue for the need for wet samples! "Ironically, in some instances, a limited amount of water may actually help preserve biomolecules such as collagen" (p. 63). My question becomes, which is it? Wet or dry? His answer is apparently, both!
4. For this condition, Rana identifies oxygen as a "highly reactive, chemically destructive material that readily destroys organics" (p. 64), and therefore soft tissues in dinosaur remains must be segregated from oxygen in order to remain preserved. In several places in my *Acta Histochemica* paper,[7] including the figures, we noted that plant roots were abundant (even underlying some of the soft brown sheets) and that they probably contributed to the fracturing of the horn. Therefore, oxygen would have been present into the far reaches of the fractured bone. Yet large sheets of fibrillar bone, and exquisitely preserved osteocytes were present. Therefore #4 is invalidated.
5. For the fifth stabilizing condition, Rana emphasizes that soft tissue remains must be kept away from environmental influences, such as digestive enzymes or other chemicals that would otherwise destroy soft tissues. The standard and oft-repeated argument is that the soft tissues are protected by encapsulating hard bone, thus destructive enzymes cannot get to them. Programmed cell death and simple entropy alone would cause unfed, unattended cells to rot on their own, whether they were embedded in bone mineral or not. Therefore, they must have been preserved quickly to yield the stunningly preserved cells that we observe.

   Hence, for the 'iron preservation' theory to work and work quickly to prevent decay, cells and tissues had to

be available to 'free' iron, operating with water, under Fenton chemistry reaction conditions, which yield hydroxyls and peroxyls that supposedly stabilize the very tissues they are destroying. The soft tissues we observe must somehow have been miraculously sequestered from enzymatic actions and hydrolysis, while some 'stabilization' using these chemicals supposedly occurred. The 'free' iron must have been ripped away from the heme—an "extremely stable compound" (p. 61) which prevents the iron from actually being 'free'. The 'free' iron must avoid combining with oxygen in the presence of water, forming iron oxide compounds. Moreover, one other miracle, which must occur, is that all of this must take place in less than about 20 minutes before all of the blood clots make the 'free' iron less accessible.

Rana also identifies the presence of microorganisms, which would be the 'death-knell', as it were, to preserving soft tissues. Once again, hemoglobin purportedly comes into play in a miraculous way by serving as an antimicrobial, all-purpose disinfectant, protector, stabilizer, formaldehyde-fixing marvel that solves the problems that need solving and ignores the ones that need ignoring. In this case 'you can have your soft tissue and you can eat it too'.

6. It is at this point that Rana fully endorses the 'iron preservation' experiment, discussed above. It seems every creationist knows about this infamous and naïve experiment, and every evolutionist uses it to silence any opposition to its miraculous powers at preserving stunning cells and tissues for eons. Some of my objections to it must be answered by evolutionists, like Rana, if they wish to preserve credibility in the world of science.

   a. Schweitzer *et al.*'s materials and methods for the 'iron preservation' paper,[11] (which at one time were only available by searching the *Proceedings of the Royal Society B* website) are most telling. It appears, however, that the materials and methods 'electronic supplemental material' is no longer available online, at least not at the URL printed in the Schweitzer *et al.* paper. Nevertheless, the lengths that these workers had to go to gain access to the 'free' iron was monumental. Firstly, chicken and ostrich blood was combined with EDTA, which would have prevented any clotting. Next the blood solution was high-speed centrifuged multiple times to remove all plasma (which contains clotting proteins and enzymes), all platelets, and all white cells. Then, after subjecting the remaining red blood cells (RBCs) to a lysing solution on ice, which broke all of the RBC membranes, only hemoglobin was left. This is what the fresh tissues were soaked in for two years. This preparation of raw hemoglobin is hardly representative of conditions in the Hell Creek Formation deposits.

   b. Schweitzer *et al.*[11] used mass spectrometry (MS) to identify nine peptides (almost complete proteins) in dinosaur osteocytes, yet no MS was employed to study these peptides for results of hydrolysis, an easy test to do. The damage that hydroxyl and peroxyl molecules do to amino acids, such as asparagine and glutamine, would have been evident due to oxidation. Additionally, evidence of hydrolysis could have been looked for. We are told that the Hell Creek Formation was deposited under inland shallow seas, therefore hydrolytic damage should show up if Fenton reactions were active in the presence of water in these tissues. Moreover, as discussed above, the hydroxyls and peroxyls produced by Fenton chemistry are well known to be highly destructive to tissues.[10,14] Damage to these amino acids would be observable. What is more, Schweitzer *et al.*[11] explicitly state, "Oxy radicals facilitate protein cross-linking like formaldehyde", and then they reference Hawkins and Davies[15], whose cite some 240 papers showing that hydroxyls actually destroy tissues.

   Notwithstanding the problems mentioned above in liberating the 'free' iron from the clotting, the hemoglobin, and the heme molecule, plus the miraculous 'fixation' of Fenton reaction oxy radicals, Schweitzer *et al.*[11] merely examined the incubated tissues with light microscopy (only light micrographs were published) after the two-year experiment. No further detailed analysis was done.

   Rana[1] makes mention of the iron filaments found in concentrated form, and only in some samples by Schweitzer, but this reminds one of the well-known pooling of blood products at the lower portions of limbs and bodies after death, called livor-mortis. In fact, when I spoke at the Microscopy Society of America meeting in 2013, I flipped one of Schweitzer *et al.*'s[11] figures upside down and asked how iron filaments could reach across large swaths of tissue and provide fixation? Every head in the room bobbed up and down in agreement.

   c. Incubating soft tissue in highly prepared hemoglobin for two years in a laboratory container at constant temperature in the absence of water, heat, the freeze–thaw cycle of the Montana winters, microbes, bacteria, plant roots, fungal mats, insects, rodents, and all of the other naturally occurring environmental factors is unrepresentative of the conditions that these dinosaur remains were buried in. A more realistic experiment should be done that includes all these factors.

7. Rana admits that high temperatures are more detrimental to the preservation of soft tissues than are cooler

temperatures, but then he argues that high temperatures actually assist in their preservation! So again, which is it? The average Montana summer and winter temperatures are 31°C (88°F) and 13°C (9°F) respectively, plus rainwater, and melting snow and ice are large environmental factors that cannot be ignored. Therefore, the *Triceratops* horn that yielded soft tissues cycled through hot and below-freezing temperatures year after year and yet shows stunning preservation.

8. Neutral pH is desirable according to Rana's logic, but then so is highly acidic or highly alkaline! Again, I ask, which is it? Nevertheless, with all of the biotic activity in the Hell Creek Formation layers it is assumed that neutral pH, conducive to the presence of all the living organisms listed above, was the case for the *Triceratops* horn. Once again, a 'must have' stabilizing factor is invalidated.
9. Finally, Rana[1] argues that collagen survives better when buried in mineral-rich environments that coat collagen and sequester it from enzymes, decomposers, and the like. However, stunningly preserved osteocytes are not collagen, yet I am finding fully supple and soft cells, in large numbers with no evidence of permineralization. Once again, a 'must have' stabilizing condition outlined by Rana is invalidated.

Conclusion

None of these conditions apply to the soft sheets of fibrillar bone that I peeled away from interior sections of the fractured *Triceratops* horn collected less than 61 cm (2 ft) from the surface of the Montana badlands, nor to the thousands of soft cells I have recovered from within that horn to date.

More could be said about the rest of this book, but I believe the damage is done. Hastily arranged experiments that 'prove' that iron and Fenton chemistry preserved these stunning cells are demonstrably flawed. Neither can Rana expect that any of his conditions 'must' have been present to preserve the *Triceratops* horn tissues we have found.

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References

1. Rana, F., *Dinosaur Blood and the Age of the Earth*, RTB Press, Covina, CA, 2016.
2. For example, Mortenson, T. and Ury, T.H. (Eds.), *Coming to Grips with Genesis*, Green Forest, Master Books, AR, 2008.
3. Armitage, M.H., Preservation of *Triceratops horridus* tissue cells from the Hell Creek Formation, MT, *Microscopy Today* **24**(01):18–23, 2016 | doi:10.1017/S1551929515001133.
4. For example, Vardiman, L., Snelling, A.A. and Chaffin, E.F. (Eds.), *Radioisotopes and the Age of the Earth: A Young-Earth Creationist Research Initiative*, Institute for Creation Research; St. Joseph, MO, and Creation Research Society, El Cajon, CA, 2000; Vardiman, L., Snelling, A.A. and Chaffin, E.F. (Eds.), *Radioisotopes and the Age of the Earth: Results of a Young-Earth Creationist Research Initiative*, Institute for Creation Research, El Cajon, CA, and Creation Research Society, Chino Valley, AZ, 2005.
5. Jenkins, J.H., Herminghuysen, K.R. and Blue, T.E. *et al*., Additional experimental evidence for a solar influence on nuclear decay rates, *Astroparticle Physics* **37**:81–88, 2012.
6. Sibley, A., Variable radioactive decay rates and the changes in solar activity, *J. Creation* **27**(2):3–4, 2013; creation.com/radioactive-decay-rates-and-solar-activity.
7. Armitage, M.H. and Anderson, K.L., Soft sheets of fibrillar bone from a fossil of the supraorbital horn of the dinosaur *Triceratops horridus, Acta Histochemica* **115**:603–608, 2013.
8. Thomas, B. and Nelson, V., Radiocarbon in dinosaur and other fossils, *Creation Research Society Quarterly* **51**(4):299–311, 2015.
9. Vardiman, L., Snelling, A.A. and Chaffin, 2005, ref. 4.
10. McCord, J., Iron, free radicals and oxidative injury, *J. Nutrition* **134**(11): 3171S–3172S, 2004.
11. Schweitzer, M.H., Zheng, W., Cleland, T.P. *et al.*, A role for iron and oxygen in preserving soft tissues, cells and molecules from deep time, *Proceedings of the Royal Society B* **281:**2013.2741, 2014 | doi:10.1098/rspb.2013.2741; rspb.royalsocietypublishing.org/content/281/1775/20132741.
12. For more information, see DeMassa, J.M. and Boudreaux, E., Dinosaur peptide preservation and degradation, *Creation Research Society Quarterly* **51**(4):268–285, 2015.
13. Armitage and Anderson, ref. 7, p. 603.
14. Prousek, J., Fenton chemistry in biology and medicine, *Pure and Applied Chemistry* **79**(12):2325–2338, 2007.
15. Hawkins, C.L. and Davies, M.J., Generation and propagations of radical reactions on proteins, *Biochimica Biophysica Acta* **1504**:196–219, 2001.

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Flood processes into the late Cenozoic: part 3—organic evidence

Michael J. Oard

It is important in any Flood model to locate the Flood/post-Flood boundary, which will help determine which catastrophic events occurred late in the Flood and which happened after the Flood. The proper location will also determine the amount of post-Flood differentiation of animals after the Flood. Seven general features of the Tertiary organic record are summarized, showing that they are unlikely to be accounted for by post-Flood catastrophism. These evidences are thick, pure coal seams; amber; oil and natural gas; micro-organism skeletons that can be thick and pure; the lack of mammals that died in the Flood while many millions supposedly died and were fossilized after the Flood; the existence of mammal graveyards; and the Tertiary 'order' of mammals. Although there are challenges, the Flood offers a much better paradigm for explaining these Tertiary organic mysteries.

Some creation scientists are attempting to develop a sophisticated Flood model. In this model, it is important to get the lower and upper boundaries correct. As a first estimation, it is good to deduce a general boundary by assuming the geological column. The exact placement in the geological column can be refined later. Determining the boundary also affects the amount of animal differentiation that must be explained after the Flood within the Genesis kinds, as well as settling controversies on biostratigraphy. Knowing the amount of post-Flood catastrophism will give us some idea of the environment in which both people and animals repopulated the earth at God's command.

A previous paper summarized seven general features of the Cenozoic sedimentary rocks that are best explained by the Flood and not by post-Flood catastrophism.[1] This paper gives an overview of seven general features of the Tertiary organic record that suggest a similar conclusion. These are thick, pure coal seams; amber; oil and natural gas; micro-organism skeletal layers; and the characteristics of Cenozoic mammal fossils, in particular the lack of mammals in the Mesozoic, mammal bonebeds, and the order of the Tertiary fossil mammal order (table 1).

Tertiary coal

It is estimated that between 12.3% and 28.7% of coal resources are Tertiary in age.[2] Many early Tertiary coal deposits are very thick and extensive, such as those in the Powder River Basin of north-east Wyoming and south-east Montana (figure 1). Some of these coal seams are nearly pure and extend about 100 km north-to-south, 25 km east-to-west, and range up to 75 m thick in the Powder River Basin.[3] Late Tertiary coal beds are found in several areas of the world, e.g. a late Miocene coal with polystrate trees in Hungary,[4] and the Miocene Latrobe coal in south-east Australia that is 100 m thick and covers about 565 km^2.[5]

Can post-Flood catastrophism account for Tertiary coal? It is plausible that trees and plants left on the surface after Flood water drainage could be mobilized and buried or swept into a large lake to possible form coal. It would take an enormous number of trees and plants and a method to *concentrate* them during burial to form a substantial thickness of coal over a large area. Mass wasting would tend to mix trees and plants with sediments, so that a thick, widespread, pure coal seam would be implausible. Then there is the problem of burial and re-exposure of thousands of metres of sediment, since it takes deep burial to form coal.

Otherwise, the plants must first grow, which based on the diameter of some logs in coal could take hundreds of years. Petrified tree stumps with diameters up to 2 m occur in a coalmine of early Cenozoic age in Alaska.[6] Vertical petrified trees up to about 2.5 m in diameter occur in the

Table 1. Summary of Cenozoic organic evidences best explained by Flood processes. The strength is based on the comparative likelihood of the Flood over possible post-Flood explanations.

Organic Evidences	Strength
1. Coal	strong
2. Amber	strong
3. Oil and natural gas	strong
4. Large, pure micro-organism skeletal layers	moderate
5. Lack of mammals buried in the Flood but millions afterwards	strong
6. Mammal bonebeds	weak
7. Fossil order and massive, numerous extinctions	moderate

Figure 1. The Wyodak coal seam in the north-east Powder River Basin, just east of Gilette, Wyoming, USA

early Cenozoic Absaroka Volcanics of Yellowstone Park, Wyoming (figure 2). Second, the plants must be uprooted and concentrated in one very thick, widespread, accumulation with very little sediment—a problem since mass wasting mixes material. Third, the material must be buried several thousand metres, since the temperature must be raised to around 200°C to form coal. Where is the burial sediment going to come from in a timeframe sufficient to form the coal? This is a major uniformitarian problem, which post-Flood models must also account for. Fourth, the overburden must later be eroded to expose the coal at or near the surface, which requires powerful post-Flood erosional mechanisms, often at high altitudes. The conditions a post-Flood model has to satisfy closely resemble the conditions present only during the Flood. Therefore, coal measures into the late Cenozoic are much better explained by Flood processes than post-Flood catastrophism.

Amber formed in the Flood

Amber is a hard, brittle fossil resin or pitch that is derived mostly from coniferous trees. It is usually yellow to brown in colour and is translucent or transparent. Amber is commonly associated with coal, found in marine sedimentary rocks, and needs water to form but cannot be oxidized.[7] Many types of organisms are preserved in amber, which are as diverse as diatoms, radiolarians, sponge spicules, bits of coral, foraminifera, and a spine of a larval echinoderm.[8,9] Even *marine* organisms are found in Cretaceous amber,[10] This observation is puzzling to uniformitarian scientists: "The presence of marine organisms in tree resin, however, seems highly unlikely".[11]

Amber is found at hundreds of sites worldwide and can be as old as the upper Paleozoic,[12] though most of it is found from the Cretaceous into the Miocene within the uniformitarian geological timescale.[13] The youngest amber from the Miocene is found in the Dominican Republic,[14] the western Amazon basin,[15] New Zealand, and Australia.[16] Early Cenozoic Baltic amber is probably the most well-known.[15] It is found in Poland, Russia, Germany, Lithuania, Latvia, Estonia, Denmark, Sweden, Great Britain, and Holland. Ninety percent of Baltic amber is found in a thin 32–40 km long layer on a peninsula in the Baltic Sea. Storms expose the amber in sea cliffs by eroding the Tertiary sedimentary rocks that contain the amber, and redistribute the amber on the beach. Mining operations began in the 1800s when the amber layer was discovered. The quantity mined so far is staggering: half a million kilograms. The size of the Baltic amber deposits raises the question of how so much resin could be secreted in one relatively small area—a challenge for any model.

Given these mysterious observations, it is not surprising that uniformitarian scientists cannot explain the origin of amber.[13,15,17] Martinez-Declòs and others ask: "How is amber transported from the producing tree to the sediment in which it is preserved?"[18]

Several of the properties of amber make a post-Flood catastrophic scenario unlikely. How can amber, which forms from trees, end up buried in marine sediments in a non-oxidizing environment, and be commonly associated with coal? The only possibility seems to be a lake environment with floating logs, such as observed at Spirit Lake, Mount St Helens, but on a much larger scale. In this scenario, there are additional problems of accounting for all the floating logs from trees that are not living today,[16] and the production of a prodigious amount of amber, sometimes containing

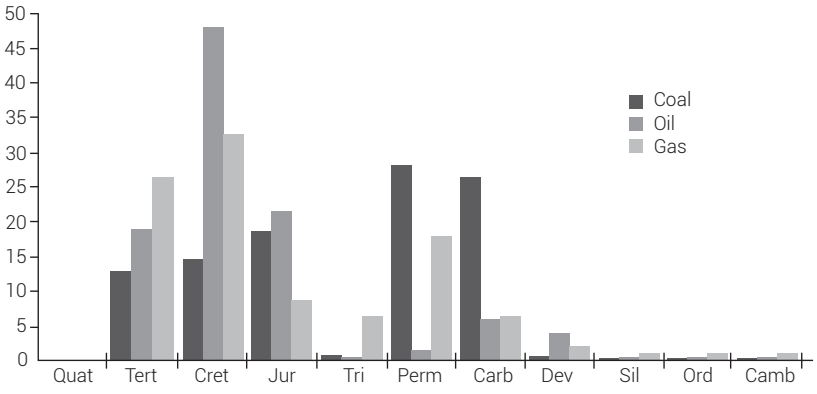

Figure 2. 2.5 m diameter vertical petrified tree at the top of Specimen Ridge, Yellowstone National Park, WY (Madison Gilmore provides scale)

organisms. The amber must still end up in a marine, non-oxidizing environment.

Logs mats floating in the Flood water potentially can account for the amber and the organisms in amber.[7] Billions of logs would likely have been floating on the Flood water and coalescing into mats after being uprooted during the onset of the Flood. These logs would be damaged by violent contact with other logs or rocks. Lambert and Poinar stated: "Numerous genera of plants all over the globe spontaneously *or as the result of trauma* produce sticky substances that have been termed resins [emphasis added]."[19] Trauma in today's environment can be caused by storm damage, fires, and outbreaks of wood-boring insects.[20] The greater trauma of Flood-induced damage would result in abundant resin exuded from the floating logs.

Since a large amount of amber comes from the Tertiary, even from the late Tertiary, amber seems best explained by the Flood and not by post-Flood catastrophism. Amber is a strong indication that the Flood/post-Flood boundary is in the very late Cenozoic, at least in those areas that contain the Miocene amber.

Oil and natural gas

Fossil fuels include coal, oil, and natural gas. They are the altered remains of buried marine and terrestrial organisms. Oil and natural gas represent only about 10% of the total carbon content in all fossil fuels; coal contains the largest amount of carbon by far. Oil is believed to form when burial temperatures of organic matter are raised to about 60–175°C, while natural gas probably forms between temperatures of 175 and 315°C.

Figure 3 shows the source rock for fossil fuels by period. Despite figure 3 being an estimate that could change with more exploration, it remains useful for this analysis. Figure 3 shows that there are no significant fossil fuels sourced from Quaternary rocks, which is mostly considered post-Flood, while substantial amounts are sourced from Tertiary and late Mesozoic rocks. It is estimated that between 15.2% and 19% of crude oil comes from Tertiary source rocks.[21]

An example of the great amount of oil from Cenozoic (Tertiary) sedimentary rock comes from the Green River Formation of Utah, Wyoming, and Colorado.[22] This formation is thought to have been deposited in a post-Flood lake by some creation scientists, and there is some evidence supporting this position, but there are several other features that point to a Flood origin. For example, it contains a huge amount of oil within the shale. It is estimated that there are 1.2 to 1.8 trillion barrels of oil, only 800 billion considered recoverable, in the Green River Formation. The recoverable oil is three times the proven oil reserves of Saudi Arabia and can supply the oil needs of the United States for 100 years.[23] Other Cenozoic sources of oil include the Orinoco oil belt of northern Venezuela and the Pear Springs, Asphalt Ridge, Hill Creek, and Sunnyside deposits in Utah.[24]

The vast quantity of fossil fuels, along with the hundreds of billions of fossils, argues for the burial of a huge amount of organisms in a large catastrophe, such as the Genesis Flood. It could be possible that local or regional mass wasting catastrophes could bury enough organisms to produce small quantities of oil and natural gas, but could they produce the amount of oil and gas generated in the Tertiary? It is possible that oil and natural gas could be abiogenic or partly abiogenic, but this is uncertain for many reasons.[25,26]

It would be difficult to account for the oil and natural gas that developed just in the Tertiary by postulated local to regional post-Flood catastrophes. This would especially be the case if oil is mostly produced from the remains of marine algae, as many petroleum geologists believe, because mass wasting would have to have occurred in the oceans or been carried into the oceans from the land. The burial of the tremendous amount of organic material to form the oil and natural gas in the Tertiary would require a very large cataclysm, consistent with the Flood but not with postulated post-Flood catastrophes. Holt summarizes the argument well:

"If one ignores the organic content of sediments, except for fossil fuels, placing the Flood/post-Flood other than late in the Cainozoic [Cenozoic] still creates severe difficulties for post-Flood

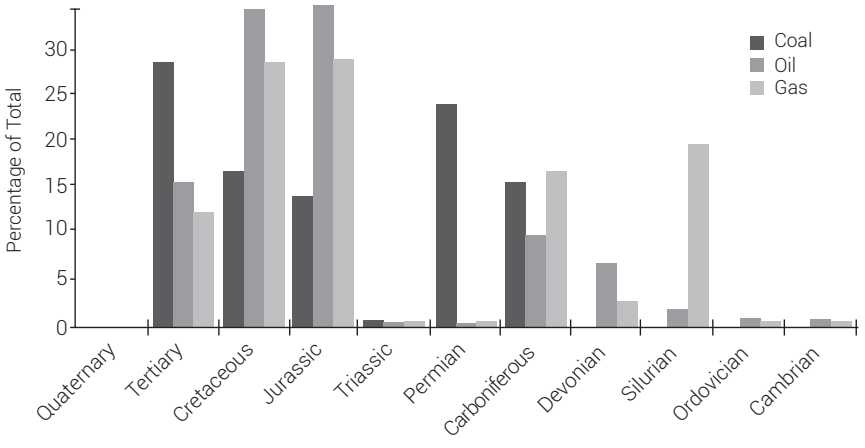

Figure 3. Distribution of coal, oil, and gas source rocks (from Holt[2] redrawn by Mrs Melanie Richard)

organic carbon accumulation and deposition. … Placement of the boundary at or near the end of the Mesozoic would require post-Flood time to be more productive than the Flood at producing heavy oil and tar sands. Any placement of the boundary other than late in the Cainozoic requires post-flood catastrophes and floods of enormous proportions."[27]

Micro-organism skeletal layers difficult to accumulate post-Flood

Extensive, thick layers of micro-organism skeletons are found in sedimentary rocks. The micro-organisms include the calcium carbonate skeletons of coccolithophores called coccoliths and the silica skeletons of diatoms. The former deposit is called chalk and the latter is diatomite or diatomaceous earth. These deposits are difficult for both uniformitarian scientists and Flood geologists to explain, but it seems like they would be even more difficult to explain by post-Flood mass wasting. Since chalk is usually dated as Cretaceous, below the K/T boundary, I will not discuss it. However, nearly pure diatomite is found in the Tertiary.

Diatoms are unicellular algae, lacking flagella, and have a skeleton of silicon dioxide (silica).[28] Living diatoms are ubiquitous, inhabiting the oceans and a wide range of freshwater habitats in abundance. Diatoms require light and so live in the upper part of water bodies. As they die and sink to the bottom, their skeletons pile up and the resulting deposit is called diatomite. Today, they mostly collect on the sea bottom below surface water that is cool, where they mix with a lot of other sediments that dilute the purity of the diatom deposit. The skeletons are also subject to dissolution in deep water.

One of the most significant Tertiary deposits of diatomite is the Miocene (early in the late Tertiary) deposit in the Monterey Formation in west-central California that has diatomite units up to 1,000 m thick.[29] Another layer is about 80 m thick in Peru within the Pisco Formation that is 200 to 1,000 m thick and dated as Miocene and Pliocene (late Tertiary).[30]

Just like with chalk, diatomite shows features that it was deposited rapidly. Whereas present ocean deposits are diluted with other sediments, those in the geological record are exceedingly pure, and therefore can be used in industrial processes.[31] Furthermore, there are also large fossils in diatomite that reinforce the conclusion that the deposits were buried rapidly. For instance, whales up to 25 m long are found in the diatomite of the Monterey Formation.[32] Creation scientists from the Geoscience Research Institute, Loma Linda University, California, found 346 whale skeletons in the Pisco Formation.[30,33] These whales were so well preserved that even some soft tissues was found. Just like with large organisms found in chalk, these well-preserved large vertebrates imply rapid burial because such large animals could not be preserved in the slow rain of diatoms to the ocean bottom observed today.

The uniformitarian model of slow accumulation of diatomite over millions of years has major problems. Huge blooms within the Flood potentially could account for them, although specific details need to be researched, similar to how Cretaceous chalk could have formed.[34] Can diatomaceous beds be explained by post-Flood catastrophism, such huge mass-wasting events? Not knowing of any specific models for these post-Flood catastrophes limits comment on them. It seems like it would be difficult to account for *pure*, *thick* Tertiary deposits of micro-organism skeletons after the Flood by heavy precipitation events and mass wasting.

Unique Cenozoic mammal fossil characteristics

Flood processes seem much better able to explain several aspects of Tertiary mammal fossilization than post-Flood mass wasting. For instance, if the Tertiary was post-Flood, then there would be a huge lack of Flood mammals, since there is a lack of fossilized mammals from the Mesozoic. Then there is the problem of how Cenozoic mammal graveyards would form. How would mass wasting concentrate mammals into thin layers? And finally, how can the Cenozoic mammal burial order be explained (if accepted by those who believe in post-Flood catastrophism)?

Where are all the Flood mammals?

Mammal fossils are almost exclusively found in the Cenozoic. There have been some mammals recently discovered in the Mesozoic,[35] and they are not the shrew-like mammals but ones with special features such as hooves and adaptions to digging, swimming, and burrowing.[35,36] These instances are still a very small number compared to those in Tertiary deposits.

If the Tertiary is a product of post-Flood mass wasting, where are the pre-Flood mammals that died and were buried in the Flood? The lack of mammals is unlikely in the Flood that buried all land creatures that breathed air. Why would the global catastrophe of the Flood bury very few mammals, while post-Flood catastrophes buried tens of millions?

If the Tertiary is post-Flood, the Tertiary mammal fossils found in the rocks would be a result of mammals spreading across the earth after leaving the Ark. The mammals would have to multiply dramatically and migrate globally, which would probably take at least a few hundred years. Then, they would have to be overwhelmed, buried, and fossilized in gigantic post-Flood mass wasting events. This would also

have to occur largely *before* the Ice Age, which is unlikely since all the conditions for the Ice Age to start were in place right after the Flood. Considering all the thick layers of Tertiary strata plus the erosion of the top of the strata, there must have been countless post-Flood catastrophes of regional scale.

How do mammal graveyards form after the Flood?

One would expect that in post-Flood catastrophes many mammals would be buried, but it seems unlikely that mammals would be concentrated into large graveyards such as those observed in Tertiary deposits. A recent book on bonebeds in sedimentary rock lists 25% of them in Tertiary strata.[37]

The Tertiary graveyard with the most concentrated mammals is likely that at Agate Springs in western Nebraska, USA. It is now Agate Fossil Beds National Monument and contains a wide variety of extinct Miocene mammals, mostly concentrated within layers in University and Carnegie Hills. Figure 4 shows a sample of the concentrated bones. There are supposed to be over 9,000 animals entombed here.

It would probably not be difficult to concentrate a *small* number of mammals into one graveyard during post-Flood catastrophes. However the Flood would better explain a large number at one location, such as those concentrated at Agate Springs.

How would the Tertiary order of mammals be explained?

According to the uniformitarian geological column, the Tertiary has a certain order of mammals that supposedly evolved and went extinct. The following arguments can also be made with other organisms in the Tertiary, but the discussion will focus on mammals. Those who believe the Tertiary represents a series of post-Flood catastrophes seem to believe this mammal fossil order.[38] So, this 'fossil order'

Figure 4. Mammal graveyard depiction at Agate Fossil Beds National Monument Visitors Center, western Nebraska, USA

must be explained during post-Flood catastrophism. It could be explained by how fast mammals multiplied and spread all over the world. Those that were fast would end up in the early Tertiary fossil record, while those that were slow would end up in the late Tertiary fossil record. Or there could have been a systematic change in climate that favoured certain mammals instead of others (see below). Regardless, in order to maintain the fossil order, mammals must go extinct in a certain order. How could so many different types of mammals go extinct over the *entire* earth throughout the Tertiary? Surely post-Flood catastrophes would not wipe out one particular mammal everywhere across the earth at the *same time*. For instance, why did the titanotheres, those rhinoceros-like beasts with strange horns, all go extinct in the late Eocene?[39]

It is claimed that the early Cenozoic was wet and warm, favouring certain types of mammals. Then the climate became cooler and drier in the late Cenozoic, causing the extinction of the early Cenozoic mammals and favouring other types of mammals that now show up in the strata of the late Cenozoic.[38] Wise and Richardson state:

> "Many of these animals would become extinct by the catastrophic and changing environments after the Flood, but many others would survive for a time—long enough to produce new generations of different organisms [within their kinds]."[40]

It is further claimed that the wet early Tertiary favoured those animals with a browsing diet, and the drier late Tertiary favoured those that ate grass.[41] That is why horses found in the Tertiary supposedly evolved longer teeth and legs with the earlier ones unable to survive and hence going extinct. The above scenario is simplistic from a climatic and environmental point of view, assuming post-Flood catastrophism, because it would be a generalization with many exceptions. In a wet, warm post-Flood climate, there would always be dry, cool areas and in a dry, cool climate, there would be warm, wet areas. So, one would expect that in the above climates very few mammals would be systematically wiped out globally. Janis *et al.* state in respect to supposed horse evolution, still used to date sedimentary layers:

> "The story of evolutionary progression to the present-day genus *Equus* also overlooks the fact that, in addition to the mid Miocene radiation [spreading out] of the hypsodont Equinae [horses with long teeth], there was also a radiation of more specialized horses within the subfamily Anchitheriinae. These equids were obviously committed browsers (very low-crowned cheek teeth), with stocky limb proportions suggestive of a preference for closed habitats such as woodland (parentheses theirs)."[42]

So, you can see that there were browsers even during the dry late Tertiary.

Those who believe in post-Flood catastrophism must explain with a realistic mechanism the order of extinctions of a large number of different mammals in the Tertiary fossil record, all going extinct within several hundred years after the Flood.

Conclusions

Explaining the scope, provenance, and history of organic deposits in the Cenozoic with respect to the Flood has been a source of much controversy in the creationist literature. Different parties have suggested different factors are more important than others in determining where the post-Flood boundary should be located. This paper summarized seven features of the Tertiary organic material record that are better explained by Flood processes than post-Flood processes, such as heavy precipitation and mass wasting. Tertiary coal deposits, comparable in scope to other coal deposits unequivocally from the Flood, imply a history of burial by thousands of metres of sediment, heating to about 200°C, and erosion of the thousands of metres of sediment—the scale and history clearly fit a Flood explanation better than post-Flood catastrophism. The formation of amber is a unique process that uniquely fits Flood processes. The large quantities of oil and gas that originate in Cenozoic sediments provide a similar problem for post-Flood catastrophism to explain as with Tertiary coal. Thick, pure micro-organism skeletons have accumulated in the Cenozoic, which does not seem plausible in a scenario invoking heavy precipitation and mass wasting.

There are three mammal conundrums if the Tertiary were post-Flood. First, hardly any mammals would have died in the Flood while many millions were overwhelmed, buried, and fossilized *after* the Flood. Second, mammal graveyards found in thin Tertiary layers are also difficult to explain. And third, the evolutionary order of the mammals must be accounted for by post-Flood catastrophes.

These factors favour a Flood mechanism for Tertiary organic remains, and Tertiary sedimentary rocks.

References

1. Oard, M.J., Flood processes into the late Cenozoic—sedimentary rock evidence, *J. Creation* **30**(2):67–75, 2016.
2. Holt, R.D., Evidence for a late Cainozoic Flood/post-Flood boundary, *J. Creation* **10**(1):157, 1996.
3. Seeland, D., Origin of thick Lower Tertiary coal beds in the Powder River Basins, Wyoming and Montana—some paleogeographic constraints, *U.S. Geological Survey Bulletin 1917—Q*, United States Geological Survey, Washington, D.C., 1993.
4. Hámor-Vidó, M., Hofmann, T. and Albert, L., In situ preservation and paleoenvironmental assessment of *Taxodiacea* fossil trees in the Bükkalja Lignite Formation, Bükkábrány open cast mine, Hungary, *International J. Coal Geology* **81**:203–210, 2010.

5. Holdgate, G.R., Cartwright, I., Blackburn, D.L. *et al.*, The middle Miocene Yallourn coal seam—the last coal in Australia, *International J. Coal Geology* **70**: 95–115, 2007.
6. Oard, M. J. and H. Giesecke, Polystrate fossils require rapid deposition, *Creation Research Society Quarterly* **43**(4):232–240, 2007.
7. Oard, M.J., (ebook). *The Genesis Flood and Floating Log Mats: Solving Geological Riddles*, Creation Book Publishers, Powder Springs, GA, 2014; usstore.creation.com/catalog/flood-floating-epub-digital-p-1954.html?osCsid=hhql8llu2q4jhfnp3hddj9dv41.
8. Girard, V., Schmidt, A.R., Saint Martin, S. *et al.*, Evidence for marine microfossils from amber, *Proceedings of the National Academy of Science* **105**(45): 17426–17429, 2008.
9. Girard, V., Saint Martin, S., Saint Martin, J.-P. *et al.*, Exceptional preservation of marine diatoms in upper Albian amber, *Geology* **37**(1):83–86, 2009.
10. Oard, M.J., Marine fossils in amber suggest the Flood log-mat model, *J. Creation* **24**(1):9–10, 2010; http://creation.com/images/pdfs/tj/j24_1/j24_1_9-10.pdf.
11. Girard *et al.*, ref. 8, p. 17426.
12. Antoine, P.-O., Franceschi, D.D., Flynn, J.J. *et al.*, Amber from western Amazonia reveals neotropical diversity during the middle Miocene, *Proceedings of the National Academy of Science* **103**(37):13595–13600, 2006.
13. Martinez-Declòs, X., Briggs, D.E.G. and Peñalver, E., Taphonomy of insects in carbonates and amber. *Palaeogeography, Palaeoclimatology, Palaeoecology* **203**:19–64, 2004.
14. Grimaldi, D. and Engel, M.S., *The Evolution of Insects*, Cambridge University Press, New York, NY, 2005.
15. Poinar, Jr., G.O., *Life in Amber*, Stanford University Press, Stanford, CA, pp. 16–29, 1992.
16. Lambert, J.B., Johnson, S.C., Poinar, Jr., G.O. and Frye, J.S., Recent and fossil resins from New Zealand and Australia, *Geoarchaeology* **8**(2):141–155, 1993.
17. McKellar, R.C., Wolfe, A.P., Tappert, R. and Muehlenbachs, K., Correlation of Grassy Lake and Cedar Lake ambers using infrared spectroscopy, stable isotopes, and palaeoentomology, *Canadian J. Earth Sciences* **45**: 1061–1082, 2008.
18. Martinez-Declòs *et al*., ref. 13, p. 51.
19. Lambert, J.B. and Poinar, Jr., G.O., Amber: the organic gemstone, *Accounts of Chemical Research* **35**(8):628–636, 2002.
20. Grimaldi and Engel, ref. 14, p. 57.
21. Holt, ref. 2, p. 157.
22. Oard, M.J. and Klevberg, P., Green River Formation very likely did not form in a postdiluvial lake, *Answers Research J.* **1**:99–107, 2008.
23. Bartis, J.T., LaTourrette, T., Dixon, L. *et al*., *RAND Corporation oil shale development in the United States prospects and policy issues*, MG-414-NETL, 2005.
24. Holt, ref. 2, p. 158.
25. Snelling, A.A., *Earth's Catastrophic Past: Geology, Creation & the Flood*, Institute for Creation Research, Dallas, TX, pp. 965–976, 2009.
26. Holt, ref. 2, p. 154.
27. Holt, ref. 2, pp. 160–161.
28. Brasier, M.D., *Microfossils*, George Allen and Unwin, London, UK, pp. 39–44, 1980.
29. Brasier, ref. 28, p. 43.
30. Brand, L.R., Esperante, R., Chadwick, A.V. *et al*., Fossil whale preservation implies high diatom accumulation rate in the Miocene-Pliocene Pisco Formation of Peru, *Geology* **32**(2):165–168, 2004.
31. Snelling, ref. 25, p. 926.
32. Snelling, A.A., The whale fossil in diatomite, Lompoc, California, *J. Creation* **9**(2): 244–258, 1995.
33. Oard, M.J., Dead whales: telling tales? *Creation* **26**(4):10–14, 2004.
34. Snelling, A.A., Can Flood geology explain thick chalk beds? *J. Creation* **8**(1): 11–15, 1994; creation.com/can-flood-geology-explain-thick-chalk-beds.
35. Oard, M.J., Jurassic mammals—more surprisingly diverse, *J. Creation* **21**(2): 10–11, 2007.
36. Werner, C., *Evolution: The Grand Experiment Vol. 2: Living Fossils*, New Leaf Press, Green Forest, AR, pp. 169–182, 2008.
37. Behrensmeyer, A.K., Bonebeds through time; in: Rogers, R.R., Eberth, D.A. and Fiorillo, A.R. (Eds.), *Bonebeds: Genesis, Analysis, and Paleobiological Significance*, University of Chicago Press, Chicago, IL, p. 72, 2006.
38. Wise, K.P., *Faith, Form, and Time: What the Bible Teaches and Science Confirms about Creation and the Age of the Universe*, Broadman & Holman Publishers, Nashville, TN, pp. 218–219, 2002.
39. Part of this extinction timing is due to circular reasoning in that when a titanothere fossil is found in the rocks, it is automatically dated no older than late Eocene.
40. Wise, K.P. and Richardson, S.A., *Something from Nothing: Understanding What You Believe about Creation and Why*, Broadman & Holman Publishers, Nashville, TN, p. 173, 2004
41. Janis, C.M., Damuth, J. and Theodor, J.M., The origins and evolution of the North American grassland biome: the story from the hoofed mammals, *Palaeogeography, Palaeoclimatology, Palaeoecology* **177**:183–198, 2002.
42. Janis and Theodor, ref. 41, pp. 184–185.

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Flood processes into the late Cenozoic: part 4—tectonic evidence

Michael J. Oard

This paper presents five Cenozoic Erathem tectonic processes best explained by the Flood. These are the stupendous differential vertical tectonics: huge horizontal plate movements, including the crashing of India into Asia (assuming catastrophic plate tectonics); the emplacement of ophiolites; the development of metamorphic core complexes; and the emplacement of ultrahigh-pressure minerals.

Tectonics, more than any other process or event, should show whether the Cenozoic Erathem, mainly the Paleogene and Neogene Systems, was a result of the Flood. The sheer magnitude of the Cenozoic tectonic events should be most persuasive. This paper will explore five tectonic processes evident in the Cenozoic Erathem. These are additional evidences that are best explained by Flood tectonics and not post-Flood catastrophism (table 1).

Huge Cenozoic vertical tectonics

The Cenozoic Erathem is characterized by huge vertical tectonics. Many of the mountain ranges within the greater Rocky Mountains in the western US, which include about 100 individual small ranges, have uplifted *thousands of metres* relative to the same rocks in adjacent valleys or basins. The mountains rose or the basins sank or both. During uplift, the valleys and basins filled up with thousands of metres of sediment. Later, hundreds of metres of these same sediments were eroded off the top.[1]

Differential vertical tectonics, Rocky Mountains

In Wyoming, the spread of quartzite cobbles and gravels during the Cenozoic ended up several mountain ranges from their source in the western Rocky Mountains. This indicates that the granitic upper crust probably was generally level at one time (figure 1).[2,3] Therefore, mountains must not have been a barrier at the beginning of quartzite transport. Moreover, the same sedimentary rocks found as erosional remnants on the tops of the mountains (figure 2) match tilted sedimentary rocks along the edges of the adjacent basins that continue underneath the flatter sedimentary rocks in the middle of the basins (figure 3). Since sediments are generally laid horizontally, it indicates a generally flat upper crust over large areas at the time of deposition.

So, if we compare the height of the granite and gneiss upper crust in the mountains and the same crust in the adjacent valleys or basins, we can determine the amount of uplift of the mountains relative to the valleys and basins. This comparison suggests that the Beartooth Mountains rose 7,000 m,[4] the Teton Mountains rose about 9,000 m,[5] the Wind River Mountains about 13,500 m,[6] and the Rawlins uplift was 11,300 m with respect to the Hanna Basin.[7,8] Moreover, the Uinta Mountains of northeast Utah rose over 12,000 m.[9] Wallace Hansen summarizes:

> "The upbuckling that produced the mountains was accompanied by comparable downbuckling under the basins. *As the mountains rose, the basins subsided*, so that deposits once near sea level throughout the region are now 12,000–13,000 feet high in the mountains but are as much as 30,000 feet below sea level beneath the Green River and Uinta Basins [emphasis added]."[10]

Hansen essentially paraphrases Psalm 104:8 in discussing the differential vertical tectonics of the Uinta Range. Figure 4 is a schematic summarizing the 12,000 m of differential vertical tectonics between the Uinta Range and the adjacent basins.

Practically all this tectonic offset in the Rocky Mountains occurred during the Cenozoic. For instance, the Uinta Mountains rose in the Cenozoic. The Teton Mountains are believed to have risen mostly in the past 5 Ma (in the uniformitarian timescale), near the end of the late Cenozoic.[11]

Table 1. Summary of Cenozoic tectonic evidences best explained by Flood processes. The strength is based on my subjective opinion on whether a K/Pg Flood/post-Flood boundary interpretation can explain them with post-Flood catastrophes.

Tectonic Evidences	Strength
1. Huge vertical tectonics	Strong
2. Tremendous horizontal plate movements	Strong
3. Ophiolites	Strong
4. Metamorphic core complexes	Moderate
5. Ultrahigh-pressure minerals	Strong

Differential vertical tectonics, worldwide

It can be shown that such uplift as deduced from the Rocky Mountains also occurred *worldwide*. Several examples will be presented with a summary from Ollier and Pain's book, *The Origin of Mountains*.[12] The Atlas Mountains of northwest Africa rose to a height of 4,167 m, while some of the basins within and surrounding the Atlas Mountains have sunk by at least this same amount.[13] All this uplift occurred in the late Cenozoic.[14]

The Mediterranean Sea basins, including the Pannonian Basin of Romania and Hungary, developed mostly in the Cenozoic.[15,16] At the same time, the surrounding mountains uplifted, many of which were overthrusted away from the basins during extensional tectonics accompanied by much metamorphism. The Cenozoic differential vertical tectonics amounted to thousands of metres.

The mountains of south-central Asia, including the Himalayas, the Tian Shan, and the Zagros Mountains, as well as the Tibetan Plateau, rose thousands of metres while surrounding basins sank thousands of metres. During this time, tremendous erosion of the mountains piled up coarse gravel deposits up to 3,000 m thick, extending from the edge of the mountains and thinning toward the centre of the basins.[17] The coarse gravel is generally rounded by water, and sometimes composed of boulders longer than 2 m. Gravel layers parallel to the mountains are sheet-like, hundreds of miles long. Figure 5 shows the sheet

Figure 2. Beartooth Butte, 490 m thick, with marine fossils is an erosional remnant on top of the Beartooth Mountains, south-central Montana and north-central Wyoming.

Figure 3. Tilted Paleozoic and Mesozoic Erathem strata at the northwest edge of the Bighorn Basin at Clarks Canyon adjacent to the southeast Beartooth Mountains

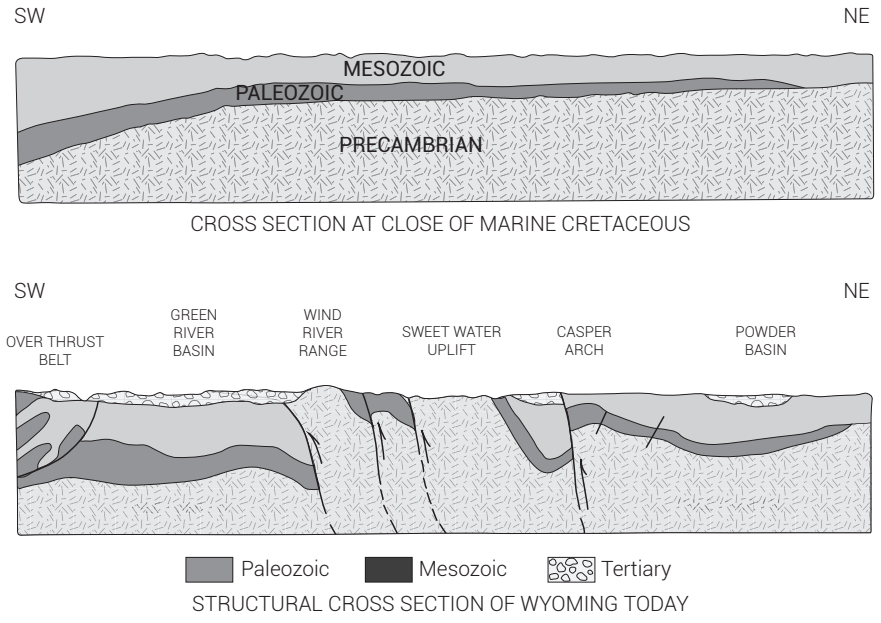

Figure 1. Schematic of the uniformitarian view of the Precambrian granitic crust below Paleozoic and Mesozoic Erathem sedimentary rocks in Wyoming at the end of the Mesozoic deposition and at present (redrawn by Mrs Melanie Richard from Glass, G.B., and Blackstone, D.L., Geology of Wyoming, Information Pamphlet No. 2, The Geological Survey of Wyoming, Laramie, WY, 1994, p. 3).

like gravels in the Sichuan Basin east of the Tibetan Plateau. All this activity is dated to the late Cenozoic.[18]

In southwest Asia, the Greater Caucasus Mountains have risen as much as 5,642 m while the South Caspian Basin has subsided around 27,000 m.[19,20] The Alborz Mountains, Iran, wrap around the southern part of this basin and are believed to have uplifted a significant amount at the same time as the South Caspian Basin subsided.[21] This tremendous differential vertical tectonics of 32,600 m all happened in the Cenozoic: "The South Caspian basin evolved adjacent to the rapidly uplifting Greater Caucasus Mountains since the Paleogene [early Cenozoic]".[22]

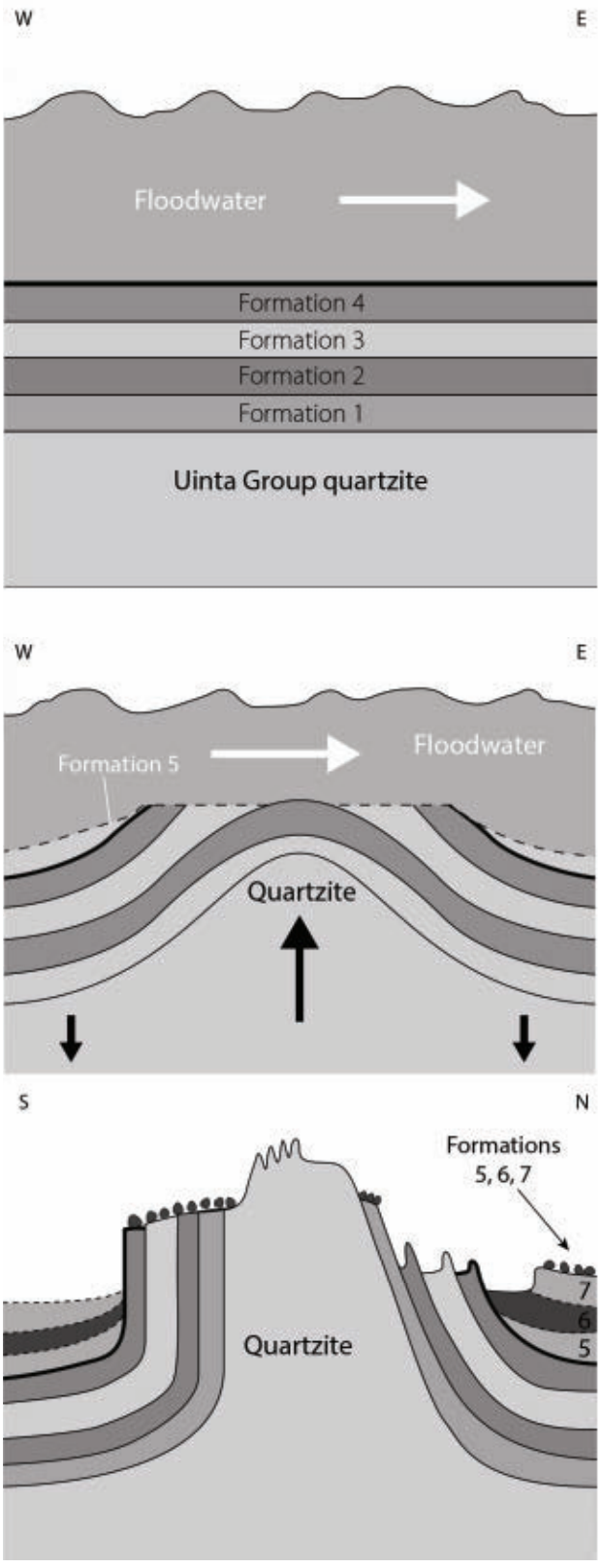

Figure 4. Three-step schematic of differential vertical tectonics during the Flood for the Uinta Mountains and the adjacent basins (drawn by Mrs Melanie Richard)

Implication

Ollier and Pain stated that the major uplift of nearly *all* the mountains of the world occurred in the last part of the latest Cenozoic Erathem.[14] Presumably the basins and valleys sank at the same time. Whitmore has suggested uplifts of a thousand metres or so after the Flood,[23] but the actual Cenozoic differential vertical tectonics is sometimes an order of magnitude or more than he has suggested. Such tremendous global-scale differential vertical tectonics is more likely characteristic of the Flood and harder to explain with a local catastrophe after the Flood.

Tremendous horizontal plate movements

Not only were there tremendous differential vertical movements during the Cenozoic Erathem, but there were also tremendous horizontal plate movements, assuming the catastrophic plate tectonics (CPT) model. The amount of movement can be calculated by marine magnetic anomalies. Advocates of plate tectonics translate the small intensity variations into different magnetic directions.[24] In areas of below average magnetic intensity, it is assumed that the magnetic field was reversed, and vice versa, with above average intensity. However, changes in magnetic intensity can be due to other causes, such as changes in magnetic susceptibility, which opens up other possibilities for the explanation of marine magnetic anomalies besides plate tectonics.[25]

According to CPT theory, the supercontinent Pangaea did not start breaking apart until about midway through the Mesozoic Erathem, just prior to the Cenozoic Erathem. This implies much of the total plate movement occurred during the Cenozoic, which Whitmore believes is post-Flood.[25] For instance, the South Atlantic Ocean opened up 2,400 km, the South Pacific 2,600 km, and the North Pacific 5,000 km during the Cenozoic alone.[26]

Also during the Cenozoic, India collided with Asia.[27] This is the time when Tibet, the Himalaya Mountains, and other mountains of south-central Asia started to rise with the greatest rise in the late Cenozoic. Such an event seems like it could only have happened during the Flood and not afterwards.

Special catastrophic tectonics during the Cenozoic

Besides rapid and intense vertical and horizontal tectonics of the earth's crust and upper mantle, there were also a number of other catastrophic tectonic events during the Cenozoic. These include the emplacement of ophiolites, metamorphic core complexes, and ultrahigh-pressure minerals.

Ophiolites

Ophiolites are claimed to be pieces of ocean crust and upper mantle that have been thrust up onto continental crust and are now found especially in mountains and along continental margins.[28–30] Numerous ophiolites outcrop extensively in the mountains from the Alps eastward into the Himalayas.[31] An ideal ophiolite suite consists from bottom to top of peridotite, gabbro, sheeted dikes, basalt with pillow lavas, and sedimentary rocks. The peridotite is an upper mantle rock, while the remainder of the sequence is considered ocean crustal layers. However, there are parts of this vertical sequence commonly missing, except for the upper mantle rocks. For instance, the sheeted dike complex and the sedimentary rocks are often missing. The basalt can also vary from thin to absent. So, ophiolites are mainly identified by upper mantle rocks, and they may not necessarily represent ancient ocean crust since one or more of the oceanic upper crustal components are missing.

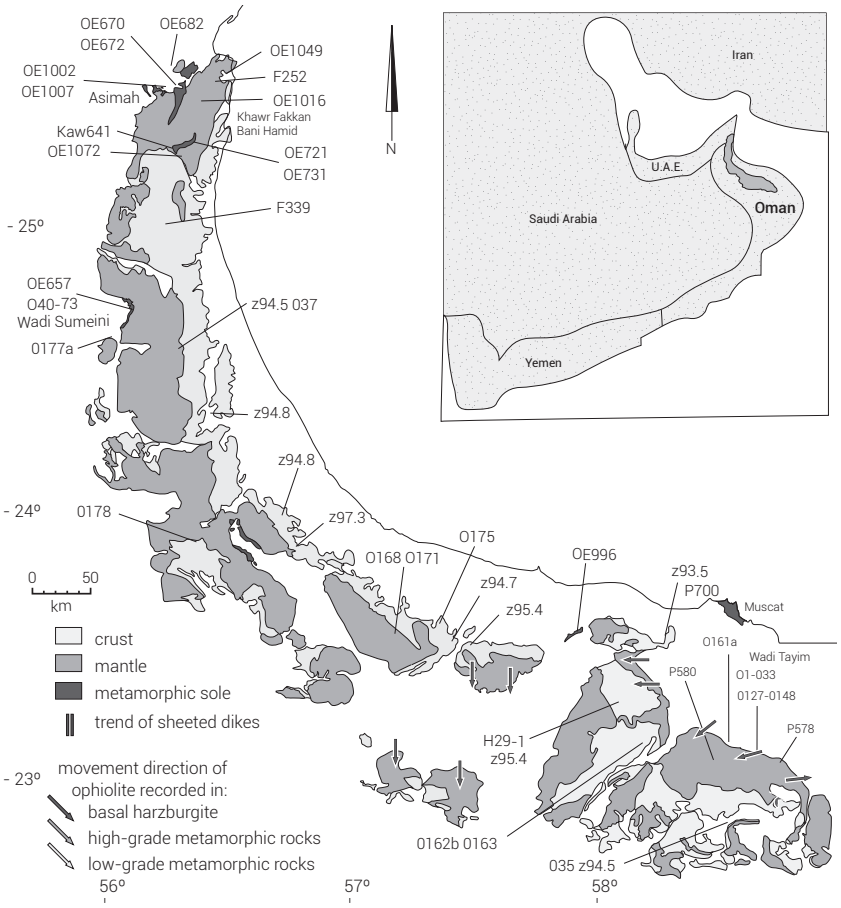

Figure 6. Oman ophiolite, also called the Samail ophiolite (from Hacker *et al.*,[32] p. 1231)

Figure 5. Thick gravel western Sichuan Basin, China (courtesy of Dr Vern Bissell)

Ophiolites can be over 10 km thick and sometimes of large geographical scale, such as the impressive arc-shaped Oman ophiolite that is about 150 km wide and 550 km long (figure 6).[32,33]

The origin of ophiolites has long been a subject of controversy.[34] A favoured hypothesis is that ocean crust was generated at mid-ocean ridges (MORs); spread out from the MORs; and, after colliding with continents, was forced up and over the continental crust, in some cases for possibly hundreds of kilometres. Ophiolites sometimes possess high temperature metamorphic rocks at their bases,[35] the grade of metamorphism decreasing downward below the base, indicating heating from sliding friction.[36] However, most ophiolites are now believed to have something to do with subduction zones, in which an oceanic

plate is diving below another oceanic plate or a continental plate. How this happens is a subject of dispute.[37]

Another problem is that there are no locations today where ophiolites are currently being 'slammed' against continental crust or being raised in mountains. In other words, there are no modern analogues,[38] which is contrary to the uniformitarianism principle upon which all mainstream geological interpretation is based. It also makes it difficult to develop a thorough understanding of any proposed mechanism. Dewey writes, "… no credible mechanisms have yet been devised for ophiolite obduction [pushed over continental crust] from ocean ridges onto rifted continental margins."[39] In regard to the Oman ophiolite, believed to have been thrust 200 km westward onto a passive continental margin, Hacker and colleagues are understandably mystified:

> "The emplacement of oceanic lithosphere [crust and upper mantle] onto continents remains one of the great mysteries of plate tectonics—how does ophiolitic material with a density of 3.0–3.3 g/cm^3 rise from its natural depths of ≥2.5 km beneath the ocean surface to elevations more than 1 km above sea level on continents with densities of 2.7–2.8 g/cm^3?"[40]

Ophiolites represent a conundrum to creationists also, but it is not the purpose of this article to define a mechanism.

Nonetheless, opthiolites are widespread and are dated anywhere from the mid Precambrian, about two billion years ago,[41] to the Cenozoic. There are not many Cenozoic ophiolites; they are more common in the Jurassic and Cretaceous System of rocks. Cenozoic ophiolites are found mainly in the southwest Pacific, especially Indonesia; the Red Sea area; southern Chile; and Japan.[42] Ophiolites have been studied in the northern Philippine Islands that are dated as late Mesozoic and early Cenozoic.[43] An ophiolite on Macquarie Island, south of New Zealand, is even dated as late Cenozoic.[44] Some of these Cenozoic ophiolites are on the continents and believed to have been emplaced somehow by plate tectonics. So, how would old ocean crust be emplaced by catastrophic plate tectonics *after* the Flood, if the Cenozoic was post-Flood?

Figure 7. Eastern Bitterroot Mountains showing the consistent 25° eastward slope of the edges of the mountains (view north down the Bitterroot Valley)

Ophiolites represent tremendous tectonic upheaval. The Flood was a colossal catastrophe and it seems more reasonable to emplace them during the Flood and not after the Flood.

Metamorphic core complexes

Metamorphic core complexes (MCCs) are generally domal or arch-like uplifts of metamorphic and granitic-type rock overlain by unmetamorphosed rocks that have usually slid downhill on a low-angle fault during doming.[45] The slide is commonly called a detachment fault. The resulting dome can sometimes be called a gneiss dome,[46] since it is mostly gneiss and granite that make up the dome. Sometimes ultrahigh-pressure minerals (see below) are associated with MCCs.[47] MCCs are relatively large structures; they can range from a few tens of km to around 100 km in width.[48] It is believed by many that the domes uplifted around 16 km,[49] and as a result the MCCs are often the highest mountains in the region.[50] MCCs are accompanied by much volcanism.

MCCs are numerous and their uniformitarian age is *predominantly* Cenozoic.[51] There are 25 MCCs near the axis of the mountains of the western United States, from southern Canada to northwest Mexico.[52] They are dated as both early and late Cenozoic. The largest is the Bitterroot dome-Sapphire block of west central Idaho and southwestern Montana.[53,54] In this MCC, the eastern edge of the Idaho Batholith uplifted and a block of rock 100 km long, 70 km wide, and 15 km thick broke off and apparently slid eastward about 60 km. The block that came to rest is the Sapphire Mountains. In between the Sapphire Mountains and the eastern edge of the Idaho Batholith, the Bitterroot Mountains, is the straight Bitterroot Valley (figure 7). Along the western edge of the valley, the angle of the mountain slope is the same at about 25°, which represents the slide surface for the eastward slide of the Sapphire block. Below the slide surface, several hundred feet of sheared rock, called mylonite, caused by the slide, are found.

Other Cenozoic MCCs are located in the Aegean Sea, Greece, Turkey, Iran, Tibet, Slovakia, Venezuela, Trinidad, New Zealand, and eastern New Guinea. The latter is the youngest, being dated as 2 to 8 Ma old.[55] It is also associated with ultrahigh-pressure minerals (see below).

MCCs are a uniformitarian conundrum. In regard to the rapid exposure of the core of the MCC in Papua, New Guinea, Little and colleagues stated, "The tectonic [uplift] processes by which this rapid exposure has been accomplished remain poorly understood."[56] MCCs are

believed to have formed during extension when the crust was being pushed apart horizontally. The late date of MCCs, mostly in the Cenozoic, was a surprise.

MCCS represent tremendous tectonic events. Scott Rugg points out that they uplifted rapidly with the sliding of huge blocks occurring rapidly late in the Flood.[57] Just like with ophiolites and ultrahigh-pressure metamorphic rocks (see below), the catastrophism of the Cenozoic was tremendous, which seems more like a Flood signature than a post-Flood phenomenon.

Ultrahigh-pressure minerals

Ultrahigh-pressure (UHP) minerals, as well as high-pressure (HP) minerals, and microdiamonds have been increasingly discovered on the earth's surface over the past 40 years or more.[58] These minerals have caused much frustration to uniformitarian scientists because such UHP minerals imply metamorphism at high pressures deep down in the earth, but the minerals are now found in a low-pressure environment at the earth's surface.

UHP minerals are believed to have originated predominantly from continental crust, which is lighter than ocean crust and the mantle. So, how does buoyant continental crust sink to depths deep enough to form UHP? Uniformitarian scientists used to say it could not happen. But the UHP minerals have forced these scientists to conclude that continental rocks must have been rapidly forced downward to great depths and then rapidly exhumed to the surface. Furthermore, the rocks often remained at low temperature while descending into a much hotter environment, implying rapid descent. UHP minerals must have also ascended rapidly because a slow exhumation should cause retrograde metamorphism and destroy the UHP minerals by converting them back to low pressure forms.

Each new discovery of UHP minerals has pushed the depth of descent farther downward, causing a predictable cycle of uniformitarian disbelief followed by forced acceptance.[59] Therefore, a paradigm change has been underway in geology because of UHP minerals:

> "The story of ultrahigh-pressure metamorphism (UHPM) is a confused mixture of surprising, sometimes spectacular, discoveries and emotional reactions. Surprisingly, the process has been a repeating cycle of disbelief followed by confirmation, with little evidence that the community response in a given cycle has learned from previous cycles."[60]

Uniformitarian geologists have hypothesized that continental collisions may account for the data, but the depth of descent is overwhelming. How such radical vertical tectonics can occur with continental collisions remains enigmatic:

> "As a consequence, thermomechanical insights inferred from P-T-t [pressure-temperature-time] reconstruction and structural studies of high-pressure terranes have relentlessly failed to reproduce the trajectories and the velocity field of mass transport in the crust during the entire orogenic [vertical tectonic] period and, most importantly, show no clue to the basic processes responsible for burial and rock exhumation and their relation to the global velocity framework of plate tectonics."[61]

That is not all. An analysis of UHP minerals suggests that some minerals had been driven down to depths of around 300 or 400 km and exhumed![62,63] Ultrahigh-pressure minerals, therefore, imply rapid sinking and uplift, unless they are the result of asteroid impacts, which can also cause such ultrahigh-pressure minerals to form, as well as microdiamonds.

Ultrahigh-pressure minerals are *commonly* found in Cenozoic rocks. UHP minerals in the Alps imply rapid uplift from about 100 km depth.[64] Late Cenozoic ultrahigh-pressure rocks are found in eastern Papua New Guinea, in a gneiss dome, also implying rapid exhumation from about 100 km depth.[65] High-pressure minerals from the mountains of southeast Spain are believed to have been uplifted from about 65 km in the *late* Cenozoic.[66] The ultrahigh-pressure rocks in the Himalayas, implying uplift from below 90 km, also have a Cenozoic age.[67] Diamonds in rocks from an intrusion in Japan indicate uplift of over 170 km.[68] It is interesting that the rock is assumed to be scrapped off and deformed material from the ocean as the Pacific Plate subducted beneath Japan. This means that the origin of the rock is believed to be from shallow depths, but the diamonds say otherwise. So, the diamonds with the assumed uplift are another uniformitarian mystery.

Catastrophic tectonics with sinking and uplifts of over 300 km would be expected during the Flood, since the Flood was a time of intense vertical tectonics, and possibly numerous impacts,[69] which may also have been a cause for the UHP minerals and microdiamonds. However, one would not expect such radical vertical tectonics after the Flood.

Conclusion

Evidence of major tectonics of various sorts occurred during the deposition of the Cenozoic Erathem rocks. This includes the many thousands of metres, sometimes over ten thousand metres, of differential vertical tectonics; the thousands of kilometres of horizontal plate movement, including the collision of India with south-central Asia; the emplacement of ophiolites; the development of metamorphic core complexes; and the emplacement of ultrahigh-pressure minerals.

Such enormous Cenozoic tectonics is much better placed in the Flood instead of afterwards. Every time the plates of the earth shift several metres, seismic waves cause intense earthquakes that kill people. With so much horizontal plate movement, including the crashing of India into the Himalayas, large movements on strike-slip faults, extreme differential vertical tectonics, and other tectonic events, the seismic violence would be immense and continuous for hundreds of years. The earthquakes would most likely have been equally intense all over the world. Huge areas would have flooded as regions tectonically sank. How could man and the animals spread and thrive after the Flood as God directed them if all these tectonics in the Cenozoic are placed after the Flood? It would be more logical for these events to have been part of the Flood catastrophe, as advocated by Baumgardner, one of the original authors of CPT.[70] In that way, significant CPT would not occur after the Flood; it would really have to have been part of Flood, if it occurred at all.[71]

References

1. Oard, M.J., Surficial continental erosion places the Flood/post-Flood boundary in the late Cenozoic, *J. Creation* **27**(2):62–70, 2013.
2. Oard, M.J., *Flood by Design: Earth's Surface Shaped by Receding Water*, Master Books, Green Forest, AR, 2008.
3. Oard, M.J., *Earth's Surface Shaped by Genesis Flood Runoff*, michael.oards.net/GenesisFloodRunoff.htm, 2013.
4. Wise, D.U., Laramide structures in basement and cover of the Beartooth uplift near Red Lodge, Montana, *AAPG Bulletin* **84**(3):360–375, 2000.
5. Love, J.D., Reed, Jr, J.C. and Pierce, K.L., *Creation of the Teton Landscape: Geological Chronicle of Jackson Hole & the Teton Range*, Grand Teton Association, Moose, WY, 2007.
6. Steidtmann, J.R., Middleton, L.T. and Shuster, M.W., Post-Laramide (Oligocene) uplift in the Wind River Range, Wyoming, *Geology* **17**: 38–41, 1989.
7. Otteman, A.S. and Snoke, S.W., Structural analysis of a Laramide, basement-involved, foreland fault zone, Rawlins uplift, south-central Wyoming, *Rocky Mountain Geology* **40**(1):65–89, 2005.
8. Love, J.D., Cenozoic sedimentation and crustal movement in Wyoming, *American J. Science* **258-A**:204–214, 1960.
9. Oard, M.J., The Uinta Mountains and the Flood Part I, Geology, *CRSQ* **49**(2): 109–121, 2012.
10. Hansen, W., *The Geologic Story of the Uinta Mountains*, Falcon guide, Guilford, CN, p. 104, 2005.
11. Love *et al*., ref. 5, p. 1.
12. Ollier C. and Pain, C., *The Origin of Mountains*, Routledge, London, 2000.
13. Sébrier, M., Siame, L., Zouine, E.M. *et al*., Active tectonics in the Moroccan high Atlas, *C.R. Geoscience* **338**:65–79, 2006.
14. Babault, J., Teixell, A., Arboley, M.L. and Charroud, M., A Late Cenozoic age for long-wavelength surface uplift of the Atlas Mountains of Morocco, *Terra Nova* **20**:102–107, 2008.
15. Agostini, S., Doglioni, C., Innocenit, F. *et al*., On the geodynamics of the Aegean rift, *Tectonophysics* **488**:7–21, 2010.
16. Faccenna, C., Piromallo, C., Crespo-Blanc, A. and Jolivet, L., Lateral slab deformation and the origin of the western Mediterranean arcs, *Tectonics* **23**, TC1012, doi:10.1029/2002TC001488, 2004.
17. Oard, M.J., Retreating Stage formation of gravel sheets in south-central Asia, *J. Creation* **25**(3):68–73, 2011.
18. Donnelly, T.W., Worldwide continental denudation and climatic deterioration during the late Tertiary: evidence from deep-sea sediments, *Geology* **10**: 451–454, 1982.
19. Knapp, C.C., Knapp, J.H. and Connor, J.A., Crustal-scale structure of the South Caspian Basin revealed by deep seismic reflection profiling, *Marine and Petroleum Geology* **21**:1073–1081, 2004.
20. Nadirov, R.S., Bagirov, E., Tagiyev, M. and Lerche, I., Flexural plate subsidence, sedimentation rates, and structural development of the super-deep South Caspian Basin, *Marine and Petroleum Geology* **14**:383–400, 1997.
21. Axen, G.J., Lam, P.S., Grove, M. and Stockli, D.F., Exhumation of the west-central Alborz Mountains, Iran, Caspian subsidence, and collision-related tectonics, *Geology* **29**:559–562, 2001.
22. Knapp *et al*., ref. 19, p. 1073.
23. Whitmore, J., The potential for and implications of widespread post-Flood erosion and mass wasting processes; in: Horstemeyer, M. (Ed.), *Proceedings of the Seventh International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, 2013.
24. Fowler, C.M.R., *The Solid Earth: An Introduction to Global Geophysics*, Cambridge University Press, New York, p. 43, 1990.
25. Oard, M.J., Literature criticisms of plate tectonics; in: Reed, J.K. (Ed.), *Plate Tectonics: A Different View*, Creation Research Society, Chino Valley, AZ, pp. 25–64, 2000.
26. Kennett, J., *Marine Geology*, Prentice-Hall, Englewood Cliffs, NJ, p. 121, 1982.
27. Hetzel, R., Dunki, I., Haider, V. *et al*., Peneplain formation in southern Tibet predates the India-Asia collision and plateau uplift, *Geology* **39**(1): 983–986, 2011.
28. Dilek, Y., Moores, E.M., Elthon, D. and Nicolas, A. (Eds.), *Ophiolites and Ocean Crust: New Insights from Field Studies and the Ocean Drilling Program*, GSA Special Paper 349, Geological Society of America, Boulder, CO, 2000.
29. Dilek, Y. and Newcomb, S. (Eds.), *Ophiolite Concept and Evolution of Geological Thought*, GSA Special Paper 373, Geological Society of America, Boulder, CO., 2003
30. Oard, M.J., What is the meaning of ophiolites? *J. Creation* **22**(3):13–15, 2008.
31. Moores, E.M., Kellogg, L.H. and Dilek, Y., Tethyan ophiolites, mangle convection, and tectonic 'historical contingency': a resolution of the 'ophiolite conundrum'; in: Dilek, Y., Moores, E.M., Elthon, D. and Nicolas, A. (Eds.), *Ophiolites and Ocean Crust: New Insights from Field Studies and the Ocean Drilling Program*, GSA Special Paper 349, Geological Society of America, Boulder, CO, pp. 3–12, 2000.
32. Hacker, B.R., Mosenfelder, J.L. and Gnos, E., Rapid emplacement of the Oman ophiolite: thermal and geochronologic constraints, *Tectonics* **15**(6): 1230–1247, 1996.
33. Searle, M. and Cox, J., Tectonic setting, origin, and obduction of the Oman ophiolite, *GSA Bulletin* **111**:104–122, 1999.
34. Dilek, Y., Ophiolite concept and its evolution; in: Dilek, Y. and Newcomb, S. (Eds.), *Ophiolite Concept and Evolution of Geological Thought*, GSA Special Paper 373, Geological Society of America, Boulder, CO, pp. 1–16, 2003.
35. Dewey, J., Ophiolites and lost oceans: rifts, ridges, arcs, and/or scrapings? in: Dilek, Y. and Newcomb, S. (Eds.), *Ophiolite Concept and Evolution of Geological Thought*, GSA Special Paper 373, Geological Society of America, Boulder, CO, pp. 153–158, 2003.
36. Whitehead, J., Reynolds, P.H. and Spray, J.G., The sub-ophiolitic metamorphic rocks of the Québec Appalachians, *J. Geodynamics* **19**:325–350, 1995.
37. Dewey, J.F. and Casey, J.F., The sole of an ophiolite: the Ordovician Bay of Islands Complex, Newfoundland, *J. the Geological Society, London* **170**: 715–722, 2013.
38. Dilek, ref. 34, p. 8.
39. Dewey, ref. 35, p. 156.
40. Hacker *et al*. ref. 32, p. 1230.
41. Kumar, K.V., Ernst, W.G., Leelanandam, C. *et al*., First Paleoproterozoic ophiolite from Gondwana: geochronologic-geochemical documentation of ancient oceanic crust from Kandra, SE India, *Tectonophysics* **487**: 22–32, 2010.
42. Dilek, Y. and Furnes, H., Ophiolite genesis and global tectonics: geochemical and tectonic fingerprinting of ancient oceanic lithosphere, *GSA Bulletin* **123**(3/4): 387–411, 2011.
43. Queaño, K.L., Ali, J.R., Aitchison, J.C. *et al*., Geochemistry of Cretaceous to Eocene ophiolitic rocks of the Central Cordillera: implications for Mesozoic–early Cenozoic evolution of the northern Philippines, *International Geology Review* **50**:407–421, 2008.

44. Varne, R., Brown, A.V. and Falloon, T., Macquarie Island: its geology, structural history, and the timing and tectonic setting of its N-Morb to E-Morb magmatism; in: Dilek, Y., Moores, E.M., Elthon, D. and Nicolas, A. (Eds.), *Ophiolites and Ocean Crust: New Insights from Field Studies and the Ocean Drilling Program*, GSA Special Paper 349, Geological Society of America, Boulder, CO, pp. 301–320, 2000.
45. Neuendorf, K.K.E., Mehl, Jr., J.P. and Jackson, J.A., *Glossary of Geology*, 5th edn, American Geological Institute, Alexandria, VA, p. 407, 2005.
46. Gressner, K., Wijns, C. and Moresi, L., Significance of strain localization in the lower crust for structural evolution and thermal history of metamorphic core complexes, *Tectonics* **26**, doi:10.2029/2004TC001768, 2007.
47. Ring, W., Will, T., Glodny, J. *et al.*, Early exhumation of high-pressure rocks in extrusion wedges: Cycladic blueschist unit in the eastern Aegean, Greece, and Turkey, *Tectonics* **26**: doi:10.1029/2005TC001872, 2007.
48. Tirel, C., Brun, J.-P. and Burov, E., Dynamics and structural development of metamorphic core complexes, *J. Geophysical Research* **113**, doi:10.1029/2005JB003694, 2008.
49. Boswell, J.T. and Colberg, M.R., Vertical variations in footwall rocks of the northern Snake Range, Nevada; implications for metamorphic core complex development, *GSA, Rocky Mountain Section Abstracts with Programs* **39**(5): 41, 2007.
50. Davis, G.H., Structural characteristics of metamorphic core complexes, southern Arizona; in: Crittenden, M.D., Coney, P.J. and Davis, G.H. (Eds.), *Cordilleran Metamorphic Core Complexes*, GSA Memoir 153, Geological Society of America, Boulder, CO, pp. 35–77, 1980.
51. Coney, P.J., Introduction; in: Crittenden, M.D., Coney, P.J. and Davis, G.H. (Eds.), *Cordilleran Metamorphic Core Complexes*, GSA Memoir 153, Geological Society of America, Boulder, CO, pp. 3–6, 1980.
52. Coney, P.J., Cordilleran metamorphic core complexes: an overview; in: Crittenden, M.D., Coney, P.J. and Davis, G.H. (Eds.), *Cordilleran Metamorphic Core Complexes*, GSA Memoir 153, Geological Society of America, Boulder, CO, pp. 7–31, 1980.
53. Hyndman, D.W., Bitterroot dome-Sapphire tectonic block, an example of a plutonic-core gneiss-dome complex with its detached suprastructure; in: Crittenden, M.D., Coney, P.J. and Davis, G.H. (Eds.), *Cordilleran Metamorphic Core Complexes*, GSA Memoir 153, Geological Society of America, Boulder, CO, pp. 427–443, 1980.
54. Hodges, K.V. and Applegate, J.D., Age of Tertiary extension in the Bitterroot metamorphic core complex, Montana and Idaho, *Geology* **21**:161–164, 1993.
55. Little, T.A., Baldwin, S.L., Fitzgerald, P.G. and Monteleone, B., Continental rifting and metamorphic core complex formation ahead of the Woodlark spreading ridge, D'Entrecasteaux Islands, Papua New Guinea, *Tectonics* **26**: doi;10.1029/2005TC001911, 2007.
56. Little *et al.*, ref. 55, p. 2.
57. Rugg, S.H., Detachment faults in the Southwestern United States—evidence for a short and catastrophic Tertiary period; in: Walsh, R.E. and Brooks, C.L. (Eds.), *Proceedings of the Second International Conference on Creationism*, technical symposium sessions and additional topics, Creation Science Fellowship, Pittsburgh, PA, pp. 217–229, 1990.
58. Oard, M.J., The uniformitarian challenge to ultrahigh-pressure minerals, *J. Creation* **20**(1):5–6, 2006.
59. Green II, H.W., Psychology of a changing paradigm: 40+ years of high-pressure metamorphism, *International Geology Review* **47**:439–456, 2005.
60. Green, ref. 59, p. 439.
61. Philippot, P. and Arnaud, N., Preface to "Exhumation of high-pressure rocks: kinetic, thermal, and mechanical constraints", *Tectonophysics* **342**:vii, 2001.
62. Kerr, R.A., A deeper look beneath tall mountains, *Science* **284**:24, 1999.
63. Green, ref. 59, pp. 448–450.
64. Janak, M., Froitzheim, N., Lupták, B. *et al.*, First evidence for ultrahigh-pressure metamorphism of eclogite in Pohorje, Slovenia: tracing deep continental subduction in the Eastern Alps, *Tectonics* **23**, TC5015, doi:10.1029/2004TC001641: 1–10, 2004.
65. Korchinski, M., Little, T.A., Smith, E. and Millet, M.-A., Variation of Ti-in-quartz in gneiss domes exposing the world's youngest ultrahigh-pressure rocks, D'Entrecasteaux Islands, Papua New Guinea, *Geochemistry, Geophysics, Geosystems* **13**(1):1–27, 2012.
66. Sánchez-Vizcaíno, V.L., Rubatto, D., Gómez-Pugnaire, M.T. *et al.*, Middle Miocene high-pressure metamorphism and fast exhumation of the Nevado-Filábride Complex, SE Spain, *Terra Nova* **13**:327–332, 2001.
67. Epard, J.-L. and Steck, A., Structural development of the Tso Morari ultra-high pressure nappe of the Ladakh Himalaya, *Tectonophysics* **451**:242–264, 2008.
68. Mizukami, T., Wallis, S., Enami, M. and Kagi, H., Forearc diamond from Japan, *Geology* **36**(3):219–222, 2008.
69. Oard, M.J., How many impact craters should there be on the earth? *J. Creation* **23**(3):61–69, 2009.
70. Baumgardner, J., Do radioisotope methods yield trustworthy relative ages for the earth's rocks? *J. Creation* **26**(3):68–75, 2012.
71. Reed, J.K. (Ed.), *Plate Tectonics: A Different View*, Creation Research Society, Chino Valley, AZ, 2000.

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Understanding 'stretching of the heavens' in Scripture—a call for balance

Jim Melnick

One or more leading creationist cosmologists have become committed to the view that scriptural references to the 'stretching of the heavens' cannot possibly refer to cosmological expansion, labelling such a position eisegesis. But have they, in fact, moved in the direction of eisegesis themselves in some of their interpretation of these verses? There is no strong scriptural reason for creationists to be wedded to the view that these 'stretching' verses cannot possibly have any present-day context. If expansion is still occurring, God may intend this to be a present-day witness to mankind. Accepting that some form of expansion *might* be occurring today does not pre-suppose acceptance of big bang cosmology. On the contrary, big bang presuppositions have led secular cosmology today into a severe crisis. Creationists should take advantage of this situation in our apologetics, while also explaining that possible present-day expansion of the heavens, while not required, is also not inconsistent with Scripture. Ultimately, we need balance in how we approach this issue.

The scriptural argument

What does the phrase, the 'stretching of the heavens' (*natah ha-shamayim*), refer to in the Scriptures?[1] The phrase appears in the books of Job, 2 Samuel, several of the Psalms, Isaiah, Jeremiah, and Zechariah, but it does not appear in Genesis nor anywhere in the Pentateuch. Did God create the heavens (the stars and galaxies) and then stretch these within a fixed empty space, or did He stretch space as a whole and the galaxies' positions within it? Did all this occur during Creation Week and then end, or are 'the heavens' still being stretched today? Alan Pace recently referred to Dr Russell Humphreys' "now famous 17 verses on the stretching out or spreading out of the heavens" in the latter's 1994 book, *Starlight and Time*.[2] The implication of this analysis, also citing Dr John G. Hartnett and Dr Charles Taylor, is that the Hebrew word *natah* should not be interpreted as relating to expansion.[3] I respectfully disagree. I believe that an expansionist interpretation of these verses, that is, the view that a 'stretching of the heavens' *may* still be occurring today, remains perfectly reasonable within their scriptural context. Whether this is *actually* occurring today, however, remains an open question.

The Hartnett/Humphreys view

Formerly, Hartnett thought these verses could describe a cosmological expansion of space,[4] but he no longer believes that. He asserts that the very "idea that the biblical text could at all allude to expansion of space … now seems quite preposterous".[5] He published this revised view in 2011.[6] Thereupon Humphreys, who previously held an expansionist perspective on the 'stretching' verses as well, also came to change his point of view, agreeing with Hartnett.[7] Hartnett has recently reaffirmed his view that the Hebrew verbs cited in these passages "cannot be used for [describing] cosmological expansion". Those who might hold the latter view he accuses of eisegesis.[8] The expansionist view is more and more under assault within the creationist community—it is apparently seen as merely an extension of presuppositions related to big bang cosmology (inflation, dark energy, etc.). Whether true or false scientifically, the idea that possible present-day expansion in the context of the 'stretching of the heavens' verses should be rejected on *scriptural* grounds is, in my opinion, unwarranted.[9]

The 'Hartnett/Humphreys view', as I shall refer to it here, constrains how we should interpret many of these verses by limiting them to the idea of the heavens and/or of space being able to be so stretched only so far 'as a tent'. Humphreys asks: "why would God compare the material being stretched to such materials as tent curtains, which can extend their dimensions by only a few percent before tearing?"[10] It may be a good question to ask with respect to the model that Humphreys is developing, but perhaps it is the wrong question to ask with respect to what I believe to be the chief intention of Scripture in these passages.

The fabric issue and the tent/curtain analogy

In my assessment, the Hartnett/Humphreys view places an unwarranted focus on the question of fabric, both in presenting a particular creationist model and in critiquing "the rubber-sheet analogy of modern big bang cosmology".[11] While the fabric referred to in these verses is not irrelevant in discussing this topic, it may be secondary to the actual *role* of the tent in nomadic life and to what the biblical writers may have been intending to convey.

A desert-based Bedouin tent is the closest thing we have today to understanding how the nomadic ancient Israelites might have viewed and responded to the scriptural descriptions of the heavens 'as a tent' (figure 1). When one thinks of an ordinary tent for a poor Bedouin family living in Israel or Jordan today, it is not usually very large. However, it is home to that family. It is also a place of refuge from the dangers of the desert and all that is outside the tent. Meanwhile, the head of the family is the master of everything that takes place inside the tent. It is his domain. The tent sets a *boundary*, so to speak, of the master's absolute authority.

Within the scriptural context, God is the Master of the heavens—they are *His* domain; they are *His* tent. His authority and power extend throughout. These are some of the broad concepts that the writers of Scripture sought to convey, I believe, when, under the guidance of the Holy Spirit, they used the phrase 'as a tent' or 'as a curtain'. I don't think that they were focusing on the fabric of the tent or curtain nor trying to describe a specific kind of cosmological model. Others may have a different view.

There is safety and security in the tent. All of the ancient Near East nomadic customs of protection are conferred upon the guest who has come to visit and is under the roof of the tent. One can picture a visitor lying down on a carpet inside the tent, and, perhaps while eating a meal, looking up through an opening in the tent at the great expanse of the night sky overhead. In a similar way, God's tent—the heavens—cover all of us; we are under His power, authority and protection.

In Bedouin culture today, the greater or grander the power and authority of the Bedouin *sheik* or personage, the larger the tent will likely be to house his family, relatives and guests. A pastor-friend of mine in Israel and his wife have been guests among many Bedouins in Israel and Jordan over the years and know Bedouin culture very well. They were once feted by a powerful *sheik* in a large Bedouin tent. They agree with the general proposition that 'the greater the personage, the greater the tent', and also with the view that a tent might be enlarged as needed to entertain a greater number of guests. Thus, there is no reason to assume that the analogy in Scripture to the heavens being stretched 'as a tent' must necessarily be constrained or limited by a single type of fabric. The tent might simply be expanded as needed, irrespective of the fabric used.

Figure 1. Bedouin tent in Israel today (near Sde Boker, Israel)

Psalm 104:2, Isaiah 40:22, Isaiah 54:2

Psalm 104:2 is one of the key verses that refers to "stretching out heaven like a [tent] curtain". In that same verse we also see God covering Himself "with light as with a cloak". He is "clothed with splendor and majesty". These descriptions depict God's greatness as being far beyond anything man can comprehend. 'Stretching the heavens' is expressed in the same vein. 'God's tent' represents the vastness of Creation. This is poetic language describing the greatness of God and His power, not an exact physical description of a universe that can only stretch as far as some fabric in a tent. This view is echoed in Isaiah 40:22, where the scripture describes God stretching the heavens "like a curtain … like a tent to dwell in". Note that it is God (not man) who would be doing the dwelling if He sought to do so within the vastness of space! The incredible vastness of the universe was a notion beyond the wildest imaginings of the ancients. Majesty and greatness are the attributes conveyed in these passages, which seem much more aligned with the concept of vastness than with the image of a constrained universe where the fabric of space or of the heavens themselves might tear if stretched too far.

Humphreys also seeks to enlist Isaiah 54:2 on behalf of his position: "*Enlarge the place of your tent; Stretch out the curtains of your dwellings, spare not ...*". He writes:

> "It is likely that the outer coverings of the tabernacle in the wilderness were stretched taut … to prevent them from flapping in the wind. This is an example from Old Testament times of applying tension to a fabric without having much extension of its length or width."[12]

However, this passage actually implies the exact opposite meaning in my view—it is not discussing tension, tautness, or constraint, but rather expansion, growth, and

increase. God was preparing His people for something *way beyond* what they had been used to. Linking Isaiah 54:2 to the Tabernacle and to the question of 'stretching the heavens' seems, if the reader will pardon the expression, quite a stretch in itself—we need to dispense with that image entirely.

Our focus should instead be on *why* the Israelites are being told by God to "enlarge the place of [their] tent". The reason He is telling them this is because they "*will spread abroad to the right and to the left … your descendants will possess nations. And they will resettle the desolate cities"* (v. 3). There is no sense here of limitation or constraint. Instead, the 'tent' of Israel is to be greatly enlarged to accommodate all of the new territory and nations that will come under the Israelites' purview. The Lord is saying to Israel, in effect, 'Get ready, I am going to expand you beyond anything you can imagine'.

Stretching only during Creation Week?

According to Genesis, in the beginning God made the expanse [*raw-kee-ah*] and called it 'heaven' (Genesis 1:8). Neither placing the lights in the expanse of the heavens, nor the creation of the stars (Genesis 1:14–16) *necessarily* refer to any stretching or spreading.[13] Later, when the Flood takes place and the floodgates of heaven are opened (Genesis 7:11; 8:2), there is also no reference to stretching. The idea that the 'stretching of the heavens' *had* to occur during Creation Week is not demanded by Scripture. It might have occurred then, or it might have occurred at a later time, or there may have been a combination of these events.

Hartnett and Humphreys, however, assume that most or all of the 'stretching of the heavens', whatever it consisted of, occurred during Creation Week. Pace agrees.[14] Humphreys claims: "Many of the seventeen verses connect the stretching with events of the Creation Week." He concludes that "the stretching (an increasing of tension) occurred during the first six days of Creation, and was completed (stopping the increase of tension) during that period".[15] While possibly true, this is unsubstantiated on scriptural grounds in terms of forcing us to accept that it *had to occur* during Creation Week. This is because there are *no* passages in Scripture that directly connect the 'stretching of the heavens' with the act of Creation. It is merely an assumption by some creationists.

Job 9:8

Job is believed to be one of the oldest books in the Bible. Job 9:8 says: "He alone stretches out the heavens and treads on the waves of the sea." The context seems to be in the present tense, not the past. Consider the last part of the verse: "[He] … treads on the waves of the sea …". Think of Jesus Himself walking upon the water (Matthew 14:25 and elsewhere). The image of God treading on the waves of the sea is a *present* description of His continuing power—it has nothing to do with Creation Week. Since the last part of Job 9:8 is clearly not tied to Creation Week, we need not assume that the first part of the verse *must* relate to Creation Week.

Irrelevant verses

Looking at the Hebrew text, Humphreys asserts that several of the 'stretching' verses "are *qal* perfect, implying a past action", while two other verses (2 Samuel 22:9–10 and Psalm 18:8–9) "follow a *qal* perfect verb with a *waw* consecutive prefixing a *qal* imperfect verb, which implies past action".[15] But these two particular passages (2 Samuel and Psalm 18) relate to God coming down and 'bowing the heavens' in a theophany. Hebrew scholar David Brewer states: "The imagery here is similar to what we see when the Lord descended to Mount Sinai (Exodus 19:16–19)."[16] These verses are about God's judgment and rescue, not about Creation or Creation Week. These passages are irrelevant to the question of when the 'stretching of the heavens' occurred and should be dropped from the discussion.

Past action with continuing after-effects?

Humphreys also refers to Isaiah 45:12; 48:13 and Jeremiah 10:12; 51:15, stating that these are all '*qal* perfect, implying past action'.[15] Yes, these verses do imply past action. But does that mean that the action has been completed? Isaiah 40:22 may provide greater insight to our understanding. Here we see *natah* used as a *qal* active participle (He '… is stretching'), followed by a *waw* consecutive with the verb *maw-thakh'* as a *qal* imperfect, which might be translated as 'and He has spread them out like a tent …'. So we may have past action in some of the relevant passages, but this does not necessarily signify *completed* action.

Apart from how we may interpret these verses, Humphreys asserts that, even with all of the stretching (an increase of tension) of the heavens occurring during Creation Week, the "results of the increase, such as a slow increasing of the gravitational potential of the cosmos, could still be occurring to this day".[15] In other words, we might have an action during Creation Week (the initial stretching), but there may be after-effects of that stretching up to the present day (in Humphreys' view, possibly "a slow increasing of the gravitational potential of the cosmos"). But in that context, if there are *any* after-effects of past stretching into the present day, regardless of what they are, then it is also plausible to infer that current expansion *might* be among those after-effects in terms of how we interpret the text.

Viewed in that context, the debate over whether these verses must be interpreted as implying past *completed* action collapses. The after-effects of the stretching, whether they occurred during Creation Week or later, could be being described by the writers of Scripture as having both a past and present component to them. This doesn't mean that present-day expansion is occurring, but it does mean that we have no strong reason to rule it out on scriptural grounds.

It is also very clear that God has a *present-day* relationship with the stars and galaxies. The scripture says: He "*leads* forth their host by number; He *calls* them all by name". And because of the greatness of His power, "Not one of them is missing" (Psalm 40:26). The heavens *today* "are telling of the glory of God … their expanse is declaring the work of His hands" (Psalm 19:1).

Not one of the stars is lost or misplaced. God knows where each one is, and each has a specific place—what a wonderful analogy this was not only for ancient Israel but also for us today! Isaiah compares this incredible truth to God's relationship with the Jewish people, asking: "Why do you say, O Jacob, and assert, O Israel, 'My way is hidden from the Lord…?'" (Isaiah 40:27). God's 'stretching of the heavens' is one of several witnesses primarily to the Jewish people that He is a God who keeps His covenants.

A witness to mankind

Much of Isaiah 42 is devoted to describing God's majesty and His care for His people. Verse 5 refers to "God the Lord who created the heavens *and* stretched them out …" The 'creating' and the 'stretching' *could* be interpreted as two separate events. If so, Scripture places no obligation on the text that the latter event *must* have occurred during Creation Week. Whatever the case, both events are *witnesses* of God's power to feeble mankind.

Isaiah 48:13 has a similar passage. The Lord "founded the earth" and His "right hand spread out the heavens". Next He says, "When I call to them, they stand together." God may have been stretching the heavens and then fixed them in place, or this passage may mean something else. We see God creating, stretching and calling out. The purpose of the passage is not to give us an exact chronological description but rather to give us a glimpse of God's majesty and power. This passage serves as a *witness* to us and especially to the people of Israel, to get their attention: "Listen to Me, O Jacob, even Israel whom I called; I am He, I am the first, I am also the last …" (Isaiah 48:12).

The notion of a limited, barely stretchable 'tent/curtain' view in these verses as the *only view* consistent with Scripture is unsupported. We all must be careful to avoid placing our own preconceived ideas onto Scripture, seeking the Holy Spirit's aid at every turn to interpret Scripture properly. The question of the 'stretching of the heavens' and what that really means remains unresolved. While one can agree with Hartnett "that *it is not possible* to categorically state that Scripture requires that the universe is expanding at all [emphasis in original]",[17] the possibility that the heavens *may* currently be being stretched (expanded) is also not inconsistent with Scripture.

The apologetical argument

The *apologetical argument* flows from our assessment of Scripture. Secular observers today certainly believe in a currently expanding universe. That, of course, does not make it true, but a simple belief in cosmological expansion today—stripped of its big bang presuppositions—is not unscriptural in the way that, for example, belief in macroevolution is. The idea that the 'stretching of the heavens' *might* still be occurring today should not automatically be equated with what Hartnett calls the 'dark science' regarding "the notion of expansion of the fabric of space."[18] Perhaps there is another alternative.

The purpose for 'stretching the heavens'?

What was or is the real *purpose* of God's stretching the heavens? We don't know—perhaps it has a *utilitarian* purpose so that the universe is not static. However, the broader purpose of stretching the heavens, as Scripture makes clear, was and is *to be a witness to mankind of God's greatness and glory!* This is extremely important. The numerous references to 'stretching the heavens' are mostly apologetical in tone and intent. They imply that mankind should be aware of this stretching, that knowledge of its existence or occurrence would be an argument for showing God's greatness and power. Here then, perhaps, is a question at least as important to ask as the question about the nature of the fabric of the tent (or space)—*why would God tell us in His Word over and over again that He had stretched the heavens unless He also provided some evidence that He had stretched or is continuing to stretch the heavens?*

God is speaking to us through His inerrant Word, telling us that He has indeed 'stretched the heavens' in the past and/or is still stretching the heavens in the present and that this is evidence of His glory. And who is supposed to be the *primary* audience for this evidence?—the people of Israel, the Jewish people.

In Zechariah 12:1, the 'stretching of the heavens' is cited by the Lord as one of three events defining His majesty and power and proclaiming what He is *yet* to do with the people of Israel. Those three events are: 1) stretching the heavens; 2) laying the foundation of the Earth; and 3) forming the spirit of man within him. In this passage, God is citing His

credentials as a witness and testimony that He is yet to do something that is extraordinary and beyond human understanding: *He is going to redeem unrepentant Israel*. ('Redeeming Israel' is also related to God's promises in the New Testament in Romans 11.)

When Zechariah penned his words under the guidance of the Holy Spirit, he could have had no understanding (unless God revealed it to him supernaturally) of the incredible vastness of space, of hundreds of billions of galaxies, or of the speed of light. But God Himself, speaking though the prophet, uses this example of stretching the heavens to show His power and authority. The other two events—laying the foundation of the Earth and forming the spirit of man within him—were things that Zechariah would have understood. But '*stretching the heavens*'? As a prophet, he was only repeating what the Lord had told him. God used Zechariah as His mouthpiece to give "The word of the Lord concerning Israel." And that word had to do with the 'last days' and what God is *yet* going to do when all nations of the earth are gathered against Jerusalem (12:3). God will deliver the people of Israel, and then they shall look on Him whom "they have pierced" (the Messiah) (12:10).

The 'stretching of the heavens' in Zechariah thus stands *as a testimony against the world by the living God.* In Isaiah 51, the Lord rebukes the children of Israel, saying, you "have forgotten the Lord your Maker, [the One] who stretched forth the heavens and laid the foundations of the earth ..." (Isaiah 51:13). These scriptures are *primarily* about the Jewish people. They are intended both as a witness for salvation to those who will believe and a witness *against* those who will not, both in the prophets' days and in our own.

Many of the best-known cosmologists today are self-proclaimed atheists of Jewish background. They accept cosmological expansion as a given, based on big bang cosmology, including alleged inflation of the universe, and related factors. As a creationist, I reject those presuppositions, as well as attempts to derive an age of the universe based on them. At the same time, believing that these passages *might* refer to present-day expansion of the universe does not thereby obligate me to accept the whole rotten edifice of big bang cosmology. Can these two things be divorced from each other? That is the question.

The biblical passages about the 'stretching of the heavens' are stark statements made centuries ago by the Hebrew prophets—perhaps, in part, as a witness to our own unbelieving generation. To me, this is really more an apologetical or missiological question at this point in time rather than primarily an academic or scientific one. We are in a struggle for men's souls. If pointing to the possible expansion of the heavens can challenge non-believers to look into Scripture and God's promises, I believe that we have a wonderful opportunity here to use this as part of our witness. Meanwhile, I am also concerned that we, as the creationist community, do not, as the saying goes, 'cut off our nose to spite our face' by unnecessarily dismissing one possible interpretation of Scripture at a moment in time when it can give us great advantage.

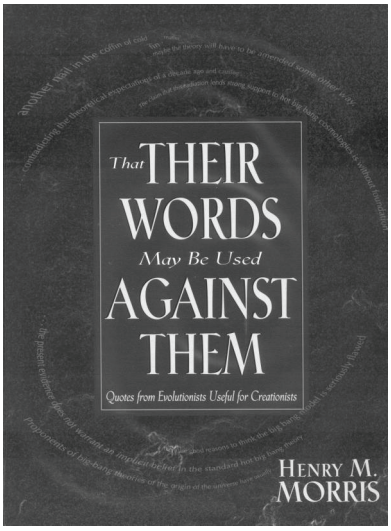

Figure 2. Cover of Dr Henry M. Morris's 1997 book, *That Their Words May Be Used Against Them*

'That their cosmology may be used against them'

I have always deeply appreciated Dr Henry Morris's book, *That Their Words May Be Used Against Them* and the spirit behind it regarding evolutionists' quotes and worldview.[19] (this year is also the twentieth anniversary of its publication in 1997). We can certainly use similar approaches in our apologetics when it comes to aspects of big bang cosmology without embracing the big bang itself, in the spirit that 'Their Cosmology May Be Used Against Them' (figure 2). What does modern-day cosmology claim?

Three of the most important indicators that appear to support cosmological expansion include: redshift measurements of distant galaxies according to Hubble's Law; the predictions of general relativity; and, based on supernovae data, the change in the rate of expansion derived from measurements of the purported cosmological constant. Hartnett has examined these and related factors in depth and their pros and cons with respect to expansion in two key articles that appeared in this journal in 2011.[20]

Redshift and Hubble's Law

As readily admitted by a leading cosmologist, while Hubble's Law may be "almost exactly true nearby, [it is] … not necessarily true over a large fraction of the observable universe".[21] Beyond that, Hartnett has recently shown that *'the greater the redshift, the greater the distance rule'* upon which big bang cosmology and the Standard Model of expansion are based may not hold for quasars and active galactic nuclei (AGNs).[22] Thus, while redshift measurements may indicate an expanding universe (and most cosmologists

believe that they do), Hartnett has noted that some of the data can fit "a static universe with a simple Euclidean non-expanding space just as well as … the standard concordance BB model".[23]

General relativity

General relativity predicts that the universe is expanding. Whether this is interpreted as other galaxies moving away from us at tremendous speeds or whether space itself is expanding, general relativity asserts "that these two equivalent viewpoints … are equally valid". General relativity also allows for the possibility that space itself may be expanding faster than the speed of light: according to physicist Max Tegmark, "while nothing is allowed to move faster than light *through space*, … space itself is free to stretch however fast it wants to".[24]

The supernovae data and the cosmological constant

In recent decades, cosmologists have considered type 1a supernovae explosions as a form of calibrated 'standard candles' used as yardsticks for measuring distances.[25] Celebrated efforts by two research teams in 1998 resulted in measurements of dozens of supernovae in numerous galaxies. Figure 3 shows a photo of a 1994 type 1a supernova. According to secular cosmologists, these measurements from type 1a supernovae (SN1a) indicate that the universe is expanding and that the expansion rate may be accelerating.[26]

Hartnett himself stated in 2011: "The type 1a supernova (SN) measurements are the *very best evidence for an expanding universe* [emphasis in original]." At the same time, he also examines the many assumptions that are built into the interpretation of that evidence.[27] For secular cosmologists, however, the supernovae measurements confirmed an extremely tiny but positive cosmological constant, known as *Lambda* (Λ), at a stunning measurement of 10^{-120} power smaller than what was estimated from theory—a knife-edge so fine as to defy comprehension. Conflict between theory and observation concerning this value has produced a deep crisis within physics and cosmology today. It is difficult to over-estimate the depth of this crisis, which hit the physics and cosmology communities like a 'proverbial ton of bricks', according to well-known Jewish atheist physicist Leonard Susskind. Susskind acknowledged: "No missing mathematical logic is going to explain that."[28] Alluding to William Paley's famous watch analogy, self-proclaimed atheist and NASA scientist Carlos I. Calle has referred to this apparent extreme fine-tuning measurement of the cosmological constant as the "the biggest watch of all".[29] Physics writer Brian Greene admitted that when he first heard of the supernovae measurements, his first reaction was: "It just can't be."[30]

This crisis in cosmology has been so extensive that it has helped propel *multiverse* theory as the only way out for many secular cosmologists, since they cannot believe that a designer designed *this* universe with such apparent fine-tuning.[31] In other words, their own theory and observation have led them to this cosmological dead-end (from their perspective). This has then led to the ridiculous notion that there are near-endless trillions upon trillions of universes, or that 'all possible universes exist' and that we just happen to find ourselves in 'one that contains life' (the so-called *anthropic principle*). Dissenting Jewish atheist philosopher Thomas Nagel, whose critique of the standard neo-Darwinian materialist worldview in his book, *Mind & Cosmos,* has upset so many of his colleagues, rightly calls this notion of the *multiverse* a 'cop-out'.[32]

Thus, the supernovae data present a huge problem for secular cosmologists. Further, these SN1as "can equally be telling us that the presumptuous assumption of the Cosmological Principle is not a certain doctrine upon which to build one's worldview".[33] The Cosmological Principle assumes that there is 'no unique centre, and no edge' in our universe. This is a separate issue from the question of expansion, but it shows how much impact the supernovae data have had.

Since the rest of the scientific world today *assumes* that the universe is expanding, we can and should use this conundrum of secular cosmology in our apologetics. We can do so without embracing big bang cosmology with all of its presuppositions. We can point out to non-believers that present-day 'science' has reached a complete dead-end on this issue and is thoroughly confused, making up 'fudge factors' to try to get out of this dilemma, while at the same time showing that, if the universe is indeed expanding at present, Scripture pointed to that fact long ago. This can serve as a powerful witness to our world today.

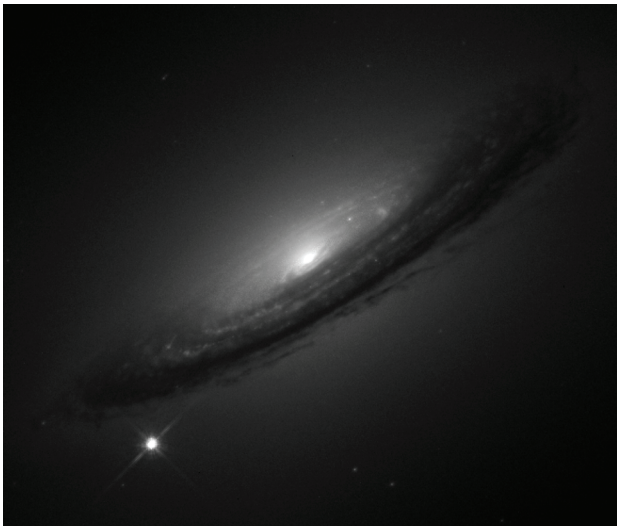

Figure 3. Type Ia Supernova, SN1994d

Conclusion

We know from the Word of God that the heavens (and/or space) were indeed stretched in the past, either during Creation Week or later. They may also still be being stretched or expanded today. There is no *scriptural* requirement to exclude this possibility. Thus, I believe that Hartnett has gone too far to conclude: "To suggest that these texts describe cosmological expansion of space … is not justifiable and is pure eisegesis."[34] If believing that current cosmological expansion might be occurring (with respect to these texts) is eisegesis, then the same charge might be applied to the Hartnett/Humphreys view as well—to the extent that perhaps more is being inferred from the text with respect to the tent fabric analogy than the text supplies. In 2011, after examining all the current scientific evidence for and against an expanding universe, Hartnett stated: "it is impossible to conclude either way whether the universe is expanding or static. The evidence is equivocal."[35] Given that reality on the scientific front, what we need now is balance on the scriptural side as well, allowing both views to have their proverbial 'day in court' to see where true science leads within a biblical framework.

References

1. The Hebrew verb *natah* is variously translated as 'to stretch', 'to stretch out', 'to extend', 'to spread out', 'to bend', and related meanings.
2. Pace, A., What does the Bible say about the fabric of space? *J. Creation* **30**(1):51, 2016. See page 53, table 1, for a recent chart on the 17 verses identified by Humphreys. In the chart, Psalm 102:4 is an error and should be 104:2. Humphreys' book is *Starlight and Time: Solving the puzzle of distant starlight in a young universe*, Master Books, Green Forest, AR, pp. 66–68, 1994.
3. Taylor, C.V., Waters above or beyond? *J. Creation* **10**(2):211–213, 1996; creation.com/images/pdfs/tj/j10-2/j10_2_211-213.pdf.
4. Hartnett, J.G., *Starlight, Time and the New Physics*, Creation Book Publishers, pp. 102–103, 2007.
5. Hartnett, J.G., Expansion of Space—A Dark Science, *Answers Research J.* **7**: 457, 2014.
6. Hartnett, J.G., Does the Bible really describe expansion of the universe? *J. Creation* **25**(2):125–127, August 2011; creation.com/images/pdfs/tj/j25_2/j25_2_125-127.pdf.
7. Humphreys, D.H., New view of gravity explains cosmic microwave background radiation, *J. Creation* **28**(3):106–114, 2014.
8. Hartnett, J.G., Our eternal universe, *J. Creation* **30**(3):105, 2016.
9. Mary Beth de Repentigny noted in 2011: "Creation scientists do not necessarily have a philosophical problem with the idea that the expansion rate of the universe might be accelerating, as the data from type 1a supernovae could be telling us." Repentigny, M., What are type 1a supernovae telling us? *J. Creation* **25**(1):123, 2011.
10. Humphreys, ref. 7, p. 107.
11. Hartnett, ref. 8, p. 105.
12. Humphreys, ref. 7, p. 108.
13. Unless one assumes that God's creative act itself of placing the stars *in the expanse* of the heavens actually equates to the 'stretching of the heavens', which it might.
14. Pace, ref. 2, p. 54.
15. Humphreys, ref. 7, p. 109.
16. Emails to and from the author with Hebrew scholar David Brewer, February–March 2015. We see a similar theme and imagery in Psalm 144:5.
17. Hartnett, ref. 6, p. 126.
18. Hartnett, ref. 5, p. 457.
19. Morris, H., *That Their Words May Be Used Against Them*, Institute for Creation Research, Green Forest, AR, 1997.
20. Hartnett, J.G., Does observational evidence indicate the universe is expanding? —part 1: the case for time dilation, *J. Creation* **25**(3):109–114, December 2011; and, Does observational evidence indicate the universe is expanding—part 2: the case against expansion, *J. Creation* **25**(3):115–120, December 2011.
21. Kirshner, R.P., *The Extravagant Universe,* Princeton University Press, Princeton, NJ, p. 158. 2002.
22. Hartnett, J.G., The Lyman-α forest and distances to quasars, *J. Creation* **30**(3):9, 2016.
23. Hartnett, J.G., ref. 20, part 2, p. 119.
24. Tegmark, M., *Our Mathematical Universe: My Quest for the Ultimate Nature of Reality*, Alfred A. Knopf, New York, pp. 47–48, 2014.
25. Panek, R., *The 4% Universe: Dark Matter, Dark Energy, and the Race to Discover the Rest of Reality,* ch. 8, Hello, Lambda, Houghton Mifflin Harcourt, New York, pp. 140–163, 2011; Riess, A. *et al.*, Observational Evidence from Supernovae for an Accelerating Universe and a Cosmological Constant, arxiv.org/abs/astro-ph/9805201, 1998.
26. However, this is not necessarily true. As de Repentigny has pointed out: "an objective handling of the data does not necessitate this interpretation" (de Repentigny, ref. 9, p. 127).
27. Hartnett, J.G., ref. 20, part 1, p. 111.
28. Susskind, L., *Cosmic Landscape: String Theory and the Illusion of Intelligent Design,* Little, Brown and Company, New York, p. 185, 2006.
29. Calle, C.I., *The Universe—Order without Design,* Prometheus Books, Amherst, New York, p. 19, 2009.
30. Greene, B., *The Hidden Reality: Parallel Universes and the Deep Laws of the Cosmos*, Alfred A. Knopf, New York, p. 142, 2011.
31. I critique the current secular crisis in cosmology, multiverse theory and fine-tuning in Melnick, A.J., The Quantum World: A Fine-Tuned Multiversal Reality? *J. Interdisciplinary Studies* **27**:45–60, 2015.
32. Nagel, T., *Mind and Cosmos: Why the Materialist Neo-Darwinian Conception of Nature is Almost Certainly False,* Oxford University Press, New York, p. 95, fn 8, 2012.
33. de Repentigny, ref. 9, p. 127. Jake Hebert and Jason Lisle have recently published two extensive articles in the *Creation Research Society Quarterly* regarding galactic luminosity and the question of special location in the universe. They describe the *cosmological principle* as "the assumption that on the largest distance and angular scales, there are no special places or directions in the cosmos". They state: "The biblical worldview may well allow for this principle, but it does not require it." Herbert, J. and Lisle, J., A Review of the Lynden-Bell/Choloniewski Method for Obtaining Galaxy Luminosity Functions. Part I, *Creation Research Society Quarterly* **52**(3):177–178, 2016.
34. Hartnett, J.G., ref. 6, *J. Creation* **25**(2):125. Elsewhere he has repeated that charge and added "and not good exegesis" (Hartnett, ref. 5, p. 457).
35. Hartnett, J.G., ref. 20, part 2, p. 120.

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Baraminic analysis of nucleocytoplasmic large DNA viruses

Jean O'Micks

The origin of nucleocytoplasmic large DNA viruses (NCLDVs) is very intriguing. While some researchers think they are large-sized viruses, there is proof that they might be degenerate bacteria. The Bible does not mention bacteria, viruses, or NCLDVs. Very little is known about their baraminology, so this analysis serves as a seminal attempt to discover what kinds of species relationships exist between them. Therefore, gene sequences were downloaded for 49 NCLDVs from the COG database, and BLASTed against one another to see whether NCLDVs form groups, such as the kinds of complex multicellular organisms, such as plants or animals. Here we employed a measure of gene content similarity called the Jaccard Coefficient Value (JCV) to measure the similarity between two species, and to see which species can be grouped together based on high gene content similarity between the individual members. Eight NCLDV clusters were found which have at least three members each. Although few species were analyzed, this study may serve as the basis for future baraminology studies on bacteria, viruses, or other microorganisms.

The origin of nucleocytoplasmic large DNA viruses, and where they come from, is still unclear. Some evolutionists have proposed that these microorganisms are large-sized viruses with very large genomes that broke out of the nuclei of eukaryotes, taking a host of genes along with them. On the other hand, they also carry a large number of genes from cellular organisms, raising the possibility that they are really degenerate bacterial species. Also, what is peculiar to these organisms is that they have a very high percentage of genes which do not have any homologs with any other organism,[1] supporting the view that NCLDVs have a separate origin from all other organisms.[2]

An important question to be addressed is whether baraminic analysis can be performed on NCLDVs. Since they have such a high proportion of unique genes, we can assume that they could form a possible apobaramin, which is defined as a group of one or more holobaramins independent from one another. The Bible does not mention microorganisms specifically, but if God created all living things, why would He create microorganisms in a different manner than plants or animals, after their kinds? If neither plants nor animals evolve, why would microorganisms evolve? Therefore, we can assume that transferring statistical baraminological methodology from complex organisms to microorganisms such as NCLDVs is warranted.

Principle of analysis

In this analysis, the number of common proteins were studied between 49 NCLDV species, whose protein sequences were available in the COG database.[3] Two different proteins were considered homologs if they had a minimal similarity of 40%, which is considered to be the lower limit of protein sequence homology.[4] A Jaccard Coefficient Value (JCV) was calculated to measure the degree of similarity between two NCLDV species. The higher the JCV, the higher the similar gene content between two species. As to what constitutes a high JCV, it depends on the kind of study being done. For example, here, the median JCV was 0.065. A matrix was made which contains the JCVs of all possible NCLDV species pairs, and can be seen in figure 1. Out of 1,176 possible species pairs, only 41 had a JCV ≥ 0.25, and only 8 pairs had a JCV ≥ 0.5. In figure 1 we can see 10 clusters of species, with 2–8 members each. A list of the species forming these clusters can be seen in table 1. According to our model, these clusters correspond to individual NCLDV baramins. If we lower the cutoff JCV to 0.1 (warranted due to the high rate of HGT in NCLDVs), we pick up three extra pairs of NCLDV species: Frog virus 3 and Singapore grouper Iridovirus (Iridoviridae), *Acanthocystis turfacea Chlorella* virus 1 and *Paramecium bursaria Chlorella* virus 1 NY2A (Phycodnaviridae), and *Ectocarpus siliculosus* virus 1 and *Feldmannia* species virus (Phycodnaviridae).

Description of different NCLDV baramins found in the analysis

Phaecocystis

The three *Phaecocystis* species all have JCVs greater than 0.98 with each other. However, notably, they also have JCVs of around 0.11 with Organic Lake phycodnaviruses, which belong to the same family. Therefore, these NCLDVs may be classified together into one baramin, thereby aggregating

clusters 1 and 6. Both Koonin *et al*.[5] and Santini *et al*.[6] have reported similar relationships between the genus *Phaecocytis* and the Organic Lake phycodnaviruses.

Prasinophyceae

Group 2 is made up of six Prasinophyceae species from the family Phycodnaviridae, a genetically diverse but morphologically similar group with an icosahedric capsid, which infect algal hosts from both fresh and marine waters.[7,8] They have few genes in common, and thus appear to be an apobaramin.

The Prasinoviruses however, appear to be a monophyletic clade, encompassing the genera *Bathycoccus*, *Ostreococcus*, and *Micromonas* based on alignments of the DNA *pol* protein.[9] Bellec *et al*.[9] found that the phylogenic position of *Emiliana huxleyi* 'virus' is close to that of Prasinophyceae,

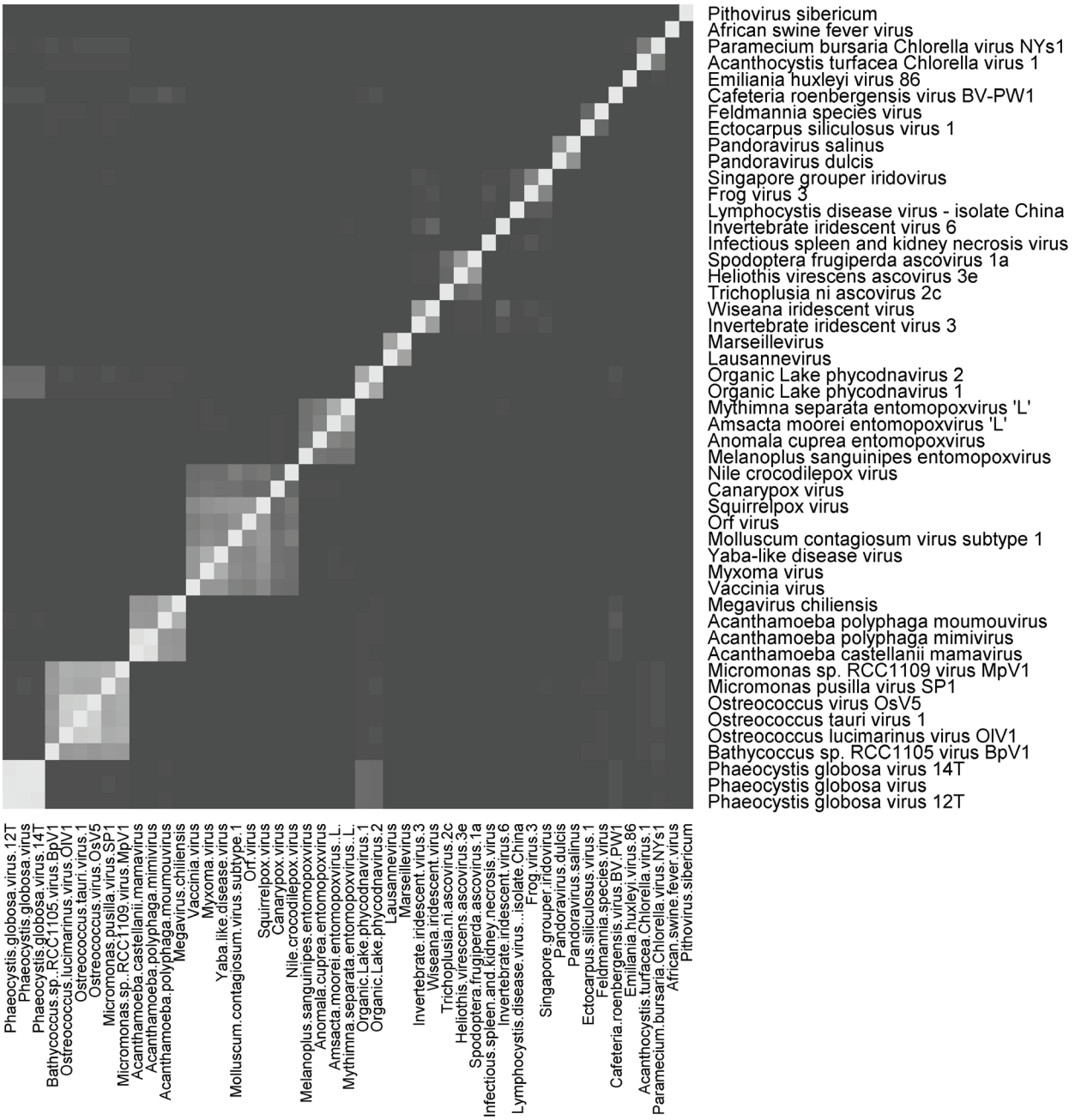

Figure 1. Heat map depicting Jaccard coefficients for pairs of NCLDV virus species which had protein sequences in the COG database. The Jaccard-Coefficient measures the common genes content between a given pair of NCLDV species. Lighter values correspond to higher values. Ten baramins can be seen on the heatmap with 2–8 members each, listed in table 4.

Table 1. Clusters of NCLDV species with a relatively high proportion of common genes

Species in cluster	Virus family	Average ± std var. JCV	Genome size range
Phaecocystis globosa virus, *Phaecocystis globosa* virus 12T, *Phaecocystis globosa* virus 14T	Phycodnaviridae	0.97 ± 0.01	460 Kbp
Bathycoccus sp. RCC1105 virus BpV1, *Ostreococcus tauri* virus 1, *Ostreococcus virus* OsV5, *Ostreococcus lucimarinus* virus OlV1, *Micromonas sp.* RCC1109 virus MpV1, *Micromonas pusilla* virus SP1	Phycodnaviridae	0.49 ± 0.15	184–199 Kbp
Acanthamoeba castellanii mamavirus, *Acanthamoeba polyphaga* mimivirus, *Acanthamoeba polyphaga* moumouvirus, *Megavirus chiliensis*	Mimiviridae	0.46 ± 0.24; 0.6 ± 0.28	1.02–1.26 Mbp
Vaccinia virus, Myxoma virus, Yaba-like disease virus, *Molluscum contagiosum* virus subtype 1, Orf virus, Nile crocodilepox virus, Canarypox virus, Squirrelpox virus	Poxviridae	0.22 ± 0.1	140–360 Kbp
Melanoplus sanguinipes entomopoxvirus, *Anomala cuprea* entomopoxvirus, *Amsacta moorei* entomopoxvirus 'L', *Mythimna separata* entomopoxvirus 'L'	Poxviridae	0.22 ± 0.13	232–281 Kbp
Organic Lake phycodnavirus 1, Organic Lake phycodnavirus 2	Phycodnaviridae	0.46	n.a.
Lausannevirus, Marseillevirus	Marseillevirus	0.41; 0.55 ± 0.15	347–368 Kbp
Invertebrate iridescent virus 3, Wiseana iridescent virus	Iridoviridae	0.38	191–206 Kbp
Trichoplusia ni ascovirus 2c, *Heliothis virescens* ascovirus 3e, *Spodoptera frugiperda* ascovirus 1a	Ascoviridae	0.19 ± 0.14	157–186 Kbp
Pandoravirus dulcis, Pandoravirus salinus	Pandoraviridae	0.3; 0.32 ± 0.02	1.9–2.5 Mbp
Frog virus 3, Singapore grouper virus, Tiger frog virus, *Ambystoma tigrinum* virus	Iridoviridae	0.22; 0.52 ± 0.25; 0.71 ± 0.07	150–170 Kbp

but still not fully resolved. The average JCV between this species and that of Prasinophyceae is 0.0085, compared to the average JCV of 0.62 within this baramin. Similarly, we have an average JCV of 0.02 between the members of the baramin Prasinophyceae and *Paramecium bursaria Chlorella* 'virus' NY and *Acanthocystis turfacea Chlorella* 'virus' 1.

Figure 2 depicts a baraminological tree for the six species in this baramin based on the DNA polymerase protein. The species Yellowstone Lake phycodnavirus 2 (YLPV2) was chosen as an outlier (belonging to another baramin) based on BLAST results as the next most similar species. As we can see, YLPV2 is separate from the other six species on a long branch of its own. The gene similarity between this species and the others is 49%, whereas between the others the average similarity is 76.2%.

Mimiviridae

Mimiviridae is represented by four species: Mimivirus, Mamavirus, Moumouvirus, and *Megavirus chiliensis*. Considering some of their genes, these species could be considered to have originated from soil bacteria.[2] Of these four species, Mimivirus and Mamavirus had the highest JCV of 0.91. Both of these species had a lower JCV compared to Megavirus; about 0.32. Arslan *et al.*[10] suggest that Mimiviridae species all descended from a single ancestor through genome reduction, and have lost genes in a lineage-specific fashion, similar to what we see in other bacteria. Eighty-five percent of the 258 Megavirus genes[11] not present in the Mimivirus cluster towards the end of the Megavirus chromosome. Rost[4] calculated that orthologs and orthologous intergenic regions between these species are 65% similar, which is greater than the 40%

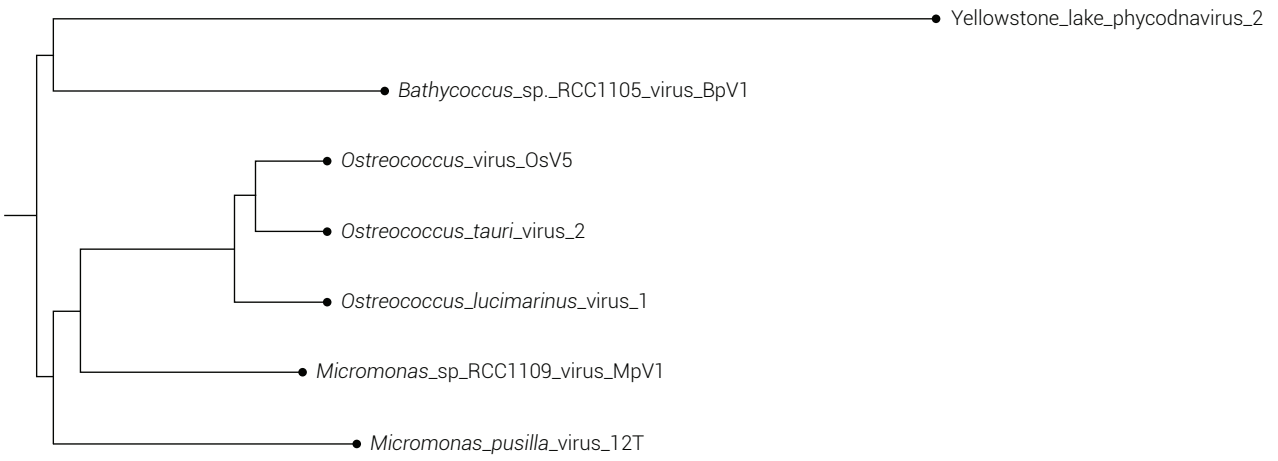

Figure 2. Baraminological tree of *Ostreococcus*, *Micromonas*, and *Bathycoccus* species

limit which serves as a lower limit for protein homology. Boughalmi *et al.*[12] described a new member of the family Mimiviridae from the medicinal leech, *Hirudo medicinalis*, called Hirudovirus, with a genome represented by two scaffolds, 1.16 Mbp and 25.7 Kbp long, each.[13] This species has 998 ORFs, 47% of which had orthologs in other species. The number of common genes, JCVs with the previous four species can be seen in table 2. Hirudovirus is most similar to Mimivirus and Mamavirus, possibly only a new strain. With the inclusion of this new species, the average JCV increases to 0.6.

Though *Cafeteria roenbergensis* virus is considered to be a distant member of the Mimiviridae family, Yoosuf *et al.*[14] found ≤ 5% of its genes to be in common with two strains of Mimiviridae, the Terra1 and Terra2 viruses. Indeed, when compared to the four members of this group, we see that the average JCV is 0.03, which is very low, thus we should exclude *Cafeteria roenbergensis* virus from this group.

The Poxviridae apobaramin

The Poxviridae are another group of highly variable NCLDVs, similar to Phycodnaviridae, made up of two subfamilies, and also of several genera. The Entomopoxvirinae (EPV) infect insect hosts, whereas the Chordopoxvirinae (ChPV) infect vertebrates. While these NCLDVs infect a wide range of hosts, each species infects a narrow range of hosts. Genetically, these organisms have a genome size range of 133–360 kbp, and from 133–328 genes, and also vary in AT%. Cluster 4 is comprised of Chordopoxvirinae species, whereas cluster 5 is made up of Entomopoxvirus species. Lefkowitz *et al.*[15] also did pairwise sequence comparison (PASC) on DNA polymerase for all Poxviridae species, and found that comparisons between the two subfamilies yielded a sequence identity of 23–31%, which is below the protein homology threshold of 40%.[4] This is strong evidence that the ChPVs and the EPVs belong to different baramins. Species in separate EPV genera also "show almost as much divergence between themselves as they do with ChPVs".[15]

Table 2. Jaccard Coefficient Values between Hirudovirus and members of the Mimivirus baramin

Species	Number of common genes	JCV
Acanthamoeba castellanii mamavirus	975	0.99
Acanthamoeba polyphaga mimivirus	982	0.69
Acanthamoeba polyphaga moumouvirus	772	0.96
Megavirus chiliensis	835	0.65

Marseilleviridae

Marseilleviridae consists of NCLDVs discovered in water sources in France, Tunisia[16] and Senegal.[17] These species form a compact baramin, with the majority of their genomes being collinear with each other, and also share a large number of orthologous proteins. Even their GC% content ranges only between 43–45%, which reflects a very similar genomic makeup. Approximately two thirds of their genes are ORFans.[16,18] An analysis of six Marseillevirus species showed that the pan-genome contained a total of 608 genes of which 233 genes were common to all six species. The genomes of these organisms, which are particularly stable despite varying between distinctly different ecological niches, further support the stability of baranomes (the created genome within a specific kind). Recently, the Port-Miou virus was discovered, which is 99% similar to Lausannevirus, exhibiting only one indel per 1,000 bp.[19]

Based on data from several studies, JCVs were calculated for for Marseillevirus, Lausannevirus, Tunis virus, Cannes 8 virus,[20] and Insectomime virus.[12] The JCVs can be seen in table 3. Based on this, the revised average JCV for the Marseilleviridae is 0.55, indicating they make up a single baramin.

Wiseana iridescent virus and Invertebrate iridescent virus 3

Group 8 is made up of two species, which belong to the family of Iridoviridae, which is a genetically diverse group of viruses. Not much is known about the relationship between these two viruses, but their JCV is significant enough to group them together.

Ascovirus

Group 9 is made up of three Ascovirus species: *Trichoplusia ni* ascovirus 2c (TnAV), *Heliothis virescens* ascovirus 3e (HvAV), and *Spodoptera frugiperda* ascovirus 1a (SfAV). As of date only five Ascovirus species in the genus Ascovirus have been recognized by the International Committee on Taxonomy of Viruses,[21] so not much is known about them. They mainly infect lepidopteran insects, and induce reorganization of the host cell nucleus, resulting in lysis.

This group has the lowest average JCV value for all species pairs, 0.19, therefore these species could probably form an apobaramin. There were 119 protein sequences available for a fourth Ascovirus species, *Diadromus pulchellus* ascovirus 6a (DpAV), so JCV values were calculated with the other three species, but were much lower than 0.19 (0.021, 0.01, and 0.022). This supports the idea that *D. pulchellus* may be a member of another Ascovirus baramin. In fact, Stasiak *et al.*[22] analyzed the PolIII-PolI regions of the δ DNA polymerase gene between these four species, and found that they were very divergent (with a similarity of less than 50%), thereby separating these four species into two groups, with TnAV, HvAV, and SfAV in one group, and DpAV in the other. Interestingly, these two groups are divided based on how their host organisms (wasps) infect their prey (caterpillars).

Table 3. Jaccard Coefficient Values between members of the family Marseilleviridae

	Lausannevirus	Tunis virus	Cannes 8 virus	Insectomime virus
Marseillevirus	0.41	0.43	0.76	0.43
Lausannevirus		0.59	0.48	0.59
Tunis virus			0.42	0.86
Cannes 8 virus				0.5

Pandoraviridae

The small group Pandoraviridae is made up of two species, *Pandoravirus salinus*, discovered in marine water near Chile, and *Pandoravirus dulcis*, discovered in fresh water near Melbourne. A third species has also been discovered, *P. inopinatum*, with a genome size of 2.24 Mbp. The ORFan content for *P. salinus* is 84% (its most abundant virion protein is an ORF), yet only three species have been discovered, so this intrabaraminic ORFan gene content may decrease with more newly discovered *Pandoravirus* species. However, one characteristic which separates these species from other NCLDVs is that it lacks a major capsid protein which is present in all other groups.[23] JCVs were calculated between *P. inopinatum* and the other two *Pandoravirus* species, resulting in a revised average JCV of 0.32 ± 0.02. It was also found that the average JCV between *Pandoravirus* and *Pithovirus sibericum* is only 0.008, therefore *P. sibericum* should be separated into another baramin. Similarly, an average JCV of 0.04 ± 0.01 was calculated between the three *Pandoravirus* species and *Mollivirus sibericum*, another possible NCLDV species which is also held to be similar to Pandoraviridae. This low-protein content is similar to results described in Abergel *et al.*[23] (89% of 18% of its genes similar to Pandoraviridae). Due to the low JCVs it is also suggested that this species be separated from Pandoraviridae.

Other species pairs

Besides the aforementioned 10 virus clusters there are three pairs of viruses who show a faint similarity with each other. *Paramecium bursaria* Chlorella virus NYs1 and *Acanthocystis turfacea* Chlorella virus 1 (both Phycodnaviruses) have a JCV of 0.19, similar to the three *Ascovirus* species of group 9. *Feldmannia* virus and *Ectocarpus siliculosus* virus 1 (Phycodnaviruses) have a JCV of 0.098. According to Park *et al.*[24], their DNA adenine methyltransferase proteins have an identity of 36%.

Ranaviruses

A third pair of species, Singapore grouper iridovirus (SGIV), and Frog virus 3 (FV3) come from the genus *Ranavirus*, within the family Iridoviridae. Their JCV is 0.22. These viruses infect mainly amphibians and/or fish.[25] The proteomes for three other Ranaviruses were downloaded (Epizootic hematopoietic necrosis virus (EHNV), Tiger frog virus (TFV) and *Ambystoma tigrinum* virus (ATV)), and compared to the other two virus proteomes. It was found that with these

Table 4. Jaccard Coefficient Values between members of the genus Ranavirus. ATV = *Ambystoma tigrinum* virus, EHNV = Epizootic hemtopoietic necrosis virus, FV3 = Frog virus 3, SGIV = Singapore grouper iridovirus, TFV = Tiger frog virus.

	SGIV	TFV	ATV	EHNV
FV3	0.22	0.67	0.63	0.67
SGIV		0.22	0.26	0.27
TFV			0.81	0.74
EHNV				0.74

four species, the average JCV was 0.52 ± 0.25, meaning that it is possible that these species form a baramin. The JCVs for these five species can be seen in table 4. It might be possible that these four species group together into a baramin due to their common host range.

The Singapore grouper is a fish, which leads us to the question that since the host belongs to a different order (fish as compared to amphibians), then does it also belong to a different baramin? Holopainen *et al.*[25] studied the sequence similarity of the major capsid protein (MCP), DNA polymerase, and neurofilament triplet H1-like protein (NF-H1) between a number of Iridoviruses, and found that SGIV is always an outlier compared to the other four species mentioned here. If we exclude SGIV from the other four species of Ranaviruses, the average JCV rises to 0.71 ± 0.07.

Table 5. Jaccard Coefficient Values calculated for two groups of Ranaviruses, according to data from Eaton *et al.* [26]. ATV = *Ambystoma tigrinum* virus, FV3 = Frog virus 3, GIV = grouper iridovirus, SGIV = Singapore grouper iridovirus, TFV = Tiger frog virus.

First species	No. genes	Second species	No. genes	No. common genes	JCV
Amphibian Ranaviruses					
ATV	91	FV3	97	86	0.88
ATV	91	TFV	103	91	0.84
FV3	97	TFV	103	92	0.85
Fish vs Amphibian Ranaviruses					
ATV	91	GIV	139	72	0.46
ATV	91	SGIV	139	72	0.46
FV3	97	GIV	139	72	0.44
FV3	97	SGIV	139	72	0.44
GIV	139	TFV	103	72	0.42
SGIV	139	TFV	103	72	0.42
Fish Ranaviruses					
GIV	139	SGIV	139	138	0.99

Eaton *et al.*[26] arrived at similar results. They compared FV3, TFV, and ATV with SGIV and grouper iridovirus (GIV). The two grouper iridoviruses had a JCV of 0.99, whereas an average JCV of 0.86 for FV3, TFV and ATV. However, the average JCV dropped to 0.44 when comparing between these two groups (see table 5).

Also, for example, if we exclude SGIV from the other four species of Ranaviruses, the average JCV rises to 0.71±0.07 for that group. This is interesting, since this way, the standard error of the JCVs is reduced 3.6-fold (0.25 to 0.07). This is a useful method of subtractive evidence in excluding species from a baramin, if these groups can be classified this way.

African Swine Fever Virus

African Swine Fever Virus (ASFV) is the single species in the family Asfarviridae. It has a genome size of 170–193 Kbp depending on the isolate, which encodes 150–167 ORFs. It is icosahedral in shape, and replicates in the cytoplasm of infected cells.[27] It is not very much related to any other NCLDV family. It has an average JCV of 0.0023 ± 0.001 with other species in our analysis, showing high discontinuity; therefore, it belongs to its own baramin.

Summary and conclusion

This study was a preliminary analysis of 49 NCLDV species, based on the assumption that microorganisms follow the same kind of speciation patterns as seen in different kinds of created animals and plants. Here eight clusters were found, or groups with at least three species each. Since there are likely several hundreds or even thousands of NCLDV species in nature, this study is only a preliminary analysis, especially since the baraminology of NCLDVs and microorganisms in general is very much unknown.

The present study shows that NCLDV species from different groups do not have too many genes in common. Thus, if two NCLDV species happen to have a high number of common genes, it suggests they belong to the same group (kind) of organisms. Different NCLDV groups had an average JCV of 0.45, or 0.23 or even 0.18. These relatively low numbers of common genes even within groups could be due to the propensity of NCLDVs to have a high ratio of unique genes, possibly due to HGT. Comparing total gene/protein content is a simpler, robust and holistic way of determining species relationships than creating dozens of contradicting evolutionary trees based on single genes. Thus the theory of a 'fourth domain' of life is not well founded.

In the analysis of 49 NCLDV species, only a number of cases indicated groups equal to the level of genus (*Phaecocystis*, *Prasinophyceae*, *Pandoraviruses*, *Ranaviruses*), suggesting that this might be a good boundary for the limits of NCLDV groups (or kinds). Similarly, for

other microorganisms, such as viruses, van Regenmortel[28] also described a lack of higher taxonomic classification than the family.

In conclusion, it seems that baraminic analysis can be performed on microorganisms such as NCLDVs, however, as of yet, only a few species have been analyzed. Though this analysis serves as a starting point, much more careful thought is needed to proceed in taxonomic analysis of microorganisms from a biblical perspective.

Materials and methods

NCLDV protein sequences were retrieved from the COG website: ftp://ftp.ncbi.nih.gov/pub/wolf/COGs/NCVOG. All 20,086 protein sequences from 49 species were BLASTed (BLASTP) against each other, with an e-score < 1e-4. A Jaccard Coefficient Value J was calculated between each possible pair of 1,176 species, where $0 \leq J \leq 1$, and where $J = |A \cap B|/(|A|+|B|+|A \cap B|)$ for species A and B. The Jaccard Coefficient Values (JCVs) were put into a matrix and visualized by the heatmap function in R, version 3.1.3. Lighter colours mean higher JCVs. The JCV is a measure of how similar the gene content of two genomes. A JCV of 1 means that the two organisms have the exact same genes. The lower the JCV, the less related two viruses are to each other. Protein sequences for Epizootic hematopoietic necrosis virus, *Pandoravirus inopinatum*, *Mollivirus sibericum*, *Diadromus pulchellus* ascovirus 6a, *Ambystoma tigrinum* virus, Tiger frog virus, Tunis virus, Cannes 8 virus, and Insectomime virus were downloaded from NCBI. Figure 2 was generated by using CLC Genomics, version 8. The JCV values for all NCLDV species pairs can be found in Supplementary data file 1.

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References

1. Claverie, J.M. and Ogata, H., Ten good reasons not to exclude giruses from the evolutionary picture, *Nat. Rev. Microbiol.* **7**(8):615, 2009.
2. O'Micks, J., Creation perspective of nucleocytoplasmic large DNA viruses, *J. Creation* **30**(3):110–117, 2017.
3. Yutin, N., Wolf, Y.I., Raoult, D. and Koonin, E.V., Eukaryotic large nucleo-cytoplasmic DNA viruses: clusters of orthologous genes and reconstruction of viral genome evolution, *Virol. J.* **6**:223, 2009.
4. Rost, B., Twilight zone of protein sequence alignments, *Protein Eng* **12**(2): 85–94, 1999.
5. Koonin, E.V., Krupovic, M. and Yutin, N., Evolution of double-stranded DNA viruses of eukaryotes: from bacteriophages to transposons to giant viruses, *Ann. N.Y. Acad. Sci.* **1341**:10–24, 2015.
6. Santini, S., Jeudy, S., Bartoli, J. *et al.*, Genome of Phaeocystis globosa virus PgV-16T highlights the common ancestry of the largest known DNA viruses infecting eukaryotes, *Proc. Natl. Acad. Sci. USA* **110**(26):10800–10805, 2013.
7. Dunigan, D.D., Fitzgerald, L.A. and Van Etten, J.L., Phycodnaviruses: a peek at genetic diversity, *Virus Res.* **117**(1):11932, 2006.
8. Derelle, E., Ferraz, C., Escande, M.L., Eychenié, S. and Cooke, R., Life-cycle and genome of OtV5, a large DNA virus of the pelagic marine unicellular green alga *Ostreococcus tauri*, *PLoS One* **3**(5):e2250, 2008.
9. Bellec, L., Grimsley, N., Moreau, H. and Desdevises, Y., Phylogenetic analysis of new Prasinoviruses (Phycodnaviridae) that infect the green unicellular algae Ostreococcus, Bathycoccus and Micromonas, *Environ. Microbiol. Rep.* **1**(2): 114–123, 2009.
10. Arslan, D., Legendre, M., Seltzer, V., Abergel, C. and Claverie, J.M., Distant Mimivirus relative with a larger genome highlights the fundamental features of Megaviridae, *Proc. Natl. Acad. Sci. USA* **108**(42):17486–17491, 2011.
11. Legendre, M., Arslan, D., Abergel, C. and Claverie, J.M., Genomics of Megavirus and the elusive fourth domain of life, *Commun. Integr. Biol.* **5**(1): 102–106, 2012.
12. Boughalmi, M., Pagnier, I., Aherfi, S. *et al*., First isolation of a Marseillevirus in the Diptera Syrphidae Eristalis tenax, *Intervirology* **56**(6):386–394, 2013a.
13. Boughalmi, M., Pagnier, I., Aherfi, S. *et al*., First isolation of a giant virus from wild Hirudo medicinalis leech: Mimiviridae isolation in Hirudo medicinalis, *Viruses* **5**(12):2920–2930, 2013b.
14. Yoosuf, N., Pagnier, I., Fournous, G., Robert, C., Raoult, D. *et al*., Draft genome sequences of Terra1 and Terra2 viruses, new members of the family Mimiviridae isolated from soil, *Virology* **452–453**:125–32, 2014.
15. Lefkowitz, E.J., Wang, C. and Upton, C., Poxviruses: past, present and future, *Virus Res.* **117**(1):105–118, 2006.
16. Aherfi, S., Boughalmi, M., Pagnier, I., *et al*. Complete genome sequence of Tunisvirus, a new member of the proposed family Marseilleviridae. *Arch Virol* **159**(9):2349–2358, 2014a.
17. Colson, P., Fancello, L., Gimenez, G., Armougom, F. and Desnues, C., Evidence of the megavirome in humans, *J. Clin. Virol.* **57**(3):191–200, 2013.
18. Aherfi, S., La Scola, B., Pagnier, I., Raoult, D. and Colson, P., The expanding family Marseilleviridae, *Virology* **466–467**:27–37, 2014b.
19. Doutre, G., Arfib, B., Rochette, P. *et al*., Complete Genome Sequence of a New Member of the Marseilleviridae Recovered from the Brackish Submarine Spring in the Cassis Port-Miou Calanque, France, *Genome Announc.* **3**(6): e01148-15, 2015, doi:10.1128/genomeA.01148-15.
20. Aherfi, S., Pagnier, I., Fournous, G. *et al*., Complete genome sequence of Cannes 8 virus, a new member of the proposed family 'Marseilleviridae', *Virus Genes* **47**(3):550–555, 2013.
21. Wei, Y.L., Hu, J., Li, S.J. *et al*., Genome sequence and organization analysis of Heliothis virescens ascovirus 3f isolated from a Helicoverpa zea larva, *J. Invertebr. Pathol.* **122**:40–3, 2014.
22. Stasiak, K., Demattei, M.V., Federici, B.A. and Bigot, Y., Phylogenetic position of the Diadromus pulchellus ascovirus DNA polymerase among viruses with large double-stranded DNA genomes, *J. Gen. Virol.* **81**(12):3059–3072, 2000.
23. Abergel, C., Legendre, M. and Claverie, J.M., The rapidly expanding universe of giant viruses: Mimivirus, Pandoravirus, Pithovirus and Mollivirus, *FEMS Microbiol. Rev.* **39**(6):779–796, 2015.
24. Park, Y., Kim, G.D. and Choi, T.J., Molecular cloning and characterization of the DNA adenine methyltransferase gene in Feldmannia sp. Virus, *Virus Genes* **34**(2):177–183, 2007.
25. Holopainen, R., Ohlemeyer, S., Schütze, H., Bergmann, S.M. and Tapiovaara, H., Ranavirus phylogeny and differentiation based on major capsid protein, DNA polymerase and neurofilament triplet H1-like protein genes, *Dis. Aquat. Organ.* **85**(2):81–91, 2009.
26. Eaton, H.E., Metcalf, J., Penny, E. *et al*., Comparative genomic analysis of the family Iridoviridae: re-annotating and defining the core set of iridovirus genes, *Virol. J.* **4**:11, 2007.
27. Dixon, L.K., Chapman, D.A., Netherton, C.L. and Upton, C., African swine fever virus replication and genomics, *Virus Res.* **173**(1):3–14, 2013.
28. Van Regenmortel, M.H.V., Introduction to the species concept in virus taxonomy; in: Van Regenmortel, M.H.V., Fauquet, C.M., Bishop, D.H.L., Carstens, E.B., Estes, M.K., Lemon, S.M., Maniloff, J., Mayo, M.A., McGeoch, D.J., Pringle, C.R. and Wickner, R.B. (Eds.), Virus Taxonomy, *Seventh Report of the International Committee on Taxonomy of Viruses*, Academic Press, San Diego, CA, pp. 3–16, 2000.

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Dating the Tower of Babel events with reference to Peleg and Joktan

Andrew Sibley

This paper discusses and seeks to identify the date of the Babel event from the writing of biblical and extra-biblical sources. This is a relevant question for creationists because of questions about the timing of post-Flood climatic changes and human migration. Sources used include the Masoretic Text, the Samaritan Pentateuch, the Septuagint, and the *Book of Jubilees*, and related historical commentaries. Historical sources suggest that the Babel dispersion occurred in the time of Joktan's extended family and Peleg's life. The preferred solution of this paper is to follow the Masoretic Text and the *Seder Olam Rabbah* commentary that places the Babel event 340 years post-Flood at Peleg's death. Other texts of the Second Temple period vary from this by only three to six decades, which lends some support to the conclusion.

This paper seeks to identify the date of the Babel incident with reference to events in the life of Eber's sons, Peleg and Joktan. Traditionally the Babel event is associated with a division (Genesis 10:25) in the life of Peleg, and this traditional understanding, relating to confusion of languages and demographic scattering, is accepted here. There are various biblical and extra-biblical sources that are available for consultation, including the Masoretic Text (MT), the Samaritan Pentateuch (SP), the Septuagint (LXX) and the *Book of Jubilees*. The text of Genesis 10:25 reads as follows:

> "To Eber were born two sons: the name of the one was Peleg, for in his days the earth was divided, and his brother's name was Joktan" (Genesis 10:25).

But at what point in Peleg's life do the events occur? Answering this question is important because it will help us understand the timeframe of post-Flood climatic changes and human migration. A number of present-day Christians who hold to a literal reading of Genesis consider that the reference to Peleg is linked to his birth, combined with acceptance of the MT. This suggests the Babel incident occurred as early as 101 years after the Noahic Flood, although with some flexibility of several decades (figure 1).[1] The very earliest dates are, however, implausible because other verses in Genesis 10 (26–32) inform the reader that the demographic scattering occurred in the time of Joktan's extended family, and this problem was recognised by both Augustine of Hippo and Bishop Ussher.[2] Genesis 10:26–32 reads as follows:

> "Joktan fathered Almodad, Sheleph, Hazarmaveth, Jerah, Hadoram, Uzal, Diklah, Obal, Abimael, Sheba, Ophir, Havilah, and Jobab; all these were the sons of Joktan. The territory in which they lived extended from Mesha in the direction of Sephar to the hill country of the east.
>
> "These are the sons of Shem, by their clans, their languages, their lands, and their nations.
>
> "These are the clans of the sons of Noah, according to their genealogies, in their nations, and from these the nations spread abroad on the earth after the flood."

The problem is that even if Joktan was the elder brother (which is doubtful because the name implies lesser or younger)[3] it would be impossible for him, according to the period relayed in the MT, to grow up and have such a large family prior to Peleg's birth. This natal event occurred when his father Eber was 34 years old. But in addition to this consideration, the first-century commentary of Josephus, *Antiquities of the Jews*, follows the longer timeframe of the Septuagint (LXX) and Samaritan Pentateuch (SP), and places the events at Peleg's birth.[4] While early commentaries on the MT, for instance the *Seder Olam Rabbah*, place the events at a later stage in Peleg's life, namely at his death.[3] But both *early* approaches require at least several hundred years from the Flood to the Babel event, and this length of time is supported by the *Book of Jubilees*.[5] This evidence constrains the time of the Babel scattering to several centuries post-Flood.

Supporting the traditional view

The traditional view of the meaning of the verb 'was divided' [*nip̄·lə·ḡāh* נִפְלְגָה] (Genesis 10:25) holds that it is a reference to the destruction of the Tower of Babel episode (figure 2), which is recorded in Genesis 11 and involves a geographical scattering of people, following the confusion of languages. This traditional view is supported by Fouts[6] and Sarfati,[7] who both point to the commentaries of a number of conservative theologians, or at least Fouts thinks the traditional view is the one with the least problems.[8] John Calvin spoke of the division of Peleg in terms of the Babel confusion of languages,[9] as did Bede in his chronology.[10] John Gill also held to a traditional view,

although acknowledging a diversity of views, for instance he discussed whether the events occurred at the birth of Peleg or afterwards, and highlights several positions from Josephus and other Jewish writers.[11] Some suggested the division occurred at Peleg's birth, while others pointed to events during his life, or his demise. Keil and Delitzsch, and Leupold, also hold to this traditional view, with the former commentary suggesting it correlates with Peleg's birth, while Leupold suggests Peleg was named in memory of the Babel incident.[12]

Are different events implied?

John Skinner suggested there was no strong reason to hold the division to the event of Babel and considered that it may refer to some other dispersal, or to the separation of Peleg's family from that of his brother Joktan.[13] Recent comment from Morris and Johnson points out that a different verb, *parad*, is used in Genesis 10:5 and 10:32, which might imply separate events. Genesis 10:5 is with reference to the sons of Japheth: "From these the coastland peoples spread [*nip̄·rə·ḏū* נִפְרְדוּ] in their lands, each with his own language, by their clans, in their nations." And Genesis 10:32: for all the sons of Noah "These are the clans of the sons of Noah, according to their genealogies, in their nations, and from these the nations spread [*nip̄·rə·ḏū* נִפְרָדוּ] abroad on the earth after the flood."[14] At a superficial level use of *nip̄·lə·ḡāh*, instead of *nip̄·rə·ḏū*, might suggest that a different event is alluded to in Genesis 10:25.[15]

Taken as a whole, the passage through Genesis 10 and 11 appears to be giving a single account of the life and subsequent separation of the sons of Noah into geographic locations after the Flood. But the actual time of division occurred at some significant point in the lifespan of Peleg. The use of the verb *nip̄·lə·ḡāh* in Genesis 10:25, as opposed to alternatives, may be merely giving the reader additional information about the nature of the event without the need to hold to separate events. The verb *nip̄·rə·ḏū* is often used to refer to the act of *separation* of people (for instance in Genesis 13: 9, 11), while *nip̄·lə·ḡāh* is sometimes used of a more general *division* or *splitting in two* (Psalm 55:10).[16]

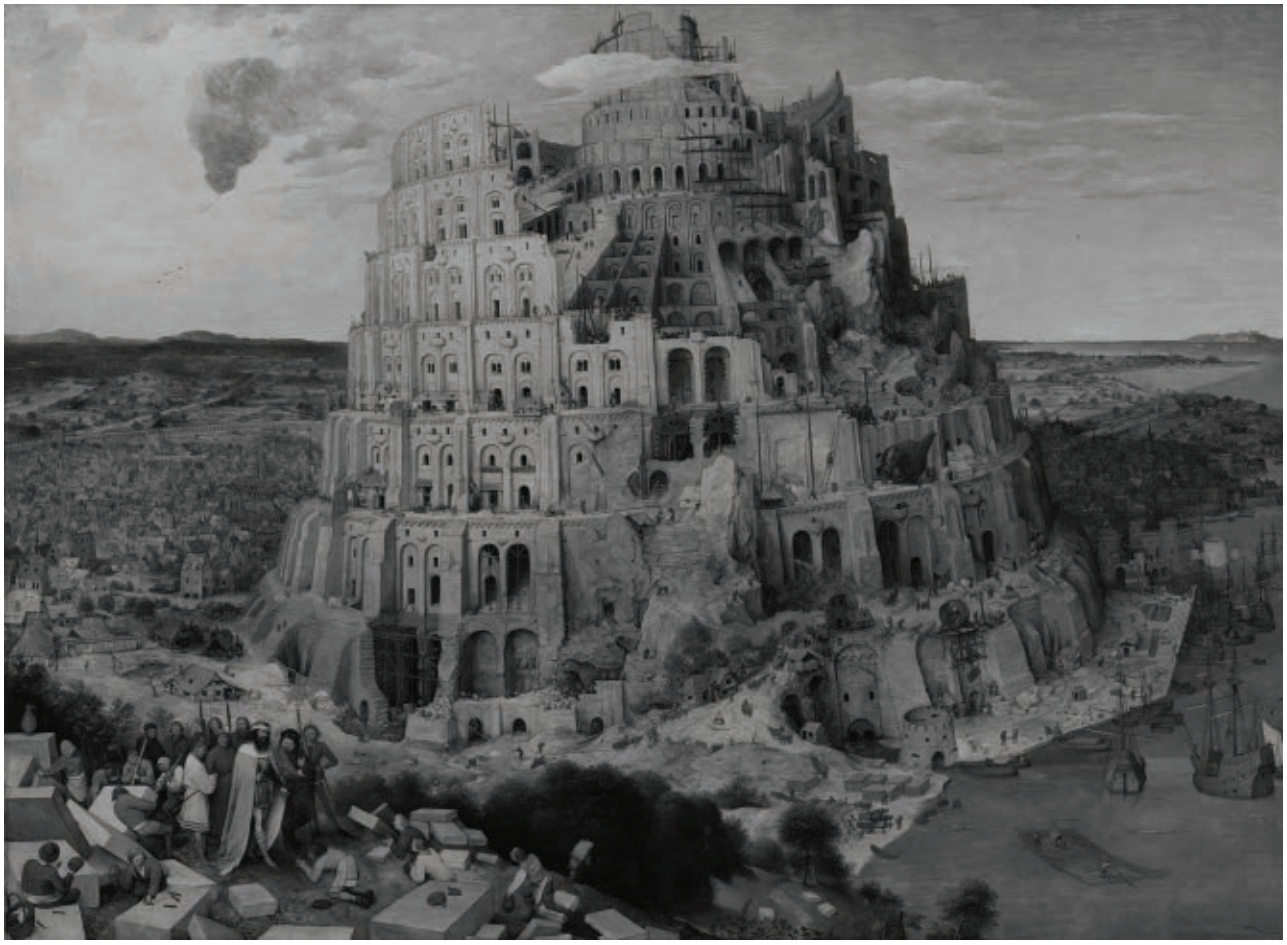

Figure 1. The Tower of Babel by Pieter Bruegel the Elder 1563

Figure 2. The Tower of Babel, Ur and Noah's Ark on the Mappa Mundi (world map) in Hereford Cathedral, England, c.1300

There are other places where the text of Genesis introduces a theme and then elaborates on it shortly afterwards. The creation account of Genesis 2 in relation to the Garden of Eden and the formation of Adam relays a more detailed account of events of the sixth day after they are first mentioned in Genesis 1. And the details of the Babel confusion of languages in Genesis 11 are first alluded to in Genesis 10. There are good reasons from the biblical text and commentaries to hold to the traditional understanding, not least that it is closest to a plain sense reading of Genesis 10 and 11 in giving a single account.

Date of Peleg's division

There are two main points to consider in order to determine from the biblical text the time of Peleg's division, and from this the destruction of the Tower of Babel. This will help constrain the time of the Babel incident. First, at what point in Peleg's life did the events take place, and second, which Old Testament source should be considered the more reliable out of the main Old Testament document types available: especially the Masoretic Text (MT), the Septuagint (LXX), and the Samaritan Pentateuch (SP)? The extra-biblical *Book of Jubilees* may also be consulted for historical purposes. These give different dates for the lifespan and life events of the post-Flood Patriarchs, even though they broadly record the same information. Cosner and Carter have in fact already provided a useful analysis of the problem and give good reasons why the MT is the more reliable, and their view is preferred here.[17] However, as will be shown below, the different sources in fact offer support to the MT in placing the Babel event several hundred years after the Flood.

Creationist views

There are a number of views in the thinking of present-day creationists, ranging from those who hold to the LXX and those who hold to the MT. John Whitcomb and Henry Morris were at one time sympathetic to the LXX in *The Genesis Flood* and even considered the possibility of early gaps in the record. Babel they thought might have occurred 1,000 years post-Flood.[18] But more recent creationists tend towards acceptance of the MT. Bodie Hodge suggests a date for the Babel incident related to Peleg's birth between 101 and 130 years after the Flood, acknowledging the influence of the MT (although he prefers 120 years). He also acknowledges Ussher's work on his view, but suggests Ussher's work is sometimes influenced by Manetho and not without error.[19] Snelling and Matthews suggest a similar view correlating with Peleg's birth as a 'first estimate', and have a graphic which offers support to this early view, but they are open to later times in Peleg's 239 years of life.[20] John Morris and James Johnson broadly follow Ussher in suggesting that the birth of Peleg took place around 101 years after the Flood according to the MT, although because they suggest two events may be implied, it is not clear that it is linked to Babel.[21] The view of Sarfati, who follows the MT, is that the Babel event and dispersion may have occurred around the time of Peleg's birth or at some

other point in his life. So Peleg may have been named prophetically, perhaps in a similar way to the prophecy implicit in Methuselah's name.[22]

The timeframe of the LXX and SP

There does initially seem to be support from some sources for the earlier time in Peleg's life. Josephus comments that "Heber begat Joetan and Phaleg: he was called Phaleg, because he was born at the dispersion of the nations to their several countries; for Phaleg among the Hebrews signifies *division*."[4] Among the Church Fathers, Julias Africanus thought the dispersion took place at least 399 years after the Noahic event (from 2262 to 2661 AM): "Heber, when 134 years old, begets Phalec in the year 2661, so called because the earth was divided in his days."[23] Augustine was also of the view that the name was linked to the separation of languages and that the event occurred at the time of Peleg's birth.[24] Augustine thought Peleg was much younger than Joktan:

> "And therefore we must by no means suppose that they were born in the order in which they were set down; otherwise, how could the twelve sons of Joktan, another son of Heber's, and brother of Peleg, have already founded nations, if Joktan was born, as he is registered, after his brother Peleg, since the earth was divided at Peleg's birth? We are therefore to understand that, though Peleg is named first, he was born long after Joktan, whose twelve sons[25] had already families so large as to admit of their being divided by different languages. There is nothing extraordinary in the last born being first named."[26]

Josephus, Africanus, and Augustine broadly followed the timeframe of the LXX, which has Peleg's birth 401 to 411 years respectively, after the Flood; that is if we ignore the possibly late addition of Cainan into the LXX lineage.[27] Another source that followed a similar timeframe to the LXX was Manetho's *Book of Sothis*, which spoke of the Dispersion being 5 years into Peleg's life "… from the general cosmic year 2776, in which the Dispersion took place in the 34th year of the rule of Arphaxad and the 5th year of Phalec."[28] But while Manetho lived several hundred years before Christ, this is widely considered to be of questionable origin, and may have been written in the early Christian era, then translated by George Syncellus after AD 810.[29] It does seem to set out a similar chronology to the LXX, in which Peleg was born in the year 2773 AM. Although there is the wider possibility that the writers of the Alexandrian LXX extended their chronology by several hundred years in order to fit with Manetho's broader history.[30]

Book of Jubilees

A shorter timeframe from the Flood to the birth of Peleg of 256 years (from 1309 to 1567 AM) is found in the pseudepigraphical *Book of Jubilees,* with the land said to be divided by lots at this time between the sons of Noah.[31] But instead of dispersion, according to *Jubilees*, the people rebelled against God's command to fill the earth and instead built a tower in Shinar. This work has the Babel dispersion around 379 years into the post-Flood era, some point after the birth of Reu. The building is said to have taken place between 1645 to 1688 AM.[32] However, if the period of Cainan's insertion (of 64 years) is subtracted from the text, the date for the Babel incident would need to be reduced to 315 years into the post-Flood era, although it is not clear in *Jubilees* whether the date of the Babel event is dependent upon this insertion.

This work is not considered Scripture by most Western Christians, but it is clearly present in the literature of the Second Temple period. Although the early church used this work, and translated it into Greek and Latin, much of it became lost, although in the nineteenth century complete copies were discovered in the Ethiopian Ge'ez text. Hebrew fragments of *Jubilees* have also been uncovered in the Qumran caves and lend support to the notion that it originated in the intertestament period, some copies existing from around 100 BC.[33] This work, sometimes referred to as Lesser Genesis (Leptogenesis) was known to the Church Fathers and seems to reflect a chronological tradition that is somewhat different from the LXX, MT, and SP, perhaps being influenced by a pre-MT manuscript.[34] However, popular copies seem to record the Christian era error of an additional Cainan, copies that have passed down to us from the Greek to the Ethiopian source.[35]

Sources that favour the timeframe of the MT

There are other views regarding the timeframe of Peleg's division, mainly from Hebraic sources, that are different from the Greek textual influence of Josephus and Augustine. Gill's *Exposition of the Bible* points out that the Medieval Jewish scholar Jarchi (Rashi Yitzhaki) favoured Peleg's demise as the implied time.[36] The earlier Hebrew Rabbi Jose ben Halafta, in his second century *Seder Olam Rabbah*, linked the events to the division of languages and placed the incident at the time of Peleg's death, 340 years after the Flood.[3] He comments that the division cannot have occurred at the time of Peleg's birth because Genesis records that the demographic separation affected Joktan's thirteen sons, and Joktan was Peleg's younger brother (Genesis 10:26–30). The name Joktan infers that he was the younger or lesser brother.

Rabbi Jose further suggested the events could not have happened during Peleg's life because the time would then

be hidden in Scripture, when in reality Scripture is trying to explain events. This leaves the death of Peleg as the likely time, which Rabbi Jose suggests implies that Peleg was named at his birth through prophecy. We may note as well that in a few cases in Genesis names change to denote theological significance: for example, Abram to Abraham (Genesis 17:5), and Jacob to Israel (Genesis 32:28). So, as an alternative to a prophetic name, we may consider whether the name Peleg, as recorded in Genesis, was actually his name given at birth, or perhaps use of it is given in Scripture as a means of conveying a meaning that relates to division.

Although the early Greek-speaking Christian community used the LXX there was a move in subsequent centuries to accept the MT as the more reliable version, with influence from scholars such as Bede. However, a problem arose in this because of insufficient attention to chronological differences. The problem appears, for instance, in Bede's chronology from AD 725 *De Temporum Ratione* (*The Reckoning of Time*). Although he compared both the timeframe of the LXX and MT, he seemed to prefer the chronology of the MT. But he maintained in part the interpretation of commentators such as Josephus and Augustine, who placed the division at Peleg's birth, according to the LXX:

> "Peleg means 'division' and his parents gave him this name because at the time of his birth the Earth was divided by the confusion of languages."[10]

This conflation of texts and commentaries across different traditions introduces a problem that needs to be addressed. It leads to an earlier time for the Babel event than the one held by historical Jewish commentators. However, Ussher's chronology of AD 1650 is slightly more circumspect and does consider some of the issues that arise from this transition of texts, but not all.

Ussher's contribution

So, historical sources that follow the LXX or SP point to Peleg's birth as the time of the Babel event, while early Hebraic sources that follow the MT present Peleg's death as the preferred time. However, Ussher seems to do something slightly different. In some ways Ussher's discussion reflects commentary in Rabbinical literature (and the *Book of Wisdom*), although the source of some of his comments is not clear, and he would only have had fragmentary access to *Jubilees* via the Church Fathers. He also seeks to address the problem of Joktan's children in a similar way to that of Augustine in the *City of God*. This is done by proposing that Joktan was older than Peleg, and in effect places the confusion of languages at least several decades after Peleg's birth.

Ussher's commentary on the division in the time of Peleg mirrors comment in *Jubilees*. In *Jubilees* there was a division of land by allotment: the text informs that the sons of Noah took lots in the presence of Noah (*Jubilees 8:8–9:14*). But the people rebelled against scattering and conspired to build the Tower of Babel in the Plain of Shinar. Later God destroyed the tower and confused the languages because of their disobedience. This is reflected in Ussher's commentary on the basis of a conditional opening statement, although Ussher's source is not clear:

> "If this happened at the day of his birth [*Quod quidem fi de illius natali accipiatur*[37]], then it seems that when Peleg was born, Noah, who formerly knew all the places which were now covered with bushes and thorns, divided the land among his grandchildren. When this was done, they then went from those eastern parts (where they first went from the mountains of Ararat) into the valley of Shinar. Ge 11:2 Here the people impiously conspired as we find in the book of Wisdom /APC Wis 10:5 to hinder this dispersion of them as commanded by God and began by Noah (as may be gathered from Ge 11:4, 6, 8, 9 compared together). They went together to build the city and tower of Babylon. God frustrated this project by the confusion of languages he sent among them. (Hence it took the name of Babel Ge 11:9). The dispersion of nations followed."[38]

Ussher further discussed the problem of Joktan's children along Augustinian lines, pointing out the age problem: that even if Joktan was the elder, and born when Eber was only 20 years old, it would take many decades for the thirteen children of Joktan to reach sufficient age to be leaders or captains of people. Ussher then is conditionally suggesting the actual division occurred 'some years after' the birth of Reu (after 130 years post-Flood). Ussher's text reads as follows:

> "Many companies and colonies settled down in various places according to their languages. The 13 sons of Joktan, the brothers of Peleg, as recorded in Ge 10:26–30 were among the captains and heads of the various companies. These brothers were not yet born when Peleg was born. Eber was only 34 years old when Peleg was born to him. Though we should suppose that Joktan was born, when Eber was only 20 years of age and that Joktan's oldest son was born to him when he was likewise 20 years old, yet still it appears, that the oldest son of Joktan must be 6 years younger than Peleg. So that at least the youngest of those 13 sons of Joktan, namely, Jobab and 3 other brothers of his are mentioned before him must be younger still. These countries rich in gold, Sheba, Ps 72:15 Ophir 1Ki 9:28 and Havilah Ge 2:11 were named after these men. These brothers could not be capable of such an expedition of leading colonies because of their youth until some years after Reu was born to Peleg."[38]

Table 1. Different views on the Babel incident in relation to Peleg's life. Shaded areas are favoured dates given by major *early* biblical commentators for division in the time of Peleg.

	MT	*Jubilees*	SP	LXX	Josephus LXX	Manetho	Augustine LXX	Julius Africanus
Year of birth of Peleg after Flood	101	256	401	401[a]	411[a]	509	401[a]	399[a]
Possible date of Babel in Peleg's life	140–200[c]	315–379[b]				514		
Year of death of Peleg after the Flood	340		640	740[a]	/	/	/	738

[a] I have omitted Cainan as it is considered to be a late addition in the LXX. Otherwise, these dates would be 100 years higher.
[b] This is the date at which Babel was destroyed; the lower figure (315 years) is obtained by omitting the extra Cainan. It is 379 years if Cainan is included.
[c] Estimated from Ussher's writing to account for the necessary maturity of Joktan's children.

To put this into closer context, if we assume that Joktan was born when Eber was 20 years old (1743 AM), then it might realistically be assumed that it would take 55 or 60 years for Joktan to: (a) grow up and marry (20 years), and (b) bring up a family of thirteen to the point where the youngest reached the age of 20 years old (35 to 40 years). This would take the *minimum* timeframe to 142 to 147 years post-Flood for the Babel event (with reference to the MT). Gill seems to offer some support to this, but is uncertain over the actual date and provides the reader with the possible range through Peleg's life. Gill also notes that some "eastern writers say, that it was in the fortieth year of the life of Peleg, and then it must be in the year after the flood one hundred and forty one."[39] But if Joktan was feasibly born 20 years after Peleg, then that time would run out to 181 years. And if we were to assume the more normal 30 years in the MT to birth of first born, then that *minimum* period would stretch to 200 years. Ussher doesn't directly provide an actual date, but only a *minimum* period to deal with the problem of Joktan's children. However, he does suggest that Babylon was founded when Peleg was 13 years old, and Egypt was founded 160 years post-Flood, which may indicate his view of the Babel dispersion.[40] But there is the possibility that the dates given by the sources Ussher used are inflated, which reduces confidence in this at this time.

Discussion

As noted, there are several primary sources for the dating of Peleg's life. The dates in table 1 and figure 3 have been determined by subtracting the birth of Arphaxad from Peleg's life events, and adding a number of years back to the Flood. The texts record that Arphaxad was born two years after the family came out of the Ark, except Josephus' LXX, which has 12 years. The LXX is inflated, partly because it includes the birth of Cainan, which the other texts omit, although this is probably a result of a transcription error.[41]

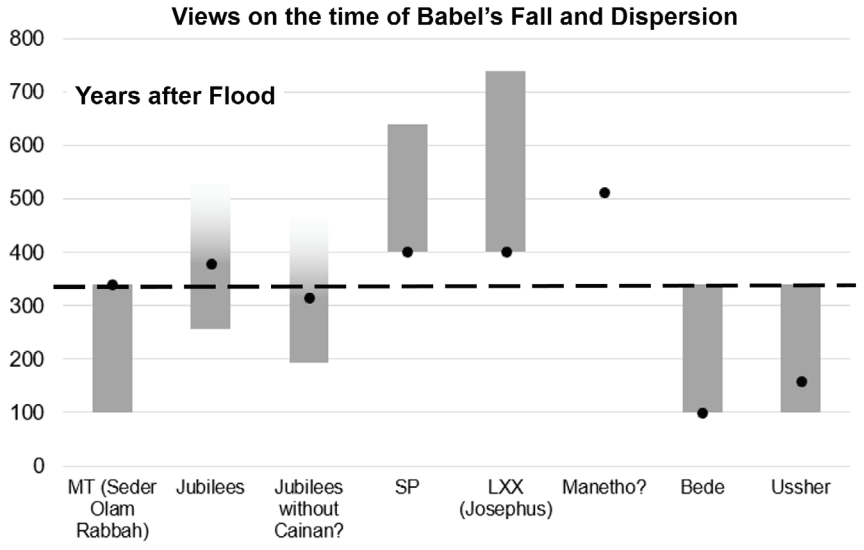

Figure 3. Time of the Babel scattering from the Flood according to historical sources. The grey boxes are the lifespan of Peleg. The black dots are the time of the Babel event from various sources. The dotted line is the proposed time of the Babel event. Note that *Jubilees* doesn't give the death of Peleg, and the date of the Babel event in *Jubilees* is not strictly dependent upon the Cainan insertion. Ussher's date for Babel is only hinted at in Ussher. The SP and LXX are plotted without the Cainan insertion.

But the SP and LXX have also *systematically* added 100 years to the time of birth of the sons for each of Peleg's descendants back to Arphaxad, while the LXX has extended Peleg's life for 100 years over the other two versions. These extensions may be influenced by Egyptian sources (Manetho) or Greek and Babylonian chronology at the time of writing of the LXX. The MT and SP are much closer to each other chronologically before the Flood, and the SP and LXX cohere better after the Flood. It may, however, be asked whether historians such as Josephus would have placed the Babel event around 400 years after the Flood if the LXX and SP had not artificially extended the lifespan of Peleg's ancestors. In response, the evidence suggests that other Hebrew manuscripts such as *Jubilees*, and commentaries on the MT, would still force constraint of the possible dates to a period of several hundred years after Noah's Flood. This view seems to have formed a consensus during the Second Temple period.

It is considered here that the MT is the more accurate, with the LXX and SP showing some inconsistencies, not least the obvious error that Methuselah outlived the Flood. *Jubilees* seems to fall between both MT and LXX, as does the SP. However, we should not forget that the MT text was standardized during the first century, possibly in part as a way of differentiating it from the Old Testament texts (mainly Greek LXX and pre-MT Hebrew text) available to the early Christian community.[42] Other earlier Second Temple texts that existed prior to AD 70 seem to have been lost, although with the discovery of the Dead Sea Scrolls there may be the possibility of recovering some understanding of it, and *Jubilees* may, in part, reflect this earlier version. According to Lawrence Schiffman, evidence from Qumran caves suggests that proto-Masoretic text types comprise 60% of documents, while another 20% are in the Qumran style with proto-Masoretic text bases. Only 5% are of the proto-Samaritan type, with another 5% of the Septuagint text type, and around 10% are non-aligned.[43] However, other scholars have suggested the 60% for proto-MT is too high with greater textual diversity evident.[44] This may, however, only reflect manuscripts available to the Qumran scribes, but overall it does suggest the proto-MT type formed a major understanding within the Second Temple Jewish community.

So, there is some reason to regard the MT text as the more reliable, and from this, and early Jewish commentaries such as Rabbi Jose's *Seder Olam Rabbah*, consider that the time of the Babel division occurred at the end of Peleg's life, 340 years after the Flood. But there are other views. *Jubilees* has the event after 379 years (or possibly 315 years if the extra Cainan is omitted). An outside possibility is that the LXX or SP are the more reliable texts and that the events occurred at Peleg's birth, 401 to 411 years after the Flood. Ussher's later novelty mixes commentary from *Jubilees* and blends it with the MT timeframe, but it gives a *minimum* period estimated at 140 to 200 years, with a tentative hint of a preferred 160 years post-Flood. Unfortunately, it is not possible to put a high confidence on Ussher's estimate because some of his non-scriptural sources may be inflated. Furthermore, it would appear from available evidence that no early Jewish commentators placed the Babel event as early as 101 years post-Flood, which suggests it is very unlikely.

Summary

This paper maintains that the reference to Peleg's division correlates with the scattering of people and confusion of language associated with the Babel event. There is good scriptural and commentary evidence in its favour, at least being a major part of the account. Any understanding of the Peleg reference needs to take this into account.

In terms of the time of the Peleg–Babel incident, it is noted that early Jewish commentators placed it either at the end of Peleg's life according to the MT (340 years post-Flood in *Seder Olam Rabbah*), or according to the SP and LXX at Peleg's birth 401 to 411 years after the Flood (in Josephus's *Antiquities*). Evidence suggests the MT is the more accurate text and in an overall sense the preferred solution here, but either way the date actually falls into quite a narrow range, between 340 to 411 years post-Flood. Although *Jubilees* has it potentially as early as 315 years, and gives more information about Babel, most Christians do not consider this work to have scriptural authority. But it would seem that the general Jewish consensus in the Second Temple period and first century AD placed the event of Babel several hundred years after the Flood of Noah. So, the preferred date of Babel here is proposed at 340 years post-Flood, with an error margin of plus or minus several decades. There doesn't appear to be a strong *early* tradition that places the events at the beginning of Peleg's life according to the MT timeframe (101 years) post-Flood, and although that doesn't make it impossible, the problem of the necessary maturity Joktan's children makes it seem implausible. Even Ussher's more recent novel calculation suggests only a *minimum* date somewhere within the range 140 to 200 years.

References

1. For instance, Hodge, B., *Tower of Babel*, Master Books, Green Forest, AR, ch. 7, 2013; Snelling AA. and Matthews, M., When was the Ice Age in biblical history? *Answers Magazine* **8**(2):46–52, 2013. This paper has a graphic which places Babel approximately 100 years after the Flood. See also Pierce, L., In the days of Peleg, *Creation* **22**(1):46–49, 1999. These papers do suggest some flexibility, but prefer an early date.
2. Augustine, *City of God*; in: Schaff, P. (Ed.), *Nicene and Post Nicene Fathers* (NPNF), Series 1, vols. 1–8, T&T Clark, Edinburgh, UK, 1886–1890, NPNF 16.11; Ussher, J., *The Annals of the World*, Pierce, L. and Pierce M. (transl.), Master Books, Green Forest, AR, vol. 1.47–52, p. 22, 2003.

3. Rabbi ben Halafta, J., *Seder Olam Rabbah: The Rabbinic View of Biblical Chronology*, Guggenheimer, H.W. (transl.), Rowman and Littlefield Publishers, Lanham, MD, p. 3, 1998.
4. Josephus, *Antiquity of the Jews*, Thackeray, H. St. J. (transl.), *Jewish Antiquities*, Books I–IV, Harvard University Press, Cambridge, MA, 1.6.4.
5. *Book of Jubilees*, in Charles, R.H. *The Apocrypha and Pseudepigrapha of the Old Testament*, Clarendon Press, Oxford, UK, 1913.
6. Fouts, D.M., Peleg in Gen. 10:25, *JETS* **41**(1):17–21, March 1998.
7. See Sarfati, J.D., *The Genesis Account*, Creation Book Publishers, Powder Springs, GA, ch. 23–24, 2015; Sarfati, J.D., 'In Peleg's days, the earth was divided': What does this mean? creation.com/in-pelegs-days-the-earth-was-divided.
8. Fouts also suggests the traditional view may point to two aspects, one related to the Babel scattering, the other to a separation between Peleg and Joktan.
9. John Calvin (1509–1564), *Sermons on Genesis: Chapters 1–11* [from 1554]; Banner of Truth, Edinburgh, UK, p. 324, 1984.
10. Bede: *The Reckoning of Time*, Wallis, F. (transl.), Liverpool University Press, Liverpool, UK, p. 164, 1999.
11. Gill, *Exposition of the Old and New Testament*, published in two parts: firstly, in 3 volumes on *An Exposition of the New Testament* (1746–1748), and secondly, in 6 volumes on *An Exposition of the Old Testament* (1748–1763). Commentary on Genesis 10:25 and 11:8.
12. See, for instance, Sarfati, ref. 7, p. 652; Keil, C.F. and Delitzsch, F., *Biblical Commentary on the Old Testament* **1**:171, 176, 1857; and Leupold, H.C., *Exposition of Genesis*, 1:378, 1942.
13. Skinner, J., *A Critical and Exegetical Commentary on Genesis*, (2nd edn), ICC: T and T Clark, Edinburgh, UK, p. 220, 1930.
14. Morris, J.D. and Johnson J.J.S., Rightly dividing the word about Peleg, Presentation at CRS Conference, 10 July 2009.
15. One Jewish source from the 16th century, the midrash *Sefer haYashar*, also suggests two events: a division of people, and later a division of the earth. However, most Christian and Jewish sources consider it to be of questionable origin, and therefore unreliable. Sefer haYashar, ch.7:19 "These are the generations of Shem; Shem begat Arpachshad and Arpachshad begat Shelach, and Shelach begat Eber and to Eber were born two children, the name of one was Peleg, for in his days the sons of men were divided, and in the latter days, the earth was divided." Edited by Parry, J.H., Published Parry and Company, Salt Lake City, UT, 1887. Claimed first edition 1552, Naples, surviving printed edition from Venice, 1625. See Jacobs, J. and Ochser, S., YASHAR, SEFER HA-, *Jewish Encyclopedia*, vol.12, pp. 588–589, 1906.
16. Often *nip̄·la·ḡāh* is used with reference to water, but there is insufficient space to discuss that here.
17. Cosner, L., Carter., R., Textual traditions and biblical chronology, *J. Creation* **29**(2):99–105, 2015.
18. Whitcomb J.C. and Morris, H.M., *The Genesis Flood*, P and R Publishing, p. 41–42, 1961.
19. Hodge, B., *Tower of Babel,* Master Books, Green Forest, AR, ch. 7, 2013.
20. Snelling AA. and Matthews, M., *When Was the Ice Age in Biblical History? Answers* **6**:46–52, 2013.
21. Ussher, ref. 2.
22. Sarfati, ref. 7, p. 655.
23. Africanus, J., Extant Fragments of Five Books of Chronology of Julius Africanus, VI–VIII; in: Schaff, P. (Ed.), *Ante-Nicene Fathers (ANF),* vol. 6, T and T Clark, Edinburgh, UK, 1886–1890.
24. Augustine, ref. 2. He also thought the original language was Hebrew and this was retained by the descendants of Eber.
25. Augustine suggests only 12 sons of Joktan; Augustine, ref. 2.
26. Augustine, ref. 2.
27. Josephus, ref. 4, 1.6.5; Augustine, *City of God*, NPNF, 16.10.
28. Waddell, W.G, (trans.), *The Fragments of Manetho*, Loeb Classical Library edition, Harvard University Press, appendix IV—The Book of Sôthis or The Sôthic Cycle (from Syncellus), pp. 238–239, 1940.
29. Adler, W., Berossus, Manetho, and 1 Enoch in the World Chronicle of Panodorus, vol. 76, no. 4, *The Harvard Theological Review*, Cambridge Uni. Press, pp. 419–442, 1983.
30. Pierce, L., In the days of Peleg, *Creation* **22**(1):46–59, 1999.
31. *Jubilees* 8:8–11, "And in the sixth year [1567 AM] thereof, she bare him son, and he called his name Peleg; for in the days when he was born the children of Noah began to divide the earth amongst themselves: for this reason he called his name Peleg. And it came to pass in the beginning of the thirty-third jubilee [1569 AM] … [Noah] called his sons, and they drew nigh to him, they and their children, and he divided the earth into the lots, which his three sons were to take in possession." in Charles, R.H. *The Apocrypha and Pseudepigrapha of the Old Testament*, Clarendon Press, Oxford, UK, 1913; also Segal. M., *The Book of Jubilees: Rewritten Bible, Redaction, Ideology and Theology*, Koninklijke Brill NV, Leiden, Netherlands, p. 125, 2007.
32. *Jubilees* 10:18, 20, 21, "And in the three and thirtieth jubilee, in the first year in the second week, Peleg took to himself a wife ... and she bare him a son in the fourth year of this week [1628 AM], and he called his name Reu; for he said: 'Behold the children of men have become evil through the wicked purpose of building for themselves a city and a tower in the land of Shinar.' And they began to build, and in the fourth week they made brick with fire ... . And they built it: forty and three years [1645–1688 AM]."
33. VanderKam J.C. and Milik, J.T., The first Jubilees manuscript from Qumrall Cave 4: A preliminary publication, *J. Biblical Literature* **110**:243–270, 1991.
34. Shanks, H., Understanding the Dead Sea Scrolls, *Biblical Archaeology Review*, 29 June 1993; VanderKam, J.C., Book of Jubilees; in: Schiffman L.H. and VanderKam J.C. (Eds.), *Encyclopedia of the Dead Sea Scrolls*, Oxford University Press, UK, vol. I, p. 435, 2000.
35. For instance, Sarfati, J.D., Cainan of Luke 3:36, *J. Creation* **12**(1):39–40, 1998; and Pierce, L., Cainan in Luke 3:36*:* insight from Josephus, *J. Creation* **13**(2):75–76, 1999.
36. Gill suggested that Josephus favoured the later date, but the comment above suggests the earlier date.
37. Ussher, J., *Annales Veteris Testamenti of Prima Mundi Origine, Dedducti: Una Cum Rerum Asiaticarum et AEgyptiacarum Chronico, A Temporis Historici Principio, Jacobo Usserio Armachano, Londini*, MDCL (1650).
38. Ussher, ref. 2, p. 21.
39. Gill, ref. 11, Commentary on Genesis 11:8 (Gill quotes, for instance, from Elmacinus *al-Majmu` al-Mubarak* (*The blessed collection*), pp. 1262–1268, and Hottinger, J.H., *Smegma Oriental*, p. 267, 1658.) Anderson suggests 'in his days' of Gen. 10:25 refers to Peleg's life. Anderson, L., CRS 2016 Conference Abstracts, The Peleg problem, part 1: when did the event described in Genesis 10:25 occur? *CRSQ* **53**(1):59–60, 2016.
40. Ussher, J., *The Annals of the World,* 49, p. 22. 1,903 years elapsed from this time [1771 AM, 2234 BC] to the capture of Babylon by Alexander the Great. This calculation and number of years was made according to astronomical observations by Porphyry, as we find in Simplicius, in his second book, *de Coelo.* This he affirms to have been transmitted into Greece from Babylon by Chalisthenes at Aristotle's request; Constantinus Manasses states that the Egyptian state lasted 1,663 years. Counting backward from the time that Cambyses, king of Persia, conquered Egypt, leads us to this period [1816 AM, 2188 BC]. About this time Mizraim, the son of Ham, led his colony into Egypt. See also Pierce, ref. 30.
41. For instance, Sarfati, ref. 35, and Pierce, ref. 35: *insight from Josephus*.
42. Cohen, M., The Idea of the Sanctity of the Biblical Text and the Science of Textual Criticism; in: HaMikrah V'anachnu (Ed.), Uriel Simon, HaMachon L'Yahadut U'Machshava Bat-Z'mananu and Dvir, Tel-Aviv, 1979.
43. Schiffman, L., *Reclaiming the Dead Sea Scrolls*, Illustrated Edition, Yale University Press, New Haven, CT, 2007.
44. Peter Flint responds to a figure given by Emmanuel Tov of 47%, and suggests less than half are properly proto-MT type, with the majority showing influence from the SP or LXX. Flint, P., The biblical scrolls and the text of the Hebrew Bible/Old Testament; in: VanderKam, J. and Flint, P., *The Meaning of the Dead Sea Scrolls: Their Significance for Understanding the Bible, Judaism, Jesus, and Christianity*, Harper San Francisco, San Francisco, CA, p. 146, 2002.

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A broken climate pacemaker?—part 1

Jake Hebert

The results from the well-known "Pacemaker of the ice ages" paper, which convinced uniformitarian scientists of the validity of Milankovitch climate forcing, are now largely invalid, due to a significant revision in the age of the Brunhes–Matuyama magnetic reversal boundary. Unfortunately, the Blackman–Tukey method used to obtain both the original and new results is somewhat obscure. Because of the important role that Milankovitch theory plays in both geochronology and 'climate change' speculation, it would be helpful if there were a simple way that other scientists, and even non-specialists, could confirm these new results without the need for extensive computation. Here I summarize the results of these new calculations and present a simple conceptual argument that allows others to partially verify these results, using only a pocket calculator or an Excel spreadsheet. This would make an excellent critical thinking exercise for high school or middle school science or mathematics students.

Milankovitch climate forcing is now the dominant secular explanation for the fifty or so Pleistocene glacial intervals ('ice ages') said to have occurred within the last 2.6 Ma.[1] This theory posits that changes in the seasonal and latitudinal distribution of sunlight, resulting from variations in Earth's orbital motions, pace the Pleistocene ice ages. In particular, these climate changes are thought to result from variations in the elongation of the earth's orbit (eccentricity), the tilt of the earth's axis (obliquity), and the longitude of the earth's perihelion (point of closest approach to the sun), measured with respect to the vernal equinox. The concept of Milankovitch climate forcing has numerous problems[2–5] but is today largely accepted because of a well-known 1976 paper titled, "Variations in the earth's orbit: the pacemaker of the ice ages".[6] The paper's authors, James Hays, John Imbrie, and Nicholas Shackleton, performed spectral analyses on three quantities (of assumed climatic significance), sampled at 10 cm intervals, within two deep-sea sediment cores from the southern Indian Ocean. The cores were designated as RC11-120 (length of 9.5 m) and E49-18 (length of 15.5 m). A third core, designated as V28-238, in the western Pacific Ocean, played an important, but indirect, role in the analysis (figure 1). Analyses of the oxygen isotope data (discussed below) and other variables showed climate cycles having periods of approximately 100, 42, and 23 thousand years (ka). Because the lengths of these cycles corresponded well to those of inferred cycles in Earth's orbital and rotational motions, the Pacemaker paper was seen as providing strong support for the Milankovitch theory.

Experts acknowledge that evidence for the Milankovitch (or astronomical) theory comes almost exclusively—if not *exclusively*—from spectral and/or time series analyses performed on paleoclimate data, like those performed in the Pacemaker paper. Physicist Richard Muller and geophysicist Gordon MacDonald noted:

> "In fact, the evidence for the role of astronomy [in climate variation] comes almost exclusively from spectral analysis. The seminal paper was published in 1976, titled, 'Variations of [sic] the earth's orbit: pacemaker of the ice ages.'"[7]

Likewise, noted physicist Walter Alvarez stated:

> "The widely accepted Croll-Milankovitch theory that fluctuating climate conditions during the Quaternary glaciation have been driven by astronomical cycles is based *entirely* on time-series analysis of paleoclimatic and orbital data [emphasis added]."[7]

Implications for geochronology and the 'climate change' debate

This paper argues that the original results presented in the Pacemaker paper are invalid, even by uniformitarian reckoning. Before discussing why this is the case, it is good to explain why this is significant.

The Milankovitch theory has become an extremely important aspect of secular geochronology. Uniformitarian scientists now generally assume the theory to be valid and use that assumption to assign relatively 'young' ages (thousands of years to a few million years) to deep-sea sediment cores via a technique called 'orbital tuning'.[8] These ages are then used to assign ages to other deep-sea cores, as well as the deep ice cores of Greenland and Antarctica.[9] Likewise, uniformitarian scientists are now using the Milankovitch theory in an attempt to assign ages even to Triassic sediments.[10] Incredibly, the Milankovitch theory is even used to assign ages to the dating standards used in argon-argon dating.[11,12] If the evidence for the Milankovitch theory is weak, then all of these age assignments are called into question—even by uniformitarian reckoning. The

consequences to uniformitarian geochronology would obviously be devastating.

Likewise, the Milankovitch theory is making a subtle contribution to 'climate change' alarmism, a subject which is discussed in more detail in part 2 of this series.[13]

Pacemaker problems

However, there are serious problems with the Pacemaker paper.[14–16] First, multiple versions of the data from these two cores exist, raising the question, which versions are the 'real' ones? Most of the differences between data sets are trivial, but in some cases, data points (and even small blocks of data) used in the original Pacemaker analysis have been removed from the newer versions of the data.[17] Furthermore, the original 10-cm resolution data actually used by the Pacemaker authors do not seem to be publicly available. I requested these data from the two surviving Pacemaker authors, but they did not respond to those requests. Hence, in order to replicate their results, I had to carefully reconstruct the data from figures 2 and 3 in the original Pacemaker paper. I have compiled these different data versions into tables in order to facilitate side-by-side comparisons of the older and newer data sets.[18]

Second, the Pacemaker authors excluded from their analysis all data from depths above 4.9 m within the E49-18 core, probably needlessly. In fact, they did not even bother to plot the oxygen isotope data for depths above 3.5 m (figure 3 in the original Pacemaker paper) in the E49-18 core! The purported justification for this exclusion of data was that the age at the top of the E49-18 core was uncertain (and possibly as old as 60,000 years), making the upper third of the E49-18 core unusable for analysis.[19] However, other secular

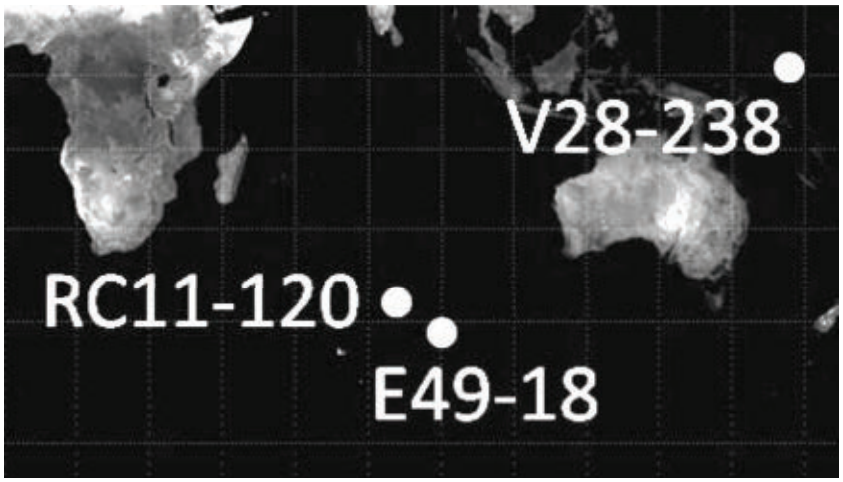

Figure 1. The 'Pacemaker of the ice ages' paper used data from the two Indian Ocean deep-sea cores RC11-120 and E49-18. Another core from the western Pacific, V28-238, played an important role in establishing the timescales for the two Indian Ocean cores.

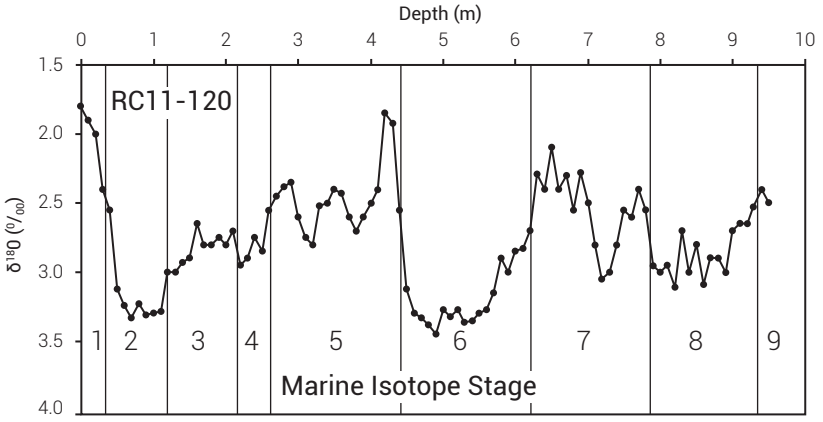

Figure 2. Reconstructed $\delta^{18}O$ data from the RC11-120 core, along with approximate locations of the Marine Isotope Stage (MIS) boundaries

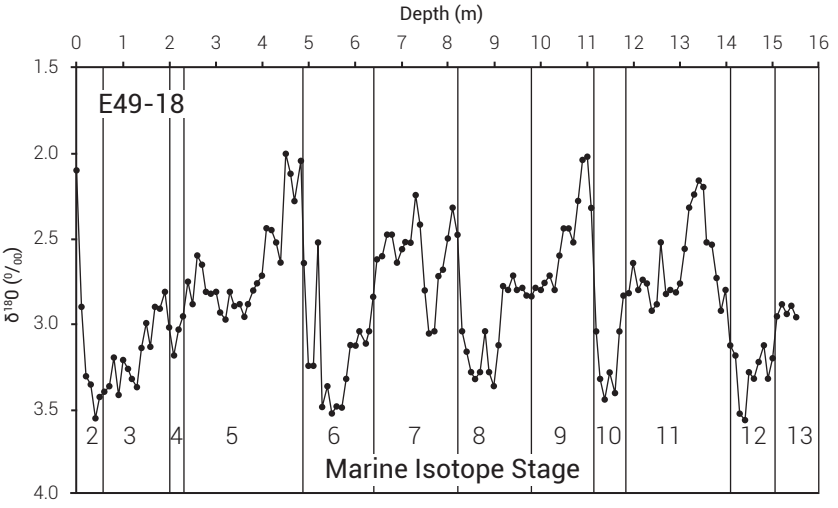

Figure 3. Reconstructed $\delta^{18}O$ data for the E49-18 core, along with approximate locations of the Marine Isotope Stage (MIS) boundaries. Data from above 3.5 m depth were obtained from SPECMAP data, archived, as of 13 October 2016, at doi.pangaea.de/10.1594/PANGAEA.52207.

scientists disagreed, arguing that the top of the core was quite young.[20] That would imply that the upper section of the E49-19 core was potentially datable by the radiocarbon method (even within a uniformitarian framework), which would mean that the uppermost E49-18 data were indeed usable for their analysis.

Third, before performing their analyses, the Pacemaker authors had to assign tentative timescales to the two cores. Critical to these timescales, especially for the longer E49-18 core, was an assumed age of 700 ka for the most recent magnetic reversal boundary, the Brunhes–Matuyama (B–M) magnetic reversal boundary. This age was based on K-Ar dating of volcanic rocks which recorded this reversal.[21] However, uniformitarian scientists have since revised the age of the B–M reversal boundary upward to 780 ka.[22–24] Incredibly, it seems that uniformitarian scientists never bothered to see what effect this age revision would have on the original Pacemaker results!

I have recently reperformed the Pacemaker frequency domain calculations, using the same method as the paper's authors, but taking into account this revision to the age of the B–M reversal boundary, as well as the inclusion of the previously excluded data from the second core. These changes dramatically weaken, if not completely invalidate, the original argument for Milankovitch climate forcing presented in that paper.[16]

In order to understand the original and new Pacemaker results, it is necessary to consider some background material.

Foraminifera, oxygen isotope ratios, and marine isotope stages

Microscopic marine organisms called foraminifera construct shells composed of calcium carbonate, $CaCO_3$. When these organisms die, their remains become part of the debris accumulating on the seafloor. Scientists often measure the amount of ^{18}O in a foraminiferal shell compared to the amount of ^{16}O and calculate a quantity called the oxygen isotope ratio, denoted by the symbol $\delta^{18}O$.

If one plots $\delta^{18}O$ values from a sediment core as a function of depth, many 'wiggles' are readily apparent (figures 2 and 3). These oxygen isotope values are thought to be global climate indicators: maximum values of $\delta^{18}O$ within seafloor sediments are thought to indicate times at which global ice volumes were largest, and minimum $\delta^{18}O$ values are thought to indicate times when global ice volumes were smallest.[25]

Because uniformitarian paleoclimatologists think that the $\delta^{18}O$ signal is a global climate indicator, they believe that the same basic pattern of $\delta^{18}O$ wiggles present in one core should be present in other cores. Of course, they recognize that changes in sedimentation rate, local weather effects, etc., can alter or distort this signal. Nevertheless, they believe that it is possible to 'match' $\delta^{18}O$ features within one core to corresponding $\delta^{18}O$ features in another core, even if the two cores are separated by great distances. Hence, they believe it is possible to transfer ages assigned to prominent $\delta^{18}O$ features within one core to (presumed) corresponding $\delta^{18}O$ features in another core.

To facilitate this wiggle-matching process, uniformitarian scientists have invented a numbering system involving marine isotope stages (MIS). Our present-day climate is part of MIS 1, which includes the so-called Holocene epoch. The most recent ice age corresponds to MIS 2-4, and most of MIS 5. MIS 5 was originally classified entirely as an interglacial, but secular paleoclimateologists now restrict the interglacial classification to the earliest $\delta^{18}O$ 'trough' within MIS 5, substage MIS 5e.[26] Likewise, MIS 6 corresponds to the penultimate (second-to-last) ice age. Generally, the boundaries between marine isotope stages occur at the depths at which the $\delta^{18}O$ values have transitioned halfway from a very low to a very high $\delta^{18}O$, or *vice versa*. The oxygen isotope values from the RC11-120 and E49-18 sediment cores are shown in figures 2 and 3, along with the approximate MIS boundary locations.

Age assignments for marine isotope stage boundaries

Before the Pacemaker authors could analyze the RC11-120 and E49-18 data, they had to assign timescales to these two cores. Radioisotope dating methods cannot generally be used to date the deeper sediments (although protactinium-thorium dating is theoretically capable of dating sediments thought to be less than 175,000 ka old[27]), and uniformitarian scientists believe that radiocarbon dating methods can only be used on the uppermost sediments. Hence, uniformitarian scientists used the long western Pacific V28-238 core to indirectly assign ages to the sediments. They chose this particular core because it was believed to have the most nearly constant sedimentation rate of all the cores that had been examined.[28] Magnetic minerals within the sediments showed a reversal of the earth's magnetic field at a depth of 1200 cm within the V28-238 core. Uniformitarian scientists had already used K-Ar dating to assign an age of 700 ka to volcanic rocks showing this same reversal. Hence, they concluded that the sediments at a depth of 1200 cm within the V28-238 core were 700 ka old. By assuming that the top of the V28-238 core had an age of 0 ka and that the seafloor sediments at that location had accumulated at a nearly constant rate, they were able to assign tentative ages to the first 21 MIS boundaries within the core (figure 4).[29] The results of these calculations are shown in table 1 (third column from left), as are the results

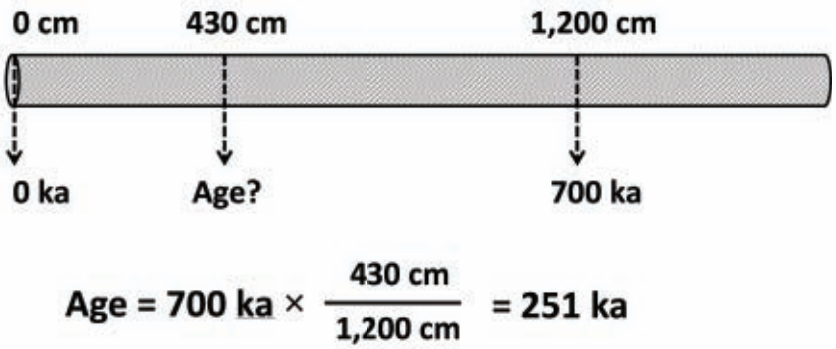

Figure 4. Method used to obtain age estimates for the MIS stage boundaries within the V28-238 core. The MIS 8-7 boundary was identified at a depth of 430 cm within the V28-238 core. Hence, it was assigned an age of 251 ka.

if one changes the assumed age of the B–M reversal from 700 ka to 780 ka (far right column).

The Pacemaker authors transferred the age assignment of 440 ka for the MIS 12-11 boundary, the age assignment of 251 ka for the MIS 8-7 boundary, and the age assignment of 128 ka for the MIS 6-5 boundary to the presumed corresponding MIS boundaries in the RC11-120 and E49-18 cores. Technically, however, the Pacemaker authors did not actually use this last age estimate of 128 ka in their analysis. Protactinium-thorium dating applied to the V12-122 Caribbean core had already yielded an age estimate of 127 ka for the MIS 6-5 boundary, and the Pacemaker authors felt that this slightly lower age estimate was a little more accurate.[30] They no doubt, however, considered the close agreement between these two age estimates of 127 ka and 128 ka to be a confirmation of the validity of their assumption of a (nearly) constant sedimentation rate within the V28-238 core.

They then used these three-age control (or anchor) points to construct timescales for the two sediment cores. For their initial analysis, they employed simple timescales (which they dubbed as 'SIMPLEX'), utilizing only two age control points within each core and the assumption of a constant sedimentation rate. Within the RC11-120 core, the MIS 6-5 boundary was identified at a depth of 4.40 m. Hence, an age of 127 ka was assigned to this depth in the RC11-120 core. An age of 0 ka was assumed for the top of the RC11-120 core, and ages were assumed to increase at a constant rate with depth within the core.

As noted earlier, they completely excluded the upper third of the E49-18 core from their analysis. The MIS 6-5 boundary was identified at a depth of 4.90 m within this second core; hence the age of 127 ka was assigned to this depth. The MIS 12-11 boundary was identified at a depth of 14.05 m; hence, this depth within the E49-18 core was assigned an age of 440 ka. Again, age was assumed to increase linearly with depth down the core.

Spectral analysis

Figure 5 shows the manner in which three waves of different frequencies, amplitudes, and phase constants may be added (superposed) together to yield a composite waveform. Although the number of waves needed to construct the $\delta^{18}O$ waveforms shown in figures 2 and 3 is much larger, the principle is the same: these complicated waveforms may also be constructed by adding together waves of different frequencies, amplitudes, and phase constants. It is also possible to 'reverse-engineer' the waves that have been superposed in order to obtain the final resulting waveform. This is the rationale behind spectral analysis, in which composite waveforms are decomposed into their constituent waves. A Discrete Fourier Transform (DFT) may be used for this purpose. However, the DFT is subject to some weaknesses, discussed briefly below, which makes it less than ideal for such an analysis.[31] After assigning their SIMPLEX timescales to the two Indian Ocean sediment cores, the Pacemaker authors used the Blackman–Tukey

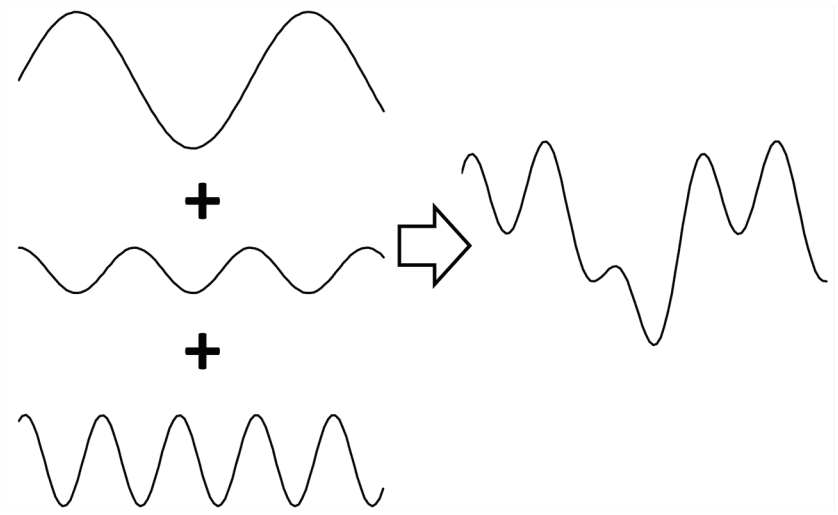

Figure 5. A complicated waveform may be constructed by adding together (superposing) waves of different frequencies, amplitudes, and phase constants. All three component waves shown here have an average value of zero.

method[32] to analyze the three variables that had been measured in the cores: the $\delta^{18}O$ values of the planktonic foraminiferal species *Globigerina bulloides*, the percent abundance of one particular radiolarian species (*Cycladophora davisiana*) relative to the other radiolarian species, and (southern hemisphere) summer sea surface temperatures (also inferred from radiolarian data). Their analysis resulted in graphs called power spectra. A power spectrum is a graph consisting of peaks of varying height, plotted against frequency. Prominent peaks occur at the frequencies corresponding to large-amplitude waves making a large contribution to the overall signal.[33] One of the difficulties with a DFT is that spurious peaks often appear in the resulting power spectra. The Blackman-Tukey method, on the other hand, alleviates this difficulty. Likewise, the Blackman-Tukey method is a good choice when the timescale is uncertain, as in the Pacemaker analysis.The results from their original spectral analyses are shown in figure 5 of the original Pacemaker paper, as well as in figures 9-17 in my second paper.[34,35] Comparison of these graphs show generally good agreement between my results and theirs, despite the fact that I obtained my results using a reconstructed data set.[36]

Figure 6 depicts the original $\delta^{18}O$ power spectrum results for a composite 'core' called PATCH which the Pacemaker authors constructed using the uppermost RC11-120 data and the lowermost E49-18 data. This power spectrum was calculated for the time interval 0 to 486 ka. In the original Pacemaker paper, the authors used a relatively small number (51) of discrete frequencies when calculating their power spectra. However, experts cited by the Pacemaker authors claim that one can legitimately use 2–3 times as many discrete frequencies as did the

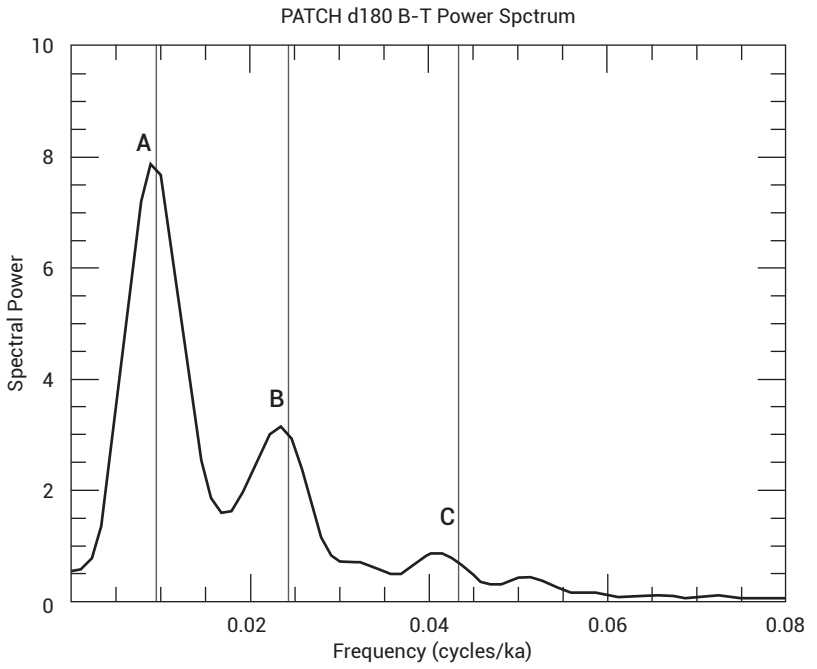

Figure 6. PATCH $\delta^{18}O$ power spectrum, obtained using the original ELBOW chronology in the Pacemaker paper, based on an assumed age of 700 ka for the B–M reversal boundary. The peaks align well with the vertical lines indicating the eccentricity, obliquity, and precession frequencies obtained from orbital calculations.

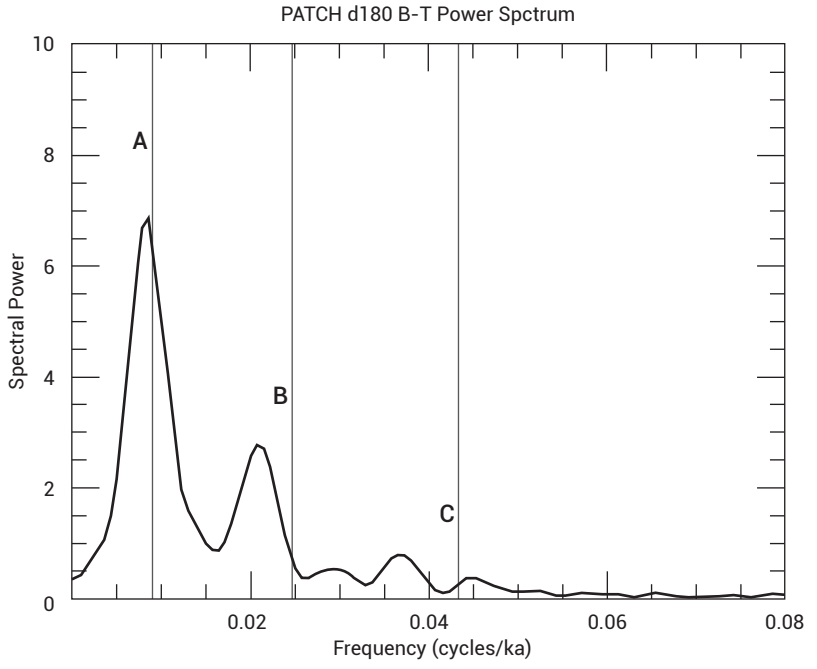

Figure 7. PATCH $\delta^{18}O$ power spectrum, obtained using a revised ELBOW chronology, based on an assumed age of 780 ka for the B–M reversal boundary. Peaks B and C no longer coincide with the obliquity and precession frequencies (vertical lines) calculated from the orbital data. The positions of the lines are shifted slightly from those in figure 6 because the revised chronology changed the time interval for the calculations from 0–486 ka to 0–544 ka.

Pacemaker authors.[37] I have taken the liberty of doing so, as well as 'zooming in' on the pertinent part of the spectrum. The vertical lines in figure 6 indicate the eccentricity, obliquity, and precessional frequencies calculated by the Pacemaker authors. The peaks align well with the vertical lines, indicating good agreement between the results and Milankovitch expectations (even though the last vertical line does not pass directly through the centre of the C peak, this can still be reasonably counted as a 'hit' for the theory).

Figure 7 shows the same $\delta^{18}O$ power spectrum, but after taking into account the revised age of 780 ka for the B–M magnetic reversal boundary. The new time interval corresponding to the PATCH 'core' extended from 0 to 544 ka. The vertical lines in figure 7 indicate the eccentricity, obliquity, and precessional frequencies I calculated using the B-T method and the astronomical data for the interval 0 to 544 ka.[38,39]

Note that the age revision has noticeably shifted the locations of the smaller B and C peaks in figure 7 (corresponding to the obliquity and precession frequencies, respectively) so that those peak frequencies no longer agree with frequencies expected by the Milankovitch theory.

This age revision also shifts the results for the RC11-120 core and the bottom section of the E49-18 core.

Spectral analysis performed using all the data from the E49-18 core (including the originally excluded section) also yielded results that were generally in poor agreement with Milankovitch expectations.[16]

Verifying the results

Because these calculations require integral calculus and a computer, laypeople may not have the technical expertise to use the Blackman–Tukey method to verify these results. Furthermore, those who *do* have the necessary expertise may simply not have the time to check the results. Given the potential importance of these results for geochronology and the 'climate change' debate (discussed in a second paper), is there a way that others can at least partially test them (which we are enjoined to do in I Thessalonians 5:21)?

Yes. First, one can easily verify both the old and new estimated ages for the MIS boundaries (table 1) using the method shown in figure 4. Also, these new age estimates introduce an apparent cause-and-effect problem. The original MIS boundary age estimates (at least those for the twelve most recent boundaries identified in the two Indian Ocean cores) were reasonably close to tuned ages (second column from right in table 1) that were based on a simple ice model tied to summer insolation at 65° N [40]: nearly all the discrepancies between the two methods were less than 10 ka. However, after the age revision for the B–M reversal boundary, six of these twelve age estimates are now at least 32 ka greater than expected, based on Milankovitch expectations, and one (the MIS 12-11 boundary) is 67 ka greater than expected! This raises a question: how can the climate be changing multiple tens of thousands of years *before* the changes in summer insolation that supposedly caused the changes?

Table 1. An assumed age of 700 ka for the Brunhes–Matuyama (B–M) magnetic reversal boundary yields age estimates (third column from left) for the MIS boundaries that are in reasonable agreement with 'orbitally tuned' ages (second column from right), at least for the twelve most recent MIS boundaries. However, the new age estimate of 780 ka for this magnetic reversal causes many of the new age estimates (far right column) to be multiple tens of thousands of years older than expected based on Milankovitch expectations. The 'tuned' age estimates for the MIS boundaries are from Lisiecki *et al.*[40]

MIS Boundary	Depth in V28-238 (cm)	Old Age (ka)	L&R Tuned Age (ka)	New Age (ka)
1–2 (TI)	22	13	14	14
2–3	55	32	29	36
3–4	110	64	57	72
4–5	128	75	71	83
5–6 (T II)	220	128	130	143
6–7	335	195	191	218
7–8 (T III)	430	251	243	280
8–9	510	298	300	332
9–10 (T IV)	595	347	337	387
10–11	630	368	374	410
11–12 (T V)	755	440	424	491
12–13	810	473	478	527
13–14 (T VI)	860	502	533	559
14–15	930	543	563	605
15–16 (T VII)	1015	592	621	660
16–17	1075	627	676	699
17–18 (T_{18})	1110	648	712	722
18–19	1180	688	761	767
19–20 (T_{20})	1210	706	790	787
20–21	1250	729	814	813
21–22 (T_{22})	1340	782	866	871

Likewise, one may use simple algebra and the two SIMPLEX age control points within the RC11-120 core to show that the original RC11-120 SIMPLEX ages (in ka), as a function of depth (in metres), are given by

$$age_{RC11\text{-}120\ (original)} = (28.864\ ka/m) \times depth \quad (1)$$

Likewise, the original SIMPLEX ages (in ka) for the bottom two-thirds of the E49-18 core are given by

$$\text{age}_{\text{bottom of E49-18 (original)}} = (34.208 \text{ ka/m}) \times \text{depth} - 40.619 \text{ ka} \quad (2)$$

Inserting depths of first 0.0 m and then 9.50 m into Eq. (1) enables one to show that the ages corresponding to the top and bottom of the RC11-120 core are, respectively, 0.0 ka and 274.2 ka. Hence the total time assigned to the length of the RC11-120 core is 274.2 ka – 0.0 ka = 274.2 ka. Likewise, inserting depths of 4.9 m and 15.5 m into Eq. (2) allows one to verify that the length of time assigned to the bottom section of the E49-18 core is 489.6 ka – 127.0 ka = 362.6 ka. Even though the preliminary timescales used in the Pacemaker analysis assume a constant sedimentation rate, round-off error may cause the time increments between data points to vary slightly. Because the Blackman–Tukey method requires evenly spaced data points, the Pacemaker authors had to specify a time increment Δt and then interpolate the data so that the total time intervals were integer multiples of Δt. They chose their time increment Δt to be 3 ka for both cores. Hence, the time intervals for the core sections, after interpolation, were 273 and 363 ka (figures 8 and 9, respectively). This corresponded to 92 interpolated data points for the RC11-120 core and 122 interpolated data points for the bottom section of the E49-18 core.

New timescales

Of course, the revised age of 780 ka for the B–M reversal boundary alters the ages for the MIS boundaries, which, in turn, alters Eqs. (1) and (2). The original age estimates of 127 and 128 ka for the MIS 6-5 boundary were in good agreement with one another, but the revised age of 780 ka for the B–M reversal boundary yields an age estimate of 143 ka for this boundary, resulting in an apparent discordance between the two age estimates. Someone hoping to salvage at least some of the original Pacemaker results might think that the age of 127 ka would be the better choice, as this would leave the original RC11-120 results unaffected by the age revision. However, the RC11-120 results are apparently not statistically distinguishable from the background noise.[41] Hence, they are not, in and of themselves, a convincing argument for Milankovitch climate forcing.

What about the E49-18 core? The new age of 780 ka for the B–M reversal boundary and the method of Shackleton and Opydke (table 1) implies an age estimate of 279.5 ka for the MIS 8-7, as well as an age estimate of 490.75 ka for the MIS 12-11 boundary. But the B–M reversal boundary in the V28-238 core was apparently the *only* means available

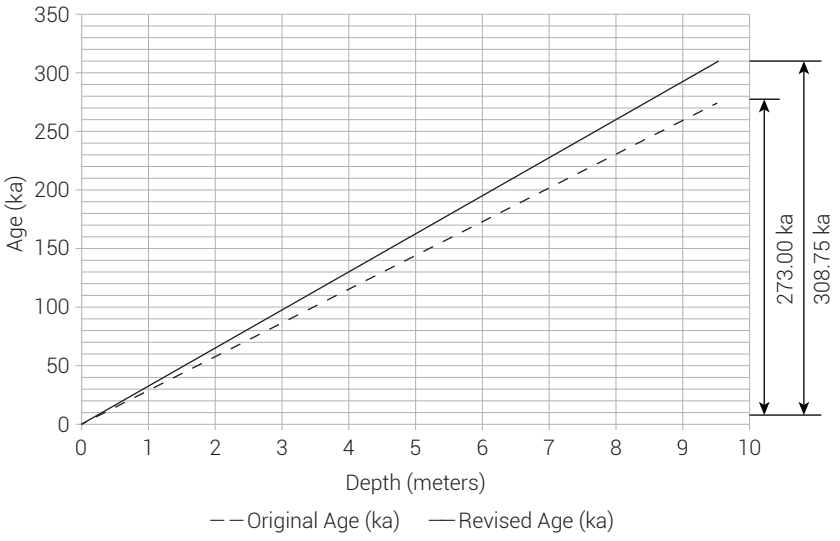

Figure 8. Original and revised SIMPLEX age models for the RC11-120 sediment core

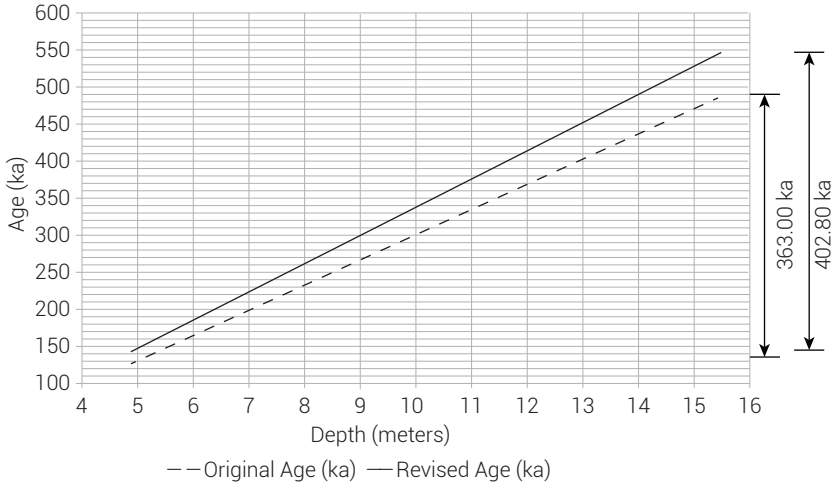

Figure 9. Original and revised SIMPLEX age models for the E49-18 sediment core

to the Pacemaker authors to assign ages to the MIS 8-7 and 12-11 boundaries. For this reason, the oxygen isotope signal in the V28-238 core was extremely important to secular paleoclimatologists and has been called an ice age 'Rosetta Stone'.[42] Hence, if one wants to redo the calculations for the E49-18 core using the method of the Pacemaker authors (but after taking into account the age revision to the B–M reversal boundary), he has no choice but to use these new age estimates for the MIS 8-7 and 12-11 boundaries. But if one is willing to trust this method to obtain age estimates for the MIS 8-7 and 12-11 boundaries, then logically one should also be willing to use that method to obtain an age estimate for the MIS 6-5 boundary. Hence, the pragmatic (but not necessarily scientifically objective!) choice would be to go ahead and use the age estimate of 143 ka for the MIS 6-5 boundary, despite the resulting apparent cause-and-effect problem.

The new age estimates (as a function of depth) within the two cores are given by

$$\text{age}_{\text{RC11-120 (new)}} = (32.5 \text{ ka/m}) \times \text{depth} \quad (3)$$

$$\text{age}_{\text{bottom of E49-18 (new)}} = (38.005 \text{ ka/m}) \times \text{depth} - 43.227 \text{ ka.} \quad (4)$$

One can verify that Eq. (3) yields an age of 0 ka at the top of the RC11-120 core and an age of 143 ka at a depth of 4.40 m in the RC11-120 core, as should be the case. Likewise, Eq. (4) yields an age estimate of 143 ka at a depth of 4.90 m within the E49-18 core, and an age of 490.75 ka at a depth of 14.05 m, also as expected. The age for the MIS 8-7 boundary was not used in these calculations, as it was only used later to construct the 'ELBOW' chronology for the 'PATCH' core (table 2 in the Pacemaker paper).

One can also use Eqs. (3) and (4) and to verify that the new total time (prior to interpolation) assigned to the RC11-120 core is 308.75 ka and that the new time assigned to the bottom section of the E49-18 core is 402.85 ka.

When redoing the Pacemaker calculations, I attempted to minimize interpolation as much as possible, as it is always preferable, if possible, to perform the analysis on the original data, rather than on interpolations from that data. I chose $\Delta t = 3.25$ ka for the RC11-120 core, which completely eliminated the need for interpolation of the data (3.25 ka just happened to be the time increment between the original data points). Hence, the total time assigned to the RC11-120 core was still 308.75 ka. For the bottom 10.6 m of the E49-18 core, the time increments fluctuated slightly between 3.800 and 3.801. Hence, a value of $\Delta t = 3.8$ ka was used, resulting in a total length of time of 402.8 ka being assigned to this core section.

Both the original and revised age models (after interpolation) are shown in figures 8 and 9.

Estimating the new periods—a shortcut

The revised age for the B–M reversal boundary has stretched the SIMPLEX timescales assigned to the two core sections, but, as before, age down the core still varies linearly with depth. Hence, it is fairly easy to estimate the new expected periods of the dominant spectral peaks. Figure 10 illustrates the logic behind this method with a hypothetical signal constructed by superposing three different waves. The original length of time corresponding to the sampled portion of the composite waveform is T_0. After stretching of the timescale, this length of time becomes T_{new}. Note, however, that increasing the timescale to T_{new} has not changed the shape of the resultant waveform. Furthermore, since the resultant waveform is composed of simple sinusoids, the amplitudes and relative phases of the sinusoids are unaffected by this stretching.

Because the shapes of the individual sinusoids have not been affected by the stretching of the timescale, the number of wave cycles N (i.e. the number of periods) contained within the time interval for waves 1, 2, and 3 will be the same both before and after the stretching process. For instance, wave 2 in figure 10 exhibits $N \approx 3.2$ periods within the space of time T_0. After stretching, the number of cycles N will *still* be about 3.2, but those 3.2 wave cycles must now fit

Table 2. Period estimates for the dominant spectral peaks calculated for RC11-120 summer sea surface temperature (SST), oxygen isotope values ($\delta^{18}O$), and percent abundance of the radiolarian species *Cyclodophora davisiana* (%Cd). Original period estimates were reported to the nearest thousand years in Hebert[15], although I have here reported the smaller period estimates to one decimal place to reduce round-off error. The new period estimates were obtained using both the Blackman–Tukey method and the 'easy' method described in the text.

RC11-120 SIMPLEX			
Original Time Interval (ka)	273.00		
New Time Interval (ka)	308.75		
SST P_0 (ka)	102	37.6	21.0
SST P_{new}: easy method (ka)	115	42.5	23.8
SST P_{new}: B–T method (ka)	111	41.8	23.8
$\delta^{18}O$ P_0 (ka)	95	37.6	23.8
$\delta^{18}O$ P_{new}: easy method (ka)	107	42.5	26.9
δ18O P_{new}: B–T method (ka)	111	43.0	27.1
% C. d. P_0 (ka)	119	38.6	23.4
% C. d. P_{new}: easy method (ka)	135	43.7	26.5
% C. d. P_{new}: B–T method (ka)	129	43.0	26.7

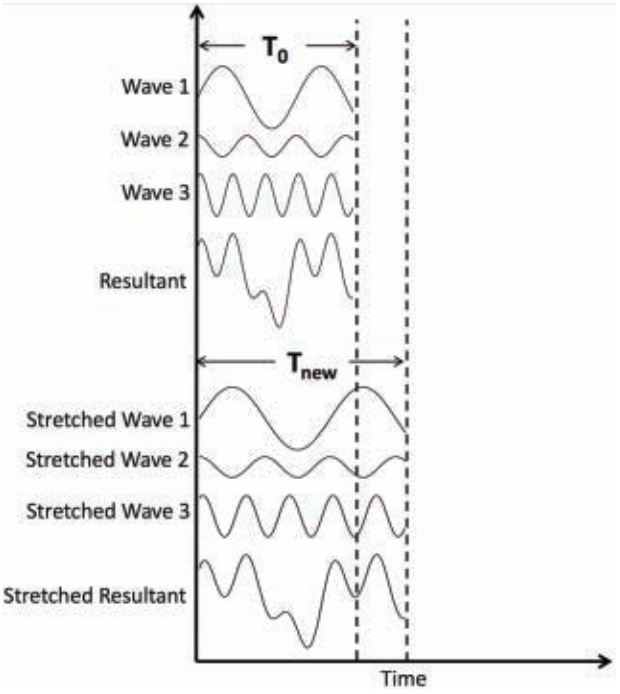

Figure 10. A stretching of the timescale over which a waveform has been sampled will also stretch the component waves comprising the signal. This fact enables one to quickly estimate the new periods of the prominent spectral peaks, provided that the original periods of those spectral peaks are already known.

into the larger time interval T_{new}. But the number of periods N may be calculated by dividing the original time interval T_0 by the original period estimate for wave 2, which we here call P_0. Thus, if we know the original period P_0 for wave 2, we can estimate the new period P_{new}:

$$P_{new} = \frac{T_{new}}{N} = T_{new} \div \left(\frac{T_0}{P_0}\right) = P_0 \times \left(\frac{T_{new}}{T_0}\right) \quad (5)$$

Eq. (5) may also be used to estimate the new periods for the other two waves comprising the composite signal.

Here we have made an assumption that is generally not strictly correct, but which is 'good enough' for our purposes. We assume that the frequency of a dominant spectral peak corresponds exactly to the frequency of one of the individual waves comprising the resultant signal. Because the signal is composed of a finite number of waves, this is not really correct—an estimated peak frequency often falls 'between' two of the discrete frequencies in the power spectrum. Nevertheless, for a power spectrum with a reasonably large number of discrete frequencies within a finite frequency band, we expect a particular peak frequency to be quite close to one of those discrete frequencies. This means that we can *also* use Eq. (5) to estimate the new periods (after stretching) of the spectral peaks, provided that we know the original periods for those peaks. In the following discussion, we treat the Blackman–Tukey method of obtaining those original period estimates as a 'black box' and accept as a given that the original period estimates are accurate.

Confirming the results

My original SIMPLEX values of P_0 (obtained using my reconstructed Pacemaker data and the Blackman–Tukey method) are shown in tables 2 and 3. For instance, the middle section of table 2 lists my original periods for the three dominant RC11-120 $\delta^{18}O$ spectral peaks. The period of the smallest spectral peak was 23.8 ka. Eq. (5) implies that the estimated value for the new (stretched) period is P_{new} = (308.75 ka ÷ 273.00 ka) × 23.8 ka = 26.9 ka. This compares favourably with the new period of 27.1 ka I obtained using the Blackman–Tukey method. The agreement between these estimated periods and those obtained by the B–T method is generally poorer for the longer (~100 ka) periods (i.e. the estimated uncertainty in the new period estimate is larger for larger periods). The reason for this is given in the online appendix,[43] which provides a means of estimating this uncertainty.

Unlike the SIMPLEX timescales, the ELBOW timescale for the PATCH Composite 'core' did not have a perfectly constant slope versus depth; the radiocarbon age of 9.4 ka (table 2 in the Pacemaker paper) remained the same both before and after stretching of the timescale, and a third anchor point (at 8.25 cm) was used in the E49-18 section of the PATCH core. Hence, this shortcut method was not strictly valid, and I did not calculate error estimates for this particular case. Nevertheless, there was still generally good agreement between periods calculated using this 'easy' method and the B–T method (table 4).

These comparisons were obtained using my estimates for the periods of the spectral peaks, calculated using reconstructed data. Although these results are generally in good agreement with the original published Pacemaker results, there are some discrepancies, likely due to subtle errors in the values of the reconstructed data. However, one can also use this method and the original published Pacemaker results to estimate the periods that the Pacemaker authors would have themselves obtained had they used the currently accepted age of 780 ka for the B–M reversal boundary in their calculations.

Since the earth's inferred orbital cycles are quasi-periodic, the frequencies expected from Milankovitch theory will not be exactly the same before and after the stretching of the timescales for the cores. However, one typically expects periods of lengths ~100, 41, and 19–23 ka to result from such orbital calculations. The new results are generally in poor agreement with Milankovitch expectations. This is especially true for the new E49-18 and PATCH results (tables 3 and 4).

Table 3. Period estimates for the dominant spectral peaks calculated for E49-18 summer sea surface temperature (SST), oxygen isotope ($\delta^{18}O$), and percent abundance of the radiolarian species *Cyclodophora davisiana* (%Cd). Original period estimates were reported to the nearest thousand years in Hebert[15], although I have here reported the smaller period estimates to one decimal place to reduce round-off error. The new period estimates were obtained using both the Blackman–Tukey method and the 'easy' method described in the text.

E49-18 SIMPLEX			
Original Time Interval (ka)	363.0		
New Time Interval (ka)	402.8		
SST P_0 (ka)	99	43.6	23.5
SST P_{new}: easy method (ka)	110	48.4	26.1
SST P_{new}: B–T method (ka)	113	48.9	26.2
$\delta^{18}O$ P_0 (ka)	105	47.1	25.2
$\delta^{18}O$ P_{new}: easy method (ka)	117	52.3	28.0
$\delta^{18}O$ P_{new}: B–T method (ka)	120	53.1	27.8
% C. d. P_0 (ka)	149		
% C. d. P_{new}: easy method (ka)	165		
% C. d. P_{new}: B–T method (ka)	151		

Table 4. Period estimates for the dominant spectral peaks within the PATCH composite 'core'. Shown are the periods of dominant spectral peaks for summer sea surface temperature (SST), oxygen isotope ($\delta^{18}O$), and percent abundance of the radiolarian species *Cyclodophora davisiana* (%Cd). Original period estimates were reported to the nearest thousand years in Hebert[15], although I have here reported the smaller period estimates to one decimal place to reduce round-off error. The new period estimates were obtained using both the Blackman–Tukey method and the 'easy' method described in the text.

PATCH ELBOW				
Original Time Interval (ka)	486			
New Time Interval (ka)	544			
SST P_0 (ka)	94	40.6	23.2	
SST P_{new}: easy method (ka)	105	45.4	25.9	
SST P_{new}: B–T method (ka)	112	45.8	26.4	
$\delta^{18}O$ P_0 (ka)	105	42.6	24.2	19.4
$\delta^{18}O$ P_{new}: easy method (ka)	117	47.6	27.1	21.7
δ18O P_{new}: B–T method (ka)	121	48.2	27.1	22.3
% C. d. P_0 (ka)	138	41.6	24.2	
% C. d. P_{new}: easy method (ka)	154	46.5	27.1	
% C. d. P_{new}: B–T method (ka)	155	45.8	26.9	

Power to the people!

That the original Pacemaker results are now moot has important implications for both geochronology and 'climate change' speculation, discussed in part 2 of this series. Due to the complicated issues involved in the 'climate change' debate, it is often very difficult for voters, policy makers (and even other scientists!) to verify for themselves scientific results that are relevant to the debate. *This is a rare exception*—laypeople without a knowledge of calculus, and even high school students, *can* verify these new results. I have verified for myself that the original period estimates P_0 in the original Pacemaker paper are approximately correct,[15] but one does not need to take my word for it in order to make a logically compelling internal critique against the Pacemaker paper. Remember that uniformitarian scientists have *themselves* claimed for 40 years that the original Pacemaker results were accurate and that we should believe them. For the sake of argument, one can simply accept this claim as a 'given'. And since uniformitarians are *now* claiming that the age of the B–M reversal boundary is 780 ka (rather than 700 ka), the new results (which agree poorly with Milankovitch expectations) are the logical consequence of their own claims. Uniformitarians have shot themselves in the proverbial foot!

Unfortunately, this shortcut method will not work with the trials using the uppermost E49-18 data that had been omitted in the original Pacemaker analysis. However, given that the estimated age of 12 ka for the top of the E49-18 core used in those trials seems to have been obtained via little more than an educated uniformitarian guess,[44] the significance of those results is somewhat in doubt, anyway.

References

1. Walker, M. and Lowe, J., Quaternary Science 2007: a 50-year Retrospective, *J. Geological Society, London* **164**(6):1073–1092, 2007.
2. Oard, M.J., The astronomical theory of the Ice Age becomes more complicated, *J. Creation* **19**(2):16–18, 2005.
3. Oard, M.J., Astronomical troubles for the astronomical hypothesis of ice ages, *J. Creation* **21**(3):19–23, 2007.
4. Cronin, T.M., *Paleoclimates: Understanding Climate Change Past and Present*, Columbia University Press, New York, pp. 130–139, 2010.
5. Oard, M.J., Phase problems with the astronomical theory, *J. Creation* **28**(2):11–13, 2014.
6. Hayes, J.D., Imbrie, J. and Shackleton, N.J., Variations in the earth's orbit: pacemaker of the ice ages, *Science* **194**(4270):1121–1132, 1976.
7. Muller, R.A., MacDonald, G.J. and Alvarez, W., Preface and Forward; in: *Ice Ages and Astronomical Causes: Data, Spectral Analysis, and Mechanisms*, Springer, Chichester, UK, pp. xiv and xvii, 2000.
8. Hebert, T.D., Paleoceanography: Orbitally Tuned Timescales; in: Steele, J.H. (Ed.), *Climates and Oceans*, Academic Press, Amsterdam, The Netherlands, pp. 370–377, 2010.

9. Hebert, J., The dating 'pedigree' of seafloor sediment core md97-2120: a case study, *Creation Research Society Quarterly* **51**(3):152–164, 2015.
10. Hinnov, L.A. and Hilgen, F.J., Cyclostratigraphy and astrochronology; in: Gradstein, F.M., Ogg, J.G., Schmitz, M.D. and Ogg, G.M. (Eds.), *The Geologic Time Scale 2012*, Elsevier, Amsterdam pp. 63–83, 2012.
11. Anonymous, New Mexico Bureau of Geology and Mineral Resources: New Mexico Geochronology Research Laboratory, K/Ar and $^{40}Ar/^{39}Ar$ Methods: The $^{40}Ar/^{39}Ar$ Dating technique, 2014, geoinfo.nmt.edu/labs/argon/methods/home.html, accessed 7 May 2014.
12. Renne, P.R., Deino, A.L. Walter, R.C. *et al.*, Intercalibration of astronomical and radioisotope time, *Geology* **22**(9):783–786, 1994.
13. Vardiman, L., *Climates Before and After the Genesis Flood*, El Cajon, CA, Institute for Creation Research, p. 79, 2001.
14. Hebert, J., Revisiting an iconic argument for Milankovitch climate forcing: should the 'Pacemaker of the ice ages' paper be retracted? part 1, *Answers Research J.* **9**:25–56, 2016.
15. Hebert, J., Revisiting an iconic argument for Milankovitch climate forcing: should the 'pacemaker of the ice ages' paper be retracted? part 2, *Answers Research J.* **9:**131–147, 2016.
16. Hebert, J., Revisiting an iconic argument for Milankovitch climate forcing: should the 'pacemaker of the ice ages' paper be retracted? part 3, *Answers Research J.* **9**:229–255, 2016.
17. Hebert, ref. 14, pp. 39–42.
18. Hebert, ref. 14, pp. 38–56.
19. Hays *et al.*, ref. 6, p. 1123.
20. Howard, W.R. and Prell, W.L., Late Quaternary Surface Circulation of the Southern Indian Ocean and Its Relationship to Orbital Variations, *Paleoceanography* **7**(1):79–117, 1992.
21. Shackleton, N.J. and Opdyke, N.D., Oxygen isotope and palaeomagnetic stratigraphy of Equatorial Pacific Core V28-238: oxygen isotope temperatures and ice volumes on a 10^5 year and 10^6 year scale, *Quaternary Research* **3**:39–55, 1973.
22. Shackleton, N.J., Berger, A. and Peltier, W.R., An alternative astronomical calibration of the lower Pleistocene timescale based on ODP Site 677, *Transactions of the Royal Society of Edinburgh: Earth Sciences* **81**(4):251–261, 1990.
23. Hilgen, F.J., Astronomical calibration of Gauss to Matuyama Sapropels in the Mediterranean and implication for the geomagnetic polarity time scale, *Earth and Planetary Science Letters* **104**(2–4):226–244, 1991.
24. Spell, T.L. and McDougall, I., Revisions to the age of the Brunhes–Matuyama boundary and the Pleistocene geomagnetic polarity timescale, *Geophysical Research Letters* **19**(12):1181–1184, 1992.
25. Wright, J.D., Cenozoic climate—oxygen isotope evidence; in: Steele, J.H. (Ed.), *Climates and Oceans*, Academic Press, Amsterdam pp. 316–227, 2010.
26. McManus, J.F., Bond, G.C. Broecker, W.S. *et al.*, High-resolution climate records from the North Atlantic during the last interglacial, *Nature* **371**: 326–329, 1994.
27. Anonymous, Protactinium-231-thorium-230 dating, Encyclopedia Britannica, accessed 14 October 2016 at britannica.com/science/protactinium-231-thorium-230-dating.
28. Shackleton, Berger and Peltier, ref. 22, p. 258.
29. Shackleton and Opdke, ref. 21, p. 49.
30. Broecker, W.S. and van Donk, J., Insolation Changes, Ice Volumes, and the O^{18} Record in Deep-Sea Cores, *Reviews of Geophysics and Space Physics* **8**(1):169–98, 1970.
31. Hebert, ref. 15, pp. 132–133.
32. Blackman, R.B. and Tukey, J.W., *The Measurement of Power Spectra from the Point of View of Communications Engineering*, Dover Publications, New York, 1958.
33. This peak frequency often does not agree perfectly with the frequency of one of the component waves, as the very tip of the spectral peak often is located at a frequency that falls 'between' two of the discrete frequencies for which values of spectral power have been calculated. However, as more and more discrete frequencies are plotted within a finite frequency band, this error will become smaller and smaller.
34. Hays, Imbrie and Shackleton, ref. 6, p. 1126.
35. Hebert, ref. 15, pp. 143–146.
36. The numbers on the vertical axes of our graphs disagree by a factor of ~2. This discrepancy appears to be the result of a normalization error on the part of the Pacemaker authors. Apparently, they forgot to multiply their spectral powers by 2 when converting from a two-sided power spectrum (negative and positive frequencies) to a one-sided power spectrum (positive frequencies only).
37. Jenkins, G.W. and Watts, D.G., *Spectral Analysis and Its Applications*, Holden-Day, San Francisco, CA, p. 260, 1968.
38. Berger, A. and Loutre, M.F., Insolation values for the climate of the last 10 million years, *Quaternary Science Reviews* **10**(4):297–317, 1991.
39. The orbital data, as of 17 June 2016, were archived at: doi.pangaea.de/10.1594/PANGAEA.56040?format=html#lcol0.ds1004521.
40. Lisiecki, L.E. and Raymo, M.E., A Pliocene-Pleistocene stack of 57 globally distributed benthic $\delta^{18}O$ records, *Paleoceanography* **20**, PA1003, 2005, doi:10.1029/2004PA001071, MIS age estimates, lorraine-lisiecki.com/LR04_MISboundaries.txt, accessed 14 October 2016.
41. Hebert, ref. 16, pp. 241–242.
42. Woodward, J., *The Ice Age: A Very Short Introduction*, Oxford University Press, Oxford, United Kingdom, p. 97, 2014.
43. creation.com/images/pdfs/tj/j31_1/a_broken_climate_pacemaker_part1_appendix.pdf
44. Howard and Prell, ref. 20, pp. 87–91.

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Reading 'places' in Genesis 1–11

Alistair McKitterick

The debate about Genesis's genre is influenced by the perceived historicity of Eden in Genesis 2. A method for examining the genre of the early chapters of Genesis is to identify the relative frequency of deixis indicators, in particular the author's use of places. The distribution and type of place references suggests that the author intended an historical genre for Genesis 1–11, but that there is a discontinuity between old and new worlds as a result of the Flood. The use of place names associated with Eden is thought to be for etiological purposes.

Given the dispute over the genre of Genesis 1–11, this paper first overviews the dispute historically, focuses on the role that the description of Eden has played in the dispute, assesses a representative evangelical scholar's indeterminacy, and then offers a potential solution based on the deixis of place names which supports the historicity of Genesis 1–11.[1]

The usual considerations in this debate are the relationship between Genesis and historical events, and the relationship between Genesis and other Ancient Near Eastern texts. Classical readings such as Augustine and Origen have tended towards reading Genesis as an allegory but usually based on an underlying presupposition that the authorial intention was to write historically first of all.[2] Thomas Aquinas, for example,

> "... insisted on the primacy of the literal and held that it was sufficient for doing theology. He affirmed a literal garden of Eden … declaring that 'the things which are said of Paradise in scripture are set forth by means of an historical narrative. Now in everything which scripture thus sets forth, the truth (of the story) must be taken as a foundation and upon it spiritual expositions are to be built.'"[3]

There is a well-worn debate over the extent of linguistic and structural dependency between Genesis 1 and the other ANE cosmological texts.[4] The debate centres over whether we should view Genesis 1 as a polemic against other cosmologies of the sort found in Mesopotamia.[5] The argument turns on the relationship of certain key words such as *tehom* and *tohu vabohu* being connected in some way to mythological conflict. *Tehom*, the deep, is read as a demythologized water goddess, Tiamat in *Enuma Elish*, and *tohu vabohu*, which the NIV translates as 'formless and empty', is understood as some kind of malevolent chaotic force that God has to overcome in order to create the universe. For many readers of Genesis, then, these words are codes for a conflict that has been deliberately removed or suppressed by the author in order to turn Genesis 1 into a polemic against the equivalent ANE worldview which still has a cosmic battle at the heart of their creation narrative.

I have followed David Tsumura's arguments against such linguistic dependency and argued that to read conflict into Genesis 1 (or even to believe that it has been removed from the text) is to read against the grain.[6] Kenneth Matthews' *Genesis* commentary takes a similarly nuanced approach to the idea of polemic as a description of the genre of Genesis. Rather than seeing the texts as a historicization of myth for polemic reasons, he thinks it "doubtful that the biblical writer intentionally set out to attack pagan notions, as the word 'polemic' has come to mean."[7] Instead, the text of Genesis 1 should be read as a calm series of highly structured, if somewhat enigmatic, statements.

If we extend our discussion to the first 11 chapters of Genesis, we note that many accept some correspondence between the biblical record and history and consider it to be part of the authorial intention, whilst others deny this as a possible category at all. Walter Brueggemann, for instance, writes, "[o]ur exposition will insist that these texts be taken neither as history nor as myth."[8] A similar view is taken by George Knight in his commentary on Genesis 1–11. He sees the genre as being picture language, a genre that the author both invented and perfected in these chapters. "Thus in the Genesis Prologue he uses a distinctly different *Gattung* from that which he employs from Genesis 12 onwards."[9] Bernhard Anderson also believes the genre of Genesis changes after Genesis 11.

> "Passing from Genesis 11 to Genesis 12, we leave the nebulous realm of primeval history and enter the historical arena of the second millennium BCE … [N]one of the episodes of the primeval history is anchored to anything with which a modern historian could deal."[10]

However, the historical sceptic Hans Barstad makes the point that this distinction is a modern category, one that would not have been recognized by the initial readers of Genesis. He writes: "To the biblical authors there was no difference between the 'historicity' of, for instance, the Primeval Story and that of other stories in the Hebrew Bible."[11]

Genesis 2 as example

A prime example of the complexity and confusion of the position of some on the question of the genre of these chapters in Genesis can be seen from Bruce Waltke's various comments on the rivers of Eden in Genesis 2. In a brief introduction, Waltke believes that "the author of Genesis represents himself as a historian, not as a prophet who receives visions of events",[12] and thinks that the creation account has "historical solidity… [but] is not merely a historical account".[13]

When thinking about the references to the four headwaters, he writes that the "geographic depictions express the historical basis of the account".[14] He sees the details in 2:10–14 as part of the material that validate the "coherent chronological succession of events" by "locating his story in time and space".[15] Yet when talking about the source of these rivers in Eden he refers to it as the "heavenly river" that is "symbolic of the springs of living water, the life that issues from the throne of the living God".[16]

Waltke is pulled in two directions by the text; its 'other-worldly' content in the narrative evokes symbolism, yet its very 'this-worldly' features (place names) implies historicity. Waltke notes the geographical problems associated with the names of the four headwaters. "Havilah is in Arabia, so Pishon should be identified with Arabia, possibly the Persian Gulf. According to Gen. 10:8, Cush should be in western Iran. Is Gihon one of the rivers or canals of Mesopotamia?"[14] An earlier illustration of the same confusion comes from George Knight:

> "Although we are speaking in symbols, these rivers are meant to be geographically definable within the known world of ancient near-eastern man. The Tigris and the Euphrates we know. What Pishon and Gihon represent bring us only to guesswork ... . So what we now have are two historical rivers, and two symbolic rivers, as if to show us that we are to think in terms of the two areas of theological enquiry at once."[17]

In the last century, Dr E.A. Speiser, the Chairman of the Department of Oriental Studies at the University of Pennsylvania in Philadelphia, argued that the physical background of the account of the rivers in Genesis 2 was authentic, and should be taken seriously, and he made attempts to identify the Pishon and Gihon with rivers currently in the Persian Gulf.[18] In an article in 1959 he wrote:

> "Although the Paradise of the Bible was manifestly a place of mystery, its physical setting cannot be dismissed offhand as sheer imagination. To the writer of the account in Gen 2:8ff., in any case, and to his ultimate source or sources, the Garden of Eden was obviously a reality."[19]

Rather like the search for Atlantis, many have tried to locate Eden's rivers in the hope of finding the divine garden. Marco Polo attempted to find it somewhere in the Mongolian borders. The Jerusalem Targum suggests it might be in India.[20] Some today think it lies near or beneath the waters of the Persian Gulf.[21]

Is the hunt for the location of Eden based on Genesis 2 reasonable today, and if not, then why not? Most agree that despite the familiar sounding names of Hiddeqel/Tigris, Ashur, Cush and Euphrates, we simply cannot identify Cush with Ethiopia or Nubia,[22] nor Ashur with Assyria.[23] Claus Westermann concludes that "we cannot then identify the first two rivers with any rivers known to us."[22] If that is so, and if we cannot associate the lands with their modern namesakes, then we cannot hope to identify the location of Eden. It is just not useful geographical data, and the usual response to this conclusion would be to attribute the narratives of Genesis 1–11 to myth or symbolism.

Figure 1. The location of Eden by Hieronymus Bosch (c. 1450–1516)

Cassuto's solution

However, the solution that Umberto Cassuto has put forward might help us to understand the tension between the historical and geographical details within the text and the lack of historical and geographical correspondence on the ground today.[24] Cassuto begins his commentary on this section by asking what the purpose of this reflection on the four rivers is. Some, like Waltke, think that the five verses about the rivers "function as a pause in the narrative".[25] That is, they have a literary value in the narrative. John Collins thinks of it as an excursus in the text.[26] But Cassuto thinks that the value of these passages is

Table 1. Distribution of location deixis for Genesis 1–12

Chp	Number	Places
1	0	
2	12	In the East; Eden; Pishon, Havilah; Gihon; Cush; Tigris; Ashur; Euphrates; Garden of Eden; in the garden
3	8	Middle of the garden; in the garden, Garden of Eden
4	2	Land of Nod, east of Eden
5	0	
6	0	
7	0	
8	1	Mountains of Ararat
9	0	
10	23	Territories; Babylon; Uruk; Akkad; Kalneh; Shinar; Assyria; Nineveh; Rehoboth Ir; Calah; Resen; borders of Canaan; Sidon; Gerar; Gaza; Sodom; Gomorah; Admah; Zeboyim; Lasha; Mesha; Sephar; eastern hill country.
11	5	Shinar; Babel; Ur of the Chaldeans; Canaan; Harran
12	9	Harran; Canaan; great tree of Moreh; Shechem; hills east of Bethel; Bethel; Ai; Negev; Egypt

to describe a state of nature that existed prior to the fall of humanity. Genesis 2, he thinks, describes the irrigation of the earth before Adam and Eve were disobedient and before the ground was cursed. Prior to the fall, the earth was watered from the אֵד (*ēd*), Genesis 2:6, as a gracious gift; after the fall, it rained only at God's discretion. He writes:

> "We remarked earlier that the conditions envisaged here are different from those prevailing in our present world; before the first man's fall, the ground absorbed moisture from below and the waters of the springs and streams sufficed to irrigate the whole face of the earth (see above, on v. 6); but after man's sin, when it was decreed as his punishment that the subterranean waters should be insufficient for his needs, and he was compelled to depend on rain water, the world-order, including the rivers mentioned in our passage, suffered a change. At first they had all issued from one place, but now they became separated and far-removed from one another, two flowing in one direction and two in [an]other. Nevertheless, they are all still in existence, serving to remind us of the former state of bliss."[27]

The advantage of Cassuto's approach is that it reframes the discussion of the geographical details of the text. Instead of being location markers to be identified today, they are *memories* of the way things were before the world changed, and all attempts to locate Eden today must end in frustration. Cassuto was well aware of the various suggestions as to where to find Eden, but writes:

> "But in the light of our exposition all these theorizings are valueless. Our text, as stated, describes a state of affairs that no longer exists, and it is impossible to determine the details on the premise of present-day geographical data. The garden of Eden according to the Torah was not situated in our world."[28]

Cassuto argues that the fall of Genesis 3 has changed the geography of the world. There is now a new world today and an old world that is no longer accessible but still described in 'real world' terms and concepts. It seems to me that an approach of this kind might point towards a solution to the problem of historicity in Genesis 1–11.

Deixis

I now want to turn to some analysis of the text in light of this proposal. The proposal is that, from the author's perspective, the world now is not the same as the world then, but the accounts of both are equally historical. What is required is evidence to support this viewpoint that the author's intention was to write historically about the old world and the new. One way of addressing this question is to turn to the literary features associated with historicity, namely places, times, and names. These reference details are known as deixis or indexicality, and are indicators that the genre of the author's intention was historical.[29] These terms are what Charles Fillmore calls the "major grammaticalized types" of deixis.[30] John Lyons, in his *Introduction to Theoretical Linguistics*, call deixis the "'orientational' features of language which are relative to the time and place of utterance".[31] To simplify this study somewhat the decision was made to consider only very unambiguous deitic features of place. For instance, instead of the terms 'here' and 'there', this study only included specific place names.

The result of studying deixis can be illustrated using the example of Genesis 12, the story of Abram, starting from the beginning of the *toledoth* of Terah. What we see in this passage is a narrative with some standard historical features in the narrative. There is a good mixture of personal names identifying realistic characters, set in particular places (which seem to require no explanation as to where they refer, so we can assume that the reader was expected to know them), and a smaller number of key time markers to guide the reader as to where the story fits in the passing of time. In particular, the place deixes are fairly extensive, and the reader is expected to know them directly: Ur of the

Chaldeans; the place called Harran; Canaan; the great tree of Moreh at Shechem; the hills east of Bethel; Ai to the east; the Negev (south); Egypt. This extensive amount of contextual information indicates to the reader that the genre of this section is historical narrative.

When we do a similar exercise for Genesis 1–11, however, we get an interesting distribution of location deixis. The deixis indicators for place are outlined in table 1.

The results are significant. In Genesis 1–8, the location deixes are rather vague indicators, occurring almost exclusively in Genesis 2–4, and all related to Eden. The garden is 'in Eden', and the two trees are in the middle of that garden, v. 9. The *'ēd* water is brought up from Eden, v. 10, and the four headwaters flow out from there to the lands of Havilah, Cush and Ashur that are directly connected to Eden through these rivers, Pishon, Gihon, Hiddekel, and Euphrates. This is especially seen in the 'Land of Nod' reference in Gen 4:16. Quite apart from the ambiguity over whether it should be thought of as the 'land of wandering', the writer does not expect the reader to have independent knowledge of its location because it is followed by an additional location indicator, namely 'East of Eden'. There are no more location deixes until Genesis 8 when we read about the place where the Ark landed, namely the Mountains of Ararat, after the Flood.

From then on there is a significant increase in the number of location references that need no additional explanation: the reader is just expected to know these places: Babylon; Uruk; Akkad; Kalneh; Shinar; Assyria; Nineveh; Rehoboth Ir; Calah; Resen; borders of Canaan; Sidon; Gerar; Gaza; Sodom; Gomorah; Admah; Zeboyim; Lasha; Mesha; Sephar; and so on. The location deixes of Genesis 2–4 should be understood differently from those from Genesis 8 onwards. Those before the Flood are all in relationship to Eden; after the Flood, geographical references are assumed to be knowable independently.

Explanation

The observation that the use of location deixes is not uniform throughout Genesis 1–11 is significant and requires a coherent explanation. The reader is not expected to know the whereabouts of the geographical features of Genesis 2–4 independently, and each is related to Eden. This is in stark contrast to the geography of Genesis 8 onwards where these locations are stated without any extra explanation, indicating that these locations were known and accessible to the intended reader. This distinction is missed by Munday who thinks that "the post-Flood landscape had real correspondence with the pre-Flood landscape, and that this correspondence was sufficiently close to permit the audience to generally understand the garden location."[32]

The best way of accounting for this distinct distribution of deictic indicators is to revise Umberto Cassuto's explanation for how to understand the geographical references for the rivers of Eden. He argued that the Garden of Eden was no longer 'in our world' because of the fall. However, from the location deixis pattern identified in this study, a better explanation is that the Garden of Eden is no longer 'in our world' because of the effects of the Flood, Genesis 6–8. There is no independent location deixis indicator prior to the Flood because all pre-Flood locations, including Eden and the tree of life, have been destroyed by the waters of Noah's Flood.

This perspective finds support in the New Testament: "By these waters also the world of that time was deluged and destroyed" (2 Peter 3:6).

This verse points to a clear sense of discontinuity between our world and the pre-Flood world ('the world of that time'). This reading enables us to suggest a way of explaining why many commentators have struggled to settle on the correct genre for Genesis 1–11. By focusing on the rather 'other-world' and inaccessible feel of the geographical place names, commentators have tended to disassociate the narrative from history. However, if we accept that the biblical author considered the Garden of Eden, or indeed any human settlement or natural feature, to be no longer geographically accessible to the reader (because of the effects of Noah's Flood on the earth) then this allows us to acknowledge the various deictic features of the text as indicating a genre of historical narrative without giving encouragement to those who would seek to find the geographical source of the four rivers today.

A challenge to this view would be to ask why the author gave such attention to the places and features of the four headwaters if they are nowhere relevant to the geography of the rest of the text. The mention of the gold in Havilah beside the Pishon, according to Cassuto, was to emphasize that gold didn't originate in paradise, and therefore shouldn't be seen as coming from the 'garden of the gods'. Cassuto comments: "The very *best* gold is simply a natural substance, a metal like any of the other metals, which are found in the ground in one of the countries of our own world."[33] Thus Cassuto sees the purpose of the mention of gold and jewels at a distance from Eden was to relativize their connection with Eden: "this indirect association alluded to here by the Torah, which at the same time rejects the direct relationship that the poets held to exist, suffices to give the gold and the *bdellium* and the *šōham*, and generally all precious stones, the character of tokens and memorials of the garden of Eden."[33]

We can explain the reason for including the names of the pre-Flood rivers by noticing that, apart from the Pishon, the names mentioned in Genesis 2:10–14 also have a post-Flood referent. The land of Cush is also the name of a son of Ham in Genesis 10:6; the land of Ashur was the son of Shem in v. 22. Havilah, in Genesis 10:7, is the name of one of the grandsons of Ham and one of the great-great grandsons of Shem in v. 29, and also a land named in Genesis 25. The

use of these place names after the Flood carries over the memories of the pre-Flood world. It is a vehicle of tradition and remembrance associated with the paradise of Eden.

A more contemporary example is in AD 1620 when the Pilgrim Fathers sailed in the 'Mayflower' from Plymouth in England and landed near Cape Cod. They named their first permanent settlement 'Plymouth' in 'New England'. That is, they took a name from the old world with them into the new world in order to invest their environment with tradition.

We see this when the manna in the wilderness is compared to Bdellium in Numbers 11:7. We see it again in the biblical reusing of the name Gihon for a river in Jerusalem. The Israelites did not think they had found the original river Gihon when they gave the spring near Jerusalem that name (1 Kings 1:33), but instead wished to ascribe to Jerusalem the theological significance that the original Gihon had in Eden.[34] That is, Jerusalem was to be considered like a New Eden. The river section in Genesis 2 is therefore, amongst other things, etiological, explaining the historical origins of the names of important places.[35]

Claus Westermann declares that "all attempts to explain or locate the sources of the four rivers geographically are ruled out" on the basis that the "intention of the author ... was not to determine where paradise lay."[36] Rex Mason says that "the writer does not intend us to try to identify the exact topography of the garden."[37] I agree with them both: all attempts to identify the location of the paradise of Eden today are considered hopeless, but not because the language is "hazy and primitive"[38] or mythological. The author of Genesis intended to write of these places historically whilst at the same time knowing that Eden was destroyed with the cataclysmic Flood and therefore no longer exists in our post-Flood world.

References

1. See, for instance, Halton, C., Hoffmeier, J.K., Wenham, G.J. and Sparks, K.L., *Genesis: History, Fiction, or Neither?—Three Views on the Bible's Earliest Chapters*, Zondervan, Grand Rapids, MI, 2015.
2. As an illustration, see the second century writer Theophilus, *Letter to Autolycus*. After asserting the factuality and historicity of Genesis 1, he indulges in a good deal of allegory. See Bouteneff, P., *Beginnings: Ancient Christian Readings of the Biblical Creation Narratives*, Baker Academic, Grand Rapids, MI, pp. 68–70, 2008.
3. As cited in Matthews, K.A., *Genesis 1–11:26*, NAC, B&H Publishers, Nashville, TN, p. 67, 1996; himself citing Grant, R. and Tracy, D., *A Short History of the Interpretation of the Bible*, 2nd edn, Fortress, Philadelphia, PA, p. 90, 1984.
4. See, for instance, Averbeck, R.E., A literary day, inter-textual, and contextual reading of Genesis 1–2; in: Peabody, J.D.C. (Ed.), *Reading Genesis 1–2: An Evangelical Conversation*, Hendrickson, Peabody, MA, pp. 7–34, 2013.
5. See, for instance, Longman III, T., *How to Read Genesis*, Paternoster Press, Milton Keynes, UK, pp. 78–79, 2005.
6. See work of Tsumura, D., *The Earth and the Waters in Genesis 1 and 2: a linguistic investigation*, JSOTSupp 83, Sheffield Academic Press, Sheffield, 1989; and my own, McKitterick, A., The Language of Genesis; in: Nevin, N.C. (Ed.), *Should Christians Embrace Evolution?: Biblical and Scientific Responses*, InterVarsity Press, Nottingham, UK, pp. 27–42, 2009.
7. Matthews, ref. 3, p. 89.
8. Brueggemann, W., *Genesis,* John Knox Press, Atlanta, GA, p. 16, 1982.
9. Knight, G.A.F., *Theology in Pictures: A Commentary on Genesis, Chapters 1–11,* Handsel Press, Edinburgh, UK, p. x, 1981.
10. Anderson, B.W., *The Living World of the Old Testament*, 4th edn, Longman, Harlow, UK, p. 167, 1988.
11. Barstad, H.M., History and the Hebrew Bible; in: Grabbe, L.E. (Ed.), *Can a 'History of Israel' Be Written?*, Sheffield Academic Press, Sheffield, UK, pp. 37–64, 45, 1997.
12. Waltke, B.K., *Genesis*, Zondervan, Grand Rapids, MI, p. 29, 2001.
13. Waltke, ref. 12, p. 80.
14. Waltke, ref. 12, p. 87.
15. Waltke, ref. 12, p. 29.
16. Waltke, ref. 12, p. 86f.
17. Knight, ref. 9, p. 27.
18. Speiser, E.A., The rivers of paradise; in: Hess, R.S. and Tsumura, D.T. (Eds.), *I Studied Inscriptions from Before the Flood*, Eisenbrauns, Winona Lake, IN, pp. 175–182, 179, 1994.
19. Speiser, ref. 18, p. 175.
20. See Hirsch, E.G., *et al*., Garden of Eden; in: *Jerusalem Encyclopedia*, www.jewishencyclopedia.com/articles/5428-eden-garden-of, accessed 16 December 2016.
21. Collins, C.J., *Genesis 1–4: A Linguistic, Literary, and Theological Commentary,* P&R Publishing, Phillipsburg, NJ, p. 120, 2006. See also the reference to archaeologist Dr Juris Zarins in Dora Jane Hamblin, Has the Garden of Eden been located at last?, www.ldolphin.org/eden/, accessed 26 August 2016.
22. Westermann, C., *Genesis 1–11: A commentary*, Augsburg, Minneapolis, MN, p. 218, 1984.
23. "If the city of Ashur is meant, then there must be a very ancient tradition here which goes back to the time before Nineveh became the capital of the Assyrian kingdom." Westermann, ref. 22.
24. Cassuto, U., *A Commentary of the Book of Genesis*, *Part 1*, *From Adam to Noah, Genesis I–VI*, Magnes Press, Jerusalem, pp. 115–121, 1978.
25. Waltke, ref. 12, p. 86.
26. Collins, ref. 21, p. 119.
27. Cassuto, ref. 24, p. 117.
28. Cassuto, ref. 24, p. 118.
29. For a fulsome discussion about deixis and its related term 'indexicality' see Levinson, S.C., 'Deixis and Pragmatics' for Handbook of Pragmatics, Online: pubman.mpdl.mpg.de/pubman/item/escidoc:59489:2/component/escidoc:59490/Levinson_2004_deixis.pdf .
30. Fillmore, C.J., *Lectures on Deixis*, CSLI Publications, Stanford, CA,1971.
31. Lyons, J., *Introduction to Theoretical Linguistics*, Cambridge University Press, Cambridge, UK, p. 275, 1969.
32. Munday Jr, J.C., Eden's Geography Erodes Flood Geology, *Westminster Theological J.* **58**:123–154, 129, 1996.
33. Cassuto, ref. 24, p. 119.
34. For extensive illustration of this point, see Beale, G.K., Eden, The Temple, and the Church's Mission in the New Creation, *JETS* **48**(1):5–31, 2005; and Beale, G.K., *The Temple and the Church's Mission: A Biblical Theology of the Dwelling Place of God*, IVP, Downers Grove, IL, 2004.
35. So, when settlers found a river flowing to the East of a land they called 'New *Ashur'*, they would, of course, call it the Tigris (*Hiddeqel*). And later readers of Genesis 2 would say to themselves: "Ah, so that's why they call it the Tigris." Thus there were two 'Tigris' and two 'Euphrates' rivers: one in Eden before the Flood, one in Mesopotamia after it.
36. Westermann, ref. 22, p. 216.
37. Mason, R., *Propaganda and Subversion in the Old Testament*, SPCK, London, UK, p. 26, 1997.
38. Westermann, ref. 22, p. 216.

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A broken climate pacemaker?—part 2

Jake Hebert

Recent calculations have shown that the "Pacemaker of the Ice Ages" paper, by Hays, Imbrie, and Shackleton, which convinced many scientists of the seeming validity of Milankovitch climate forcing, is actually largely invalid, even by uniformitarian reckoning, due to a significant revision in the age of the Brunhes–Matuyama magnetic reversal boundary. This article asks the question, can uniformitarian scientists still make a strong argument for Milankovitch climate forcing from other paleoclimatological data sets? Although they can, and indeed often do, make a case from other data sets for some kind of Milankovitch climate forcing, uniformitarian scientists do not agree on the details of the forcing model. In other words, uniformitarian scientists seem unable to reconcile all the paleoclimate data with a single, consistent version of the Milankovitch theory. Hence, the theory is probably much weaker than generally assumed. Implications for geochronology and the debate over 'global warming' or 'climate change' are also discussed.

Milankovitch climate forcing is now the dominant secular explanation for the dozens of Pleistocene glacial intervals ('ice ages') said to have occurred within the last 2.6 Ma.[1] The Milankovitch (or astronomical) theory posits that changes in the seasonal and latitudinal distribution of sunlight, resulting from slow, gradual, variations in Earth's orbital and rotational motions, pace the Pleistocene ice ages. These changes in sunlight distribution are themselves caused by changes in the elongation of the earth's orbit (eccentricity), changes in the tilt of the earth's rotational axis (obliquity), and a combination of axial and orbital precessions (figure 1). These variations are expected to exhibit quasi-periodic cycles of about, respectively, 100, 41, and 19–23 ka. The concept of Milankovitch climate forcing has numerous problems.[2,3] In fact, these problems are serious enough that they arguably must be resolved if the theory is to survive.[4] Nevertheless, the theory is today largely accepted because of the well-known 1976 paper "Variations in the Earth's Orbit: Pacemaker of the Ice Ages".[5] The Pacemaker authors analyzed data from two southern Indian Ocean cores designated as RC11-120 and E49-18. A third core, designated V28-238, also played a major, but indirect, role in the analysis (figure 2). However, this paper is now largely invalid, even by uniformitarian reckoning, due to a significant revision in the age of the Brunhes–Matuyama magnetic reversal boundary, discussed in depth in Part 1 of this series.[6]

Ironically, uniformitarians made this age revision because they were attempting to 'tune' data within *other* sediment cores to align with Milankovitch expectations.[7,8] So uniformitarians used an age of 700 ka to help convince the world of the validity of Milankovitch climate forcing, but then revised this age to 780 ka because they were having difficulty reconciling *other* data with the Milankovitch theory! After this revision was made, it was supposedly 'confirmed' by radioisotope dating.[9] Part 1 in this series summarized the results[10–12] when the Pacemaker calculations are reperformed after taking into account this age revision.[6] It also presented a simple method whereby even non-specialists can quickly verify that the results of this iconic paper are invalid.

As an aside, it is worth noting that even after multiple extensive internet searches, I been unable to find a single, solitary candid acknowledgment in the secular literature of this serious problem with the Pacemaker results. In fact, as I show later, many uniformitarian scientists may not even be aware of the problem!

Given that there are likely hundreds of published papers that discuss the astronomical theory, one might be tempted to assume that the evidence for the astronomical theory is still very strong, despite invalidation of the Pacemaker results. However, many, if not most, of these papers simply *assume* the validity of the theory and then use that assumption to derive conclusions about geochronology or paleoclimates. However, there are at least four reasons (given below) to suspect that the astronomical theory is without a firm logical foundation.

Confirmation of the theory is difficult

First, confirmation of the astronomical theory is difficult to achieve in practice, even if one assumes 'deep time' is real. Such confirmation requires a long, undisturbed deep-sea sediment core or cores characterized by sufficiently high sedimentation rates to enable detection of the frequencies expected by Milankovitch theory. Furthermore, this core should be located in a place where the seafloor sediment data will yield the most information possible about past climate variables. The Pacemaker authors claimed that in 1976 only *two* sediment cores out of several hundred met those requirements.[13]

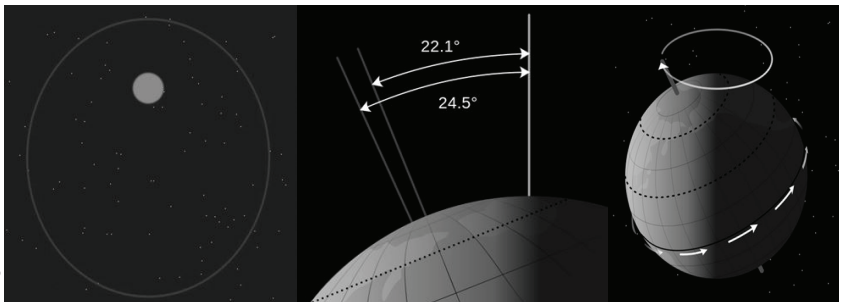

Image: NASA

Figure 1. The Milankovitch (or astronomical theory) posits that slow changes in the seasonal and latitudinal distribution of sunlight resulting from changes in Earth's (a) eccentricity and (b) axial tilt (or obliquity) 'pace' ice age cycles. Also contributing is the influence of axial precession (c), as it combines with orbital precession (not shown).

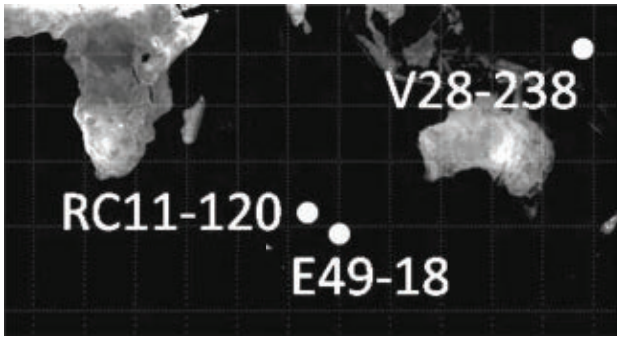

Figure 2. The "Pacemaker of the Ice Ages" paper, by Hays, Imbrie, and Shackleton, utilized data from the two southern Indian Ocean sediment cores, RC11-120 and E49-18. Another core from the equatorial western Pacific, V28-238, played an important role in establishing the timescales for the two Indian Ocean cores, particularly the longer E49-18 core.

Confirmation also requires a means of assigning tentative ages to the sediments within those cores, and this method must be independent of any implicit Milankovitch assumptions. Because radioisotope dating (within a uniformitarian framework) can only be applied to seafloor sediments in special cases (e.g. radiocarbon and uranium series dating), these timescales must be derived indirectly. The original Pacemaker paper used an assumed age of 700 ka for the Brunhes–Matuyama (B–M) magnetic reversal boundary as well as oxygen isotope ($\delta^{18}O$) data from the V28-238 western Pacific sediment core to help derive these timescales.[14,15] Because the B–M magnetic reversal was recorded at a depth of 1,200 cm within the V28-238 core, uniformitarians were able to assign ages to prominent $\delta^{18}O$ features within the V28-238 core by assuming an age of 0 ka for the top of the core and a constant sedimentation rate. These age estimates were then transferred via 'wiggle matching' to the two Indian Ocean cores used in the Pacemaker analysis. At the time of the Pacemaker paper's publication, the V28-238 core seems to have been the *only* means available to uniformitarians to assign ages to the deeper seafloor sediments.[16] In fact, the importance of the V28-238 $\delta^{18}O$ record for uniformitarian scientists is highlighted by the fact that it has been called a kind of ice age 'Rosetta Stone'.[17] But now that uniformitarians have revised the age of the B–M reversal to 780 ka, use of that very same method yields age estimates that are significantly different from those used in the Pacemaker paper. This raises the question, do uniformitarians have *another* means (independent of Milankovitch assumptions) of assigning ages to deep seafloor sediments? Do they have some *other* long, undisturbed sediment core (characterized by a nearly constant sedimentation rate) which also contains the B–M reversal boundary? And if so, have they attempted to use it to obtain revised ages for key features within the $\delta^{18}O$ record? And even if they do have it, and are now using it rather than the V28-238 core for this purpose, doesn't this seem like 'cherry picking' of dates? On what basis does one determine that one set of age estimates is more valid than another?

The prominence of the pacemaker paper

A second reason to suspect that remaining evidence for the astronomical theory is either weak or non-existent is that the Pacemaker paper is still, even today, widely cited and acknowledged as the impetus for the modern resurgence of the Milankovitch theory. If uniformitarians had a suitable 'replacement' for the Pacemaker results, one would expect that this fact would be more widely known, and that this new paper would have since overshadowed the obsolete Pacemaker paper. It is possible, of course, that many uniformitarians are simply unaware that the Pacemaker results are now invalid. For instance, this writer stated the following about the V28-238 sediment core:

> "Shackleton and Opdyke employed a different approach to date their isotope record using reversals in the Earth's magnetic field. Opdyke made systematic down-core assessments of magnetic polarity and located a reversal in V28-238 at a depth of 1,200 cm in MIS 19 (figure 3). Because the V28-238 record does not contain any obvious breaks in sedimentation, he could be confident that this was the Brunhes–Matuyama reversal—the last time the Earth's magnetic field flipped—780,000 years ago. From this fixed point ages could be interpolated for each level in the core by assuming, quite reasonably, that the sediments had accumulated at a uniform rate."[18]

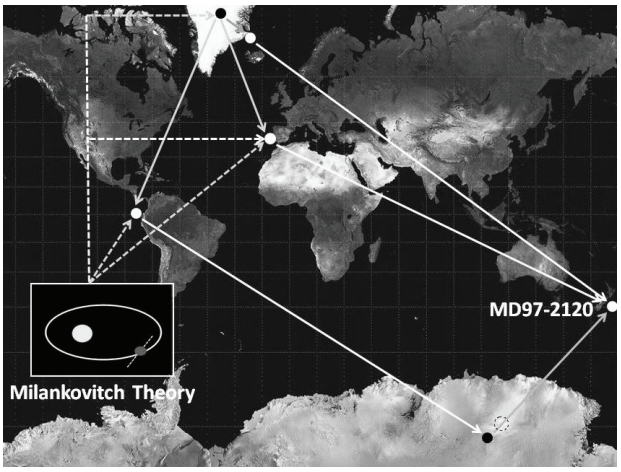

Figure 3. The age model for the New Zealand deep-sea sediment core MD97-2120 was tied to the ages assigned to other deep-sea cores and ice cores, the ages of which in turn were often tied back to the Milankovitch theory. Details are provided in references 44 and 45.

Likewise, this climate researcher made the following comment:

> "The benthic $\delta^{18}O$ ice volume record of Hays *et al*. from 1976 was one of the very first continuous records of the late Pleistocene extending back to the Brunhes-Matuyama magnetic reversal event (780,000 years ago), making it possible to construct a timescale by assuming linear accumulation rates."[19]

Both writers seem to be unaware that Shackleton and Opdyke used an age of 700 ka, rather than 780 ka, for the B-M reversal in their calculations. The confusion is understandable, as the Pacemaker paper never explicitly mentioned the age of the B-M reversal boundary. Instead, the Pacemaker paper referred back to the 1973 Shackleton and Opdyke paper, which clearly stated, more than once, that an age of 700 ka years had been assigned to the B-M reversal.[15]

In fact, the second writer seems confused on another point, too. The Pacemaker authors used planktonic (rather than benthic) $\delta^{18}O$ values in their analysis.[5] Likewise, the V28-238 $\delta^{18}O$ values used to help construct the timescales for the two Indian Ocean cores were primarily planktonic, although some benthic values were also used.[15]

Details of the theory still in flux

A third reason to suspect that evidence for the astronomical theory is very weak is that uniformitarian paleoclimatologists have apparently not yet 'nailed down' the details of the theory. That the original Pacemaker paper showed dominant spectral peaks at frequencies corresponding to the obliquity and precessional 41 ka and 23 ka cycles can be explained if one assumes that the climate is responding in a *linear* fashion to those particular orbital inputs.[5,20] In such a case, the periods/frequencies of the climate response are the same as those of Earth's orbital cycles.[21] However, one does not *have* to make this assumption. One can also assume that the climate output is characterized by *different* periods/frequencies than the orbital inputs. Many uniformitarian authors have claimed spectral peaks in paleoclimatological data sets that do *not* match the frequencies of the presumed orbital inputs.[22] In fact, a number of uniformitarian paleoclimatologists are experimenting with non-linear models in which this would be the case.[23,24]

Of course, Milankovitch proponents who advocate for non-linear climate responses to the obliquity and precessional orbital inputs could argue that invalidation of the original Pacemaker results is not 'a big deal'. After all, they don't expect the frequencies of the climate responses to the obliquity and precessional cycles to equal the frequencies of those particular orbital cycles, anyway. But if that is the case, then the original Pacemaker results (in which the frequencies of the climate responses *did* agree with those of the obliquity and precessional cycles) should never have been used as an argument for Milankovitch climate forcing in the first place!

Furthermore, Richard Muller and the late G.J. MacDonald have made forceful criticisms of the claim that the prominent ~100 ka spectral peak found in many paleoclimatological data sets is due to changes eccentricity. They claim that it is actually caused by changes in orbital inclination (the angle between the plane of the ecliptic and the plane perpendicular to the angular momentum vector of the planets). However, they acknowledge the speculative nature of their proposed mechanism.[25,26]

One specialist, in the context of defending the theory, nevertheless acknowledged that, "Surprisingly, the [Milankovitch] hypothesis remains not clearly defined despite an extensive body of research on the link between global ice volume and insolation changes arising from variations in the Earth's orbit."[27] But this raises a question, *How does one test a poorly-defined theory?* No doubt, one can reconcile the data within at least some of the hundreds of seafloor sediment cores with at least some version or versions of the Milankovitch theory. But is there a *single* version of the theory that can fit *all* the data? That uniformitarian paleoclimatologists still cannot agree on the details of their model, even after forty years of work, strongly suggests that the answer to that question is *no*.

The 'strongest argument yet' for the theory?

A fourth reason to suspect that evidence for the astronomical theory is extremely weak is a statement made by respected oceanographer and geologist Wolfgang Berger:

> "In the end, the correct timescale [for the marine sediment cores] was a matter of co-ordinating isotope stratigraphy with the results from palaeomagnetism, applying the date found in basalt layers for the Matuyama-Brunhes boundary to cores with known magnetic stratigraphy (as in Shackleton & Opdyke 1973). *The agreement of dating by that method and by Milankovitch tuning (urged by Shackleton et al. 1990) is the strongest argument yet for the correctness of Milankovitch theory* [emphasis added]"[28]

When one considers the revision to the age of the Brunhes-Matuyama reversal boundary, Berger's statement is simply jaw-dropping. Recall that the Pacemaker paper used Shackleton and Opdyke's age estimates for prominent features in the $\delta^{18}O$ record to set up the timescales used in the analysis. But these age estimates were obtained using an assumed age of 700 ka for the B-M reversal boundary.[29] However, the 1990 paper by Shackleton et al. is one of the papers that argued that the age of the B-M reversal needed to be raised to 780 ka![30] Berger may very well be correct when he says that the agreement of dates obtained by the methods in those two papers is quite good. But there is an outrageous logical contradiction hiding beneath this apparent agreement. The paper by Shackleton and Opdyke assumed an age of just 700 ka for the B–M reversal boundary, while the 1990 paper by Shackleton *et al.* required that the age for this same reversal be 780 ka. Moreover, uncertainties for such age estimates of the B–M reversal tend to be ~10 ka, implying that the two different age estimates are truly discordant.[9,31] If Berger is right, and this is indeed the strongest argument yet for Milankovitch climate forcing, then it is probably safe to say that the theory is in serious trouble!

Fifty years of failure

Despite the many theoretical problems with the Milankovitch theory, it has been widely accepted because of the results of time series and/or spectral analysis.[32,33] The results of these analyses are the only real argument in favour of the theory. Yet, additional analyses of paleoclimate data invariably result in contradictions to the theory.

For instance, a decade before publication of the Pacemaker paper, Cesare Emiliani published another paper in *Science* that seemed to show extremely convincing evidence for the Milankovitch theory, also obtained from seafloor sediment data.[34] Emiliani concluded that $\delta^{18}O$ 'wiggles' in the sediment cores were primarily temperature indicators, with as much as 70% of the variation in the $\delta^{18}O$ 'wiggles' resulting from temperature variations. Yet this interpretation of the $\delta^{18}O$ data is now generally out of favour. Most uniformitarian paleoclimatologists now believe that the $\delta^{18}O$ variations are mainly indicators of changes in global ice volume, rather than temperature *per se*.[1,35]

Emiliani's 'confirmation' of the Milankovitch theory seemed to show near-perfect correlation (a correlation coefficient of 0.997!) between the depths of supposed temperature minima (indicated by maximum $\delta^{18}O$ values) and the calculated times at which 65° N summer insolation were a minimum. However, Emiliani's confirmation of Milankovitch climate forcing was heavily dependent on data from a single sediment core.[36]

Moreover, uniformitarian scientists later revised Emiliani's timescale, increasing it by about 25%, to reflect ^{231}Pa and ^{230}Th measurements made on Caribbean core V12-122.[36] Hence, this apparent confirmation of the Milankovitch theory was soon abandoned and forgotten, despite Emiliani's apparently impressive correlation. Could this perhaps be a lesson to Christians who are tempted to embrace the latest claims of evolutionary scientists, due to results that seem outwardly impressive, despite the fact that those claims contradict Scripture?

Ironically, this timescale revision resulted in a new age assignment of 127 ± 6 ka for the MIS 6-5 (or Termination II) boundary, an age estimate that was then used in the Pacemaker paper.[5,36] As noted earlier, the 1976 Pacemaker paper was seen as providing strong evidence for the Milankovitch theory. Yet we have already observed that this apparent confirmation of the theory relied on an age estimate of 700 ka for the Brunhes–Matuyama magnetic reversal boundary, an age no longer accepted by uniformitarian scientists. In fact, the age of the B–M reversal boundary has slowly 'crept upwards' over the years. Sometime prior to 1979, it was revised to 710 ka.[37] By 1979, this age had been revised still again to 730 ka, due to a revision in the K-Ar decay constants.[31,37] Yet, in the 1990s, uniformitarian scientist arbitrarily revised the age of this reversal boundary to 780 ka, overruling the K-Ar age for this boundary, in an attempt to reconcile wiggles in other sediment cores with the theory.[7,8] It was only after uniformitarians 'needed' this higher age that it was ostensibly 'confirmed' by radioisotope dating.[9]

Of course, this revised age for the B-M reversal boundary undermines the original Pacemaker paper results. So it seems that history has repeated itself. Just as Emiliani's apparent confirmation of Milankovitch climate forcing was overturned by a subsequent age revision, the apparent 'Pacemaker' confirmation of Hays, Imbrie, and Shackleton have been overturned in a similar manner—although secular paleoclimatologists seem unwilling to acknowledge this!

This overview reveals a pattern: uniformitarian scientists obtain what they believe is a confirmation of the Milankovitch theory, but contradictions with the theory eventually emerge as new data are examined.

Implications for geochronology

Despite the fact that the details of the Milankovitch (or astronomical) theory are still in flux, it plays an enormously important role in geochronology. Now that most uniformitarian scientists believe (mistakenly, I would argue) that the theory is firmly established, they use it to assign ages to other seafloor sediments via a technique called 'orbital tuning'.[38] The tuning method has been described this way: "The general approach is to stretch, squeeze, and shift portions of a climate record so as to maximize its correspondence with a curve derived from the time history of changes in Earth's orbital configuration, a process referred to as orbital tuning."[39] However, this tuning process requires the tuner to make *assumptions* about *how* the climate responds to the orbital signal.[40,41] But, as we have already seen, paleoclimatologists do not agree on the details of the climate response. Nevertheless, the ages assigned to the seafloor sediments are then used to 'tune' theoretical age models for the deep ice cores of Greenland and Antarctica.[42] For instance, figure 3 graphically illustrates the manner in which dates for the MD97-2120 New Zealand deep-sea core were 'tied' to age assignments for other sediment and ice cores, which, in turn, were *themselves* tied back to the astronomical theory.[43,44]

In fact, the astronomical theory is even used to calibrate the dating standards for the argon-argon radioisotope dating method![45–49]

Of course, if the astronomical theory is unsubstantiated, then these age assignments are in doubt, even by uniformitarian reckoning (figure 4).

Implications for the 'climate change' issue

Creation scientists have long argued that the Milankovitch theory may be contributing to 'climate change' alarmism. Vardiman noted that the astronomical theory is leading many uniformitarian scientists to conclude that our climate is extremely sensitive to minor perturbations:

> "A major result of this need for feedback mechanisms has been the development of a perspective that the earth's climate system is extremely sensitive to minor disturbances. A relatively minor perturbation could initiate a non-linear response which might lead to another 'Ice Age' or 'Greenhouse.' Because of the fear that a small perturbation might lead to serious consequences, radical environmental policies on the release of smoke, chemicals, and other pollutants and the cutting of trees have been imposed by international agencies and some countries. If the basis for the Astronomical Theory is wrong, many of the more radical environmental efforts may be unjustified."[50]

Vardiman's conclusion is substantiated by numerous papers within the uniformitarian literature, which conclude, based on uniformitarian and Milankovitch considerations, that the climate is unstable.[51–57] Hence, the concern that factors like higher atmospheric CO_2 can contribute to some kind of climate catastrophe.

Likewise, the astronomical theory is contributing to fears over possible rapid sea-level rise due to deglaciation. As noted by Wolfgang Berger:

> "The ice-age record has relevant information on this point. As is seen in figure 5, middle panel, the rates of change of the oxygen isotope record *obtained from tuning to Milankovitch forcing* implies considerable amplitudes for the rates of melting (and hence rise of sea level) for the terminations. For the last deglaciation (where dates and thus rates are bolstered by numerous radiocarbon determinations) a change of around 100 m in sea level was achieved within about 10,000 years, for an overall rate of 1 meter per century (Emiliani, 1992). The value may be taken as a realistic baseline for fast melting. The question then is by what factor this rate is temporarily exceeded during major meltwater pulses. [emphasis added]."[58]

Note that past rates of melting and sea level rise are inferred from orbital tuning of the seafloor sediment data. Berger then notes

> "There remains yet another major unknown factor, this one in regard to the trigger or the threshold for the onset of major melting of polar ice masses. Just when can we expect to see a rapid rise of sea level, ten times higher than the present values of a few millimeters per year? We do not know. All we can say, *from experience*

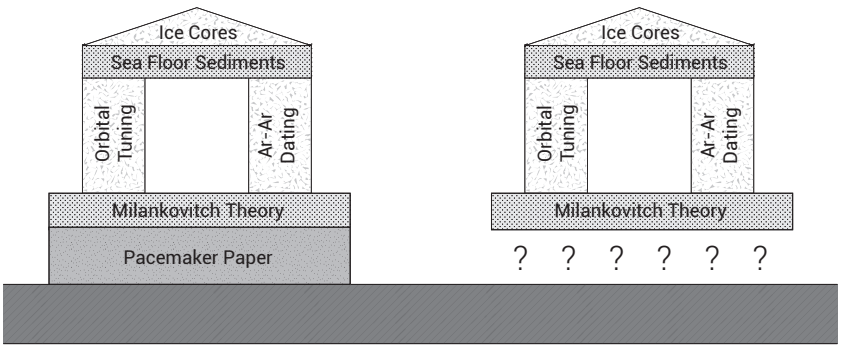

Figure 4. The "Pacemaker of the Ice Ages" paper has become the foundation (a) for modern acceptance of the idea of Milankovitch climate forcing, but now that the results from this famous paper have been invalidated, is there any firm basis (b) for belief in the theory, or for the age estimates obtained from the theory?

> *with the many millennia of the ice-age records in the deep sea*, is that once melting starts, it stimulates further melting for centuries. Deglaciation keeps going once begun in earnest: a great example of the dilemma of the sorcerer's apprentice [emphasis added].[59]

Note that what Berger calls 'experience' is really just a Milankovitch/uniformitarian interpretation of the seafloor sediment data. Thus, these conclusions are derived, not from direct observation, or even from meteorological considerations *per se*, but from a uniformitarian/Milankovitch interpretation of the seafloor sediment data. We have already seen, however, that such an interpretation of the data is logically 'shaky' and *there may be no hard evidence for it whatsoever.*

Conclusions

The secular paleoclimatological community would be wise not to ignore or attempt to 'cover up' the problems in the Pacemaker paper. But given the importance of the paper to secular thinking, they probably will. In fact, both *Science* and *Nature* ran articles commemorating the 40th anniversary of the paper's publication.[60,61] In recent years, secular paleoclimatology has taken several rather serious 'hits' to its credibility. These include the controversy over Michael Mann's 'hockey stick' graph, which purported to show unprecedented warming at the end of the 20th century.[62,63] McIntyre and McKitrick have made devastating criticisms of Mann's papers.[64] Likewise, the East Anglia 'climategate' scandals revealed evidence that influential climate scientists were attempting to 'rig' the climate change debate in rather under-handed ways.[65,66] The last thing secular paleoclimatology needs is another 'hit' to its credibility. And the problems with the Pacemaker paper *could* constitute such a 'hit', if it ever becomes common knowledge that paleoclimatologists were either unaware of the problems in the Pacemaker paper or, worse yet, that they *were* aware of them but ignored them.

It is my hope that this series of papers, particularly the conceptual exercise in part 1, will enable non-specialists to see for themselves that the Pacemaker results should be questioned, even for those who accept 'deep time'.

The evidence for the Milankovitch theory is apparently much weaker than generally assumed. Given the prominent role that Milankovitch theory plays (via orbital tuning) in uniformitarian geochronology, it is possible that many, perhaps *hundreds*, of age assignments could be in doubt, even by uniformitarian reckoning. Likewise, given the prominent role that the theory plays in paleoclimatology, anyone hoping to correctly evaluate and respond to arguments for and against catastrophic anthropogenic global warming (CAGW) should take these weaknesses into account.

References

1. Walker, M. and Lowe, J., Quaternary science 2007: a 50-year retrospective, *J. Geological Society, London* **164**(6):1073–1092, 2007.
2. Oard, M.J., Astronomical troubles for the astronomical hypothesis of ice ages, *J. Creation* **21**(3):19–23, 2007.
3. Cronin, T.M., *Paleoclimates: Understanding Climate Change Past and Present*, Columbia University Press, New York, 2010.
4. Elkibbi, M. and Rial, J.A., An outsider's review of the astronomical theory of the climate: is the eccentricity-driven insolation the main driver of the ice ages? *Earth-Science Reviews* **56**(1–4):161–177, 2001.
5. Hayes, J.D., Imbrie, J. and Shackleton, N.J., Variations in the earth's orbit: Pacemaker of the ice ages, *Science* **194**(4270):1121–1132, 1976.
6. Hebert, J. A broken climate pacemaker? —part 1, *J. Creation* **31**(1): XX–YY, 2016.
7. Shackleton, N.J., Berger, A. and Peltier, W.R., An alternative astronomical calibration of the lower Pleistocene timescale based on ODP Site 677, *Transactions of the Royal Society of Edinburgh: Earth Sciences* **81**(4):251–261, 1990.
8. Hilgen, F.J., Astronomical calibration of Gauss to Matuyama sapropels in the Mediterranean and implication for the geomagnetic polarity time scale, *Earth and Planetary Science Letters* **104**(2–4):226–244, 1991.
9. Spell, T.L. and McDougall, I., Revisions to the age of the Brunhes-Matuyama boundary and the Pleistocene geomagnetic polarity timescale, *Geophysical Research Letters* **19**(12):1181–1184, 1992.
10. Hebert, J., Revisiting an iconic argument for Milankovitch climate forcing: should the "Pacemaker of the Ice Ages" paper be retracted? part 1, *Answers Research J.* **9**:25–56, 2016.
11. Hebert, J., Revisiting an iconic argument for Milankovitch climate forcing: should the "Pacemaker of the Ice Ages" paper be retracted? part 2, *Answers Research J.* **9**:131–147, 2016.
12. Hebert, J., Revisiting an iconic argument for Milankovitch climate forcing: should the "Pacemaker of the Ice Ages" paper be retracted? part 3, *Answers Research J.* **9**:229–255, 2016.
13. Hays, Imbrie and Shackleton, ref. 5, p. 1122.
14. Hays, Imbrie and Shackleton, ref. 5, pp. 1124, 1131.
15. Shackleton, N.J. and Opdyke, N.D., Oxygen isotope and Palaeomagnetic stratigraphy of equatorial Pacific core V28-238: oxygen isotope temperatures and ice volumes on a 10^5 year and 10^6 year scale, *Quaternary Research* **3**: 39–55, 1973.
16. A nearby companion core to V28-238, the V28-239 core, contained a record of the B–M magnetic reversal boundary, as well as four other magnetic reversals, but the top three metres of the core were described by Shackleton and Opdyke , ref. 15, p. 40, as 'severely disturbed'.
17. Woodward, J., *The Ice Age: A Very Short Introduction*, Oxford University Press, Oxford, p. 97, 2014.
18. Woodward, ref. 17, p. 107.
19. Nisancioglu, K.H., Plio-Pleistocene Glacial Cycles and Milankovitch Variability; in: Steele, J.H. (Ed.), *Climates and Oceans*, Academic Press, Amsterdam, The Netherlands, pp. 344–353, 2010; quote on p. 347.
20. Manolakis, D.G. and Ingle, V.K., *Applied Digital Signal Processing: Theory and Practice,* Cambridge University Press, New York, p. 203, 2011.
21. One might assume, since the original Pacemaker results also showed dominant spectral peaks corresponding to the ~100 ka eccentricity cycle, that this particular climate response would also be linear (input frequency/period equals output frequency/period). However, changes in insolation resulting from variations in eccentricity are much too small to have a direct climatic effect. Hence, the Pacemaker authors attributed the dominant low-frequency peaks to a non-linear response to the precession index, which depends on both eccentricity and the longitude of perihelion (see pp. 1130–1131 in reference 5. See also the discussion at scienceofdoom.com/2014/03/03/ghosts-of-climates-past-eighteen-probably-nonlinearity-of-unknown-origin/, accessed 17 November 2016).
22. Nobes, D.C., Bloomer, S.F., Mienert, J. and Westall F., Milankovitch cycles and nonlinear response in the Quaternary record in the Atlantic sector of the southern oceans; in: Ciesielski, P.F., Kristoffersen, Y. *et al.*, *Proceedings of the Ocean Drilling Program, Scientific Results* 114, Ocean Drilling Program, College Station, TX, pp. 551–576, 1991.

23. Rial, J.A. and Anaclerio C.A., Understanding nonlinear responses of the climate system to orbital forcing. *Quaternary Science Reviews* **19**:1709–1722, 2000.
24. Lourens, L.J., Becker, J., Bintanja, R. *et al.*, Linear and non-linear response of late Neogene glacial cycles to obliquity forcing and implications for the Milankovitch theory, *Quaternary Science Reviews* **29**(1–2): 352–365, 2010.
25. Muller, R.A. and MacDonald, G.J., Spectrum of 100-kyr glacial cycle: Orbital inclination, not eccentricity, *Proceedings of the National Academy of Sciences* **94**(16): 8329–8334, 1997.
26. Muller, R.A. and MacDonald, G.J., *Ice Ages and Astronomical Causes: Data, Spectral Analysis and Mechanisms*, Praxis Publishing, Chichester, UK, 2000.
27. Roe, G., In defense of Milankovitch, *Geophysical Research Letters* **33**(24): L24703, 2006.
28. Berger, W.H., On the Beginnings of Palaeoceanography: Foraminifera, Pioneers, and the *Albatross* expedition; in: Bowden, A.J., Gregory, F.J. and Henderson, A.S. (Eds.), *Landmarks in Foraminiferal Micropalaeontology: History and Development*, Geological Society Publishing House, London, p. 169, 2014.
29. Shackleton and Opdyke, ref. 15, pp. 40, 49.
30. Shackleton *et al.*, ref. 7, pp. 251, 257.
31. Imbrie, J., Hays, J.D., Martinson, D.G. *et al.*, The orbital theory of Pleistocene climate: support from a revised chronology of the marine $\delta^{18}O$ record; in: Berger, A., Imbrie, J., Hays, J., Kukla, G. and Saltzman, B. (Eds.), *Milankovitch and Climate, Part 1*., D. Reidel Publishing, Dordrecht, Holland, pp. 269–305, 1984.
32. Muller and MacDonald, ref. 26, p. xiv.
33. Alvarez, W., in Muller and MacDonald, ref. 26, p. xvii.
34. Emiliani, C., Isotopic paleotemperatures, *Science* **154**(3751):851–857, 1966.
35. Shackleton, N., Oxygen isotope analyses and Pleistocene temperatures re-assessed, *Nature* **215**:15–17, 1967.
36. Broecker, W.S. and van Donk, J., Insolation changes, ice volumes, and the O^{18} record in deep-sea cores, *Reviews of Geophysics and Space Physics* **8**(1):169–198, 1970.
37. Mankinen, E.A. and Dalrymple, G.B., Revised geomagnetic polarity time scale for the Interval 0–5 m.y. B.P, *J. Geophysical Research: Solid Earth* **84**(B2):615– 626, 1979.
38. Herbert, T.D., Paleoceanography: orbitally tuned timescales; in: Steele, J.H. (Ed.), *Climates and Oceans*, Academic Press, Amsterdam, pp. 370–377, 2010.
39. Huybers, P. and Aharonson, O., Orbital tuning, eccentricity, and the frequency modulation of climatic precession, *Paleoceanography* **25**:PA4228, 2010.
40. Martinson, D.G., Pisias, N.G., Hays, J.D. *et al.*, Age dating and the orbital theory of the ice ages: development of a high-resolution 0 to 300,000-year chronostratigraphy, *Quaternary Research* **27**:1–29, 1987.
41. Rial and Anaclerio, ref. 23, p. 1715.
42. Hebert, J., Circular reasoning in the dating of deep seafloor sediments and ice cores: the orbital tuning method, *Answers Research J.* **7**:297–309, 2014.
43. Hebert, J., The dating 'pedigree' of seafloor sediment core MD97-2120: a case study, *Creation Research Society Quarterly* **51**(3):152–164, 2015.
44. Hebert, J., Deep core dating and circular reasoning, *Acts & Facts* **45**(3):9–11, 2016.
45. Renne, P.R., Deino, A.L., Walter, R.C. *et al.*, Intercalibration of astronomical and radioisotope time, *Geology* **22**(9):783–786, 1994.
46. Channell, J.E.T., Hodell, D.A., Singer, B.S. and Xuan, C., Reconciling Astrochronological and $^{40}Ar/^{39}Ar$ ages for the Matuyama-Brunhes boundary and late Matuyama Chron, *Geochemistry, Geophysics, Geosystems* **11**(12): 1–21, 2010.
47. Huang, C., Hesselbo, S.P. and Hinnov, L., Astrochronology of the late Jurassic Kimmeridge clay (Dorset, England) and implications for Earth system processes, *Earth and Planetary Science Letters* **289**(1–2):242–255, 2010.
48. Rivera, T.A., Storey, M., Zeeden, C., Hilgen, F.J. and Kuiper, K., A refined astronomically calibrated $^{40}Ar/^{39}Ar$ Age for Fish Canyon sanidine, *Earth and Planetary Science Letters* **311**(3–4):420–426, 2011.
49. Meyers, S.R., Siewert, S.E., Singer, B.S. *et al.*, Intercalibration of radioisotopic and astrochronologic time scales for the Cenomanian-Turonian boundary interval, Western Interior Basin, US, *Geology* **40**(1):7–10, 2012.
50. Vardiman, L., *Climates Before and After the Genesis Flood*, Institute for Creation Research, El Cajon, CA, p. 79, 2001.
51. Dansgaard, W., Johnsen, S.J., Clausen, H.B. *et al.*, Evidence for general instability of past climate from a 250-Kyr ice-core record, *Nature* **364**(6434):218–220, 1993.
52. Alley, R.B., Mayewski, P.A., Sowers, T. *et al.*, holocene climate instability: a prominent, widespread event 8200 Yr Ago, *Geology* **25**(6):483–486, 1997.
53. Thompson, L.G., Yao, T., Davis, M.E. *et al.*, Tropical climate instability: the last glacial cycle from a Qinghai-Tibetan ice core, *Science* **276**(5320):1821–1825, 1997.
54. Schilman, B., Bar-Matthews, M., Almogi-Labin, A. and Luz, B., Global climate instability reflected by eastern Mediterranean marine records during the late Holocene, *Palaeogeography, Palaeoclimatology, Palaeoecology* **176**(1–4):157–176, 2001.
55. Keeling, R.F. and Stephens, B.B., Antarctic sea ice and the control of Pleistocene climate instability, *Paleoceanography* **16**(1):112–131, 2001.
56. Sandal, C. and Nof, D., A new analytical model for Heinrich events and climate instability, *J. Physical Oceanography* **38**(2):451–466, 2008.
57. Greenop, R., Foster, G.L., Wilson, P.A. and Lear, C.H., Middle Miocene climate instability associated with high-amplitude CO_2 variability, *Paleoceanography* **29**(9):845–853, 2014.
58. Berger, W.H., *Milankovitch Theory—Hits and Misses*, Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA, p. 15, 2012.
59. Berger, ref. 58, p. 16.
60. Hodell, D.A., The smoking gun of the ice ages, *Science* **354**(6317): 1235–1236, 2016.
61. Maslin, M., Forty years of linking orbits to ice ages, *Nature* **540**(7632): 208–210, 2016.
62. Mann, M.E., Bradley, R.S. and Hughes, M.K., Global-scale temperature patterns and climate forcing over the past six centuries, *Nature* **392**(6678):779–787, 1998.
63. Mann, M.E., Bradley, R.S. and Hughes, M.K., Northern hemisphere temperatures during the past millennium: Inferences, uncertainties, and limitations, *Geophysical Research Letters* **26**:759–762, 1999.
64. McIntyre, S. and McKitrick, R., Hockey sticks, principal components, and spurious significance, *Geophysical Research Letters* **32**:L03710, 2005.
65. Booker, C., Climate change: this is the worst scientific scandal of our generation, 28 November 2009, telegraph.co.uk/comment/columnists/christopherbooker/6679082/Climate-change-this-is-the-worst-scientific-scandal-of-our-generation.html, accessed 5 January 2017.
66. Taylor, J., Climategate 2.0: New E-mails Rock the Global Warming Debate, 23 November 2011, forbes.com/sites/jamestaylor/2011/11/23/climategate-2-0-new-e-mails-rock-the-global-warming-debate/#5740a1f3988d, accessed 5 January 2017.

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Superflares and the origin of life on Earth

Andrew Sibley

This paper considers the naturalistic view of the early sun at the time when abiogenesis was supposed to be occurring, and early life was, allegedly, evolving on Earth. Theoreticians have, historically, been concerned about answering the faint young sun paradox, but there is growing realisation that the hypothetical early Earth would have faced a very hostile environment from solar superflares, extreme coronal mass ejections, and very harmful radiation storms. While some have tried to turn this to their advantage, the evidence presented is not compelling. This also has a bearing upon the search for extra-terrestrial life. It turns out that the vast majority of star systems are not conducive to hosting Earth-like planets, but most stars are far more variable in their flare output. The sun–Earth system appears to be unique and optimally designed for organic life.

This paper will evaluate naturalistic views of the early sun, and consider the theoretical strength of solar activity at a time when life on Earth was believed to be arising within the evolutionary framework, approximately 3.5 to 4 Ga ago. Increasing evidence from other stars that are similar in size or smaller than the sun, such as red dwarfs, raises serious problems for the naturalistic view. This has a bearing upon naturalistic theories about the origin of life, and it may be noted that in comparison with other stars the sun is in fact unusual in being remarkably stable in its flare output and heat flux.[1]

Naturalistic science holds that the sun has undergone changes in the period since formation, 4.5 Ga. The first claim is that the sun was around 30% dimmer 3.5 to 4 Ga, at a time when life was believed to be arising on Earth. The Luminosity (L) of a star may be determined using Stefan Boltzmann theory if it is treated as a black-body emitter, so that $L = 4\pi R^2\sigma T^4$ (where σ = the Stefan Boltzmann constant, T is temperature, and R the radius of the star).

This lack of heat leads to a problem in that researchers consider that there would have been insufficient irradiance at Earth to allow liquid water to remain stable on the surface: the faint young sun paradox. There are various possible mechanisms raised to get around this, for instance one idea is that the earth was bombarded by asteroids that released greenhouse gases into the atmosphere, or experienced excessive volcanic emissions.[2] Another position is that life arose near deep ocean hot vents.[3] However, there is also a growing understanding that within the naturalistic framework an early Earth would have experienced an extreme space environment from the sun that would have been very harmful to life and the earth system. Although some recent papers have tried to turn this into an advantage, the evidence is not compelling.[4]

Naturalistic theories about the origin of the sun hold that it would have been spinning at a much faster rate than it is today, at a time when abiogenesis was believed to be occurring on Earth (according to naturalism, stars form when giant gas clouds collapse and the concentration of angular momentum leads to a very fast rotating object). The outcome of this excessive spin is that the strength of the sun's magnetic field would also have been much stronger. This is because of differential rotation between the sun's equator and poles, and this feeds into the strength of magnetic fields around sunspot regions. The magnetic field intensity of sunspot regions would have been extremely strong with the possibility of super-strength extreme ultra-violet light (EUV) and X-ray flares (figure 1), more powerful coronal mass ejections (CMEs) (figure 2), and very high energy particle radiation storms. Sunspots form when dynamic forces twist, contort and strengthen magnetic field lines, and greater differential rotation with an early sun would lead to an increase in strength. The theory behind this is referred to as magnetohydrodynamics (from Hannes Alfvén) and basically combines Maxwell's electromagnetic equations with Navier–Stokes equations of fluid dynamics. In CMEs, high tension magnetic fields associated with sunspot regions reconfigure and reconnect with plasma clouds breaking away at very high speeds, sometimes of the order of 2,000 to 3,000 km/s on the present sun. The shock wave ahead of CMEs can also accelerate energetic particles, such as hydrogen ions, to very high energies, even relativistic energies of the region of 500 MeV or more. The release of energy from solar magnetic reconnection is also observed as intense EUV and X-ray emissions. So, given a faster solar rotation speed, these CME emissions, X-ray flares, and radiation storms would have been stronger and thus produced a much bigger impact upon the Earth's atmosphere than at present.

Conditions on the sun and sun-like stars

Studies show that superflares occur on stars that are both slightly larger than our sun and on stars that are smaller, sometimes significantly smaller. One star has been identified that is believed by naturalists to mimic conditions on the early sun. The G5V star Kappa-1 Ceti is a similar size to the sun and about 30 light years away with an estimated age of around 0.5 Ga. From measurements, it rotates at the equator once every 9 days, three times faster than the sun, and has a mass loss in the stellar wind in excess of 50 times greater than Earth's star. The magnetic field strength averages 24 Gauss (G), and peaks at 61G, compared to the sun's 1G. The average dynamic pressure of the current solar wind is dependent upon density and velocity squared: $P = 1.6726e\text{-}6 * \rho * V^2$ (where P is in nano-pascals (nPa), density cm^{-3}, and V is in kms^{-1}). The impact upon the earth's magnetosphere is also related to the north–south component (Bz) of the interplanetary magnetic field (IMF). In the variable solar wind the direction of Bz is important in determining how it interacts with Earth. If it is opposite to the earth's, which occurs in approximately 50% of occasions, then the earth's magnetic field lines open up, recombining with the solar wind and energising the polar cap absorption regions. If conditions on Kappa-1 Ceti were applicable to an early sun spinning at a similar rate, it is estimated that it would compress the earth's magnetopause[5] to 34–48% of the current level.[6]

Another recent paper, by Airapetian and colleagues, suggests that the earth was bombarded by daily superflares, high energy solar proton storms, and CMEs. They suggest that such CMEs would have compressed the magnetopause to one-sixth of its current level (from 9 Earth radii (Re) to 1.5 Re (approximately 9,000 km above ground level) and opened up the earth's atmosphere to harmful radiation. Solar flares they suggest were 1,000 times stronger than those in recent history. Their work argues that the earth experienced events more powerful than the extreme 1859 Carrington event[7] as frequently as one per day for 500 Ma, with levels gradually reducing to present-day levels of activity through prehistory.

However, they also suggest that this radiation led to the formation of nitrous oxides and ammonia, which warmed the planet. These compounds are strong greenhouse gases, and further reactions provided the seed chemicals for life; chemicals such as hydrogen cyanide (although this molecule is highly poisonous to organic life, naturalistic scientists believe it is necessary for abiogenesis to occur). The paper's authors argue that nitrous oxides provide more stable greenhouse gases than CO_2 and CH^4 even though it requires a lot of energy to break molecular nitrogen. Solarflares they think provided sufficient energy. But in response Ramirez questions how these products, produced in the ionosphere, might get down to ground level.[8]

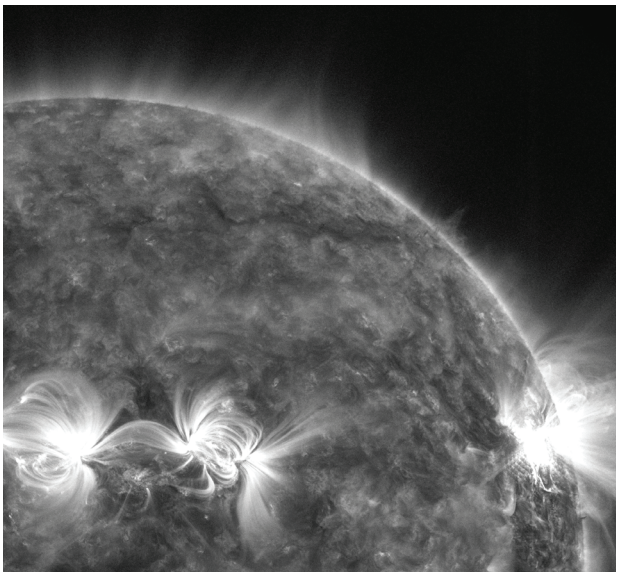

Figure 1. NASA Solar Dynamics Observatory composite image AIA 171 Angstrom (A), 9 Aug 2011 0810 UTC. This shows an X6.9 flare in the right. The magnetic field lines are clearly visible around the sunspot groups.

It also needs to be recognized that very high-energy proton storms in the upper atmosphere may lead to secondary products in the form of harmful neutron radiation at ground level. These events are referred to as ground level events (GLEs). A daily stream of superflares (over 500 Ma) would lead to very harmful radiation levels for organic life, as well as excessive EUV and X-ray radiation. Airapetian acknowledges the problem, but believes that some shielding was possible, although without adequately identifying a solution. He writes:

> "On one hand, our studies suggest that the harsh conditions introduced by intensive radiation from flare and CME activity had a detrimental effect on life … . On the other hand, high levels of steady, intense radiation could have opened a 'window of opportunity' for the origin of life on Earth by setting a stage for prebiotic chemistry it requires."[9]

Naturalists believe the early earth's atmosphere (at 3.5 Ga) consisted of 80% N_2, 20% CO_2 and a small fraction of CH^4. The first life they hold to have been cyanobacteria, organisms that are able to convert the hostile chemistry into free oxygen through photosynthesis. Over the following 3 Ga, naturalists believe that atmospheric oxygen levels rose slowly so that higher organisms could evolve, but much oxygen was reabsorbed into the ocean and land surfaces. These organisms would also have been subject to harmful EUV, X-ray, and neutron radiation on the ocean surface.[10] In the present-day atmosphere stratospheric oxygen and ozone protect against EUV, but this is missing from naturalistic models of the early earth. The susceptibility and importance of ozone in protecting the earth can be seen when it is proposed that

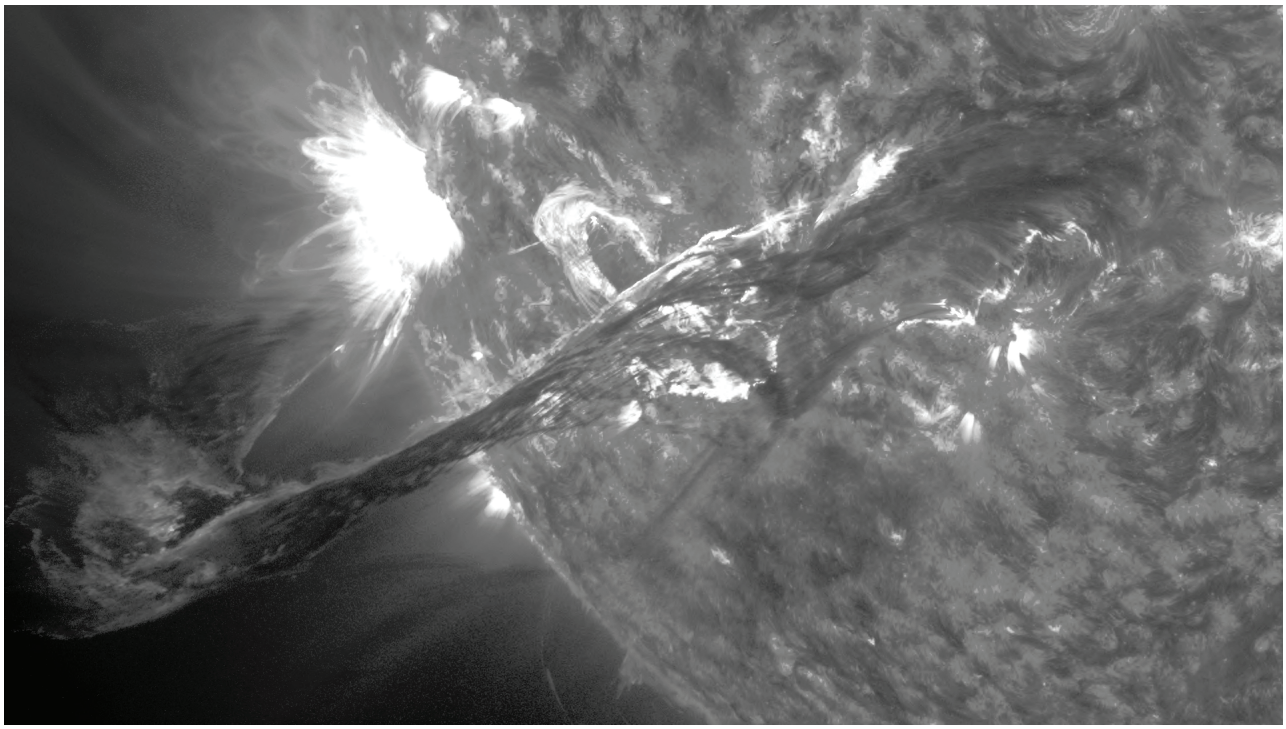

Figure 2. Massive filament eruption / coronal mass ejection from the Sun 31 August 2012 4:36 EDT (USA). This was associated with a C8 flare. Image is NASA SDO AIA 304 A and 171 A.

the 1859 Carrington event enhanced stratospheric nitrous oxides, which in turn lowered ozone concentrations by some 5% for several years. This reduction allowed more harmful UV to pass to ground level.[11]

Such levels of solar activity (as proposed by Airapetian and others) may also harmfully modify and erode the earth's atmosphere. Given a higher dynamic pressure from an early sun and frequent powerful CMEs on a daily basis, severe atmospheric modification might be expected. Although this is not fully quantified at present, superflares, extreme coronal mass ejections, and pressure from the solar wind, with its changeable magnetic field, might be expected to seriously erode the atmosphere of an Earth-like planet over hundreds of millions of years. Further work needs to be carried out to try and quantify this.

An electric wind

There is also increasing evidence that the planets in near sun orbits (Mercury, Venus, Earth, and Mars) are subject to an electric force that impacts upon the ionosphere of each. This is able to denude oxygen and hydrogen if sufficiently strong, whether or not there is a protective magnetic field. Venus and Mars do have very weak magnetic fields and appear to have lost a substantial amount of water as a result of an electric potential drop in the upper atmosphere. The atmosphere of Mars is very tenuous, while that of Venus is at a higher pressure and temperature than Earth, and enriched in CO_2 with smaller amounts of N_2 and SO_2. The ionosphere of these planets is charged as a result of solar EUV and X-ray energy being absorbed by atmospheric molecules, including that of available water and bi-atomic oxygen. Although the Coulomb force seeks to retain balance, highly energized electrons increase the potential difference and lead to loss of these ions to space. The ESA *Venus Express* mission has detected an unexpectedly large ambipolar electric field of the order of 10–12V, sufficient to accelerate ions of oxygen from the atmosphere.[12] Both hydrogen and oxygen ions have been detected downstream from the planet. This electric field is five times greater than the equivalent field strength on Earth and appears to be the major cause of water loss. It is thought that a similar electric field has caused the loss of water on Mars.[12] Although the present Earth has a sufficiently weak electric field that prevents water and oxygen loss to space, it ought to be asked how the strength of an electric field would be modified by stronger ionizing radiation from the sun as well as ionizing polar cap events from a stronger solar wind and faster CMEs. According to naturalism, in the period from 3.5 to 0.5 Ga early life forms were supposed to be leading to an increase in O_2, but at the same time the earth may have been faced with the potential loss to space of free oxygen and water vapour due to a stronger electric force in the ionosphere.

Origin of life on other planets—superflares on brown and red dwarfs

The evidence suggests that the majority of superflares on other stars are formed by a similar mechanism to solar flares on the sun, that is coronal magnetic reconnection in association with star-spot regions involving magnetohydrodynamic forces. Other possibilities that are considered feasible for the observed data are star–star interaction, star–disk interaction and star–planet interaction, but these are less frequent.[13]

Superflares have been detected on stars smaller than the sun, even on stars that may be classified as ultra-cool brown dwarfs. Being so faint, it means that the theoretical habitable zone needs to be much closer to the star than the equivalent habitable zone in the solar system, perhaps even closer than the orbit of Mercury for some star systems. These stars may make up 80% of all stars, and they are believed to be long-lived, potentially lasting for hundreds of billions of years. For these reasons those seeking to find extra-terrestrial life on other planets suggest these small stars provide good candidates. For life to form, there is a need for liquid water, and habitable planets must orbit close in. But being so close a planet would become tidally locked to the star in the same way the moon is locked to the earth. One side of a planet would then experience excess heat, while the other side would be in constant icy cold. Furthermore, such a planet would lose its magnetic field and be more susceptible to the effects of the stellar wind and CMEs. A major part of a planet's magnetic field is believed to be driven by an internal dynamo, and tidal locking severely modifies its rotation and slows the driving magnetic dynamo. But although red dwarfs are small and dim they are not inactive. Many spin at very high speeds, which generates powerful magnetic fields providing very hostile environments for life to form on nearby planets. Some in fact massively exceeding the present-day sun in terms of flare generation and magnetic field strength. It is estimated that at least 40% of these nearby small stars are highly variable in their flare output.[14]

There is an increasing number of examples of powerful, but very small stars. The tiny M8.5V star TVLM 513 is less than one tenth the size of the sun. It is so small and cool that it borders into the transition to ultra-cool brown dwarf stars. It is 35 light-years away, with an estimated naturalistic age of 100–500 Ma.[15] Even so, it has a magnetic field strength several thousand times more powerful that the sun. Part of the reason for this is that it has a rotational period of only 2 hours at the equator, moving at a speed of 60 km/s. The differential speed from poles to equator generates powerful star spots, and from this releases powerful flares in the X-ray spectrum and CMEs.

TVLM 513 was detected by the ground-based ALMA instrument in Chile, but research satellites have also recently detected extremely powerful X-ray flare activity on other nearby M-class dwarf stars using NASA's *Swift* satellite. If such flares occurred on our sun it would make life on Earth impossible. The flares in question were estimated to be up to 10,000 times more powerful than any measured on the sun within the last 50 years, and from a star smaller and normally dimmer than our sun.

Beginning on 23 April 2014 a series of superflares were detected from the M4.0V dwarf binary start system known as DG Canum Venaticorum (DG CVn). This system is about 60 light-years away from Earth, and the two stars orbit about each other at a distance equivalent to three times the sun–Earth distance (3AU), roughly the distance to Ceres in the Asteroid belt. Naturalistic science holds that these stars are young, at 30 Ma old, and rotating at a much faster rate, of the order of one rotation per Earth day. Our sun rotates about once every 25 days at the equator on its own axis (27 days relative to Earth's orbit). With this event the initial Gamma-ray and X-ray flare was estimated to be at level X100,000, about 10,000 times larger than the X45 Solar flare event of November 2003. There were a series of weakening flares over the next few weeks as the star system returned to more normal levels of activity.[16]

Superflares have been detected elsewhere. The M3.5V star EV Lacertae erupted with a massive release in the X-ray spectrum in 25 April 2008, again caused by the enormous strength of its magnetic field, which is perhaps 100 times that of the present sun. This star is about one third the diameter of the sun and rotates once every few days. It lies at a distance of 16 light-years and is estimated to be several hundred million years old by secular science.[17]

Summary

There is growing evidence from satellite and ground-based instruments that dwarf and sun-like stars have the capacity for superflares with much greater stellar magnetic field strengths. Naturalistic theories about the evolution of the sun and inner solar system are beginning to recognize that a hypothetical early Earth would have been faced with a severe space environment from CMEs, energetic particles, EUV and X-ray flares; events much stronger and more frequent than those observed today and over extended periods of time. While scientists have worried about sufficient strength of irradiance from a faint young sun to give liquid water, other factors come into play that are related to magnetohydrodynamics. While naturalists suggest this may help to overcome the faint young sun paradox and provide an explanation for stable liquid surface water, it would also lead to harmful radiation for abiogenesis and evolving organisms.

Given such extreme space weather, the earth system would also be faced with many strong magnetic and dynamic forces in the solar wind. These forces have the potential to erode the atmosphere of inner planets with much stronger conditions, although at present this is not quantified. There are also electric potential forces in the ionosphere of the inner planets that are able to strip the atmosphere of oxygen and water over extended periods of time. Given these factors, it may be noted that it is remarkable that the earth's atmosphere is not like Mars, which does not have much of an atmosphere, or Venus which has very little water and oxygen.

The presence of life on Earth shows that we are in the beneficial Goldilocks position, the right distance from the sun, which is itself remarkably stable in its output of light and heat in comparison with many other stars of similar size. The earth's atmosphere and magnetosphere are also remarkable in their ability to protect life from the harmful space environment and prevent significant loss of water molecules and oxygen to space. The sun and Earth are optimally designed for life.

Evidence from small M-class dwarf stars that form the bulk of stars in the Milky Way suggests that any habitable zone would need to be closer than the earth's orbit, and yet most of these stars also present extreme space environments that would not be conducive to the formation of life. This raises problems for the search for extra-terrestrial life.

References

1. Henry, J. The sun is not an average star, *J. Creation* **17**(3):35–42, 2003.
2. Marchi, S., Black, B.A., Elkins-Tanton, L.T. and Bottke, W.F., Massive impact-induced release of carbon and sulfur gases in the early Earth's atmosphere, *Earth and Planetary Science Letters* **449**:96, 2016; doi:10.1016/j.epsl.2016.05.032, sciencedaily.com/releases/2016/06/160623095610.htm.
3. For instance, Lane, N. and Martin, W.F., The origin of membrane bioenergetics, *Cell* **151**:1406–1416, 2012.
4. Airapetian, V.S., Glocer, A., Gronoff, G., Hébrard, E. and Danchi, W., Prebiotic chemistry and atmospheric warming of early Earth by an active young Sun, *Nature Geoscience* **9**:452–455, 2016; doi:10.1038/ngeo2719, 23 May 2016.
5. Magnetopause is the boundary between the earth's magnetic field and the magnetic field of the solar wind.
6. Nascimento Jr, J.D., Vidotto, A.A., Petit, P. *et al.*, Magnetic field and wind of Kappa Ceti: towards the planetary habitability of the young Sun when life arose on Earth, *Astrophysical Journal Letters*, 12 March 2016.
7. See, for instance, Cliver, E.W. and Svalgaard, L., The 1859 solar–terrestrial disturbance and the current limits of extreme space weather activity, *Solar Physics* **224**:407–422, 2004.
8. Ramirez, R., Atmosphere's solar shock, *Nature Geoscience*, 23 May 2016; doi:10.1038/NGEO2728.
9. Interview in Hadhazy, A., Fierce 'Superflares' from the Sun Zapped an Infant Earth, Astrobiology Magazine, astrobio.net/news-exclusive/fierce-superflares-sun-zapped-infant-earth/, 2 Mar 2015.
10. One way around this for naturalists is to propose that life arose near hydrothermal vents in the deep ocean and obtained energy via chemosynthesis. Michael, S., Hydrothermal Vents Could Explain Chemical Precursors to Life, NASA Astrobiology: Life in the Universe, NASA, 24 June 2014.
11. Thomas, B.C., Jackman, C.H. and Melott, A.L., Modeling atmospheric effects of the September 1859 solar flare, *Geophysical Research Letters* **34**:L06810, 2007, doi:10.1029/2006GL029174.
12. Collinson, G.A., Frahm, R.A., Glocer, A. *et al.*, The electric wind of Venus: A global and persistent 'polar wind' like ambipolar electric field sufficient for the direct escape of heavy ionospheric ions, *Geophysical Research Letters* **43**(11), 16 June 2016. Ambipolar refers to the diffusion by an electric field of positive and negative electric ions in a broadly equal, but opposite, direction.
13. Karoff, C., Knudsen, M.F., De Cat, P. *et al.*, Observational evidence for enhanced magnetic activity of superflare stars, *Nature Communications* 7, Article number: 11058 (2016), doi:10.1038/ncomms11058, published online 24 March 2016.
14. Kowalski, A., Osten, R.A., Sahu, K.C. and Hawley, S.L., An optical flare rate census of galactic bulge dwarf stars, *Bulletin of the American Astronomical Society* **43**, 2011.
15. Williams, P.K.G., Casewell, S.L., Stark, C.R. *et al.*, The first millimeter detection of a non-accreting ultracool dwarf, *The Astrophysical J.* **815**(1):64, 9 December 2015.
16. This was presented by Stephen Drake, an astrophysicist at NASA's Goddard Space Flight Center, Maryland, at an August meeting of the American Astronomical Society, High Energy Astrophysics Division. Reported by Reddy, F., NASA's Swift Mission Observes Mega Flares from a Mini Star, NASA Goddard Space Flight Center, Greenbelt, MD, 29 September 2014, www.nasa.gov/content/goddard/nasas-swift-mission-observes-mega-flares-from-a-mini-star.
17. Naeye, R., The mouse that roared: pipsqueak star unleashes monster flare, NASA Goddard Space Flight Center, Greenbelt, MD, 19 May 2008, nasa.gov/centers/goddard/news/topstory/2008/pipsqueak_star.html.

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Strategically dismantling the evolutionary idea strongholds

Daniel A. Biddle and Jerry Bergman

A survey of 600 student-aged respondents (aged 14 to 24) produced 404 responses and 292 respondents completed the entire survey. The study revealed that only four of 10 evolutionary topics make up 72% of the 'best evidences' for evolution. These four are human evolution (25%), evolution theory proper (mutations, selection/adaptation) (21%), fossils and transitions (15%), and science in general (i.e. as an authority) (11%). Thus, these topics need to be focused on in creation presentations and journals. To evaluate the alignment between these 10 evolutionary topics and the emphasis placed on them by creationist speakers when debunking evolution, 32 experienced creation speakers were asked to assign weights to the 10 topics. Creation speakers believed that the 'deep time', evolution theory proper, and dinosaurs were the most important topics to address. The reasons for these differences are discussed and strategies for creation ministries are recommended.

Many in the biblical creation movement have found 2 Corinthians 10:4–5 inspiring:

> "For the weapons of our warfare are not carnal, but mighty through God to the pulling down of strongholds; casting down imaginations, and every high thing that exalteth itself against the knowledge of God, and bringing into captivity every thought to the obedience of Christ."

The research explored the *strongholds*, *imaginations,* and *high things* that are exalted above the *knowledge of God* that we are empowered by God to cast down. The Greek word translated *imaginations* in this passage is *logismos* and means an *imagination, reckoning, computation,* or *reasoning.* Specifically, "reconstructing the [evolutionary] past requires imagination and theory as much as brute fossil finds".[1] Given that molecules-to-human evolution has never been observed and requires enormous speculation to even postulate it might have happened in the deep, unseen past, evolution could be considered such an imagination. Secular media and education systems now are the strongholds (established systems) and high things (authorities and icons) that attempt to hold up the imagination of evolution. These strongholds and high things use the imagination of evolution to stand against the knowledge of God—the saving knowledge of a creator to whom we all must give an account (Romans 1).

The good news is that we have information for pulling down these strongholds and high things that hold up the evolution imagination. These weapons must be forged by prayer, careful thought, and research, and then used in battle with faith and action. The Word encourages us to work in faith a labour of love with patience (1 Thessalonians 1:3) and to enter into battle "by the word of truth, by the power of God, by the armour of righteousness on the right hand and on the left" (2 Corinthians 6:7).

In the case of creation apologetics, it is critical to know just exactly what the imaginations, strongholds, and high things are—their shape, composition, and nature. Paul employed this strategy when he opened the debate with the Epicurean and Stoic philosophers in Athens by *beginning with the creation account* (Acts 17:16–34). Paul integrated Genesis into his evangelical outreach by establishing there is a "God that made the world and all things therein" who "giveth to all life, and breath, and all things" and "made of one blood all nations of men for to dwell on all the face of the earth".

Darwin, no doubt due to his theological education at Cambridge, and the requirement that Cambridge students study Paley's evidences, realized the major reason most people give for believing in God is the evidence of the creation all around us. To, in his words, 'murder God', required him to come up with another creator, and this creator was evolution by natural selection.[2] Darwin was so successful in his alternative creation theory that today over 95% of all leading scientists are evolutionists, and most of these are atheists.

One concept that is helpful for defining the 'evolutionary imaginations' that bind the minds of unbelievers and some Christians is a *semantic network*. This term is used to define a knowledge framework between interrelated concepts. With the evolutionist, this 'evolutionary webbing' clouds their thinking and darkens their understanding, preventing them from seeing the truth about origins, and the authority of God's Word. To some Christians, the semantic network of evolutionary ideas becomes intertwined with sections of God's Word that they accept, but not without creating

cognitive dissonance and uncertainty in the realm of origins and the authority of Scripture. God's Word is trumped by the 'high thing' of 'science' and millions of years and many local floods that are nowhere found in Scripture.

When reaching out to those trapped in the web of evolutionary falsehoods, we, like Paul in Athens, must be strategic. The first step in this strategy is to learn exactly what the specific 'imaginations' are that are standing between those we are trying to reach and the 'knowledge of God'. These 'imaginations' make up the knowledge strongholds that keep people from knowing God. What are the specific pillars of evolution theory that are the most believable to Christians and non-Christians alike? What specific evolutionary lies are causing many believers to leave the faith?[3] Knowing these specific imaginations will help guide Creation Ministries to focus on certain areas when it comes to dismantling the lie and constructing the truth.

To illustrate the importance, we will contrast two different creation ministry approaches. Consider situation A: Bob, a passionate creation speaker, learns that his son's biology class is taught 'whale evolution' as fact and decides to give a 'Debunking Whale Evolution' talk at his local church. If 100 people show up, including many skeptics who were asked to attend by church members, what should he cover? Bob's talk is excellent—he effectively dispels the idea that whales evolved over millions of years. How many people in the audience are transformed by the presentation? Likely only a scant few. Situation B is the same, but the topic is human evolution. How many people would be swayed to abandon the lie of evolution in exchange for the truth if this topic was highlighted rather than whale evolution? According to our research, many times more!

To find answers to these questions and define the evolutionary imaginations, we surveyed[4] student-aged respondents (aged 14 to 24) to identify the 'best' and 'next best' evidences for evolution (regardless of whether they believed in evolution). Their open-ended responses (404 total responses, of which 292 were complete) were then coded into 10 categories (see table 1).

Methodology

The polling was done by the professional polling agency, Pollfish, which stops after they obtain the number requested, which in this case was limited to 600 requested subjects, as it was felt this would give a large enough sample to make reasonable deductions given the budget limits of those sponsoring the survey. Of the requested sample, 292 subjects properly and fully completed the form (49% usable) and produced interpretable, valid responses to either. This usable response rate is common for this type of survey. This is why captive audiences such as college classes are preferred but have their own problems such as lack of a wide level of demographic variables.

The sample surveyed was: 44.7% male, 55.3% female; 37.5% between the ages of 14 and 17, 62.5% between 18 and 24; and 60.2% identified themselves as 'Christian'. Interestingly, there was no statistical significance at the .05 level difference between the frequencies of the 'best evolution evidences' when the data file was split between 'Christians' and 'non-Christians'.[5] The location of the respondents was not asked, but likely relates to Amazon customers, thus a reasonably valid sample of middle and upper-middle-class consumers.

They were asked: "Regardless of whether you believe in evolution, what is the best evidence that evolution is true?" or "Regardless of whether you believe in evolution, what is the next best evidence that evolution is true?" The 308 that were not useful responded with empty or bogus answers, such as the spaghetti monster is the creator, or one or two-word answers that were not classifiable such as those responses that were loaded with obscenities. The sample polling subjects were obtained when they exited from an Amazon shopping experience by offering a $10 gift card to every n^{th} person who participated. In this case, the screening question was age-related, specifically 14 to 24 years old. If funding can be obtained, this survey should be replicated to refine the results by factors such as education level and major area of study, occupation, and conclusions about origins. Nonetheless, as shown by the data, such as the importance of the evidence for human evolution and evolution proper, several clear conclusions can be made from the existing data.

Because in some cases the coded responses overlapped between subjects, and several listed the same or nearly the same responses to the 'best' and 'next best', no priority or higher emphasis was given between these two choices.

To determine the alignment between these 'best evolutionary evidences' and the topics that are typically 'debunked' by creation speakers, 32 experienced creation speakers (with an average of 21 years' experience in creation ministry) were asked to distribute 100 points among the 10 topics to indicate the emphasis they would place on each during a hypothetical one-hour presentation that had the single goal of 'debunking' the evolutionary beliefs held by students aged 14 to 24. The results are shown graphically in figure 1.

Creation speakers selected typically included persons with at least a bachelor's degree, most had a master's degrees or higher, with 15 or more years' experience in speaking in this area and a reputation as an effective creation speaker. Most were also popular speakers involved with a formal creation ministry, such as Creation Ministries International, and most had many publications and/or books to their credit.

Table 1. Top 10 'best evidences' for evolution

Category Title	Definition	US Students (Aged 14–24, N = 292)		Average Importance by Creation Speakers (N = 32)
		Response Counts	Percentage	
Human Evolution	General human evolution, similarities between humans and apes, humans progressing over time (e.g. getting smarter), human-chimp DNA similarities, vestigial structures, embryo development.	100	25%	12%
Evolution Theory Proper (Selection/ Adaptation)	Adaptation, Darwin's theory (proper), vertical evolution, natural selection, speciation, evolution theory (proper), mutations, Ice Age (e.g. extinctions).	86	21%	14%
Fossils and Transitions	General fossil data used by secular education and media as evidence for evolution theory (including 'transitional forms').	61	15%	10%
Science in General (as an authority)	Science as an authority (e.g. 'scientists say evolution happened', 'hundreds of studies have proved evolution to be true').	45	11%	10%
Progression of Civilization	Progression of civilization over time, such as societies becoming more advanced, development of technology, knowledge advancement, etc.	24	6%	3%
DNA	DNA studies in general showing the similarities between creatures (not specifically humans and chimps, listed above) and the evolution of the cell.	23	6%	9%
Big Bang/Creation of Earth	The 'big bang' and how this shows the creation/development of Earth and the universe.	19	5%	9%
Dinosaurs	Dinosaurs in general (including their extinction, place in time, etc.).	18	5%	13%
Deep Time	Deep time, including geologic time/layers, carbon dating, radiometric dating rocks/strata.	15	4%	17%
Homologous Structures	The similarity of structures between animals.	13	3%	5%

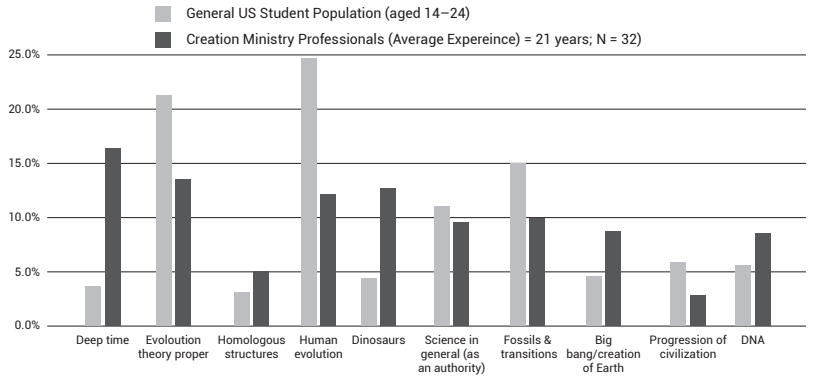

Figure 1. Comparison between the most convincing evolutionary evidences from the US student sample (aged 14–24, n = 292) and the emphasis on the same topics by creation ministry professionals (n = 32)

The level of confidence of the study

We ran a population sampling study to determine the level of confidence of our study which revealed, based on 39,183,891 people aged about 15 to 24, that our sample of 292 had a 95% confidence interval of plus or minus 5.7% reliability (precision). Doubling the study sample to 588 would have a 95% confidence level of 4% from 5.7%, indicating that we can be confident that our sample of 292 represents the population at large (young Amazon users who responded to

the study), and a larger sample would have likely only better confirmed what we found in our study.

Results and discussion

The results are shown graphically in figure 1. The most pronounced gap between the students and creation speakers was observed on the topic of 'deep time', which was only mentioned by 4% of the student population but given a 17% weight by creation speakers. We believe this is because creation speakers rightfully understand that radiometric dating is foundational to evolution theory in general, and therefore should be addressed in biblical creation ministry efforts. Conversely, the students obviously felt that this area was not a major concern, although it no doubt will be if they continue to learn about the creation position on evolution.

Another interesting observation was the responses from the student-aged sample regarding the general authority of 'science' as evidence for evolution. Comments such as 'what science has found' or 'what science can prove' made up 11% of the 'best evidences for evolution' offered. This finding clearly indicates that biblical creation ministries must differentiate between observational and historical science. Using scientific dating methods to speculate that the earth is over 4 Ga old is very different than applying scientific principles to advance the field of medicine. Many students fail to understand this distinction.

The topic of dinosaurs also revealed a gap between the two groups. Only 5% of the student-aged population placed dinosaurs on the 'best evidence' list, but the creation speakers placed a 13% weight on this topic. The creation speakers may have placed this high emphasis on dinosaurs because the topic is both interesting (i.e. it draws a crowd) and it encapsulates several of the other evolution pillars, such as deep time (i.e. fresh biomaterials[6]), evolution theory proper, and fossils and transitions (e.g. the complete missing dinosaur ancestors and transitions).

Perhaps the most remarkable finding was the emphasis placed by the student-aged population on human evolution. A total 25% of the 'best evidences for evolution' fell into this category, thus this topic should become a priority in biblical creation ministries.

Looking at the entirety of the results, only *four* evolutionary topics made up *72%* of the evolution's 'best evidences': human evolution (25%), evolution theory proper (mutations, selection/adaptation) (21%), fossils and transitions (15%), and science in general as an authority (11%). Thus, if a creation speaker had only an hour to present his case, the talk would be more likely to succeed with *72%* of the audience by focusing on these top four topics!

Conclusion

This study should help creation speakers to tailor their presentations to be more effective by focusing on the topics that are of concern to most audiences of young people, aged 14 to 24, as well as adults in general. It will also help publishers of creation literature to tailor their contents to the interests of the interested public and others.

References

1. Michael, R. and Travis, J., *Evolution: The First Four Billion Years*, Harvard University Press, Cambridge, MA, p. 462, 2009.
2. Bergman, J., *The Dark Side of Darwin*, New Leaf Press, Green Forest, AR, 2015.
3. Bergman, J., *Evolution is the Doorway to Atheism: 52 Case Histories of Prominent Atheists and others*, Leafcutter Press, Southworth, WA, expected in 2017.
4. Survey results were completed in July 2016 using Pollfish.com.
5. The frequency counts for the 10 topics for the 'Christian only' respondents were 23.2%, 20.3%, 15.4%, 12.4%, 6.6%, 6.6%, 3.7%, 4.1%, 3.7%, and 3.7% (topics listed in the same order).
6. Brian, T., Original biomaterials in fossils, *Creation Research Science Quarterly* **51**(4), 2015.

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Two date range options for Noah's Flood

Brian Thomas

Conservative authors have long argued that Genesis chapters 5 and 11 chronogenealogies contain gaps, and that these and other unanswered chronology questions require ages that conflict with at least some of the Bible's stated figures. This inadvertently diminishes confidence in Scripture's veracity. Hebrew scholars have recently resolved longstanding biblical chronology issues like the question of Genesis genealogy gaps and confusing data in 1 and 2 Kings. They can now include every time-related Bible verse into a complete and error-free chronology from Abraham to Paul. This paper merges these chronologists' results with the Masoretic text of early Genesis to confirm earlier calculations for the Flood at c. 2518 BC, and with the Septuagint text of early Genesis to offer an alternative, earlier estimate of c. 3168 BC.

Creation science books, articles, and presentations advocate recent creation. For example, assertions of powerful scientific evidence from astronomy, geology, genetics, and paleontology that the world is thousands, not millions, of years old are common. Why does this issue deserve emphasis? The perspicuity of God's Word, and by extension its everlastingly relevant truth claims dovetail with the precision level of its numbers. A more accurate understanding of the Bible's chronology can empower its defenders with more confidence in its inerrancy.

Some argue that since biblical authors nowhere claim an attempt to construct a timeline of world history (or at least a history from the First to the Last Adam), its readers should not expect one. However, the Scriptures do supply hundreds of chronological clues. Why do they exist if not to mark time? Further, if God were to mark time, He would do it without errors—though not without challenges that only study can overcome. The possibility that Scripture does supply a long chronology accurate to the year (the time unit it most often supplies) should be examined. In that light, exactly what age do the Bible's chronological data permit, suggest, or specify for the world?

Irish Anglican Archbishop James Ussher's fame endures even today from publishing his *Annals of the World* in 1650 AD. His date for the Flood of 2348 BC was printed in Bible margins for decades but has since fallen from favour.[1] The 1961 book *The Genesis Flood* gives an often referenced answer among creation researchers to the question of the biblical age of the world. Its Appendix 11 teaches, as have several generations that have followed its example, that possible gaps in Genesis genealogies permit the addition of perhaps thousands of years into what otherwise would appear to be a straightforward chronology.[2] Conservative biblical historian Eugene Merrill argues the same in his book *Kingdom of Priests*, as noted below. Adding time to accommodate presumed gaps in the Genesis 11 chronogenealogy would increase Ussher's 2348 to some unknowable but more distant year. These gap advocates (not to be confused with gap theory advocates) thus argue that the most biblically accurate chronological statements permit an earth of 6 to 10 thousand years old. This would represent a 40% error margin for scriptural data based on the Masoretic Text, and a ~25% stretch of even the longer Septuagint textual records of Genesis 5 and 11.

One recent creation paper that reviewed the gap versus no-gap perspectives of biblical chronology ended without resolution.[3] However, active chronologists have within the last half century satisfactorily resolved enough quandaries like the gap question for creation advocates to teach and defend a tighter biblical history, including two date ranges for Noah's Flood year, and thus elevate appreciation for biblical precision.

This paper outlines three steps to assigning biblically and historically accurate BC date estimates for biblical events such as Noah's Flood. Each step is treated below in more detail according to this outline: First, scholars show how the Bible best answers the question of gaps in Genesis 5 and 11 chronogenealogies, as per below. Second, following with a high view of Scripture, one can straightforwardly add years from Creation to Abram, with reasonable wiggle room and allowing the possibility of Septuagint as well as Masoretic textual traditions as described below. Third, conservative Lutheran biblical chronologists and Hebrew scholars especially including Andrew Steinmann and Rodger Young have: 1) successfully applied the inductive method that Edwin Thiele began in his attempts to harmonize dozens of apparently confusing time indicators recorded in Kings and Chronicles covering the divided kingdom period; 2) constructed a consistent year-by-year timeline from Abraham to Christ that treats every chronology-related Bible verse literally; 3) cross-checked that timeline against independently recorded Sabbatical and Jubilee years; and 4) confirmed extrabiblical events that occurred during the divided kingdom period and that anchor BC dates to the Bible's timeline. In summary, adding gap-resolved Genesis chronologies extends Steinmann *et al*.'s timeline backward from Abraham to the Flood, as described below.

Step 1: fill the gaps

Genesis 5 and 11 would need alterations in order to accommodate gaps. How might such alterations to the following sampled section look?

> "Methuselah lived one hundred and eighty-seven years, and begot Lamech. After he begot Lamech, Methuselah lived seven hundred and eighty-two years, and had sons and daughters. So all the days of Methuselah were nine hundred and sixty-nine years; and he died."[4]

If one allows name gaps, then Methuselah may have begotten an unnamed son, who begot another unnamed son (or perhaps more), making Lamech Methuselah's great grandson instead of his direct son. However, either the timespan between Methuselah and Lamech according to the phrase, "Methuselah lived one hundred and eighty seven years, and begot Lamech", must have been 187 years or the text loses some or most of its meaning. Therefore, adding years to this number could begin to strip this verse of its function and content, all without contextual justification. Hardy and Carter expressed this same objection when they wrote: "When a biblical author says a person was X years old when something happened, if we do not take that as a historical statement we quickly get to the point where words have no meaning."[5]

Merrill wrote: "Clearly, Shem preceded Abram by many more years than a strict reading will permit, and thus there was sufficient time for the knowledge of Yahweh to have disappeared from the line of Shem and for a need to have arisen for Yahweh to reveal Himself to pagan Abram."[3] Just what makes this assertion so clear? And what does "a strict reading" mean? If a doctor warns her patient of a dangerously high systolic blood pressure of 169mmHg, and the patient determines to understand this less strictly, then he puts his life at risk by lying to himself. One who fails to grasp the 'strict' meaning of statements spoken in a language fails to grasp the author's intended meaning. Merrill's phrase about having sufficient time for people to reject God falls short, sustained since that can occur in only one generation—a tiny fraction of the thousands of years he wants to add—and seems to be a red herring in any case. God recorded specific numbers for these patriarch's lifetimes, so he who doubts these numbers should present clear and powerful justifications, not unnamed allegations. Merrill's motive becomes clear in later passages of his book. He must add years to the Bible in order to accommodate the secular archaeologist's age assignments that he accepts.

Similarly, Whitcomb wrote:

> "Near Eastern cultures apparently have a rather continuous archaeological record (based upon occupation levels and pottery chronology) back to at least the fifth millennium BC, and it seems impossible to fit a catastrophe of the proportions depicted in Genesis 6–9 into such an archaeological framework."[6]

But that 'archaeological record' was compiled by secularists, who by definition have a low view of Scripture. And as creation scientists have long demonstrated in other historical disciplines like geology and paleontology, secularists often force-fit observations—in this case occupation levels and pottery ages—into their preconceived long-age timeline. In addition, assertions of fifth millennium BC rely on radiocarbon 'ages', which are systematically inflated with older samples and untrustworthy in that context.[7] These quotes reveal an eisegetical trend of adjusting factual statements from Scripture to accommodate a man-made, evolutionarily interpreted archaeological timeline.

Henry Morris seemed less sure of the need to accommodate secular archaeology's non-biblical age scheme, but begrudgingly regarded gaps when he wrote in 1976: "Assuming no gaps in these genealogies (a possibility which perhaps cannot be ruled out completely, but for which there is certainly no internal evidence), there was a total of 1656 years from the Creation to the Flood."[8]

Since then, scholars have dealt with these gaps. Sarfati enumerated helpful reasons to reject the idea of names missing from the patriarchal chronogenealogies—name gaps that old-earth apologist Hugh Ross also teaches. For example, adding unnamed generations casts doubt on the perspicuity of Jude 1:4: "Now Enoch, the seventh from Adam…" Sarfati then wrote:

> "… it's a red herring. Suppose we grant the opposition's case that there were many missing names between person A and the next in line B, such as Enosh to Kenan. It wouldn't change the fact that there are still x years between them, e.g. 90 years between Enosh and Kenan. That is, even if there were gaps between the *names*, there are no gaps in the *time*."[9]

Johnson and Ice had already argued the same. They first considered the chronogenealogies' 19 repeated stanzas, which Johnson called 'sub-timeframes', as follows:

> "In other words, deductively speaking, there are no inferrable 'gaps' (i.e. of 'unknown' time-length) in the time between these Scripturally defined 19 sequenced sub-timeframes. Each of these 19 sub-timeframes is a 'link' within the entire link-'chain' of sub-timeframes, in turn, so that the complete sequencing of all 19 sub-timeframes exactly equals the entire timeframe from Adam's creation unto Abraham's birth."[10]

However see below on the possibility of those numbers spanning the timeframe of Adam's creation to Haran. Does the inclusion of gaps carry the consequence of altering the Words of God? If so, secular archaeologist's assertions about the past fail to justify this kind of alteration. Without gaps, we can more straightforwardly calculate biblical age ranges for key events like the Flood.

Step 2: add the Bible's years

Creation to Abram's birth adds up to about 1948 years using the Masoretic text, albeit with tension over Terah's place needing some resolution. Genesis 11:26 says he was 70 years old when he "begot Abram, Nahor, and Haran". Possibly the text does not specify which of the three sons was the firstborn, that the 70 years counts to the firstborn, and thus we don't know exactly when to add Abram to the early Genesis timeline. Sarfati, along with Ussher, subtracts Abram's age at departure from Haran of 75 from Terah's 205-year lifespan, since Abram left Haran soon after Terah died in Haran.[9] So, 205 – 75 = 130 years old at Abram's birth. Does this contradict Genesis 11:26, "Now Terah lived seventy years, and begot Abram, Nahor, and Haran"? Since Haran died first according to Genesis 11:28, he may have been Terah's firstborn, not Abram. Thus, Creation to Abram's birth was 1948 + 60, or 2008 years. To suggest that the continuous timeline from Abram to Christ as outlined below cannot precisely merge with the continuous timeline from Creation to Terah would constitute a broken link so far out of place that it would require a greater defence than the present author is currently able to mount.

If nine gestation months or some months to account for birthdays should be estimated for each generation, then the Creation-to-Abram time range could have spanned 2008 years at minimum or 2044 years at maximum.[11] These two figures are derived following Johnson and Ice's summary, but counting 130 years instead of 70 as Terah's age at Abram's birth, as discussed above. Hardy and Carter also suggested the possibility of certain antediluvian patriarchs counting their own vast ages by every half-decade instead of every year, plus added a few more caveats for more wiggle room, to calculate a minimum of 1990 and a maximum of 2026 years from Creation to Abram.[9] However, Ruth Beechick speculated:

> "In trying to be exact, we might be tempted to add several years to the pre-Flood genealogy, figuring that each son was not born on his father's birthday or on New Year's day. But on second thought, we could decide that those early historians were probably smarter than we are. They would know enough to count the birth year only once in their historical chronology."[12]

The patriarchs would know enough to exclude name gaps and time gaps, and possibly to count the birth year only once as Beechick suggests. But this assumes that their intent was to supply numbers that future generations could use to calculate exact years, and we see only rare accounting of partial years, such as months or days, in their records. However, they lived long enough for up to eight *concurrent* antediluvian generations and according to the Masoretic text's numbers up to 12 concurrent post-diluvian generations that stretched even past Abraham. Conceivably, patriarchal scribes could have asked for first-hand accounting of a person's birth year or birth month, or whatever else they wanted to ask. So it may be possible that these Scriptures supply exact year lengths, with little or no wiggle room (i.e. no date slippage). Such a chronology may or may not have been important to the prophets and apostles who were carried along by the Holy Spirit as they recorded Scripture, but since the Bible does have numbers, since God is a God of order, and since His Word has no errors, it might inadvertently include a precise world chronology. In other words, it does not claim a perfect chronology, or need one, but it does need to have no errors. And if an error-free chronology emerges from Scripture, then so be it.

Could the relatively simple additive date from Creation-to-Abram of AM 2008 express the exact number of years, whether solar or sidereal, that transpired in that span? If so, the number divides thus from the Masoretic text: Genesis 5 gives the Creation-to-the-Flood span of 1,656 years, and Genesis 11 gives a Flood-to-Terah's firstborn timespan of 292 years. In order to confirm BC date estimates for the Flood, the lay chronologist next needs the timespan from Abram's birth to at least one firmly dated historical event that intersects biblical chronology.

Step 3: use Steinman and Young's chronology

Resolve the kings

One can anchor a BC date for the death of King Nebuchadnezzar—who destroyed Jerusalem in 587 BC—onto a biblical chronology spanning Adam to Solomon. British Museum tablet 21,946, the Babylonian Chronicle, notes the fall of Jerusalem "on the second day of the month of Addaru". Finegan's Handbook defends this as "the most exact information to come from cuneiform records for an event recorded in the Bible".[13] But to span from Solomon to Nebuchadnezzar, one must first solve biblical chronology challenges for the divided kingdom era.

Edwin Theile [Tee luh] (1895–1986) published his attempted solutions in *The Mysterious Numbers of the Hebrew Kings*.[14] Whitcomb referenced Thiele's work,[15] as did Hardy and Carter.[5] Though imperfect, Thiele at least looked for solutions amidst an intellectual climate that insisted that the chronology of the Kings was a hopeless tangle. Theile used an objective 'decision table' technique that answered three questions about each king's reign: 1) Did his reign begin in the month of Tishri (September/October) or the start of the ancient new year in Nisan (March/April)? 2) Did his reign overlap another's (a coregency)? 3) Did the king's scribe use accession reckoning or non-accession reckoning? Assyria, Babylonia, and Judah tended to count a king's first months prior to Nisan as a whole year—his 'year

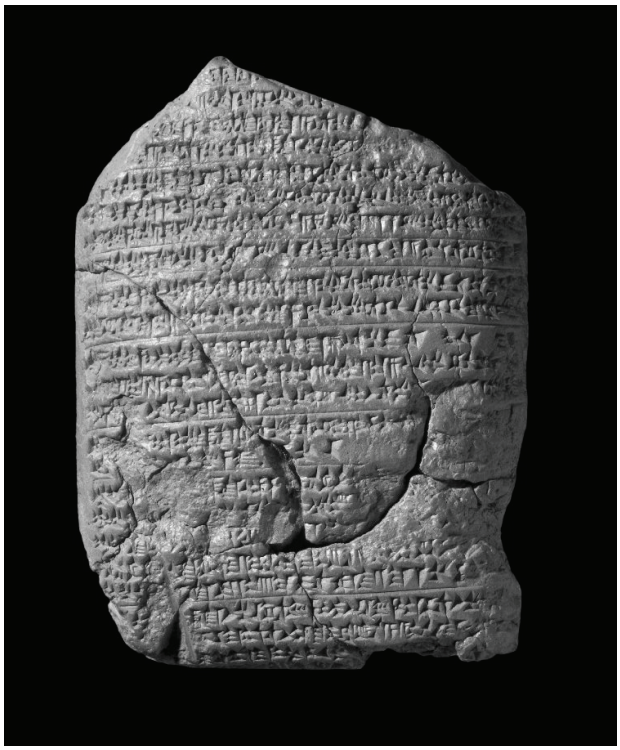

Figure 1. The Babylonian Chronicle (tablet BM21,946) helps anchor biblical chronology to a BC timeline (British Museum).

of accession'. Israel and other nations did not count a new king's first months before the new year. So the chronologist can subtract one year, the accession year, from each of certain kings of Israel (but typically not the kings of Judah) when tallying certain reign lengths.

Hardy and Carter outlined a history of chronologists who have debated the divided kingdom period in order to outline the range of possibilities.[5] But Young and Steinmann picked up where Theile, and Leslie McFall's updates to Theile, left off.[16] Their chronology for the divided kingdom era (and beyond) includes every time-related Bible verse interpreted straightforwardly, i.e. according to the standard historical-grammatical method. Young made necessary adjustments to Theile's results, thereby resolving what appear to be the last remaining questions toward an inerrantist biblical chronology for the divided kingdom.[17] These results narrow the range of possibilities down, apparently to just one. Again, Scripture does not necessarily need only one chronology. However, if each small problem has only one resolution that maintains all biblical numbers without alteration, then all those resolutions would combine into a chronology without peer among extrabiblical ancient records. Young's website provides links to relevant chronology papers, as well as summary tables that begin to reveal remarkable precision in biblical chronology.[18] Accordingly, the time from the death of Solomon/beginning of the divided kingdom in 932 BC and the fall of Jerusalem and defeat of its Judean king Zedekiah under Nebuchadnezzar in the summer of 587 BC ("the only date that can be reconciled with all the texts involved") equals 345 years.[19] These results bring a biblically consistent chronology into focus and subtract some wiggle room found in other's chronologies. The next section outlines how well-established BC events that occurred within the 345 years of the divided kingdom exactly synchronize with certain Bible events and thus anchor world history to the Bible.

Synchronize with BC dates

Chapter three in *From Abraham to Paul* summarizes synchronisms that anchor BC dates onto Scripture's chronology.[20] Key details from this chapter come from Kenneth Kitchen's article, *How We Know When Solomon Ruled*, available online.[21] First, an Assyrian record called the Monolith Inscription names Israeli King Ahab's defeat during King Shalmenesser III's sixth year of reign, in 853 BC. The Black Obelisk or Kalhu Obelisk names Israeli King Jehu's tribute payment in Shalemeneser's 18th year, in 841 BC. Using chronological data from 1 Kings that span from Jehu and/or Ahab to Solomon, Steinmann calculates the year of Solomon's death to 931 BC.

Other connections confirm this date. First, Pharoah Shoshenk (biblical Shishak) invaded Judah in Rehoboam's fifth year, 926 BC. Rehoboam was the first king after Solomon. Second, Pharoah Siamun's reign length of 986–968 overlapped Solomon's reign in just the right timeframe for Siamun to have been the pharaoh who conquered Gezer and whose daughter Solomon married. Third, Josephus recorded the Tyrian king list. It indicates 143 years from the construction of the temple to Pygmalion's seventh year, enabling yet another calculation that confirms Solomon's reign dates. Other synchronisms confirm Bible events, including Menahem's tribute to Tiglath Pileser III in 743 or 742 BC as noted on the Iran Stela, and Nebuchadnezzar's defeat of Egypt mentioned in 2 Kings 23: 29–30 (and elsewhere) as recorded on a Babylonian Chronicle at 605 BC.[22] Gritty details that comprise some tomes undergird the above sketch, according to which Solomon's last year, and thus the first year of the divided kingdom, was 931 BC. Next, Steinmann established a date for the Exodus.

He first takes 1 Kings 6:1 straightforwardly:

> "And it came to pass in the four hundred and eightieth year after the children of Israel had come out of the land of Egypt, in the fourth year of Solomon's reign over Israel, in the month of Ziv, which is the second month, that he began to build the house of the Lord."

This precludes a late date for Exodus and in conjunction with other verses specifies 1446 BC for the Exodus out of Egypt. The Mereneptah stele, Pharoah Mereneptah's victory monument erected in 1211 or 1210

BC and discovered in 1896 in Thebes, contains the earliest mention of Israel as a nation and not as wandering tribes. Thus, Israel must have been firmly established long before 1211, placing the Exodus no later than about 1270 BC, contra the late date theory.[23] Steinmann summarized how archaeological evidence from the destruction of Jericho and Ai do not support the late date theory either. If conservative archaeologist Bryant Wood's analysis of Canaanite pottery the ruins at Khirbet el-Maqatir correctly identify as Ai, then it was destroyed circa 1400 BC—40 years of desert wandering after the 1446 BC Exodus.[24] The only other city that Joshua burned and destroyed instead of just taking over was Hazor, and excavations of its relevant destruction layer also show a match with a 1446 BC Exodus.

Cross-check with an independent Rabbinic reckoning

Wouldn't it be nice for a separate system of counting to confirm this chronology? Steinmann summarized Young's description of how Jewish Jubilee years do this. The Mosaic Law provided Sabbatical years—every seventh—to rest the land. Every seventh Sabbatical year coincided with a Year of Jubilee according to Leviticus 25:8. The 50th year of Jubilee also counts as the first year of the next cycle, bringing 49 years total for each Jubilee cycle. Although many Hebrews did not faithfully observe the Sabbatical or Jubilee years, scribal records preserve them. In about ad 160, Rabbi Yose ben Halafta included key Jubilee counts in the *Seder 'Olam Rabbah*.[25] The Talmud carries this information forward for modern readers. These documents teach that the Jubilee from Ezekiel 40:1 was the seventeenth Jubilee. Ezekiel 40:1 says: "In the twenty-fifth year of our captivity, at the beginning of the year, on the tenth day of the month, in the fourteenth year after the city was captured, on the very same day the hand of the Lord was upon me; and He took me there." It names a year that began on the tenth day of the month, which could only be a Jubilee year. The first Jubilee began, according to Leviticus 45:2, on the 49th year after Joshua and Israel entered the promised land. Steinmann,[26] following Young,[27] counts backward from 574 BC (actually 574 beginning in the month Tishri, not January), a year that occurred in the 25th year of the captivity according to Ezekiel 40:1 and 14 years after the final fall of Jerusalem in 587 BC. Adding 17 Jubilee cycles of 49 to 574, plus 48 years between entering the land and the first Jubilee, plus 40 years of wilderness = 1446 BC.

A Masoretic text-based BC date for the Flood

Additional considerations will be required to update minimum-maximum age ranges. For example, can the apparent contradiction between the 400 years of Genesis 15:13 and the 430 years given in Exodus 12:40–41 be resolved? Careful Bible reading presents a satisfying solution. The former (400) gives the number of years that "they will afflict them", and the latter (430) gives the total number of years of "the sojourn". In other words, the Israelites were not afflicted for their first 30 years of their sojourn in Egypt. One can easily imagine an abrupt change in pharaonic dynasties affecting prevailing attitudes toward the Hebrews during Joseph's later years. These two numbers therefore don't conflict, but instead allow cross-checks, as do other Bible numbers.

Bible numbers (for example those found in Genesis 21:5; Genesis 25:26; Genesis 47:28; Exodus 7:7; Deuteronomy 34:7; 1 Kings 6:1; Joshua 4:19; Acts 13:21; and 2 Samuel 5:4) accumulate 1,234 years between the birth of Abram and the death of Solomon. Adding 1,234 to the death of Solomon in 932 BC sets Abram's birth to 2166 BC according to Steinmann's timeline.[28] With the Flood-to-Abram Genesis 11 chronogenealogy having no name gaps and more importantly no time gaps, the timespan between the Flood and Abram's birth should equal very nearly 352 years. This follows by adding 292 years from Genesis 11 to 60 presumed years between Terah's firstborn and Abram, as discussed above. 352 years before 2166 BC marks 2518 BC for Noah's Flood. Adding a generous 14 years for unknown gestation and paternal age months from Arphaxad to Abram gives 2532 BC for the Flood, using the Masoretic text.

How do these compare to some other calculations? First, these fall inside Hardy and Carter's range of 2600 BC to 2300 BC.[5] About a century ago, Basil Stewart calculated a Flood date of 2344 BC.[29] He did not have the solution to the kings reigns that recent chronologists have deduced and which Steinmann summarized in 2011. Also his siege of Jerusalem by Nebuchadnezzar in 585 BC should update to 587 BC as argued above, to anchor BC age estimates to biblical chronology. As another comparison to an even earlier chronologist who also had a high regard for Scripture's precision, Peter Akers supplied 3284 BC for the Flood.[30] He "constituted a fixed point on Egyptian chronology"[31] to find his much older date. Since then, enough problems have arisen with especially the older Egyptian chronologies to demonstrate their insufficiency as chronological anchors for biblical numbers.[32] Indeed some admit Egyptian chronology is a tattered collection not at all deserving the solid historical clout it enjoyed when Akers was writing.[33] Thus, 2518–2532 BC should represent a tight and yet responsible date range for the Flood using the Masoretic text. Finally, Archbishop Ussher derived a Flood date without the results of key archaeological finds, including Assyrian king records and Hazor's excavation, and without decision table resolutions for the divided kingdom chronologies that permit precise synchronizations with surely dated extrabiblical events, although he had access to historical

Table 1. Age at begetting of post-Flood patriarchs, plus Noah, from three textual traditions

Name (table1)	LXX	MT	SP
Noah	500	500	500
Shem	100	100	100
Arphaxad	135	35	135
[Cainan]	[130]	–	–
Shelah	130	30	130
Eber	134	34	134
Peleg	130	30	130
Reu	132	32	132
Serug	130	30	130
Nahor	79	29	79
Terah	70	70	70
Flood to Terah's first born Sum:	**1070**	**292**	**940**

sources now gone. Ussher also used a 215-year sojourn in Egypt, which Steinmann demonstrated unnecessarily constrains Scripture, and was influenced by a belief in 6,000 years of total world history.[34] Even with these differences, Ussher's age of 2348 BC for the Flood deserves appreciation.

A Septuagint-based BC date for the Flood

The Masoretic Text (MT) originated in the second century AD. It contains a few corruptions that other texts can resolve so that the original inspired Word can be reconstructed. More often than not, however, the MT corrects other textual traditions. Jewish scholars translated ancient Hebrew scrolls into Koine Greek to form the Septuagint during the third century BC. New Testament authors quoted the Septuagint (LXX). The MT Genesis 5 chronology from Adam to the Flood shows 24 more years in total lifespans, all of them for Lamech. The MT post-Flood chronology records 780 fewer years than the LXX—except that pre-Christ copies do not have Cainan or his 130 years in Genesis 11. Table 1 shows variants between the MT, LXX, and the Samaritan Pentateuch (SP), a third textual tradition that does bear some Samaritan-*friendly* corruptions in places.[35]

Most creation scientists use and defend the MT for biblical chronology "because the other texts show evidence of editing."[36] However, Sexton and Smith (2016) recently used at least 11 arguments in favour of the superiority of the LXX for the Genesis 5 and particularly the Genesis 11 chronologies.[37]

1. A vast majority of pre-Reformation Christians endorsed the Septuagint chronology.
2. No known pre-second century history uses the MT timeline.
3. MT-defenders' long-held speculation that LXX translators inflated patriarchal ages to conform it to Egyptian chronologies has no evidential basis. The LXX actually shows no such trend elsewhere in its text, and the copyists of that time (third century BC) were held accountable to precision record-keeping.
4. The odds that separate scribes independently inflated Genesis 11 numbers in the LXX and the Samaritan Pentateuch to exactly the same ages are unbelievable. That they were translated from a reliable original Hebrew source long ago better explains their identical numbers, shown in table 1.
5. Jewish historians from about 200 BC to 100 AD, including most of Josephus' numbers, referenced the LXX chronology.
6. Five ancient texts fit a trend of Jewish scribal chronological deflations, not inflations.
7. The earliest witness to the MT chronology occurs in the *Seder Olam Rabbah*, which severely reduced post-exilic chronology in order to disqualify Jesus as the Messiah that Daniel 9:6 foretold.
8. The earliest witness to the MT chronology thus post-dates the earliest witness to the longer LXX chronology by four centuries.
9. The MT Genesis 5 numbers fit the hypothesis that systematic chronological reduction ensured that no antediluvian patriarchs lived beyond the Flood, and yet the numbers for Noah, Shem, and Terah remained unaltered since they meshed with other chronological statements.
10. If Eber was still alive and twice Abraham's 175-year age at death, as per the MT, then why does Genesis 25:8 say that Abraham "died in a good old age, an old man and full of years"? Rather, the LXX numbers show Eber passed away four centuries before Abraham's death.
11. The Pharisees generally believed that the Messiah would arrive during the sixth millennium after creation. They marshalled the few remaining Scriptures available to them after Bar Kochba revolt in 132–136 AD to finalize the MT. This moment in history could have enabled their alteration of Genesis 11 and 5 to shrink the world's chronology enough to discredit Jesus as the sixth millennium Messiah, without accountability.

The longer chronology has a few more advantages. Geologist Steve Austin has counted Dead Sea sediment laminae and correlated specific seismites with biblical earthquakes at Jerusalem.[38,39] If the laminae below these also represent annual deposits, then they extend beyond the MT-supplied number of post-Flood years. Also, the LXX's additional Noah-to-Abraham years offer more time to accommodate archaeologically attested Mesopotamian

periods from before the Tower of Babel. Biblical archaeologist Doug Petrovich noted: "They can't just go away. They can be shortened, but they have to be counted into the equation."[40] Thus, the "rather continuous archaeological record" to which Morris and Whitcomb referred deserves a place in time, but not the authority to nullify the historically superior biblical record from either the MT or LXX.

Finally, geneticist John Sanford demonstrated that the MT-based post-Flood declining lifespan pattern over many generations fits the hypothesis that increased mutational load caused systematically diminishing lifespans.[41] Figure 2 replicates his patriarchal lifespan chart and includes the LXX numbers. The best fit power curve for the LXX data followed the formula $y = 946.21 \times 10^{-0.702}$. The best fit power curve for the MT data followed the formula $y = 726.71 \times 10^{-0.617}$. Both sets reveal similarly systematic declines and show no clear mutational basis for adjudicating between the two texts.

Ongoing research may more firmly establish or unfasten the LXX Genesis 5 and/or 11 chronologies. Until then, two Flood ages present themselves. The LXX Genesis 11 lists 780 more years than the MT. However, as Sarfati showed, later copies of it show an extra 'Cainan', and thus an extra 130 years.[36] Subtracting those 130 from 780 gives 650 years to add to the MT-based Flood age estimate of 2518 BC to produce a LXX-based Flood date of circa 3168 BC.

Conclusions

An outline of three steps to assigning biblically and historically responsible BC age estimates for Noah's Flood has been presented, and it suggests several conclusions. First, the idea that Genesis 5 and 11 genealogies have gaps is increasingly difficult to support and irrelevant in light of the internal textual evidence for complete, gapless chronogenealogies. Second, one can construct a tight year-to-year chronology using just the Bible, though it has taken several generations of chronologists to settle key questions like the web of numbers in the Kings. Third, recent scholarship has reawakened interest in the Septuagint's early Genesis chronology, which adds about 650 years to the Masoretic text's span between Noah and Abraham. Thus, instead of a continuum of age possibilities from ~2500 BC to ~3170 BC and maybe beyond, historical evidence suggests that the Flood occurred at either one or the other tight time frame. Fourth, the fifth millennium BC Flood age estimate that Morris and Whitcomb allowed in *The Genesis Flood* lies beyond the age estimates given here and beyond those of Hardy and Carter, Johnson and Ice, and Sarfati, as cited

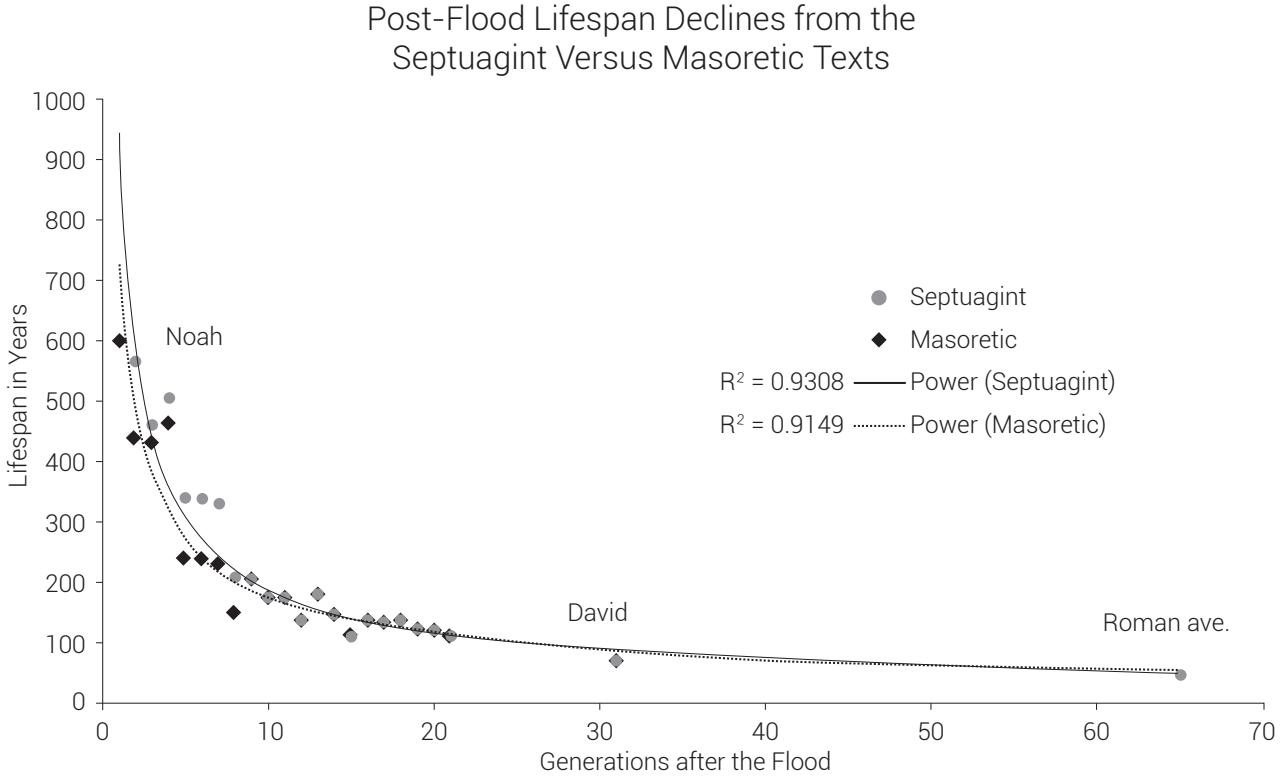

Figure 2. Age at begetting of post-Flood patriarchs, plus Noah, from two textual traditions

above. Finally, two BC date estimates for the Flood, include a Masoretic placement between 2518 and 2532 BC, and a Septuagint placement circa 3168 BC.

References

1. Morris, J., Can the Ussher Chronology Be Trusted? *Acts & Facts* **32**(12), 2003; icr.org/article/can-ussher-chronology-be-trusted.
2. Morris, H. and Whitcomb, J. *The Genesis Flood*, Presbyterian and Reformed, Phillipsburg, NJ, pp. 474–481, 1961.
3. McGee, D., Creation Date of Adam from the Perspective of Young-Earth Creationism, *Answers Research J.* **2012**:217–230; answersingenesis.org/bible-characters/adam-and-eve/creation-date-of-adam-from-young-earth-creationism-perspective/.
4. Genesis 5:25–27.
5. Hardy, C. and Carter, R., The biblical minimum and maximum age of the earth, *J. Creation*, **28**:89–96, 2014; creation.com/images/pdfs/tj/j28_2/j28_2_89-96.pdf.
6. Morris and Whitcomb, ref. 1, p. 474.
7. Tyler, D.J., Radiocarbon calibration—revised, *Creation Research Society Quarterly* **15**:16–23.
8. Morris, H., *The Genesis Record*, Baker, Grand Rapids, MI, p. 154, 1976.
9. Sarfati, J., *The Genesis Account*, Creation Book Publishers, Powder Springs, GA, p. 467, 2015.
10. Johnson, J.J.S. and Ice, T., Using Scriptural Data to Calculate a Range-Qualified Chronology from Adam to Abraham, Presented at the Southwest Regional Meeting of the Evangelical Theological Society at The Criswell College in Dallas, Texas, on 1 March 2002; icr.org/article/4639.
11. Johnson reckoned that the 70 years from Genesis 11 until Terah became a father counted the time until Terah fathered Abram (ref. 10), whereas Sarfati calculated 130 years from Terah's birth to fathering Abram, using Genesis 12:4 (ref. 9).
12. Beechick, R., Chronology for Everybody, *J. Creation* **15**:68, 2001; creation.com/images/pdfs/tj/j15_3/j15_3_67-73.pdf.
13. Finegan, J., *Handbook of Biblical Chronology, revised edn*, Hendrickson Publishers, Peabody, MA, p. 256, 1998.
14. Thiele, E., *The Mysterious Numbers of the Hebrew Kings: New Revised Edition*, Kregel Publications, Grand Rapids, MI, 1994. Originally Theile, E., *The Mysterious Numbers of the Hebrew Kings*, Macmillan, New York, 1951.
15. Morris and Whitcomb, ref. 2, p. 478.
16. McFall, L.A., Translation Guide to the Chronological Data in Kings and Chronicles, *Bibliotheca Sacra* **148**:3–45, 1991.
17. Young, R., Three Verifications of Thiele's Date for the Beginning of the Divided Kingdom, *Andrews University Seminary Studies* **45**:179–187, 2007.
18. Rodger Young's Papers on Chronology, rcyoung.org/papers.html, accessed 4 February 2016.
19. Young, R., Tables of reign lengths from the Hebrew court recorders, *J. Theological Evangelical Society* **48**:225–248, 2005.
20. Steinmann, A.E., *From Abraham to Paul*, Concordia, Saint Louis, MO, p. 37–65, 2011.
21. Kitchen, K., How we know when Solomon ruled, *Biblical Archaeology Review* Sep/Oct 2001, pp. 32–37, 58.
22. Young, R.C., Evidence for inerrancy from an unexpected source: OT chronology, *Bible and Spade* **21**:Spring 2008; biblearchaeology.org/post/2008/08/15/Evidence-for-Inerrancy-from-an-Unexpected-Source-OT-Chronology.aspx.
23. Steinmann, ref. 20, p. 55.
24. Wood, B., The search for Joshua's Ai; in: Hess, Klingbeil and Ray (Eds.), *Critical Issues in Early Israelite History* [Bulletin of Biblical Research Supplement 3], Eisenbrauns, pp. 205–240, 2008; biblearchaeology.org/file.axd?file=The+Search+for+Joshuas+Ai.pdf.
25. Steinmann, ref. 20, p. 48.
26. Steinmann, ref. 20, p. 51.
27. Young, R., The Talmud's two jubilees and their relevance to the date of the Exodus, *Westminster Theological J.* **68**:71–83, 2006.
28. Steinmann, A.E., Charts of Old Testament and Intertestamental Chronology based on From Abraham to Paul, 2010, cph.org/pdf/Helps/531185_OTChronology.pdf, accessed 11 February 2016.
29. Stewart, B., *True Bible Chronology*, Routledge & Sons, London, UK, p. 27, 1930.
30. Akers, P., *Introduction to Biblical Chronology: From Adam to the Resurrection of Christ,* Methodist Book Concern, Cincinnati, OH, p. 284, 1856.
31. Akers, ref. 30, p. 69.
32. Olaussen, V.K., How convincing are the arguments for a new Egyptian chronology? *J. Creation,* **23**:56–61, 2009; creation.com/images/pdfs/tj/j23_1/j23_1_56-61.pdf.
33. Mackey, D., Fall of the Sothic theory: Egyptian chronology revisited, *J. Creation* **17**:70–73, 2003; creation.com/fall-of-the-sothic-theory-egyptian-chronology-revisited.
34. Faulkner, D.R., Comments on Ussher's date of creation, *Answers Research J.* **9**:163–169, 2016.
35. Cooper, B., *The Authenticity of the Book of Genesis*, Creation Science Movement, Portsmouth, UK, 2012.
36. Sarfati, J., Biblical chronogenealogies, *J. Creation* **17**:14–18, 2003; creation.com/biblical-chronogenealogies#endRef3.
37. Sexton, J. and Smith, H.B., Primeval chronology restored: revisiting the genealogies of Genesis 5 and 11, *Bible and Spade* **29**:42–49, 2016.
38. Austin, S.A., Jerusalem earthquake of 33 ad: evidence within laminated mud of the Dead Sea, Israel, Presented at the 2012 Geological Society of America Annual Meeting, *GSA Abstracts with Programs* **44**:559; gsa.confex.com/gsa/2012AM/webprogram/Paper204688.html.
39. Austin, S.A., Greatest earthquakes of the Bible, *Acts & Facts* **39**:12–15, 2010; icr.org/article/greatest-earthquakes-bible/.
40. Petrovich, D., personal communication, 8 December 2016.
41. Sanford, J., Did Noah Live to 950 Years Old? Encouragement for Believers—Science Update, *FMS Foundation*, 2016; logosra.org/genetic-entropy.

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NOTE: Papers prepared according to these instructions are more likely to be considered.

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Christians need to keep on providing scientific answers within a biblical framework, and refining our case (including exposing whatever flaws there may be in old arguments). We also need to be ready to respond to challenges by critics.

Faith-funded creationist ministries like *Creation Ministries International Ltd* (CMI) can only do so much, not having access to taxpayer dollars.

Creationist membership societies with hundreds of scientist members are encouraging by their very existence. But they are usually just as hampered by funding constraints, and would dearly love more of their members to get involved in actively helping the creationist model.

We have many qualified scientists and other educated professionals on our mailing lists, and we would like to encourage more of you to each give just a little bit of spare time to creation research issues.

GETTING INFORMED

Start by getting as informed as possible through the existing literature. CMI can provide up-to-date catalogues.

JOINING THE NETWORK

Consider researching a particular area with a view to producing a paper. *Journal of Creation* is a great place to air it. CMI is more than willing to provide refereeing through our contacts. If you are concerned that publishing in a creationist journal might affect your employment, for example, a pseudonym may be acceptable. If you are keen to write, see our instructions to authors opposite.

Remember that the creation/evolution issue is often not so much about *facts* as about their *interpretation*. Often the research results produced by secular institutions operating within an evolutionary framework can be just as useful in providing answers for creationists—it just needs someone to go to the trouble of working it through. We can provide some guidance about how you can draw your research into a suitable paper.

NO CONTRIBUTION TOO SMALL

Even producing a brief Perspective item on a specialist area, if it will teach and inform *Journal of Creation* readers, and enable them to share with others, is a worthwhile contribution.

AND FINALLY …

You might want to consider a donation earmarked specifically for creationist research. If so, you could direct it to any of the CMI offices listed at the front of this journal. Such donations may be tax deductible in certain countries.

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