

CREATION RESEARCH SOCIETY



QUARTERLY

Volume 59 Fall 2022 Number 2



- **WHERE THE SEDIMENTS ARE**
- **MOLECULAR BARAMINOLOGY OF PRIMATES**
- **LATENT HEAT COULD SOLVE ACCELERATED NUCLEAR DECAY'S HEAT PROBLEM: PART 2**
- **57 YEARS OF ASTRONOMY: PART 2**
- **EVOLUTION IS MODERN DAY ALCHEMY**
- **A DOXOLOGICAL VIEW OF GRASSES**

# Creation Research Society Quarterly

**Volume 59**  
**Number 2**  
**Fall 2022**

## Articles

- Molecular Baraminology of Primates ..... 72  
Matthew Cserhati
- Fifty-Seven Years of Creation Astronomy  
Part II: Issues and Advances ..... 81  
Andrew Repp
- Latent Heat Could Solve  
Accelerated Nuclear Decay's  
Heat Problem—Part II ..... 92  
Barbara S. Helmkamp
- Where the Sediments Are ..... 103  
John K. Reed, Michael J. Oard, Peter Klevberg

## Departments

- Notes from the Panorama of Science..... 111
- Media Reviews ..... 117
- Instructions to Authors..... 119
- Membership/Subscription Application  
and Renewal Form ..... 121
- Order Blank for Past Issues..... 122

**Haec Credimus**

*For in six days the Lord made heaven and earth, the sea, and all that in them is, and rested on the seventh.—Exodus 20:11*

# Creation Research Society Quarterly

**Volume 59**  
**Number 2**  
**Fall 2022**

Cover by Michael E. Erkel, Afton, Virginia

Design services by Cindy Blandon, cblandon@aol.com

The *Creation Research Society Quarterly* is published by the Creation Research Society, 1 W. Firestorm Way #145, Glendale, AZ 85306, and it is indexed in the *Christian Periodical Index* and the *Zoological Record*.

Send papers on all subjects to the Editor:  
CRSQeditor@creationresearch.org or to  
Tim Clarey, 1806 Royal Lane, Dallas, TX 75229.

Send book reviews to the Book Review Editor:  
Mary Beth De Repentigny, Book Review Editor,  
marybethd4@gmail.com.

All authors' opinions expressed in the *Quarterly* are not necessarily the opinions of the journal's editorial staff or the members of the Creation Research Society.

Copyright © 2022 by Creation Research Society. All rights to the articles published in the *Creation Research Society Quarterly* are reserved to the Creation Research Society. Permission to reprint material in any form, including the Internet, must be obtained from the Editor.

ISSN 0092-9166

Printed in the United States of America

## CRSQ Editorial Staff

Tim Clarey, Editor  
Mary Beth De Repentigny, Managing Editor  
David Bassett, Assistant Managing Editor  
Jerry Bergman, Biology Editor  
Eugene F. Chaffin, Physics Editor  
Mary Beth De Repentigny, Book Review Editor  
Derrick M. Glasco, Biochemistry Editor  
James J.S. Johnson, Biblical Studies Editor  
Jean K. Lightner, Biology Editor  
John K. Reed, Geology Editor  
Ronald G. Samec, Astronomy Editor

## CRS Board of Directors

Robert Hill, President  
Jean K. Lightner, Vice-President  
Rob Carter, Membership Secretary  
Danny R. Faulkner, Treasurer/Financial Secretary  
Jerry Bergman  
Eugene Chaffin  
Tim Clarey  
Mark Horstemeyer  
Michael J. Oard  
John K. Reed  
Andrew Repp  
Ronald G. Samec  
Tichomir Tenev  
Jeffrey P. Tomkins

# Molecular Baraminology of Primates

Matthew Cserhati\*

## Abstract

Twenty-six species of primates were examined by the Gene Content method, and 93 mitochondrial genome sequences were downloaded from the NCBI database, aligned, and analyzed. In total, 96 species were studied, about half of all primates. The Gene Content method predicts at least six putative primate holobaramins: cercopithecines, colobines, New World monkeys, lemurs, great apes, and humans. The mitochondrial DNA analysis predicts sixteen groups, which are likely monobaraminic lineages within the groups predicted by the Gene Content method. This study predicted a larger number of groups compared to a previous study of primates and other vertebrates. Interestingly, examination of the newly sequenced mitochondrial genome of *Homo heidelbergensis* places it within the human holobaramin, in agreement with previous studies that included it based on morphological data alone. The human holobaramin also clearly separates from all other primate species, even its alleged closest relatives, the great apes. Hylobatidae is possibly a seventh primate group, and *Pongo* (orangutan) is a possible eighth group.

**Key Words:** primate, *Homo*, molecular baraminology, mitochondrial DNA, Old World monkey, New World monkey, great ape, colobine, cercopithecine, Gene Content method

## Introduction

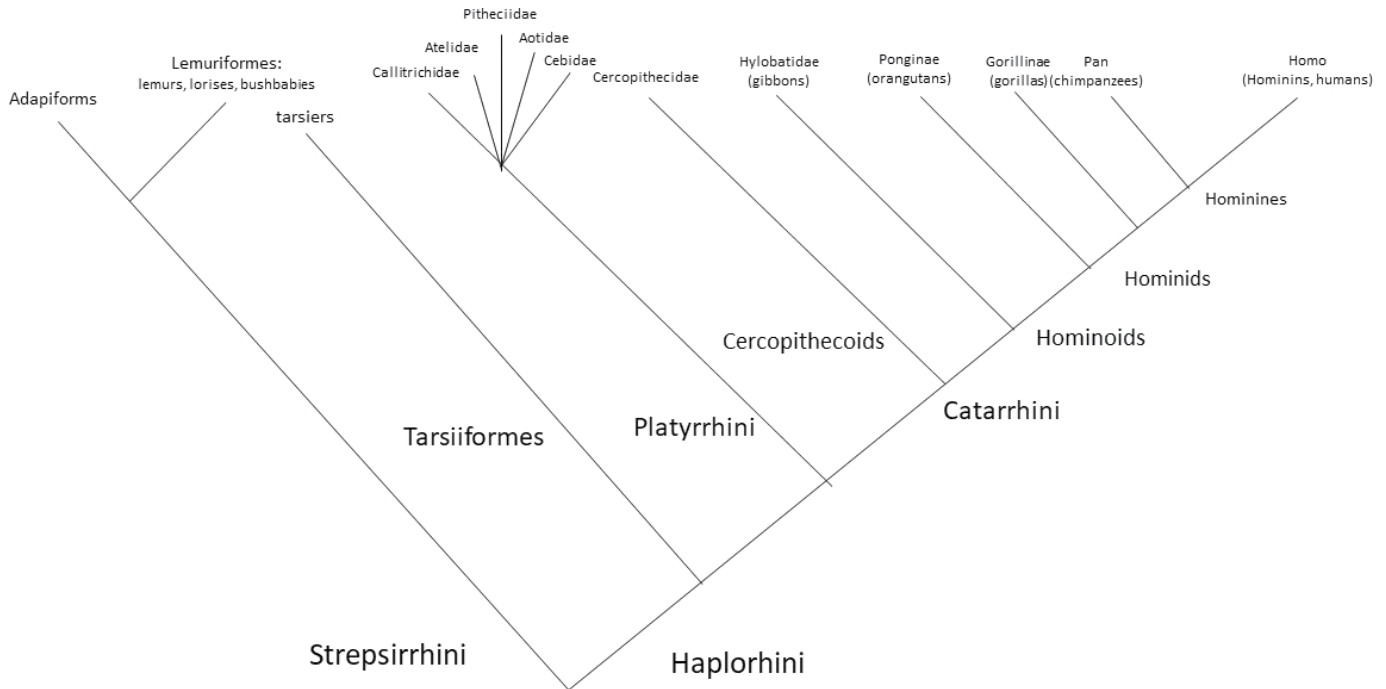
There are 194 species of living primates (Stringer and Andrews, 2011), which range in size from the tiny, palm-sized Moholi bush baby (*Galago moholi*) (around 6 oz. in weight) to the large gorilla (*Gorilla gorilla*) (up to 227 kg in males) and are (excluding humans) found on all continents except Australia and Antarctica. Primates are classified

into two suborders (see Figure 1)—Strepsirrhini, such as lemurs, lorises, and galagos; and Haplorhini: tarsiers and anthropoids. Anthropoids can be classified as either flat-nosed monkeys (Platyrrhini), otherwise known as New World monkeys, and Catarrhini, or Old World monkeys with downward-looking nostrils. Platyrrhini is subdivided into five families: Callitrichidae (marmosets

and tamarins), Cebidae (capuchins and squirrel monkeys), Aotidae (owl monkeys), Pitheciidae (titis, sakis, and uakaris), and Atelidae (howler monkeys and spider monkeys). Catarrhini is subdivided into two superfamilies, Cercopithecoidea, which has one family, Cercopithecidae (including langurs, macaques and baboons), and Hominoids. Hominoids are further classified into two

\* Matthew Cserhati, csmaty@protonmail.com

Accepted for publication June 25, 2022



**Figure 1.** Taxonomic tree of primates. Primates are divided into Strepsirrhini and Haplorhini, which are classified as Tarsiiformes (tarsiers), Platyrrhini (New World monkeys) and Catarrhini (Old World monkeys). Catarrhini is made up of cercopithecoidea and hominoidea, which themselves are made up of Hylobatidae (gibbons) and Hominoids. This latter group is made up of gorillas and orangutans and hominines (chimpanzees and humans). The human species (*Homo sapiens*) is unique among all primates.

families Hylobatidae (gibbons), and Hominoidea. Hominoidea is subdivided into the subfamilies Ponginae (orangutans), Gorillinae (gorillas), and Homininae. Hominines are made up of the tribes Panini (chimpanzees, genus *Pan*) and Hominini, otherwise known as hominins, made up of the genus *Homo* (humans) (Park, 2009; Stringer and Andrews, 2011; Gebo, 2014).

The human species (*Homo sapiens*) is unique among all extant primates, even all extant animals, in that we alone were created in God's image (Genesis 1:26–27) (Lightner and Cserhati, 2019). Archaic humans, such as Neanderthals (*Homo sapiens neanderthalensis*), Denisovans (*Homo sapiens denisova*), and other possible groups are also members of humankind (Lubenow, 2004; Savanne, 2014; Rupe and Sanford, 2017;

O'Micks, 2018a, 2018b). Based on their morphological characteristics, several other fossil species have also been considered to be members of the human hominid. These include *Homo erectus*, *Homo heidelbergensis*, *Homo naledi*, and *Homo rudolfensis* (Wood, 2010; Line, 2013; O'Micks, 2016; Wood, 2016; Rupe and Sanford, 2017). Some of these placements are controversial, so molecular data provide another line of evidence that can be useful in classifying these taxa. With the mitochondrial genome sequenced for *Homo heidelbergensis* (Meyer et al., 2014) we now have the opportunity of placing this fossil taxon into its proper category with even more confidence.

Almost all primates are characterized by grasping feet with a divergent hallux, presence of nails on most digits,

an elongated calcaneus, hind limb locomotor dominance, grasping hands with opposable thumbs, forward rotation of the closely set eyes, large brain size, relatively long gestation compared to body weight, slow fetal growth, prolonged life history, and a loss of an incisor and premolar from the tooth row (Stringer and Andrews, 2011).

Until now, the creationist literature has dealt mainly with the analysis of groups or individual hominins or australopithecines. For example, the families Cercopithecidae (Hartwig-Scherer, 1993), Galagonidae (Wood, 2008), and the subfamilies Gorillinae (Hartwig-Scherer, 1998) and Ponginae (Hartwig-Scherer, 1998) have also been studied individually. A more comprehensive study of the order Primates has been lacking. With proteomic data available

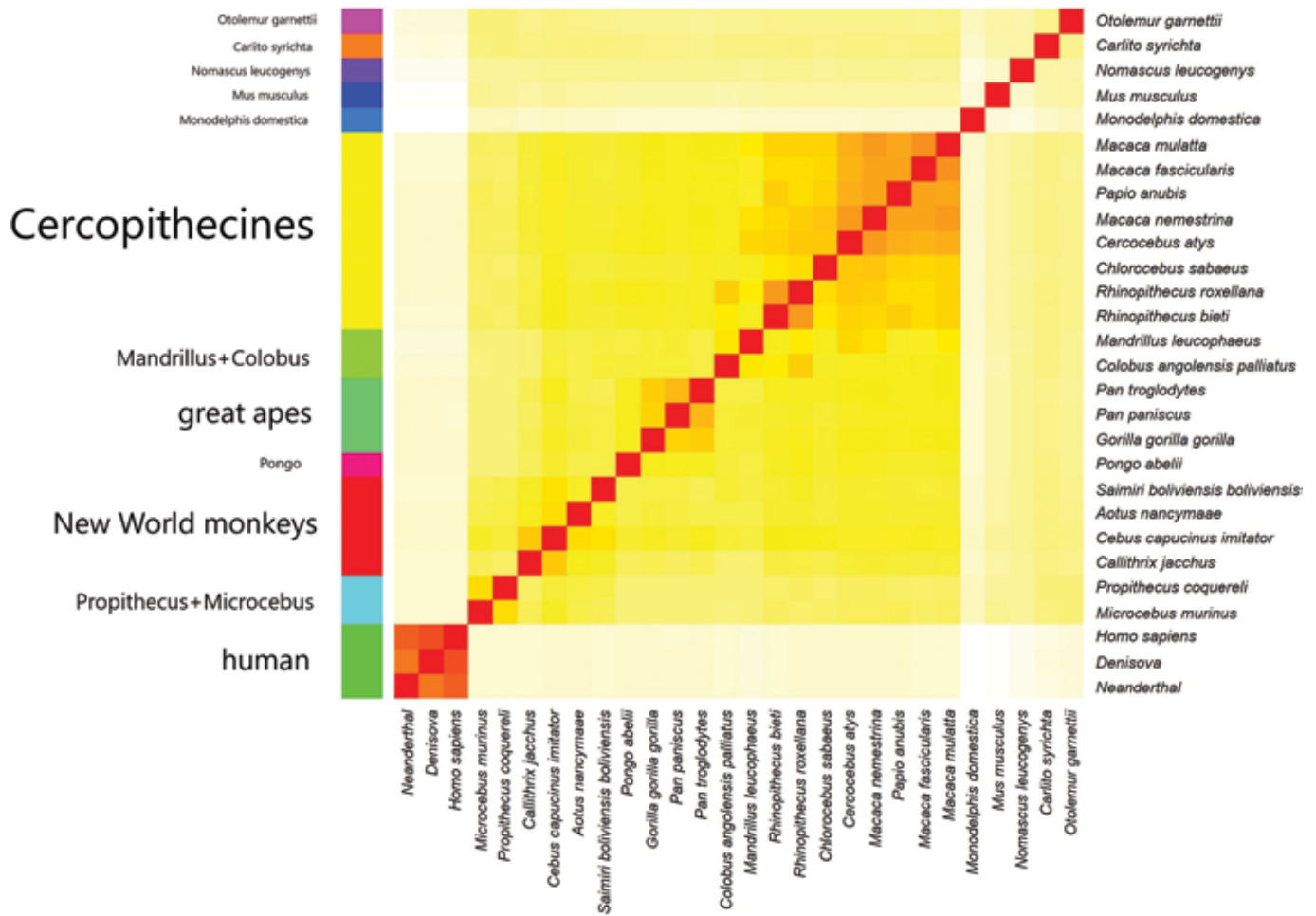


Figure 2. Heatmap showing putative baraminic relationships between primates based on analysis by the Gene Content method. Darker, redder colors correspond to higher Jaccard Coefficient values, corresponding to species showing significant continuity with one another. Lighter, yellow colors correspond to lower Jaccard coefficient values denoting species from two separate baramins.

from the NCBI database, a comprehensive molecular baraminology study can be done using the Gene Content (GC) method of O’Micks (2017).

## Materials and Methods

### Gene Content Method Analysis

The whole proteomes of 26 primate species were downloaded from the NCBI database. *Monodelphis domestica* and *Mus musculus* were used as outlier

species. Protein predictions were made for Neanderthal and Denisova using the Augustus gene prediction software. Proteins were assigned to OrthoMCL clusters following the GCM protocol (Stanke and Morgenstern, 2005; Fischer et al., 2011; O’Micks, 2017). The number of proteins and the number of proteins mapped to orthologs for each species were noted and can be seen in the ‘species’ tab of Supplementary File #1, which also contains the results for this analysis. It is available on Zenodo

at <https://zenodo.org/record/6635435#.YqWDGOzMLrc>.

### Mitochondrial DNA Analysis

The mitochondrial genome sequences of 92 primate species were downloaded from the NCBI Organelle database at [ncbi.nlm.nih.gov/genome/browse#!/organelles](https://ncbi.nlm.nih.gov/genome/browse#!/organelles). *Monodelphis domestica* was used as an outlier. One sequence each for *Gorilla gorilla gorilla* and for *Pan paniscus* was excluded because it was a duplicate. The alignment of

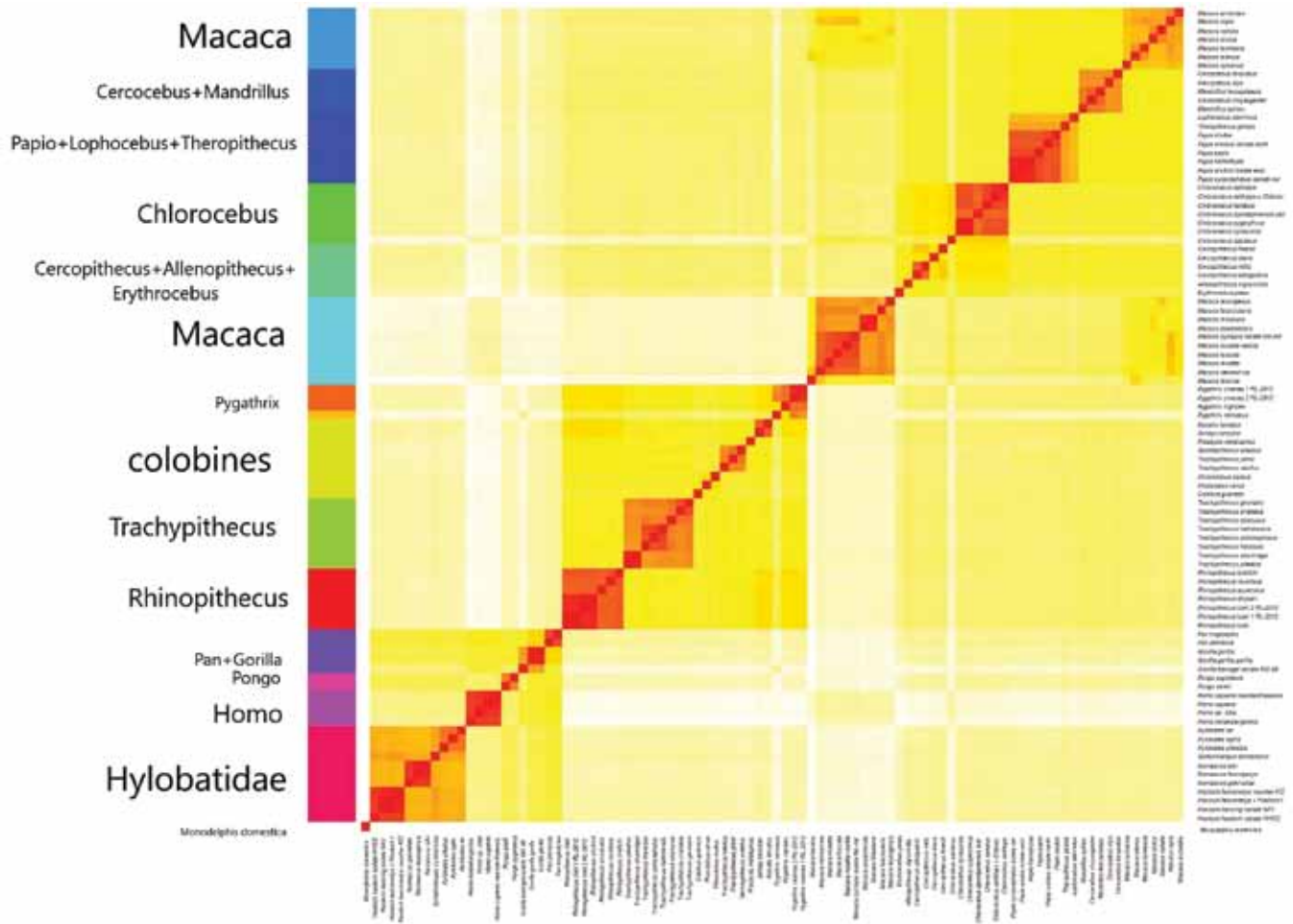


Figure 3. Heatmap showing putative baraminic relationships between primates based on analysis of the mitochondrial genome. Darker, redder colors correspond to higher sequence similarity values, corresponding to species within the same baramin. Lighter, yellower colors correspond to lower sequence similarity values suggesting species from two separate baramins.

these mtDNA sequences was done using the CLUSTALW2 alignment tool (Thompson et al., 2002). The results of the mtDNA analysis are available in Supplementary File #2.

## Results and Discussion

### Results of the Gene Content Method

The JCV matrix (see Supplementary File #1) has a Hopkins measurement

value of 0.793, which is good quality for clustering. An elbow plot (Supplementary Figure 1) generated from the matrix shows an optimal number of clusters at k=12. The Gene Content method was run to search for twelve baramins according to protocol (O’Micks, 2017). The species classification and the statistics for the predicted baramins can be found under the tabs ‘species classification’ and ‘stats’ in Supplementary File #1. It is available on Zenodo [<https://zenodo.org/record/6635435#.YqWDGOzMLrc>].

On the heat map in Figure 2, several clusters of species can be seen. Group 1 (red) includes four species of New World Monkeys: *Aotus nancymae*, *Callithrix jacchus*, *Cebus capucinus imitator*, and *Saimiri boliviensis boliviensis*. The last three belong to the family Cebidae (marmosets, tamarins, capuchin monkeys, and squirrel monkeys). *Aotus nancymae* (Ma’s Night Monkey) belongs to the family Aotidae (owl monkeys). However, according to newer primate taxonomies based on the phylogeny of the epsilon

globin and interphotoreceptor binding protein (IRBP) intron 1 (Schneider and Sampaio, 2015) the genus *Aotus* is now included in the family Cebidae as well, meaning that all species used in this study can be considered to represent a single family. This group has a p-value of  $1.4E-10$ , and a mean JCV of 0.947. Hybrids have been reported between species from the genus *Callithrix* and *Callicebus*, which belong to the families Cebidae and Pitheciidae (Neusser et al., 2005; Fantini et al., 2011).

Group 2 (yellow) makes up the largest group, in the middle, with eight species of cercopithecine Old World monkeys, with a p-value of  $3.84E-28$ , and a mean JCV of 0.96. These include species from the genera *Cercocebus*, *Chlorocebus*, *Macaca*, *Papio*, and *Rhinopithecus*.

Group 3 (olive green) is made up of another group of Old World monkeys, the colobines, with two species, *Colobus angolensis palliatus* (Angolan black-and-white colobus monkey), and *Mandrillus leucophaeus* (the mandrill). Interestingly, there have been two recorded hybridizations between members of the genus *Mandrillus* and *Cercocebus* from the previous group (Van Gelder, 1977).

Humans (group 4, light green) form a very compact cluster, visibly discontinuous with all other primate species, with a p-value of  $1.8E-07$ , and a mean JCV of 0.979. This is in accordance with results from a previous molecular baraminology study performed on mammals by Lightner and Cserhati (2019). The present study compared 26 primates with one another, as opposed to 21 in the previous analysis. Both studies underscore the uniqueness of humans compared to all other animals, even other primates, which are those animals to which humans are most similar. Whereas humans have a JCV of  $0.979 \pm 0.005$ , this drops down to  $0.8 \pm 0.001$  when the JCV are compared between humans and the great apes. This means that if we add

the great apes to the human baramin, we get meaningless results since the mean JCV is greatly reduced. If we calculate a z-score on the two JCV distributions, we get a value of 16.01, which means that the two distributions are very highly dissimilar.

Group 5 (bluish green) is made up of the great ape species: the gorilla (*Gorilla gorilla*), and two chimpanzee species (*Pan paniscus* and *Pan troglodytes*). These three species show discontinuity with all other species, with a p-value of  $2.4E-12$  and a mean JCV of 0.956.

Two species of lemurs, the Gray Mouse Lemur (*Microcebus murinus*) and Coquerel's sifaka (*Propithecus coquereli*) make up cluster 6 (cyan), with a mean JCV of 0.951.

Several individual species could not be assigned to any cluster. These include *Carlito syrichta* (Philippine tarsier, orange) and *Otolemur garnettii* (Small-Eared Galago, purple), *Nomascus leucogenys*, the White-Cheeked Gibbon (dark purple), from the family Hylobatidae, as well as *Pongo abelii* (the Sumatran orangutan, magenta). *Monodelphis domestica* (blue) and *Mus musculus* (dark blue), the two outlier species also cluster separately from all of the other species.

### Mitochondrial DNA Analysis

Putative clusters were predicted based on aligning the mtDNA sequences of 92 primate species and an outlier, *Monodelphis domestica*. The silhouette plot in Supplementary Figure 2 shows an optimum value at  $k=16$ . Thirteen of the sixteen clusters were comprised of at least 3 members and were statistically significant with a p-value less than 5%. The mtDNA sequence similarity cluster had a Hopkins clustering value of 0.897, which indicates very good clustering. The list of species used in this study, the mtDNA identity matrix, the putative clusters, and the statistics for the predicted baramins can be found in see Supplementary File #2.

The sixteen clusters are as follows: the first cluster (in red in Figure 2) consists of five species from the genus *Rhinopithecus* (snub-nosed monkeys): three *Rhinopithecus bieti* individuals, *Rh. strykeri*, *Rh. roxellana*, *Rh. brelichii*, and *Rh. avunculus*. This is a genus of Old World colobine monkeys.

The second and third clusters (orange and dark orange) are made up of three species from the genus *Pygathrix* (douc langurs): *Pygathrix cenerea*, *Pygathrix nigripes*, and *Pygathrix nemaeus*. This is a genus of Old World colobine monkeys.

Nine species make up cluster 4 (yellow): *Simias concolor* (the pig-tailed langur), *Nasalis larvatus* (the proboscis monkey), *Presbytis melalophos* (black-crested Sumatran langur), *Trachypithecus johnii*, *Trachypithecus vetulus*, *Procolobus verus* (olive colobus monkey, or Van Beneden's colobus), *Semnopithecus entellus* (the northern plains gray langur), *Ptilocolobus badius* (western red colobus), and *Colobus guereza* (mantled guereza). Some researchers prefer to put the first two species into the same genus (Groves, 1970). Whittaker et al. (2006) also came to the same conclusion based on similarities between cytochrome b and several RNA genes. These nine species in cluster 4 are all colobine monkeys. An analysis of 54 genes covering 35 Kb of nuclear DNA (Perelman et al., 2011) places *T. vetulus* within the genus *Semnopithecus*, thus explaining the incongruity of why this species is seemingly misplaced from the next group, *Trachypithecus*. This might be true of *T. johnii*, another misplaced *Trachypithecus* species. Indeed, based on an analysis of a 573 bp segment of the mitochondrial cytochrome b gene, *T. johnii* forms a clade with the South Indian form of *Semnopithecus entellus* (Osterholz et al., 2008).

Group 5 (yellow-green) consists of eight species of Old World colobine monkeys, namely lutungs (leaf monkeys) within the genus *Trachypithecus*

(*T. cristatus*, *T. francoisi*, *T. germaini*, *T. hatinhensis*, *T. obscurus*, *T. pileatus*, *T. poliocephalus*, and *T. shortridgei*).

Group 6 (light green) consists of six *Chlorocebus* species: *Chlorocebus aethiops*, *Ch. cynosuroides*, *Ch. djamdjamentis*, *Ch. pygerythrus*, *Ch. tantalus*, and *Ch. aethiops* x *Ch. pygerythrus*. Here the letter 'x' between two species names denotes a new hybrid species which is a result of the cross between the two species that make up the hybrid's name. These are all cercopithecine monkeys. A seventh group consists of only *Ch. saabaes*. The reason that this one species of *Chlorocebus* separates from all the rest may be due to mtDNA heteroplasmy, which is known to occur in this genus (Rensch et al., 2016).

Group 8 (light cyan) includes: *Cercopithecus diana*, *C. albogularis*, *C. mitis*, *C. lhoesti*, *Erythrocebus patas*, and *Allenopithecus nigroviridis*. These are all species of cercopithecine monkeys.

The ninth and tenth cluster of primate species (cyan and blue) includes seventeen species of macaques (genus *Macaca*). Macaques are cercopithecine monkeys and have a widespread geographic distribution, and live in places such as deserts to rainforests, from sea level to mountains, from North Africa to Southeast Asia. This genus might be split up into two groups because they might represent two monobaramins. Members of the first group are: *Macaca arctoides*, *M. nigra*, *M. radiata*, *M. silenus*, *M. sinica*, *M. sylvanus*, and *M. tonkeana*, whereas members of the second group are: *Macaca assamensis*, *M. cyclopis*, *M. fascicularis*, *M. fuscata*, *M. leonina*, *M. leucogenys*, *M. mulatta*, *M. mulatta vestita*, *M. nemestrina*, and *M. thibetana*.

Previous studies have usually discovered four groups of macaques (the *fascicularis*, *silenus*, *sinica*, and *sylvanus* groups). The membership of these groups varies as to which region of the mtDNA is under study, be it NADH4 and several tRNAs, the 12S and 16S ribosomal regions, the 3.1 kb TSPY and

the SRY regions, the 2322 bp region of 12S, tRNA<sup>Glu</sup>, COI, COII and COIII, or the *Alu* elements of 358 loci, or the region around the COII gene (Rahim et al., 2014). However, since these studies did not examine the entire mtDNA, they remain inconclusive.

Group 11 (darker blue) is made up of five species from two cercopithecine genera: *Cercocebus* (mangabeys) and *Mandrillus* (forest baboons or mandrills). These are: *Cercocebus atys*, *C. chrysogaster*, *C. torquatus*, *Mandrillus leucophaeus*, and *M. sphinx*. Liedigk et al. (2014) created a multiple alignment of the mitochondrial genomes of papionins (*Macaca*, *Mandrillus*, *Cercocebus*, *Lophocebus*, *Theropithecus*, *Rungwecebus*, and *Papio*). They found that *Cercocebus* + *Mandrillus* forms a clade amongst papionins. The present results reinforce previous molecular results which show that drills are more closely related to mangabeys from the genus *Cercocebus* as opposed to a previously held view grouping them together with baboons (Disotell, 1994; Fleagle, 1999). In fact, Fleagle and McGraw (1989) suggest that similar jaw, fore- and hindlimb morphology between *Mandrillus* and *Cercocebus* allow for a foraging lifestyle on the forest floor. The previously mentioned study by Perelman et al. (2011) also found the *Cercocebus*-*Mandrillus* clade to be monophyletic (Devreese and Gilbert, 2015).

Six species from the genus *Papio* make up group 12 (darkest blue), as well as two species from two other genera. These are *Papio anubis*, *P. cynocephalus*, *P. hamadryas*, *P. kindae*, *P. papio*, and *P. ursinus*. These monkeys are also cercopithecids. The two other species are *Lophocebus aterrimus* (black-crested mangabey) and *Theropithecus gelada* (gelada). These papionid monkeys form a clade together based on the molecular analysis of 57 loci (Pugh and Gilbert, 2018). According to these same authors, the genera *Cercocebus* and *Mandrillus* form another clade. This clade was also found by Liedigk et al. (2014) in a

multiple mitochondrial genome alignment. A phylogenetic tree based on the testis-specific Y-encoded protein (TSPY) shows that *M. leucophaeus* and *M. sphinx* intermingle with three species of *Cercocebus*, strongly suggesting that the species in these two genera belong to the same holobaramin (Kim and Takenaka, 1996; Harris, 2000).

Group 13 (dark purple) consists of three gorillas (*Gorilla gorilla gorilla*, *G. gorilla* and *G. beringei*) and two chimpanzee species: *Pan paniscus* and *P. troglodytes*.

The next group (14, purple) is made up of four individuals belonging to the genus *Homo*: *Homo heidelbergensis*, *H. sapiens*, *H. sapiens neanderthalensis*, and *H. sp. Altai* (Denisovan). This is a very interesting result, in that there is now molecular evidence to support the human status of *H. heidelbergensis*, which until now was classified as human based only on morphological traits (Line, 2013). It also reinforces the results that Neanderthals and Denisovans are both human.

Two species of orangutan make up group 15 (light purple), *Pongo abelii* and *P. pygmaeus*. These two species have been known to hybridize (*P. abelii* x *pygmaeus*) (Botting and Bastian, 2019).

Group 16 (magenta) is made up of eleven species from four genera: *Hoolock* (hoolock gibbons), *Hylobates* (gibbons), *Nomascus* (gibbons), and *Symphalangus* (siamangs): *Hoolock hoolock*, *H. leuconedys*, *H. leuconedys* x *H. tianxing*, *H. tianxing*, *Hylobates agilis*, *H. lar*, *H. pileatus*, *Symphalangus syndactylus*, *Nomascus gabriellae*, *N. leucogenys*, and *N. siki*. All these species belong to the family Hylobatidae.

The outlier, *Monodelphis domestica* (white), shows discontinuity with all other species.

## Summary and Conclusion

Table 1 summarizes the overlap in the results between the Gene Content

Table 1. Comparison of results between the Gene Content method and the mtDNA analysis. Names in parentheses are present in one analysis but are missing from the other.

Gene Content method	mtDNA analysis
Colobines	<i>Pygathrix</i> (2 groups)
	<i>Rhinopithecus</i>
	<i>Simias+Nasalis+Trachypithecus+Semnopithecus+Colobus+Ptilocolobus+Presbytis+Procolobus</i>
	<i>Trachypithecus</i>
<i>Colobus+Mandrillus</i>	<i>Cercocebus+Mandrillus</i>
Cercopithecines	<i>Macaca</i> (2 groups)
	<i>Papio+Lophocebus+Theropithecus</i>
	<i>Chlorocebus</i> (2 groups)
	<i>Allenopithecus+Cercopithecus+Erythrocebus</i>
Great apes	<i>Gorilla+Pan</i>
Orangutan	<i>Pongo</i>
Human	<i>Homo sapiens, Neanderthal, Denisovan, Homo heidelbergensis</i>
(Gibbons)	<i>Hoolock+Hylobates+Symphalangus+Nomascus</i>
New World monkeys, family Cebidae: <i>Aotus, Callithrix, Cebus, Saimiri</i>	(New World Monkeys)

method and the mtDNA analysis. As we can see, the Gene Content method found four groups (colobines, cercopithecines, great apes, human) also found by the mtDNA analysis. Each of these four groups, however, match several groups found by the mtDNA analysis. One group found by the mtDNA analysis (Hylobatidae) was not found by the Gene Content method. New World monkeys and lemurs were found by the Gene Content method but not by the mtDNA analysis.

What do these results mean? They most likely indicate that primate molecular baraminology has discovered seven simiform primate kinds: colobines, cercopithecines, great apes, New World

monkeys (Cebidae), great apes, gibbons, and humans. The previous study by Lightner and Cserhati (2019) predicted only four primate groups: humans, great apes, Old World monkeys, and New World monkeys. This previous study only examined 21 species, among other vertebrate groups, whereas the present study examined 98 species.

The fact that the mtDNA analysis uncovered a larger number of groups could be because these groups are monobaraminic lineages within the corresponding larger group found by the Gene Content method. Indeed, the genera *Pygathrix*, *Macaca*, and *Chlorocebus* were each split into two groups. Further, two species of *Trachypithecus*

cluster with *Semnopithecus*, in separate group from other *Trachypithecus*. Mitochondrial DNA analysis can only go so far in providing congruent results. Factors, such as heteroplasmy or higher mutation rates may obscure baraminic relationships based on mtDNA analysis.

The Gene Content method provides a more holistic view of baraminic relationships as opposed to the mtDNA study which examined only a small fraction of the genome. Interestingly, both the Gene Content method and the mtDNA analysis placed gorillas and chimpanzees into the same baramin. This may seem unusual due to the size disparity between these two species, however, such large size differences exist in other kinds, such as the cat kind (lion and house cat). Humans clearly separate from all other primates in this study, including their alleged closest relatives, the great apes, based on both the Gene Content method as well as mitochondrial DNA analysis. This highlights their unique position within creation. Lastly, a very interesting result shows that based on molecular data, *Homo heidelbergensis* is likely a member of the human holobaramin (Cserhati, 2022), confirming what many creationists had suspected, based on morphological analysis. With the isolation of genetic material from even more fossil hominins our picture of baraminic relationships within primates is becoming more complete.

## Acknowledgments

This paper was written as a part of CRS grant #62.

## References

- Botting, J., and M. Bastian. 2019. Orangutans (*Pongo pygmaeus* and Hybrid) and gorillas (*Gorilla gorilla gorilla*) modify their visual, but not auditory, communicative behaviors, depending on the attentional state of a human experimenter. *International Journal*

- of *Primate* 40(6):DOI:10.1007/s10764-019-00083-0.
- Cserhati, M. 2022. Baraminic placement of *Homo heidelbergensis* based on molecular data. *Creation Research Society Quarterly*, accepted.
- Devreese, L., and C.C. Gilbert. 2015. Phylogenetic relationships within the *Cercopithecus-Mandrillus* clade as indicated by craniodental morphology: Implications for evolutionary biogeography. *American Journal of Physical Anthropology* 158(2):227–241.
- Disotell, T.R. 1994. Generic level relationships of the Papionini (Cercopithecoidea). *American Journal of Physical Anthropology* 94(1):47–57. <https://doi.org/10.1002/ajpa.1330940105>.
- Fantini, L., M.D. Mudry, and M. Nieves. 2011. Genome size of two *Cebus* species (Primates: Platyrrhini) with a fertile hybrid and their quantitative genomic differences. *Cytogenetic and Genome Research* 135(1):33–41.
- Fischer, S., B.P. Brunk, F. Chen, X. Gao, O.S. Harb, J.B. Iodice, Shanmugam, et al. 2011. Using OrthoMCL to assign proteins to OrthoMCL-DB groups or to cluster proteomes into new ortholog groups. *Current Protocols in Bioinformatics* 35:6.12.1–6.12.19.
- Fleagle, J.G. 1999. *Primate Adaptation and Evolution*, Second Edition. San Diego, CA: Academic Press, pp. 199–200.
- Fleagle, J.G., and W.S. McGraw. 1989. Skeletal and dental morphology supports diphyletic origin of baboons and mandrills. *Proceedings of the National Academy of Sciences, USA* 96(3):1157–1161.
- Gebo, D.L. 2014. *Primate Comparative Anatomy*. Baltimore, MD: Johns Hopkins University Press, pp. 2–9.
- Groves, C.P. 1970. The forgotten leaf-eaters and the phylogeny of the Colobinae. in *Old World monkeys: evolution, systematics, and behavior* (J.R. Napier and P.H. Napier, eds.). New York, NY: Academic Press, pp. 555–587.
- Harris, E.E. 2000. Molecular systematics of the old world monkey tribe papionini: analysis of the total available genetic sequences. *Journal of Human Evolution* 38(2):235–256.
- Hartwig-Scherer, S. 1993. Hybridisierung und artbildung bei den Meerkatzenartigen (Primates, Cercopithecoidea). In: Scherer, S., ed. *Typen des Lebens*. Berlin, Germany: Pascal-Verlag, pp. 245–257.
- Hartwig-Scherer, S. 1998. Apes or ancestors? Interpretations of the hominid fossil record within evolutionary and basic type biology. In: Dembski, W.A., (ed.). *Mere Creation*. Downers Grove, IL: InterVarsity Press, pp. 212–235.
- Kim, H.-S., and O. Takenaka. 1996. A comparison of TSPY genes from Y-chromosomal DNA of the great apes and humans: Sequence, evolution, and phylogeny. *American Journal of Physical Anthropology* 100(3):301–309.
- Liedigk, R., C. Roos, M. Brameier, and D. Zinner, 2014. Mitogenomics of the Old World monkey tribe Papionini. *BMC Evolutionary Biology* 14(1):176, DOI:10.1186/s12862-014-0176-1.
- Lightner, J.K., and M. Cserhati. 2019. The uniqueness of humans is clearly demonstrated by the gene-content Statistical Baraminology Method. *Creation Research Society Quarterly* 55(3):132–141.
- Line, P. 2013. Explaining robust humans. *Journal of Creation* 27(3):64–71.
- Lubenow, M.L. 2004. *Bones of contention: A creationist assessment of human fossils*, Second Edition. Grand Rapids, Michigan: Baker Books.
- Meyer, M., Q. Fu, A. Aximu-Petri, I. Glocke, B. Nickel, J.L. Arsuaga, I. Martínez, A. Gracia, J.M. de Castro, E. Carbonell, and S. Pääbo. 2014. A mitochondrial genome sequence of a hominin from Sima de los Huesos. *Nature* 505(7483):403–406.
- Neusser, M., M. Münch, G. Anzenberger, and S. Müller. 2005. Investigation of marmoset hybrids (*Cebuella pygmaea* x *Callithrix jacchus*) and related Callitrichinae (Platyrrhini) by cross-species chromosome painting and comparative genomic hybridization. *Cytogenetic and Genome Research* 108(1–3):191–196.
- O'Micks, J. 2016. Preliminary baraminological analysis of *Homo naledi* and its place within the human baramin. *Journal of Creation Theology and Science Series B: Life Sciences* 6:31–39.
- O'Micks, J. 2017. Baraminology classification based on gene content similarity measurement. *Creation Research Society Quarterly* 54(1):27–37.
- O'Micks, J. 2018a. Modern science catches up with Neanderthal man. *Journal of Creation* 30(1):38–42.
- O'Micks, J. 2018b. Baraminic analysis of archaic and modern human genomes. *Journal of Creation* 32(3):19–24.
- Osterholz, M., L. Walter, and C. Roos. 2008. Phylogenetic position of the langur genera *Semnopithecus* and *Trachypithecus* among Asian colobines, and genus affiliations of their species groups. *BMC Evolutionary Biology* 8(1):58.
- Park, M.A. 2009. *Biological Anthropology*, Sixth Edition. New York, NY: McGraw-Hill.
- Perelman, P., W.E. Johnson, C. Roos, H.N. Seuanez, J.E. Horvath, M.A. Moreira, B.D. Kessing, J. Pontius, M. Roelke, Y. Rumpler, M.C. Schneider, A. Silva, S. O'Brien, J. Pecon-slattery. 2011. A molecular phylogeny of living primates. *PLoS Genetics* 7:e1001342.
- Pugh, K.D., and C.C. Gilbert. 2018. Phylogenetic relationships of living and fossil African papionins: Combined evidence from morphology and molecules. *Journal of Human Evolution* 123:35–51.
- Rahim, N.A., M. Gani, and M.T. Abdullah. 2014. Phylogenetic relationships of macaques (Cercopithecidae: *Macaca*) inferred from partial mitochondrial DNA (mtDNA) cytochrome oxidase II (COII) gene. *Borneo Journal of Resource Science and Technology* 4(1):42–51.
- Rensch, T., D. Villar, J. Horvath, D.T. Odom, and P. Flicek. 2016. Mitochondrial heteroplasmy in vertebrates using ChIP-sequencing data. *Genome Biology* 17(1):139.
- Rupe, C., and J. Sanford. 2017. *Contested Bones*. Waterloo, NY: FMS Publications.
- Savanne, D. 2014. Denisovans menace

- evolution—A new chapter in the human origins debate. *Journal of Creation* 28(3):5–8.
- Schneider, H., and I. Sampaio. 2015. The systematics and evolution of New World primates—A review. *Molecular Phylogenetics and Evolution* 82(Part B):348–357.
- Stanke, M., and B. Morgenstern. 2005. AUGUSTUS: a web server for gene prediction in eukaryotes that allows user-defined constraints. *Nucleic Acids Research* 33(Web Server issue):W465–W467.
- Stringer, C., and P. Andrews. 2011. *The Complete World of Human Evolution*, Second Edition. London, UK: Thames & Hudson Ltd.
- Thompson, J.D., T.J. Gibson, and D.G. Higgins. 2002. Multiple sequence alignment using ClustalW and ClustalX. *Current Protocols in Bioinformatics*, Chapter 2.
- Van Gelder, R.G. 1977. Mammalian hybrids and generic limits. *American Museum Novitates* 2635:1–25.
- Whittaker, D.J., N. Ting, and D.J. Melnick. 2006. Molecular phylogenetic affinities of the simakobu monkey (*Simias concolor*). *Molecular Phylogenetics and Evolution* 39(3):887–892.
- Wood, T.C. 2008. *Animal and Plant Baramins*. CORE (Center for Origins Research) Issues in Creation 3:1–258.
- Wood, T.C. 2010. Baraminological analysis places *Homo habilis*, *Homo rudolfensis*, and *Australopithecus sediba* in the human holobaramin. *Answers Research Journal* 3:71–90.
- Wood, T.C. 2016. An evaluation of *Homo naledi* and “Early” *Homo* from a young-age creationist perspective. *Journal of Creation Theology and Science B: Life Sciences* 6:14–30.

**amazon**smile  
You Shop. Amazon Gives.



**Help support the  
Creation Research Society  
while you shop!**

**Amazon donates 0.5% of your eligible purchases!**

1. Go to [www.smile.amazon.com](http://www.smile.amazon.com) and login to your Amazon account
2. Choose “Creation Research Society” as your charity
3. Place your order

For future orders, always go to [www.smile.amazon.com](http://www.smile.amazon.com) to place orders

**Thank you for your support!**

# Fifty-Seven Years of Creation Astronomy

## Part II: Issues and Advances

Andrew Repp\*

**Key Words:** astronomy, historical survey, fringe science, light-travel time, cosmology, stellar physics, Solar System

### Abstract

A significant quantity of creation astronomy work has appeared since the launch of *CRSQ*. A previous article analyzed the breadth and diversity of this work. The present article complements the former by examining some of the issues raised by this literature. It first notes the importance of methodological precision (e.g., mindfulness of the distinction between mixed questions and science *per se*); second, it identifies major unresolved issues (light-travel time, the cosmic microwave background, and star-formation/development); and third, it notes areas of significant progress (exploration of the light-travel time issue and a nascent young-Earth model for Solar-System history).

### Introduction

Two of the most prominent battlegrounds between mainstream- and creation-science are geology and biology; deep-time advocates appeal to the former, and neo-Darwinists, to the latter. Paleontology, occupying the intersection of the two, thus plays a significant role as well. The conflict naturally spills over into astronomy, which in some ways represents an extension of geology to the Universe as a whole. In particular, the vast distance scales of astronomy seem to

imply vast timescales as well, with many processes (including but not limited to the propagation of light) requiring millions or billions of years to occur. Thus, the application of a straightforward reading of Scripture to astronomical observations is a vital aspect of the young-Earth creation (YEC) apologetic.

Part I (Repp, 2021) surveys the astronomy efforts of the YEC community since the inception of *CRSQ*. The number of astronomy articles in creation journals exhibits vigorous and

diverse activity, comparable in quantity to that in paleontology. However, other than classifying articles into subfields, Part I largely ignores the content of these articles, making, for instance, no attempt to identify particular areas of progress or the lack thereof. To analyze such topics will involve unavoidable subjectivity; nevertheless, given more than a half-century of data, we should at least attempt to do so. Thus, this article addresses the following three questions: In which areas has creationary astronomy exhibited progress? Which major issues remain unresolved? And might any lessons be available from our own history?

Before considering these questions (in reverse order), one caveat is in order: This article does not attempt to duplicate Danny Faulkner's periodic reviews of the

\* Andrew Repp, Ph.D. mathematics; Ph.D. astronomy; arepp@clahawaii.org  
Accepted for publication August 15, 2022

state of creation astronomy (Faulkner and DeYoung, 1991; Faulkner, 1998a, 2018c, 2019ab); instead, it represents one person's attempt to answer the three questions above, making no claim to comprehensiveness. Furthermore, this article largely restricts itself to the literature surveyed in Part I, namely, *Creation Research Society Quarterly*, *Proceedings of the International Conference on Creationism*, *Journal of Creation* and predecessors, and *Answers Research Journal*.

We first examine insights to be gleaned from our own history.

## Attempting to Learn from History

### Regarding Fringe-Science Theories

One feature of creationary astrophysics in the late 70s/early 80s was its openness to what might be called fringe-science theories. We should note at the outset that some advocates of these theories made worthwhile contributions in other areas; the following discussion of their missteps (decades after the fact) should not detract from the value of their work as a whole.

At least three such categories stand out: attempts to disprove relativity, attempts to reformulate electrodynamics, and attempts (uniformly unsuccessful) to resurrect geocentrism. All three of these areas fall squarely into the realm of science *per se*, rather than reconstructive mixed questions of history. We consider each in turn.

Attacks on relativity relied heavily on arguments by relativity-skeptic Herbert Dingle (1890–1978).<sup>1</sup> Thomas G. Barnes (1911–2001) seems to have penned the first such critique in the surveyed literature; Barnes also served

for years on the editorial board of *CRSQ* and was perhaps the first to use geomagnetic decay as an argument for a young Earth (Barnes, 1971, 1973). In 1976, Barnes and Upham presented a vector theory of gravity as an alternative to general relativity (GR); the theory, to their credit, was falsifiable, predicting gravitational radiation with only a quarter of the intensity predicted by GR.<sup>2</sup> The following year, *CRSQ* published a note by Essen (1977) questioning the validity of the atomic-clock confirmations of relativity (Hafele and Keating, 1972), and a few years later, Slusher (1980)—followed by Bouw (1981)—discussed alleged problems with special-relativistic Doppler effects. As late as 1986, Ramirez Avila (1986) presented a paper at the first International Conference on Creationism (ICC) purporting to explain the precession of Mercury's perihelion without the need for GR.

However, not all creationists shared this skepticism, which may have reflected a vocal minority only; for instance, St. Peter (1974) incorporates relativity into his Big-Bang critique. The publication of *Starlight and Time* (Humphreys, 1994c), incorporating GR into a proposed distant-starlight solution, may have helped dissipate this skepticism, which thereafter seems confined to occasional letters to the editor.

The second category (revision of electrodynamics) belongs, like relativity, to physics rather than astronomy *per se*; we include it due to the relevance of electrodynamics to radiative transfer, stellar energy, stellar development, degenerate matter, etc. Barnes explicitly grounds his rejection of standard electrodynamics on his rejection of relativity

(Barnes et al., 1977),<sup>3</sup> in consequence formulating a “classical” (i.e., non-relativistic) alternative. The dependence of quantum electrodynamics (QED) on relativity entailed rejection of QED as well, yielding alternate theories for the structure of the electron (Pemper and Barnes, 1978), the proton, and the neutron (Barnes, 1980). This program seems to have culminated in an invited article (Barnes, 1984) presenting a “unified theory” to replace quantum mechanics, special relativity, and general relativity. These lines of thought continue to be promoted by the so-called Common Sense Science movement (“Common Sense Science,” 2010).

The third category is geocentrism, advocated (tangentially) in at least two *CRSQ* articles. Hanson (1978), after arguing against a Velikovsky-style realignment of the Earth's axis, presents an extended argument for geocentrism and concludes,

It is further argued that these analyses tend to discredit astronomical dating and Copernicanism and favor, respectively, ultimate dating from the Biblical testimony and geocentricity. The mathematical and textual compatibility of Joshua 10:12–14 with geocentricity is noted. (p. 68)

A later article by the same author (1981) concludes with the sentence, “This is another example of the frequent superiority of pre-Copernican astronomy over the present Copernican-evolutionary views” (p. 29).

However, these dalliances with geocentrism were vigorously challenged. The initial discussion seems to have occurred behind the scenes, as in an unpublished 1978 letter (reproduced in Bouw, 2007) from George Mulfinger to

<sup>2</sup> The theory did undergo falsification five years later, when Weisberg and Taylor (1981) calculated the gravitational radiation from the Hulse–Taylor pulsar to be within 15% of the GR prediction.

<sup>3</sup> Ironically, it was the Lorentz-invariance of classical electrodynamics which pointed Einstein toward special relativity; Maxwell's (classical) equations are inherently relativistic.

<sup>1</sup> Dingle's paradoxes depend on a fundamental misunderstanding of relativity; see, e.g., the brief explanation in Koks (2019).

Harold Armstrong and other CRS Board members. He writes, “In conclusion, I would like to protest the inclusion in the *CRSQ* of any further papers giving support to the Tychonian perspective. I believe we have gone too far already” (p. 47). More recently, the community has taken a decided stand against geocentrism; for instance, Faulkner (2001b) decisively refutes the idea, addressing the exegetical, historical, and scientific issues involved and, in the process, providing a good defense of the observational evidence for GR. Faulkner (2002ab) also ably responds to attempted rebuttals.

Furthermore, the journal editor appended a note to Faulkner’s second response stating, “The subject of geocentricity is now closed.” This decided rejection of geocentrism raises the question of why no such notes were published three decades earlier. One possible reason might involve the fact that early creation advocates were themselves continually challenging mainstream theories of neo-Darwinism (in biology) and actualism (in geology); thus they might have been amenable to—or at least reluctant to object to—challenges to other mainstream theories such as relativity, electromagnetism, and heliocentrism. If this analysis is correct, then the creation movement contains an inherent, built-in danger, namely, the temptation to give unwarranted credence to fringe theories<sup>4</sup> as a result of our own rejection of neo-Darwinism and mainstream geology. It is for this reason that the author feels it worthwhile to bring up this aspect of our history, for, if this is the case, we will continue to face this danger for the foreseeable future. Thus, even though these

4 The author is keenly aware of how ironic this sentence will sound to anti-creationists—which fact does not, of course, absolve us of the responsibility to police ourselves.

specific issues belong to the past, it is worthwhile to note the following points.

First, the distinction between science *per se* and mixed questions is essential.<sup>5</sup> The mixed questions here involve the use of scientific tools to investigate what are primarily issues of history. Attempts to address them thus require integration of both empirical science and historical reconstructions—and when this reconstruction involves Creation and the Deluge, worldview presuppositions inevitably affect the results. The repeatability of science *per se*, on the other hand, renders it much more (though not completely) robust to worldview differences. Therefore, the creation movement has typically (and wisely) accepted the conclusions of science *per se* but rejected many secular conclusions about these mixed questions. Closer attention to this distinction might have channeled some of the efforts above into more profitable directions.

Rejection of the supernatural in general (and of Biblical revelation in particular) is in large part responsible for the mainstream acceptance of neo-Darwinism and uniformitarianism. There is no such presuppositional bias affecting relativity, electrodynamics, etc.; thus, if the authors of these articles indeed had a convincing case against standard physics, the appropriate publication venue would have been the mainstream literature, not *CRSQ*. Alternatively, one could say that creation journals are for specifically *creationary* articles, whereas articles with no direct relevance to cre-

5 It is perhaps more common to express this distinction in terms of “operational science” vs. “origins (or historical) science.” The author, following Reed and Klevberg (2014ab), prefers to restrict the term “science” to investigation of “present phenomena and timeless rules of nature” and to consider issues of “origins science” as mixed questions (Adler, 1965) at the intersection of science and history.

ation should, if of sufficient quality, be publishable on their own merits in the standard journals.

Second, we should recognize a strong (and appropriate) presumption in favor of established results, arising from the fact that it is easier to mislead a few than to mislead many. (It is of course quite possible to mislead even the majority, but small groups are yet *more* amenable to error—hence the presumption in favor of established results.) It follows that weighty evidence is necessary in order to overcome this presumption. Unequivocal divine revelation certainly qualifies as the most weighty of evidence, but appeals to divine revelation should also attempt to demonstrate the influence of naturalistic presuppositions on the standard interpretation of the data. This is precisely what has occurred in the creationary rejection of neo-Darwinism. However, absent such revelation (e.g., in relativity or electrodynamics), it is difficult to find any convincing justification for rejecting the consensus view.<sup>6</sup> It is also appropriate to note that, in the field of astronomy, this presumption should breed great caution in consideration of alternative redshift interpretations—or of any far-reaching conclusions based on null results or marginal observations.

Third, and consistent with this presumption, one should beware of overly hasty presuppositional argumentation. Consider reasoning of the form, “The Bible teaches X; therefore Y cannot be true, even if observations seem to support Y.” This argument is cogent (within a Biblical worldview)—but only if Scripture indeed teaches X, and only if, in addition, X is truly incompatible with Y. In other words, rejection of a position based on Scriptural teaching requires,

6 Geocentrists would, of course, point to Scriptural passages seeming to imply a fixed Earth; see the works cited above—among many others—for demonstration of the flaws in their exegesis.

on the one hand, sound exegesis (with what degree of confidence can we hold that Scripture teaches X?) and, on the other, epistemic humility (how willing are we, if observations strongly support Y, to critically evaluate our exegetical methods, our understanding of X, our understanding of Y, or all of the above?). If we can establish a high level of confidence that Scripture indeed teaches X—and that X is indeed incompatible with Y—then presuppositional argumentation on the basis of Scripture is warranted; but if only a moderate level of confidence (that Scripture teaches X, etc.), then it is wise to question *ourselves* before seeking alternative explanations for the observations supporting Y.

This hasty presuppositionalism is evident especially in the third example above: Scripture (in context) never directly addresses heliocentrism, but geocentrists are nevertheless convinced that the consensus view is unbiblical. Consequently, they reject evidence which virtually all specialists find conclusive, and they instead treat factors of little worth as determinative. In general, the weight of an inference from Scripture depends on the solidity of the inferential process. The more numerous and tentative the deductive steps from Scripture to an inference, the more loosely one should hold that inference. And the more loosely one holds the inference, the more open one should be to contrary evidence. The fringe-science proponents seem instead to have doubled down on their inferences by dismissing the evidence.

### **A Plausible but Now-Falsified Theory**

We next consider a case in which application of (or failure to apply) these principles yielded careful (respectively, careless) handling of a more ambiguous question.

A primary challenge of creationary astronomy is to reconcile a straightforward reading of Scripture (a timescale

on the order of  $10^4$  yr.) with the natural timescales of astronomical processes (which can be on the order of  $10^{10}$  yr.). Some of these timescales are implied by the vast distances involved; others—including the timescale for stellar development—are fixed by the rate at which stars burn through their reservoir of fuel. For this reason it is unsurprising that creation scientists have investigated the possibility of alternative stellar-energy sources.

The first article (within the surveyed literature) to make such an argument (Hinderliter, 1980) claims to have predicted from young-Earth premises that the Sun's luminosity derives from Kelvin-Helmholtz contraction rather than nuclear fusion. It then adduces two pieces of observational evidence as confirmation: a decrease in solar diameter reported by Eddy and Boornazian (1979) and a deficit in the number of solar neutrinos predicted for nuclear fusion.

Steidl (1980), in a much more measured article, adds another reason to doubt the standard solar model, namely, the existence of a 160-minute solar oscillation first reported by Severnyi et al. (1976). Steidl also lists (and rejects) multiple possible explanations for the neutrino deficit but does not include the one which eventually proved correct (flavor oscillations due to neutrino mass). Commendably, the following year Steidl wrote a letter to the editor (1981) noting both the possibility of neutrino mass and the fact that transits of Mercury gave no evidence for solar contraction. He then concludes, "Perhaps the sun is burning hydrogen after all. In both cases only time will tell what the ultimate outcome will be and its importance to creationism." Despite this caution, the author remembers hearing the solar-contraction argument (without appropriate qualification) more than once during his youth.

In 1989, DeYoung and Rush took a careful and sober look at this suite of arguments. They note, first, that mea-

surements of solar diameter during the intervening decade did not confirm the results of Eddy and Boornazian; second, that the claimed rate of contraction was two orders of magnitude greater than that required for Kelvin-Helmholtz luminosity; and third, that the temperature and pressure at the Sun's core would in any case induce fusion. They also note the uncertainty of the solar neutrino question as well as the fact that many scientists disputed the existence of the 160-minute solar oscillation. Recognizing the distinction between science *per se* and mixed questions, they write, "The question we are addressing, however, is not one of origins but one of operation. . . . We can say only that the sun *may* be shrinking, not that it definitely is" (p. 51, emphasis in original).

As it turned out, the 160-minute oscillation was explained that same year as an atmospheric effect (Elsworth et al., 1989), and more-recent space-based missions have confirmed its artifactual nature (e.g., Appourchaux and Pallé, 2013). Final resolution of the neutrino question had to wait almost another decade; researchers at Super-Kamiokande published the first observational evidence of flavor oscillation in atmospheric neutrinos (Fukuda et al., 1998), and a few years later the Sudbury Neutrino Observatory established this flavor oscillation as the cause of the solar neutrino deficit (Ahmad et al., 2001). Newton (2002) in turn reported these results in the creation literature. The last article in the surveyed literature advancing this suite of arguments (160-minute oscillation and neutrino deficit) seems to have come in 2003, with a subsequent rebuttal by Faulkner and Samec (2004). Ironically, helioseismology—the use of solar oscillations to probe the sun's structure—now provides an important window into the solar interior (e.g., Basu, 2016); asteroseismology applies the same techniques to other stars (e.g., García and Ballot, 2019). Both helio- and asteroseismology have in general

confirmed (while refining) the standard understanding of stellar structure and operation.

The purpose of this review is most emphatically *not* to castigate creation researchers for considering a model which turned out to be wrong. In fact, creation researchers were not the only ones interested in these observations: one of the motivations for space-based solar observatories was the desire to investigate possible oscillatory g-modes<sup>7</sup> (Appourchaux and Pallé, 2013, p. 126). Given the potential implications of an alternative solar-energy source, it would arguably have been irresponsible for the creation community *not* to have investigated this possibility. Given the data available at the time, the problem was not with the argument itself but with how some voices presented it. Mindfulness of the fact that the operation of the Sun is a matter of science *per se* (not a mixed question), recognition of the presumption carried by accepted results, and implicit rejection of hasty presuppositionalism (Scripture does not deal with specifics of solar operation) caused some writers to advance and evaluate the argument with appropriate caution. Others, however, did the opposite.<sup>8</sup> As events later proved, the caution was wise.

## Major Unresolved Issues

The remainder of this article focuses on a few major issues—some of which remain unresolved and some of which have witnessed significant progress. We begin with three unresolved areas, namely, light-travel time, cosmology, and stellar physics.

<sup>7</sup> The 160-minute oscillation would have been a g-mode.

<sup>8</sup> E.g., “it is clear that we have witnessed a *major scientific defeat for evolutionism*” (emphasis in the original).

## Light-Travel Time

Cosmological distance indicators provide the greatest potential discrepancies with a 10-kyr. timescale; however, the distance even to the center of our Galaxy is well over 20,000 light-years, so that even galactic astronomy must contend with light-travel time. We defer a complete analysis of light-travel time to a future series of articles; here we note that most debate has involved four proposals.

The first is in-transit creation of light, usually in the context of mature-creation considerations. For many (including the author), this solution was the first to come to mind upon awareness of the issue. Its first explicit appearance in the surveyed literature seems to be Akridge (1979), whose argument is however flawed on physical grounds (Lorentz, 2019). The past twenty years have seen at least two valuable discussions of the issue by Justin Taylor (2005) and Donald DeYoung (2010). Taylor notes that the travel-time issue affects not only light but also matter (e.g., jets from active galaxies would require in-transit creation), and he argues that the in-transit proposal represents a dismissal of the problem rather than an explanation. (See further discussion in Taylor, 2006.) DeYoung on the other hand presents a thoughtful defense of the proposal, arguing that it has been too quickly rejected; in further discussion (2011) he provides the following reminder: “I readily admit to not know the correct solution to how we see distant starlight in a young universe. However, I fear that technical efforts to solve this problem have the potential to diminish the doctrine of supernatural creation.” Whether one adopts the in-transit solution or not, the discussion reminds us that Creation was a manifestly supernatural event and that we therefore we should beware of giving preference to naturalistic explanations.

The second major proposal involves decay in the speed of light.

Harris (1978) provides one of the first arguments of this type, suggesting an initially infinite speed of light, with a finite-speed zone propagating outward from the Earth at the time of the Fall. Others, most notably Setterfield (Norman and Setterfield, 1987), proposed a decay extending to modern times, discernable by careful analysis of historical measurements. However, a general consensus has emerged (see e.g., Chaffin, 1992) that the purported evidence for such decay is artifactual in nature.

A third proposal involves differential time flow, the most prominent variant being Humphreys’ relativistic time dilation (1994a, 1994b, 1994c). This theory has incited vigorous discussion, with no consensus apparent. Byl (1997) for instance argues against it on mathematical grounds (see response in Humphreys, 1997), as do Conner and Page (1998, 2000) (responses include Humphreys, 1998, 2000). Taylor (1996) on the other hand—as well as Anderson (2017)—take issue with the exegesis inspiring the model. A more recent proposal (Dennis, 2018), somewhat akin to Humphreys’ in its explicit appeal to GR, explains the travel-time disparity as the result of a specific set of initial conditions.

A fourth proposal (Anisotropic Synchrony Convention, or ASC) originated with Newton (2001), and recent advocates include Tenev et al. (2018). Careful treatments of ASC present it as a redefinition of time coordinates: the fourth day of Creation at any given point in space is *defined* as the moment when light—which would eventually reach Earth on the fourth day—arrived at that point from distant objects. (The name of the proposal expresses this understanding.) Other treatments seem to suggest an actual *physical* anisotropy in the propagation of light (i.e., that the “one-way speed of light” toward Earth is infinite)—which would seem con-

clusively ruled out by electromagnetic theory.<sup>9</sup>

This short list does not exhaust the discussion of light-travel time. Many other proposals exist (some of which the author believes have great merit) but discussion of them falls outside the scope of this article. Instead we note again the potential issue of seeking physical, naturalistic solutions in the context of supernatural creative activity. This is not to advocate retreat to mystery—for God has chosen to reveal these data (distant galaxies, etc.), presumably for us to analyze, not ignore. Nevertheless, we do well to remember that certain processes, operative during Creation Week, ceased on the seventh day (Genesis 2:2–3).

### Cosmology

In the field of cosmology, creation science has essentially played defense, in one case effectively making a prediction subsequently falsified by observations. Upton (2011) lists multiple observed phenomena explained by standard cosmology but not (yet) by creationary models, concluding, “much work still needs to be done” towards building a model which combines explanatory power with faithfulness to Scripture.

One salient example of such unfinished work is the interpretation of the cosmic microwave background (CMB); though it was detected in 1964 (Penzias and Wilson, 1965), there is no creationary consensus on its origin. Akridge et al. (1981) attempt to explain it as dust radiation, a proposal decisively refuted by Steidl (1983) and Faulkner (2014b). However, there is still no generally

accepted explanation for the CMB in a creationary framework: for instance, Humphreys (1994b) explains it as relict light from the first day, whereas Faulkner (2016) explains it as blackbody radiation from a water boundary (“the waters above”).

The situation worsens when we consider the power spectrum of the CMB—that is, the patterns exhibited by its minute temperature variations (anisotropies). As Upton (2011) notes, standard cosmology successfully predicted the major features of this spectrum as early as 1970 (Peebles and Yu, 1970). In opposition, at least one creation writer (Bouw, 1982) used the non-detection of this spectrum as an argument against standard cosmology.<sup>10</sup> Note that this line of argument constitutes an implicit prediction that the standard-cosmology power spectrum would *not* be detected in the future, for if non-detection supports a creation model, a detection would do the opposite.

The COsmic Background Explorer (COBE) satellite made the first reliable measurements of the anisotropy spectrum (Smoot et al., 1992; Bennett et al., 1996). In the creation literature, Mehlert (1994) accepted the anisotropies as real but noted that they were smaller than expected. Rushing (1995) claimed that the detections were statistical artifacts, “questionable to anyone who knows how the original data was processed.” Even after the subsequent, quite robust detection by the Wilkinson Microwave Anisotropy Probe (WMAP) (Bennett et al., 2003), one writer continued to argue that the COBE results were not real, and another called the WMAP results “smoke and mirrors.” The yet more detailed CMB mapping by *Planck* (Planck Collaboration et al., 2014) seems to have laid to rest the

idea that these anisotropies are artificial. However, there has been little if any attempt to explain them within a creation framework.

On the positive side, various writers have done the community a great service by addressing certain misconceptions. For instance, Faulkner summarizes evidence that the Universe is indeed expanding (2018b) and that redshifts (including quasar redshifts) are reliable distance indicators (2018ab); he also debunks the use of supernova remnants as indicators of a young galaxy (2017a). Likewise, DeYoung (2000) and Faulkner (2017b) present evidence for the existence of dark matter. Such work is absolutely essential to prevent wasted effort on hypotheses already precluded by observation.

### Stellar Physics

Stellar physics is a third unresolved area. On the one hand, the standard model of stellar development<sup>11</sup> reflects seemingly well-understood physics (noted by Faulkner and DeYoung, 1991). However, this physics also predicts the spontaneous formation of stars when gas clouds reach a critical density (e.g., Carroll and Ostlie, 2007).<sup>12</sup> Many creationists reject the latter, and thus they are open to skepticism about the former.

Creationist rejection of star formation proceeds on several bases. Some are physical: Mulfinger (1970) for instance argues that star formation would decrease entropy and thus violate the second law of thermodynamics. However, Faulkner (2001a) notes that this argument would disallow *any* radiative cooling whatsoever and in fact neglects

<sup>9</sup> For instance, a physically infinite  $c$  in one direction would require a zero  $\epsilon_0\mu_0$  in that direction, making either Coulomb’s Law or Ampere’s Law wildly anisotropic as well. A mere coordinate redefinition—Newton’s original proposal—would not suffer from this problem.

<sup>10</sup> The author remembers hearing an oral presentation of the same argument sometime in the late 80s/early 90s.

<sup>11</sup> Usually termed “stellar evolution,” though it has little in common with Darwinism.

<sup>12</sup> See also, in the creation literature, the recent exposition of the Jeans Criterion by Faulkner (2021).

the entropy increase of the environment.<sup>13</sup>

Other objections are Scriptural, on the basis of passages such as Psalm 33:6 and Genesis 1:14–18. Little if any exegesis typically accompanies these citations. In contrast, Faulkner (2014a) notes that God's initial creation of animals and mountains precludes neither the procreation of new animals nor the formation of new mountains (by volcanism); he raises the possibility that star formation is likewise an ongoing process, initiated at creation.

Other objections seem nothing more than apologetic tactics—for if we disallow star formation, the relatively short lifetime ( $\sim 10^6$  yrs.) of hot blue stars precludes a 13-Gyr. age for the Universe. However, the physical arguments predicting star formation seem as solid as those predicting such lifetimes; if so, it is inconsistent to accept the latter but reject the former. It has also been noted (e.g., Faulkner, 2001a) that star-formation triggers (such as supernova shocks and radiative cooling from dust) require the existence of a previous generation of stars—and thus, even if we accept ongoing star formation, the origin of first-generation stars remains problematic for the naturalist.

More to the point, the apologetic potential of an argument is no measure of its validity. If we reject the conclusions of mainstream science, we should do so on the basis of solid exegesis, not dubious inference. Rejection of the physical arguments for star formation should logically entail (1) straightforward order-of-magnitude calculations demonstrating that super-Jeans molecular clouds will *not* collapse and (2) at least the outlines of a self-consistent physical stellar development model (that does not also allow star formation).

<sup>13</sup> An attempted rebuttal (in the same issue) is nonresponsive to Faulkner's main arguments.

This bar seems extremely high. On the other hand, acceptance of star formation almost forces consideration of how stellar development processes—with their Gyr.-timescales—fit into a YEC framework. It seems safe to say that there is no consensus on this issue.

## Areas of Progress

We finally turn from unresolved issues to areas of evident progress. First, despite the lack of consensus on the light-travel time issue, creationary astronomers have accomplished significant exploration of the available solution space. Given the central relationship  $c = \Delta x / \Delta t$  ( $x$  and  $t$  being distance and time, respectively), only four options seem available: (a) unconventional light speed, as in  $c$ -decay theories; (b) unconventional  $x$ , as in small curved-space models (Byl, 1998); (c) unconventional  $t$ , as in Humphreys' time-dilation model and the ASC coordinate transformation; and (d) rejection of the relationship altogether, as with in-transit creation.

Creationary astronomers have explored each of these options, in much more detail than this brief overview reflects. The actual solution is quite possibly already present in the creation literature. We now require application of observational, exegetical, and philosophical criteria to discriminate among the proposals. The task is by no means trivial—and may result in less certainty than desired—but the situation is far superior to that fifty years ago.

A second area of definite progress is our understanding of the Solar System. For decades creation writers have pointed out rotational and orbital Solar-System anomalies (Mulfinger, 1967; Whitcomb, Jr., 1967); they have also noted the uniqueness of the Earth (Armstrong, 1970), the problematic mechanism for generating planetary magnetic fields (Humphreys, 1984), the young faint Sun paradox (Faulkner,

2001c),<sup>14</sup> and the lunar recession rate (DeYoung, 1990).

However, pointing out difficulties in naturalistic origins scenarios—while necessary and valuable work (Bergman, 2020)—falls short of actually synthesizing observations within a Biblical framework (Hill, 2021). It is this area of model-building which has seen definite progress—in particular, a model for understanding Solar-System impacts in the context of a Creation–Flood framework.

Unfred (1984) seems to have penned the first article (in the surveyed literature) suggesting a link between Solar-System impacts and the Flood.<sup>15</sup> Ten years later, Spencer (1994) noted the role of catastrophism in shaping Solar-System features, and he argued in 1998 (using crater-size counts) that a similar population of impactors affected the Earth, the Moon, and Mars at the time of the Flood (Spencer, 1998ab).

Further development of the model includes Faulkner's suggestion (1999) of two distinct lunar bombardments. The first (on Day 4) would be the final stage of a divinely-directed accretion process which formed heavenly bodies such as the Moon. The same process would be responsible for the heavy cratering of many Solar-System surfaces and would correspond roughly to the Early Heavy Bombardment of mainstream theories. A second (diluvial) episode, corresponding to the Late Heavy Bombardment, would be responsible for the lunar maria and

<sup>14</sup> This seems to be the earliest discussion of the problem in the surveyed literature, though it was mentioned in an earlier article (Faulkner, 1998b). However, the author seems to recall learning about the issue much earlier, in the late 80s or early 90s.

<sup>15</sup> Note earlier discussion in Whitcomb and DeYoung (1978).

craters (astroblemes) in the terrestrial fossil record.<sup>16</sup>

A few years later came efforts—qualitative but suggestive—to interpret features on Venus and Mars as the result of accelerated radioactive decay. Baumgardner (2003) notes evidence for catastrophic subduction of the entire crust on Venus; Hill (2008) notes the relative youth and uniformity of the Venusian surface and proposes the same, initiated by accelerated decay. Likewise, Samec (2013) notes the evidence for liquid water on Mars, proposing that accelerated decay could have produced hot-spot volcanism and a temporary terraforming of the planet.

The following year, Spencer (2014), convinced of the infeasibility of assigning all cratering to the Deluge, affirmed the likelihood of a Day-4 cratering episode, with Earth being supernaturally protected while the Moon was formed from smaller objects. He reminds us that we cannot assume identical formation mechanisms for all Solar-System bodies and that a Biblical timeframe would not allow these bodies to differentiate (by purely natural processes) from an initial molten state.

As a result of these efforts, we have the beginnings of a model explaining Solar-System surface features in a YEC framework. In this model, not all Solar-System bodies were formed in the same way or at the same time—the Genesis account specifies the uniqueness of Earth in this regard—but God formed the Moon (and perhaps other Solar-System bodies) via the accretion of smaller objects on Day 4.

Accompanying this accretion was divinely directed/accelerated interior differentiation, with heavily cratered surfaces reflecting the final accretion stages. During this episode, the Earth was divinely protected—or, perhaps

more accurately, intelligent direction of the accretion kept the impactors from striking the Earth. A second catastrophic episode occurred at the time of the Flood, in which a swarm of impactors formed the lunar maria and (possibly) triggered the Deluge on Earth.<sup>17</sup> These diluvial impactors are responsible for terrestrial impact craters, often buried and/or heavily eroded. At the same time, the accelerated decay implied by the RATE results (Vardiman et al., 2005) could have initiated catastrophic resurfacing of Venus and hot-spot volcanism on Mars, temporarily producing a thick Martian atmosphere and liquid water on its surface.

Again, this brief survey is by no means exhaustive: many others have contributed related thoughts, while others have advocated alternate understandings of the data.<sup>18</sup> Nevertheless, the model outlined above seems to represent a significant convergence of thought among creationary astronomers.

Much work remains, of course, to bring this model to maturity. More quantitative results are necessary to establish its viability; in particular, without careful simulations—using, e.g., TERRA (Baumgardner, 1985; Bunge and Baumgardner, 1995) as suggested by Hill (2008)—one cannot assert with confidence that accelerated decay would produce the proposed effects on other terrestrial planets. It is promising that simulations by Baumgardner (2013) and Seely et al. (2018) demonstrate that large-object fly-by events could have produced enormous ocean currents along with significant crustal deformation. Additional work seems necessary to clarify the relationship between the diluvial impactors and the Flood itself, for if the impactors did not actually trigger the

Flood, they seem superfluous: an impactless Deluge would be quite capable of accomplishing divine judgment.<sup>19</sup> One can hope that such further work will show whether this model requires modification or replacement.

In any case, however, the development of this model over the last few decades is a significant advance in our understanding of Solar-System history in the context of the Biblical narrative.

## Conclusions

The last half-century of creationary astronomy has touched on every major subfield of the discipline and, as we have seen, has achieved some significant progress. One can hope that future work will build on these successes by attempting to discriminate among light-travel time solutions and by quantitatively testing the emerging Solar-System model.

One should not consider the unresolved issues as failures, given the utility of multiple working hypotheses (Chamberlin, 1890). Nevertheless, employment of multiple hypotheses is ultimately a means to an end, that end being accurate understanding of actual cosmohistory. Truth is not relative, and our goal is to approach that truth as closely as possible. Thus continued analysis of cosmology—including the CMB and its anisotropies—is necessary to situate these observations within a young-Earth framework, the purpose being to bring every thought captive to the obedience of Christ.

## References

CRSQ: *Creation Research Society Quarterly*  
 TJ: *The Journal of Creation* (formerly TJ and  
*Creation Ex Nihilo* (CEN) *Technical Journal*)

Adler, M.J. 1965. *The Conditions of Philoso-*

<sup>17</sup> Though accelerated decay might have been a more significant trigger.

<sup>18</sup> E.g., Oard (2009) questions the resurfacing of Venus and suggests that its coronae might be impact craters.

<sup>19</sup> Or might the opening of the “flood-gates of the heavens” include impactors?

<sup>16</sup> An exchange of letters between Spencer (2000) and Faulkner (2000) helpfully clarifies their positions at the time.

- phy*. Athenaeum Press, New York, NY.
- Ahmad, Q.R., R.C. Allen, T.C. Andersen, J.D. Anglin, G. Bühler, J.C. Barton, E.W. Beier, et al. 2001. Measurement of the rate of  $\nu_e + d \rightarrow p + p + e^-$  interactions produced by  $^8\text{B}$  solar neutrinos at the Sudbury Neutrino Observatory. *Physical Review Letters* 87(7):071301 [6 pages].
- Akridge, G.R. 1979. The mature creation: More than a possibility. *CRSQ* 16:68–72, 83.
- Akridge, R., T. Barnes, and H.S. Slusher. 1981. A recent creation explanation of the 3K background black body radiation. *Answers Research Journal* 18:159–162.
- Anderson, L. 2017. Time dilation cosmological models: Exegetical and theological considerations. *Answers Research Journal* 10:195–211.
- Appourchaux, T., and P.L. Pallé. 2013. The history of the g-mode quest. In Jain, K., S.C. Tripathy, F. Hill, J. W. Leibacher, and A.A. Pevtsov (editors). *Fifty Years of Seismology of the Sun and Stars*. Volume 478 of *Astronomical Society of the Pacific Conference Series*, pp. 125–135.
- Armstrong, H. 1970. Are there corporeal living beings outside the Earth? *CRSQ* 7:37–42.
- Barnes, T.G. 1971. Decay of the Earth's magnetic moment and the geochronological implications. *CRSQ* 8:24–29.
- Barnes, T.G. 1973. Electromagnetics of the Earth's field and evaluation of electric conductivity, current, and Joule heating in the Earth's core. *CRSQ* 9:222–230.
- Barnes, T.G. 1980. New proton and neutron models. *CRSQ* 17:42–47.
- Barnes, T.G. 1984. A unified theory of physics. *CRSQ* 21:56–62.
- Barnes, T.G., R.R. Pemper, and H.L. Armstrong. 1977. A classical foundation for electrodynamics. *CRSQ* 14:38–45.
- Barnes, T.G., and R.J.J. Upham. 1976. Another theory of gravitation: An alternative to Einstein's general theory of relativity. *CRSQ* 12:194–197.
- Basu, S. 2016. Global seismology of the Sun. *Living Reviews in Solar Physics* 13:2 [126 pages].
- Baumgardner, J.R. 1985. Three-dimensional treatment of convective flow in the Earth's mantle. *Journal of Statistical Physics* 39:501–511.
- Baumgardner, J.R. 2003. Catastrophic plate tectonics: The physics behind the Genesis Flood. In Ivey, Jr., R.L. (editor). *Proceedings of the Fifth International Conference on Creationism (technical symposium sessions)*, pp. 113–126. Creation Science Fellowship, Pittsburgh, PA.
- Baumgardner, J.R. 2013. Explaining the continental fossil-bearing sediment record in terms of the Genesis Flood: Insights from numerical modeling of erosion, sediment transport and deposition processes on a global scale. In Horstemeyer, M. (editor). *Proceedings of the Seventh International Conference on Creationism (technical symposium sessions)*, article 3 [28 pages]. Creation Science Fellowship, Pittsburgh, PA.
- Bennett, C.L., A.J. Banday, K.M. Gorski, G. Hinshaw, P. Jackson, P. Keegstra, A. Kogut, et al. 1996. Four-year COBE DMR cosmic microwave background observations: Maps and basic results. *The Astrophysical Journal* 464:L1–L4.
- Bennett, C.L., M. Halpern, G. Hinshaw, N. Jarosik, A. Kogut, M. Limon, S.S. Meyer, et al. 2003. First-year Wilkinson Microwave Anisotropy Probe (WMAP) observations: Preliminary maps and basic results. *The Astrophysical Journal Supplement Series* 148:1–27.
- Bergman, J. 2020. Thoughts on the creation model controversy. *CRSQ* 57:153–154.
- Bouw, G.D. 1981. Two problems relativity fails to explain. *CRSQ* 18:91–92.
- Bouw, G.D. 1982. Cosmic space and time. *CRSQ* 19:28–32.
- Bouw, G.D. 2007. Physicists on geocentricity. *The Biblical Astronomer* 17(120):36–52. Online at <http://www.geocentricity.com/bal/no120/physgeo.html> (accessed September 15, 2021).
- Bunge, H.-P. and J.R. Baumgardner. 1995. Mantle convection modeling on parallel virtual machines. *Computers in Physics* 9:207–215.
- Byl, J. 1997. On time dilation in cosmology. *CRSQ* 34:26–32.
- Byl, J. 1998. Minisymposium on the speed of light part III: On small curved space models of the universe. *CRSQ* 25:138–140.
- Carroll, B.W., and D.A. Ostlie. 2007. *An Introduction to Modern Astrophysics*, 2<sup>nd</sup> edition. Pearson Addison Wesley, San Francisco, CA.
- Chaffin, E.F. 1992. A determination of the speed of light in the seventeenth century. *CRSQ* 29:115–120.
- Chamberlin, T.C. 1890. The method of multiple working hypotheses. *Science* 15:92–96.
- “Common Sense Science.” 2010. CSS scientists and affiliates. <http://www.commonssencescience.net/scientists.html> (accessed September 8, 2021).
- Conner, S.R., and D.N. Page. 1998. Starlight and time is the big bang. *CEN Technical Journal* 12(2):174–194.
- Conner, S.R., and D.N. Page. 2000. Starlight—time and again. *CEN Technical Journal* 14(2):69–73.
- Dennis, P. 2018. Consistent young-Earth relativistic cosmology. In Whitmore, J.H. (editor). *Proceedings of the Eighth International Conference on Creationism (technical symposium sessions)*, pp. 14–35. Creation Science Fellowship, Pittsburgh, PA.
- DeYoung, D.B. 1990. The Earth-Moon system. In Walsh, R.E., and C.L. Brooks (editors). *Proceedings of the Second International Conference on Creationism (technical symposium sessions)*, pp. 79–84. Creation Science Fellowship, Pittsburgh, PA.
- DeYoung, D.B. 2000. Dark matter. *CRSQ* 36:177–181.
- DeYoung, D.B. 2010. Mature creation and seeing distant starlight. *Journal of Creation* 24(3):54–59.
- DeYoung, D.B. 2011. Don B. DeYoung replies. *Journal of Creation* 25(1):47.
- DeYoung, D.B., and D.E. Rush. 1989. Is the Sun an age indicator? *CRSQ* 26:49–53.
- Eddy, J.A., and A.A. Boornazian, 1979. Secular decrease in the solar diameter, 1863–1953. In *Bulletin of the American Astronomical Society*, volume 11, p. 437.

- Elsworth, Y.P., S.M. Jefferies, C.P. McLeod, R. New, P.L. Palle, H.B. van der Raay, C. Regulo, and T. Roca Cortes. 1989. The 160-minute solar oscillation: An artifact? *The Astrophysical Journal* 338:557–562.
- Essen, L. 1977. Atomic clocks coming and going. *CRSQ* 14:46.
- Faulkner, D.R. 1998a. The current state of creation astronomy. In Walsh, R.E. (editor). *Proceedings of the Fourth International Conference on Creationism (technical symposium sessions)*, pp. 201–216. Creation Science Fellowship, Pittsburgh, PA.
- Faulkner, D.R. 1998b. The young faint Sun paradox and the age of the Solar System. *Impact (ICR)* 300:i–iv.
- Faulkner, D.R. 1999. A Biblically-based cratering theory. *CEN Technical Journal* 13(1):100–104.
- Faulkner, D.R. 2000. Danny Faulkner replies. *CEN Technical Journal* 14(1):47–49.
- Faulkner, D.R. 2001a. Does the collapse of a gas cloud to form a star violate the second law of thermodynamics? *CRSQ* 38:41–45.
- Faulkner, D.R. 2001b. Geocentrism and creation. *TJ* 15(2):110–121.
- Faulkner, D.R. 2001c. The young faint Sun paradox and the age of the Solar System. *TJ* 15(2):3–4.
- Faulkner, D.R. 2002a. Danny Faulkner replies. *TJ* 16(2):81–82.
- Faulkner, D.R. 2002b. Danny Faulkner responds. *TJ* 16(1):55–56.
- Faulkner, D.R. 2014a. Are stars still forming today? *Answers* 9(2):48–49.
- Faulkner, D.R. 2014b. Comments on the cosmic microwave background. *Answers Research Journal* 7:83–90.
- Faulkner, D.R. 2016. Thoughts on the *rāqīaʿ* and a possible explanation for the Cosmic Microwave Background. *Answers Research Journal* 9:57–65.
- Faulkner, D.R. 2017a. Are old supernova remnants really missing? Re-evaluating a well-known young-Universe argument. *Answers Research Journal* 10:245–258.
- Faulkner, D.R. 2017b. The case for dark matter. *Answers Research Journal* 10:89–101.
- Faulkner, D.R. 2018a. A test for quasar cosmological redshifts. *Answers Research Journal* 11:49–56.
- Faulkner, D.R. 2018b. The case for cosmological redshifts. *Answers Research Journal* 11:31–47.
- Faulkner, D.R. 2018c. The current state of creation astronomy II. In Whitmore, J.H. (editor). *Proceedings of the Eighth International Conference on Creationism (technical symposium sessions)*, pp. 36–45. Creation Science Fellowship, Pittsburgh, PA.
- Faulkner, D.R. 2019a. An evaluation of astronomical young-age determination methods 1: The Solar System. *Answers Research Journal* 12:255–274.
- Faulkner, D.R. 2019b. An evaluation of astronomical young-age determination methods 2: Solar, stellar, galactic, and extragalactic. *Answers Research Journal* 12:329–349.
- Faulkner, D.R. 2021. A review of stellar-formation theory. *Answers Research Journal* 14:417–426.
- Faulkner, D.R., and D.B. DeYoung. 1991. Toward a creationist astronomy. *CRSQ* 28:87–92.
- Faulkner, D.R., and R.G. Samec. 2004. Helioseismology—A reply to Jonathan Henry. *CRSQ* 40:210–212.
- Fukuda, Y., T. Hayakawa, E. Ichihara, K. Inoue, K. Ishihara, H. Ishino, Y. Itow, et al. 1998. Evidence for oscillation of atmospheric neutrinos. *Physical Review Letters* 81:1562–1567.
- García, R.A., and J. Ballot. 2019. Asteroseismology of solar-type stars. *Living Reviews in Solar Physics* 16:4 [99 pages].
- Hafele, J.C., and R.E. Keating. 1972. Around-the-world atomic clocks, observed relativistic time gains. *Science* 177:168–170.
- Hanson, J.N. 1978. Gravitational attitude deflections of the Earth's axis. *CRSQ* 15:55–68, 72.
- Hanson, J.N. 1981. The Sun's luminosity and age. *CRSQ* 18:27–29.
- Harris, D.M. 1978. A solution to seeing stars. *CRSQ* 15:112–115.
- Henry, J. 2002. Star formation: Natural or supernatural? *CRSQ* 38:217–220.
- Henry, J.F. 2003. Helioseismology: Implications for the standard solar model. *CRSQ* 40:34–40.
- Hill, R. 2008. The tectonics of Venus and creation. In Snelling, A.A. (editor). *Proceedings of the Sixth International Conference on Creationism (technical symposium sessions)*, pp. 206–212. Creation Science Fellowship, Pittsburgh, PA.
- Hill, R. 2021. A Response to “Thoughts on the creation model controversy.” *CRSQ* 57:293–294.
- Hinderliter, H. 1980. The shrinking Sun: A creationist's prediction, its verification, and the resulting implications for theories of origins. *CRSQ* 17:57–59.
- Humphreys, D.R. 1984. The creation of planetary magnetic fields. *CRSQ* 21:140–149.
- Humphreys, D.R. 1994a. Biblical basis for creationist cosmology. In Walsh, R.E. (editor). *Proceedings of the Third International Conference on Creationism (technical symposium sessions)*, pp. 255–266. Creation Science Fellowship, Pittsburgh, PA.
- Humphreys, D.R. 1994b. Progress toward a young-Earth relativistic cosmology. In Walsh, R.E. (editor). *Proceedings of the Third International Conference on Creationism (technical symposium sessions)*, pp. 267–286. Creation Science Fellowship, Pittsburgh, PA.
- Humphreys, D.R. 1994c. *Starlight and Time*. Master Books, Green Forest, AR.
- Humphreys, D.R. 1997. It's just a matter of time. *CRSQ* 34:32–34.
- Humphreys, D.R. 1998. New vistas of space-time rebut the critics. *CEN Technical Journal* 12(2):195–212.
- Humphreys, D.R. 2000. Starlight and time: A response. *CEN Technical Journal* 14(2):73–76.
- Koks, D. 2019. Attacking relativity: What was Herbert Dingle's argument? Online at <https://math.ucr.edu/home/baez/physics/Relativity/SR/attacksOnRelativity.html> (accessed October 1, 2021).
- Lorentz, M. 2019. A flawed light-in-transit argument (from forty years ago). *CRSQ* 56:105–113.

- Mehlert, A. 1994. The origin of the universe: A creationist evaluation of current scientific theories. *CEN Technical Journal* 8(2):223–237.
- Mulfinger, G. 1967. Examining the cosmogonies—A historical review. *CRSQ* 4:57–69.
- Mulfinger, G. 1970. Critique of stellar evolution. *CRSQ* 7:7–24.
- Newton, R. 2001. Distant starlight and Genesis: Conventions of time measurement. *TJ* 15(1):80–85.
- Newton, R. 2002. Missing neutrinos found! No longer an ‘age’ indicator. *TJ* 16(3):123–125.
- Norman, T., and B. Setterfield. 1987. *The Atomic Constants, Light, and Time*. Flinders University, Adelaide, South Australia.
- Oard, M. J. 2009. Venus impacts are not evidence against an astronomical trigger for the Flood. *Journal of Creation* 23(3):98–102.
- Peebles, P.J.E., and J.T. Yu. 1970. Primeval adiabatic perturbation in an expanding universe. *The Astrophysical Journal* 162:815–836.
- Pemper, R.R., and T.G. Barnes. 1978. A new theory of the electron. *CRSQ* 14:210–220.
- Penzias, A.A., and R.W. Wilson. 1965. A measurement of excess antenna temperature at 4080 Mc/s. *The Astrophysical Journal* 142:419–421.
- Planck Collaboration, P.A.R. Ade, N. Aghanim, C. Armitage-Caplan, M. Arnaud, M. Ashdown, F. Atrio-Barandela, et al. 2014. Planck 2013 results. XV. CMB power spectra and likelihood. *Astronomy & Astrophysics* 571:A15 [60 pages].
- Ramirez Avila, F.S. 1986. Is the precession of Mercury’s perihelion a natural (non-relativistic) phenomenon? In Walsh, R.E., C.L. Brooks, and R.S. Crowell (editors). *Proceedings of the First International Conference on Creationism (technical symposium sessions)*, pp. 175–186. Creation Science Fellowship, Pittsburgh, PA.
- Reed, J.K., and P. Klevberg. 2014a. Beyond “origin & operation” science, Part I: Critique of OS<sup>2</sup>. *CRSQ* 50:237–251.
- Reed, J.K., and P. Klevberg. 2014b. Beyond “origin & operation” science, Part II: An alternative. *CRSQ* 51:31–39.
- Repp, A.S. 2021. Fifty-seven years of creation astronomy: Part I: A survey. *CRSQ* 58:104–112.
- Rushing, R. 1995. COBE dating. *CEN Technical Journal* 9(2):165.
- Samec, R. 2013. The Mars desert hypothesis and the Mars-RATE connection. In Horstemeyer, M. (editor). *Proceedings of the Seventh International Conference on Creationism (technical symposium sessions)*, article 43 [20 pages]. Creation Science Fellowship, Pittsburgh, PA.
- Seely, D., A.L. Bowman, N. Cho, and M.F. Horstemeyer. 2018. Finite element analysis of large-body deformation induced by a catastrophic near impact event. In Whitmore, J.H. (editor). *Proceedings of the Eighth International Conference on Creationism (technical symposium sessions)*, pp. 52–70. Creation Science Fellowship, Pittsburgh, PA.
- Severnyi, A.B., V.A. Kotov, and T.T. Tsap. 1976. Observations of solar pulsations. *Nature* 259:87–89.
- Slusher, H.S., 1980. Cosmology and Einstein’s postulate of relativity. *CRSQ* 17:146–147.
- Smoot, G.F., C.L. Bennett, A. Kogut, E.L. Wright, J. Aymon, N.W. Boggess, E.S. Cheng, et al. 1992. Structure in the COBE differential microwave radiometer first-year maps. *The Astrophysical Journal* 396:L1–L5.
- Spencer, W. 2000. Response to Faulkner’s ‘Biblically-based cratering theory.’ *CEN Technical Journal* 14(1):46–47.
- Spencer, W. 2014. Evaluating the day four cratering hypothesis. *Answers Research Journal* 7:323–329.
- Spencer, W. R. 1994. The origin and history of the Solar System. In Walsh, R.E. (editor). *Proceedings of the Third International Conference on Creationism (technical symposium sessions)*, pp. 513–524. Creation Science Fellowship, Pittsburgh, PA.
- Spencer, W.R. 1998a. Catastrophic impact bombardment surrounding the Genesis Flood. In Walsh, R.E. (editor). *Proceedings of the Fourth International Conference on Creationism (technical symposium sessions)*, pp. 553–566. Creation Science Fellowship, Pittsburgh, PA.
- Spencer, W.R. 1998b. Geophysical effects of impacts during the Genesis Flood. In Walsh, R.E. (editor). *Proceedings of the Fourth International Conference on Creationism (technical symposium sessions)*, pp. 567–579. Creation Science Fellowship, Pittsburgh, PA.
- St. Peter, R.L. 1974. Let’s deflate the big bang hypothesis! *CRSQ* 11:143–155.
- Steidl, P. 1983. Comment on the 3° microwave background. *CRSQ* 19:228–229.
- Steidl, P.M. 1980. Solar neutrinos and a young Sun. *CRSQ* 17:60–64.
- Steidl, P.M. 1981. Recent developments about solar neutrinos. *CRSQ* 17:233.
- Taylor, C.V. 1996. Waters above or beyond? *CEN Technical Journal* 10(2):211–213.
- Taylor, J.K. 2005. The speed of matter. *Journal of Creation* 19(3):91–95.
- Taylor, J.K. 2006. Justin Taylor replies. *Journal of Creation* 20(2):51.
- Tenev, T., J.R. Baumgardner, and M. F. Horstemeyer. 2018. A solution for the distant starlight problem using creation time coordinates. In Whitmore, J.H. (editor). *Proceedings of the Eighth International Conference on Creationism (technical symposium sessions)*, pp. 82–94. Creation Science Fellowship, Pittsburgh, PA.
- Unfred, D.W. 1984. Asteroidal impacts and the Flood-judgment. *CRSQ* 21:82–87.
- Upton, J. 2011. Beyond distant starlight: Next steps for creationist cosmology. *Answers Research Journal* 4:1–9.
- Vardiman, L., A.A. Snelling, and E.F. Chaffin (editors). 2005. *Radioisotopes and the Age of the Earth: Results of a Young-Earth Creation Initiative*. Institute for Creation Research, El Cajon, CA.
- Weisberg, J.M., and J.H. Taylor. 1981. Gravitational radiation from an orbiting pulsar. *General Relativity and Gravitation* 13:1–6.
- Whitcomb, J.C., and D.B. DeYoung. 1978. *The Moon: Its Creation, Form and Significance*. BmH Books, Winona Lake, IN.
- Whitcomb, Jr., J.C. 1967. The creation of the heavens and the Earth. *CRSQ* 2:69–74.

# Latent Heat Could Solve Accelerated Nuclear Decay's Heat Problem—Part II

Barbara S. Helmkamp\*

## Abstract

In Part I, a phase change for the condensed matter comprising large nuclei was proposed as a heat sink during an episode of accelerated nuclear decay, being particularly relevant to the formation of radiohalos. The proposed nuclear phase change would occur in  $^{206}\text{Pb}$  nuclei, being the final stable progeny in the  $^{238}\text{U}$  decay chain. With each cascade of decays, the latent heat for this presumed first order phase transition would be taken from (via heat transfer, generically invoked) and thereby continuously cool the radio-center's immediate environment wherein the thermal energy is deposited. Arguing by analogy with atomic/molecular systems, the plausibility of providing sufficient cooling (absorbing enough energy) by a phase change is explored: latent heat of an MeV per alpha cluster for arguably 41 alpha clusters in lead's nucleus is roughly commensurate with the 43.7 MeV of heat produced in stopping the eight alpha particles emitted in the uranium decay series. The lower entropy phase for large, unstable nuclei during accelerated decay might consist of alpha clusters as compared with primarily nucleon pairings for the normal phase. The nuclear phase change would occur with/at the switch from unstable parent isotope to stable daughter in accordance with the dependence of a hypothetical nuclear phase diagram on the decreased strength of the nuclear force (a shallower nuclear potential) for unstable nuclei characterizing an episode of accelerated decay as compared with normalcy.

**Key Words:** radiohalo, heat sink, latent heat, cooling, phase diagram, accelerated decay, uranium, polonium, nuclear decay, alpha cluster, condensed matter

\* Barbara S. Helmkamp, Ph.D. Physics, B.S. Eng. Physics, Kepler Education consortium, Parker, CO, barbara.helmkamp@gmail.com

Accepted for publication August 9, 2022

## Introduction: A Change of Phase for the Nucleus

As a novel solution to the heat problem associated with accelerating nuclear decay, herein described in the context of radiohalo production during an episode of accelerated decay, a spontaneous endothermic process, occurring inside each new  $^{206}\text{Pb}$  nucleus at the culmination of the  $^{238}\text{U}$  decay chain, is proposed. That is, an energy-absorbing phase change occurs in the newly formed lead nuclei at the radio-center thereby removing much of the heat just produced by the preceding chain of decays. The requisite latent heat for the phase change is taken<sup>1</sup> at Series' End from the adjacent rock where it is being deposited in rapid fire at a ring's radial distance away. This process is akin to an entropy increasing first-order phase transition between two condensed states of matter in (nonnuclear) chemistry like the melting of an ice cube ( $\Delta G < 0$ ,  $\Delta H > 0$ ,  $\Delta S > 0$ ), here due to an abrupt change in the nuclear force (the mean field describing the nuclear potential) when the nuclide switches (crosses over) from being unstable to being stable with the last alpha decay in the uranium series ( $^{210}\text{Po} \rightarrow ^{206}\text{Pb} + \alpha$ ). It is assumed (or asserted) that *only unstable nuclei are significantly affected by the change in the nuclear force* (residual strong force that holds the nucleus together) *responsible for accelerated decay*. That is, the phase of stable nuclei remains a condensed fluid, consistent with the Liquid Drop Model and current scientific consensus, regardless of accelerated nuclear decay, while the unstable nuclei undergoing accelerated decay find themselves in an unknown lower entropy state.

So, like ice cubes cool a beverage by heat transfer from the beverage (as the cube's surroundings) to the ice, thereby melting the cubes, *here the alpha clusters comprising an unstable nucleus undergoing accelerated decay would disassemble into nucleon pairs and sometimes dimers once they find themselves in a stable nucleus*. As a phase transition, presumed to be first-order, this would absorb its latent heat from the surroundings, both the local rock matrix and any connate water in microfractures, thereby making the radio-center (i.e., its radiation-source nuclides) also a heat sink (i.e., its end-product nuclides) *as a natural response to accelerated nuclear decay*. So, the radio-center's unstable nuclei source the alpha particle bullets, the surrounding rock matrix heats up in stopping them, and the stable lead nuclei absorb the heat.

## Parametrizing Phase Behavior

Phase behavior can be related to a factor  $\lambda$  found in the Stillinger-Weber class of potentials used in (classi-

cal) Molecular Dynamics and Monte Carlo simulations:

$$V = \sum_i \sum_{j>i} V_2(r_{ij}) + \lambda \sum_i \sum_{j \neq i} \sum_{k>j} V_3(r_{ij}, r_{jk})$$

which describes the relative weight of many-body<sup>2</sup> as compared with two-body interactions with  $V_2$  modeling a steep repulsion plus short-range attraction (e.g., Lennard-Jones<sup>3</sup> or Morse<sup>4</sup> potentials) and  $V_3$  a directional repulsion (e.g., Simple Harmonic<sup>5</sup> or Axilrod-Teller<sup>6</sup> potentials). This  $\lambda$  is sometimes called tetrahedrality because "...the anomalies in [so called] tetrahedral liquids like water and Group XIV elements [would seem to] originate from the competition of the tetrahedral order [three-body contribution] which promotes the formation of low-density and low-entropy structures, and the pair (translational) order which promotes the formation of denser phases"<sup>7</sup> (Jabes et al., 2012). Alternatively, polar liquids like water might consist of relatively long-lived chains or large rings of its polar molecules embedded in a disordered network.<sup>8</sup> In any case, the phase at a particular pressure  $P$  and temperature  $T$  as derived from a Stillinger-Weber model potential depends on the value of the non-thermodynamic parameter  $\lambda$ , giving a three-dimensional  $\lambda$ - $P$ - $T$  diagram like the one shown in Figure 1 (Akahane et al., 2016). Here the low entropy phases are BCC,  $\beta$ -tin, dc, and scI6 solids (marked by their different crystal structures), and the high-entropy phase is a liquid (i.e., condensed fluid). Notice how much of phase space ( $P, T$ ) is

2 Meaning the three-body term as next in an infinite series, with higher order terms ignored.

3  $V_2(r) = 4\epsilon \left[ \left( \frac{\sigma}{r} \right)^{12} - \left( \frac{\sigma}{r} \right)^6 \right]$  where  $r = r_{ij}$  is the interparticle distance,  $\epsilon$  is the well depth and  $\sigma$  is the particle diameter (or maximum interparticle distance); typically  $P \rightarrow P\sigma^3\epsilon$  and  $T \rightarrow k_B T/\epsilon$  for dimensionless quantities.

4  $V_2(r) = V_0(1 - e^{-a(r-\sigma)^2})$  where  $\epsilon$  is the well depth,  $\sigma$  is the equilibrium distance between particles attached by a "spring" with force constant  $k$ , and  $a = \sqrt{k/2\epsilon}$ ; let  $P \rightarrow P\sigma^3\epsilon$  and  $T \rightarrow k_B T/\epsilon$  for dimensionless quantities.

5  $V_3(\vec{r}) = \frac{1}{2}k(\theta - \theta_0)^2$  where  $\theta$  is the (acute) angle between  $\vec{r}_{ij}$  and  $\vec{r}_{ik}$  and  $\theta_0$  is the expected angle per VSEPR in covalent bonding; for example,  $\theta_0 = 120^\circ$  for a trigonal planar carbon atom.

6  $V_3(\vec{r}) = k(1 + 3 \cos \theta_{ijk} \cos \theta_{jki} \cos \theta_{kij}) / r_{ij}^3 r_{jk}^3 r_{ki}^3$  describing three-center ( $i, j, k$ ) dispersion for ionic bonding.

7 Like water ice, silicon also floats in its liquid (as do germanium, gallium, arsenic, and bismuth) corresponding to intermediate tetrahedrality, neither low like tin, nor high like carbon.

8 There is ambiguity in interpreting X-ray data for liquids because varying structures can produce similar diffraction patterns and radial distribution functions.

1 Just how the thermal energy gets into the nucleus to effect the phase change is unknown.

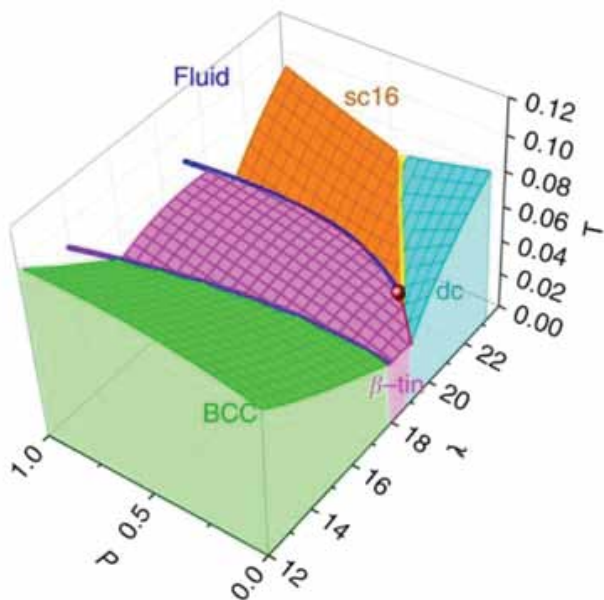


Figure 1. “The  $\lambda$ - $P$ - $T$  phase diagram. The green, pink, turquoise and orange surfaces are liquid-BCC, liquid- $\beta$ -tin, liquid-dc and liquid-sc16 coexistence surfaces...” (Akahane, 2016, Fig. 1(a), used in accordance with federal copyright fair use doctrine without implying endorsement of copyright holder).

This figure is included as a generic example from the literature of modeling phase behavior for an atomic/molecular system using a Stillinger-Weber model potential that parametrizes the interaction. Here the low-entropy phases are BCC,  $\beta$ -tin, dc, and sc16 solids (marked by their different crystal structures), and the high-entropy phase is a liquid (i.e., a condensed fluid).

subject to switching between liquid as high-entropy (everywhere above the multi-color blanket with purple trough) and a solid as lower-entropy (everywhere below it) with a change in  $\lambda$ , whether from liquid to BCC solid by its decrease or from liquid to dc/sc16 solid by its increase.

This phase-switching in relation to a parameter in the model potential is highly suggestive of how a nuclear potential with stronger many-body interactions (higher  $\lambda$ ) could mean a different phase describing the nuclei for large, unstable isotopes undergoing accelerated decay, though the precise forms of  $V_2$  and  $V_3$  would necessarily differ from those simulating so-called tetrahedral liquids in (non-nuclear) chemistry. An important difference, already acknowledged implicitly in discussing the alpha particle model of the nucleus, is the

finite number of particles involved.<sup>9</sup> While the number of particles  $\mathcal{N}$  in a molecular simulation (of say Ar or NaCl) must be large enough to rightly describe bulk behavior (with  $\mathcal{N} \rightarrow \infty$  effectively), the number of particles actually comprising the nucleus for even a large neutron-heavy isotope like  $^{206}_{82}\text{Pb}$  is quite finite where the nuclear material’s “charged molecules” are here asserted to be spin-antispin pairs with  $\mathcal{N} \sim Z$ .<sup>10</sup> Thus, the phase diagram for each isotope’s nucleus would be unique, depending not only on its  $\lambda$  but also on its particle number  $\mathcal{N}$  (and therefore its mass): not only on the relative contribution of many-body vs. two-body forces for a particular many-body configuration but also directly on the size ( $\mathcal{N}$ ) of the system.

### Insight from Helium’s Nuclear Stability

Once normalized with respect to  $\mathcal{N}$ , the nuclear material’s  $\lambda$  for a given isotope might present experimentally as the ratio between the binding energy per nucleon of the alpha particle  $^4_2\text{He}$  (7.07 MeV) and the binding energy per nucleon of the nuclide in question:

$$R = \frac{BE \text{ per nucleon of } \alpha \text{ particle}}{BE \text{ per nucleon of isotope}}$$

where  $R \equiv 1$  for the alpha particle  $^4_2\text{He}$  itself.<sup>11</sup> It is herein suggested that if  $R$  exceeds a critical value then the nucleus would be in its lower-entropy phase comprised of pre-formed alpha particles as 4-clusters of nucleons (pairs of pairs) occupying adjacent (quantum) energy levels. Interpreting  $R$  in this way necessarily excludes nuclides that are too small—like those in front of the saturation plateau on the binding energy per nucleon curve—unless they are  $4n$  ( $n$  alpha particle) nuclides like  $^{12}\text{C}$  and  $^{16}\text{O}$  with their characteristic peaks.

This critical value arguably lies near unity, between the ratios for long-lived uranium-238 on the low side and the very short-lived, surprisingly unstable beryllium-8 on the high side:  $0.93445 < R_{\text{crit}} < 1.0016$ . The half-life of  $^8\text{Be}$  is so short (8.19

<sup>9</sup> The Stillinger-Weber potential depends on  $\mathcal{N}$  through summation: the sum over  $V_2(r_{ij})$  and the double sum over  $V_3(r_{ij}, r_{jk})$ .

<sup>10</sup> This excludes the extra neutrons  $(A - Z) - Z = A - 2Z$  which might not generally form alpha clusters (though tetra-neutrons in the skin arguably do, given the fact of beta decay). For example,  $^{206}_{82}\text{Pb}$  has 42 such extra neutrons leaving 82 neutrons or 41  $n_1 n_1$  and 82 protons or 41  $p_1 p_1$  for  $\mathcal{N} \sim Z = 82$ . For  $4n$  nuclei,  $\mathcal{N} = A/2 = (2Z)/2 = Z$ .

<sup>11</sup> Here  $R$  is used instead of  $\lambda$  to avoid an overly specific connection with the Stillinger-Weber potential as it is applied to tetrahedral liquids in bulk as well as avoiding confusion with the decay constant.

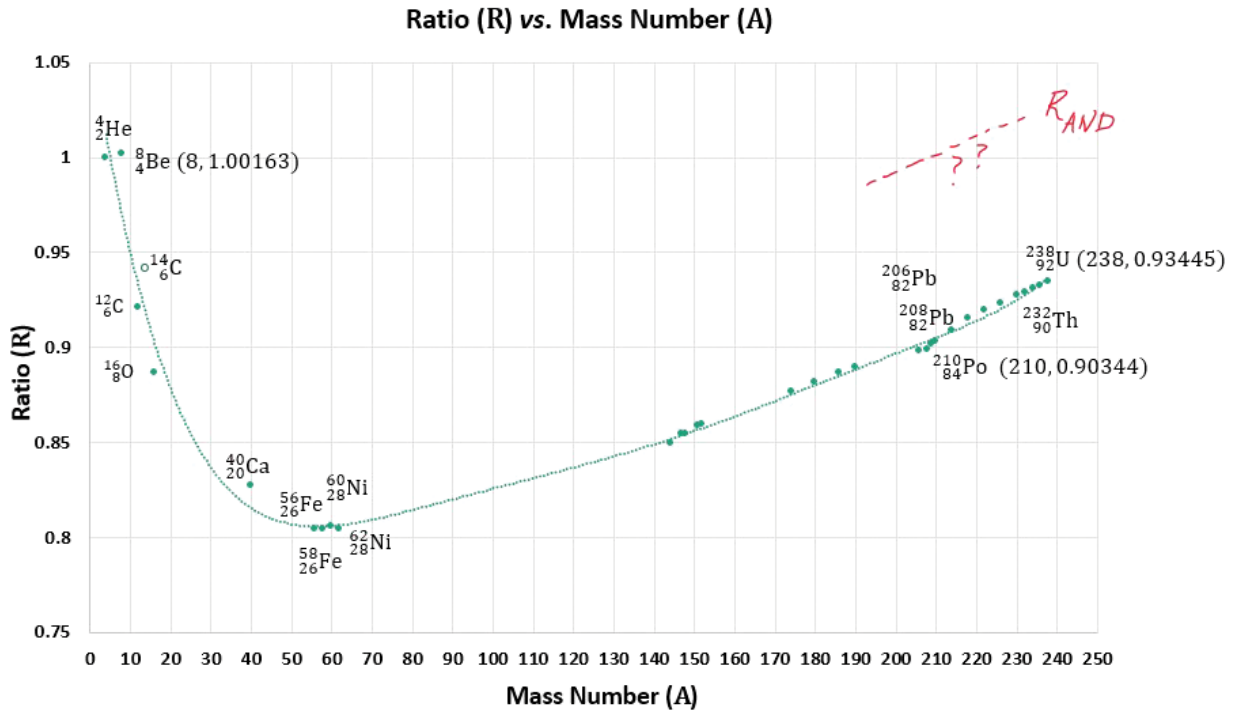


Figure 2. In this graph of the ratio  $R = \frac{BE \text{ per nucleon of } \alpha \text{ particle}}{BE \text{ per nucleon of isotope}}$  vs. mass number  $A$ , note that  $R$  lies below  $^{238}\text{U}$ 's value of 0.93445 for all the  $4n$  nuclides (except for the highly unstable  $^8\text{Be}$  and the alpha particle  $^4\text{He}$  for which  $R$  is unity by definition), and for all the stable isotopes weightier than  $^{12}\text{C}$  as well as all primordial isotopes and decay chain products that undergo alpha decay including  $^{232}\text{Th}$  and the various poloniums.

An increase in  $R$  during an episode of accelerated decay as hypothesized would push this curve upward, and a just-so increase would put its tail (after the stable isotopes of lead) above the phase-critical value at/near unity, as for the dashed red line. This cannot be a uniform translation of the curve across all  $A$  though the change in  $R$  should be similar locally.

$\times 10^{-17} \text{ sec})^{12}$  despite being a  $4n$  nuclide that it can hardly be thought of as ever being anything but two pre-formed alpha particles<sup>13</sup> so beryllium-8's  $R$  is arguably above the critical value.<sup>14</sup> On the other hand, uranium inclusions (in zircons in biotite/mica in granitic rocks) made the halos for which the

proposed phase change<sup>15</sup> must address the heat generation during accelerated decay so uranium-238's  $R$  lies below the critical value necessarily.

Note that the  $R$ -values for all the  $4n$  nuclides (except for the highly unstable  $^8\text{Be}$  and the alpha particle  $^4\text{He}$  for which  $R$  is unity by definition), and all stable isotopes weightier than  $^{12}\text{C}$ , as well as all primordial isotopes and decay chain products that undergo alpha decay including  $^{232}\text{Th}$  and all the various

12 Alpha decay width is 5.57 eV (giving  $t_{1/2} = \frac{\hbar \ln 2}{5.57 \text{ eV}} = 8.19 \cdot 10^{-17} \text{ sec}$ ), found from the Decay Radiation Search at the National Nuclear Data Center: [https://www.nndc.bnl.gov/nudat3/indx\\_sigma.jsp](https://www.nndc.bnl.gov/nudat3/indx_sigma.jsp)

13 Beryllium-8 fissions into two alpha particles though one may be considered the daughter isotope in alpha decay:  $^8\text{Be} \rightarrow ^4\text{He} + \alpha$ .

14 It is not necessary to say that  $^8\text{Be}$ 's nucleus changes phase (being too much of a stretch) but only that this small, light nuclide's four nucleon pairs really are just two unglued alpha particles.

15 The final stable daughter isotope for the thorium series is  $^{208}\text{Pb}$ , instead of  $^{206}\text{Pb}$  for the uranium series, but the same proposed cooling due to a change in phase (for the 41 bound alpha clusters) accompanying an abruptly changed  $R$ -value would apply. The long half-life of  $^{232}\text{Th}$  (14.05 Ga) means its decay, like  $^{238}\text{U}$ 's, must have been accelerated many-fold for its halos to exist within granitic plutons that intrude Phanerozoic (i.e., fossil-bearing Flood) sediments.

poloniums, lie below that of  $^{238}\text{U}$ , as shown in the graph of ratio vs. mass number (Figure 2).<sup>16</sup> Again, understand that it is meaningless, in the spirit of an alpha particle model of the nucleus, to include low mass number nuclides ( $A \lesssim 40$ ) in this graph unless they are  $4n$  ( $A = 2Z$  with  $Z$  even, or  $n$  alpha particles); obviously, the available nucleons cannot even make two alpha particles—to interact with each other—if the mass number is less than eight ( $A < 8$ ). Perhaps beryllium-8 is thus the only isotope with its nuclear material in the low-entropy state (strictly consisting of pre-formed alpha particles) under usual/natural conditions (not during an episode of accelerated decay) though it is questionable to speak of phase at all in the low- $A$  (pre-saturation) regime.

### Enter Accelerated Nuclear Decay

Chaffin modeled accelerated decay (that is, a destabilization of long-lived nuclides) by shallowing the potential seen by the alpha particle and finding that a very small change in nuclear radius and/or barrier thickness at a critical well depth can shorten the half-life by many orders of magnitude—if/when it happens that the number of nodes (zeros) in the quasi-bound wave function decreases by one (Chaffin, 2005). This is a strictly quantum effect missed by the semi-classical formula which treats the alpha particle as a Gaussian wave packet, not a quasi-eigenstate, with its energy entirely kinetic.<sup>17</sup> In other words, a Gaussian wave packet does not have countable nodes in the same sense as an eigenstate. Rather, a numerical alpha/nucleon approach to modeling alpha decay finds the potential's parameters that give a quasi-bound eigenstate,<sup>18</sup> equating this energy<sup>19</sup> to that of the escaping quasi-bound alpha particle as determined from the mass difference. But the essential idea is that a small change in the strong force, manifesting itself in

a changed potential well depth for the mean field seen by an alpha particle, would/must not appreciably affect the alpha particle's energy, thereby preserving the sizes (radii) and ordering of halo rings, per observation. And, it also would/must not otherwise affect regular chemistry (meaning the general behavior of materials) in any significant way since the Ark inhabitants survived, for one.

There is a very interesting anti-parallel in the literature wherein mainstream science (Adams and Grohs, 2016) considers what might be called *decelerated nuclear decay* (stabilization of a very short-lived nuclide) by proposing a small change in the strong force that would stabilize  $^8\text{Be}$  in an alternate universe (AU). It is implied that this would not affect regular chemistry *there* either, but only make nucleosynthesis in stars easier *there* compared to *here*. (Ironically, the hypothetical evolutionary mechanism of nucleosynthesis is thus unintentionally acknowledged as sketchy.) Interestingly, while  $^8\text{Be}$  is highly unstable in the sense that its half-life is exceedingly short ( $8.2 \times 10^{-17}$  sec), it can also be seen as barely not stable in the sense that its quasi-bound (non-negative) alpha particle's ground state energy is small (+81.8 keV). Here, a small change in one sense (slight deepening of the nuclear potential) arguably effects an infinite change in another sense (a nearly zero half-life becomes infinite). If it is scientific for the godless to ponder decelerated nuclear decay in their quest for aliens in an AU, it is no less scientific for the godly to ponder an episode of accelerated decay in the actual created universe where the Triune God who holds the nucleus together in the first place (Col. 1:17) can surely tweak His gluons for a short time. The author hereby keeps fashion with Saint Augustine in “plundering the Egyptians” (Ex. 3:22) for “Whatever has been rightly said by the heathen, we must appropriate to our uses” (*On Christian Doctrine*, Book II, Ch. 40). Thus, an episode of accelerated decay can be seen as a temporal AU of sorts, due to God's intervention rather than a fictitious contrivance of an atheistic cosmogony.

The change in the strong force causing accelerated decay and manifesting as a shallowing of the nucleon potential wells (the mean fields seen by a neutron or a proton) to varying degrees depending on the isotope, would also manifest as a shallowing of the alpha particle potential well (the mean field seen by an alpha particle), *but the effects would not necessarily be the same in degree*. So, how might the ratio  $R$  be expected to change during an episode of accelerated decay? Given that the nuclear force is itself a residue of the strong force, with alpha particles here viewed as assemblages of charged molecules (pairs of pairs) and thus secondarily residual, it seems reasonable that the numerator of this ratio:

$$R \equiv \frac{BE \text{ per nucleon of alpha particle}}{BE \text{ per nucleon of isotope}} \equiv \frac{\alpha}{I}$$

16 <https://www.wolframalpha.com/widgets/view.jsp?id=22643e4a53683c92ff1b855a0733b635>—the widget used for calculating nuclear binding energies per nucleon.

17 That is, the alpha particle freely bounces between walls of the potential with the same speed inside as out:  $v_{in} = v_{out} = \sqrt{2E_{\alpha}/m_{\alpha}}$  and  $m_{\alpha} = 4u$  where  $E_{\alpha}$  is set to the alpha particle's energy based on the mass difference between product and reactant nuclides for the nuclear decay reaction (e.g.,  $^{238}_{92}\text{U} \rightarrow ^{234}_{90}\text{Th} + ^4_2\text{He} + E_{\alpha}$ ) with the nuclide masses experimentally determined.

18 The particular solution is determined by constraining general solutions for the three regimes ( $0 < r < R_1$ ;  $R_1 < r < R_2$ ;  $r > R_2$ ) at the two tunnel boundaries.

19 This corresponds to the level spacing between a solo quasi-bound state and underlying bound state if the latter is taken to be just barely bound with  $0^-$  energy.

(where  $BE$  stands for binding energy) would decrease less in relative terms than its denominator; that is, that the attraction between nucleon pairs, strong as it is, would weaken less than the attraction or “bond” between nucleons, also in relative terms. In other words, the more residual the force, the smaller the net effect at the top from a change at the bottom, so to speak. Let the ratio of the alpha particle’s binding energy per nucleon to a particular isotope’s binding energy per nucleon during the Flood-Year episode of Accelerated Nuclear Decay (AND) be:

$$R_{AND} = \frac{\alpha_{AND}}{I_{AND}}$$

Then write numerator and denominator in terms of the normal (non-AND) values, as follows:

$$\alpha_{AND} = \alpha - (\alpha - \alpha_{AND}) = \alpha - \Delta\alpha < \alpha$$

$$I_{AND} = I - (I - I_{AND}) = I - \Delta I < I$$

where  $\Delta\alpha = |\Delta\alpha| \geq 0$  and  $\Delta I = |\Delta I| \geq 0$ , being defined for a change in the strong force that shallows the potential wells. For small relative changes with  $\frac{|\Delta\alpha|}{\alpha} < \frac{|\Delta I|}{I}$ , it follows that:

$$\begin{aligned} R_{AND} &= \frac{\alpha}{I} \left(1 - \frac{\Delta\alpha}{\alpha}\right) \left(1 - \frac{\Delta I}{I}\right)^{-1} \approx \frac{\alpha}{I} \left(1 - \frac{\Delta\alpha}{\alpha}\right) \left(1 + \frac{\Delta I}{I}\right) \\ &= R \left(1 + \frac{\Delta I}{I} - \frac{\Delta\alpha}{\alpha} - \frac{\Delta I \Delta\alpha}{I \alpha}\right) \approx R \left\{1 + \left(\frac{\Delta I}{I} - \frac{\Delta\alpha}{\alpha}\right)\right\} > R \end{aligned}$$

This increase in  $R$  for long-lived isotopes experiencing accelerated decay and thus (further) destabilizing, is consistent with beryllium-8’s high ratio ( $R > 1$ ) when seen as two marginally connected alpha particles.

In effect, during the accelerated decay episode, the distinctive peak for helium in the binding energy per nucleon vs. mass number curve would likely reach all the way up to the saturation plateau (~8.8 MeV) rather than falling short (7.1 MeV) as it does under normal conditions (not during an episode of accelerated decay). On the other hand, the opposite scenario with a shortened helium peak in the binding energy curve and:

$$R_{AU} = \frac{\alpha_{AU}}{I_{AU}} < R$$

might describe that hypothetical AU where beryllium-8 is stabilized (i.e., for a change in the strong force that deepens the potential wells) and  $\frac{|\Delta\alpha|}{\alpha} < \frac{|\Delta I|}{I}$  for  $\Delta\alpha = -|\Delta\alpha|$  and  $\Delta I = -|\Delta I|$ .

Assume that uranium-238’s new ratio during an episode of accelerated decay exceeds the phase-critical value ( $R_{AND}$

$> R_{crit}$ ), thus indicating a lower-entropy phase for its nuclear material characterized by pre-formed alpha particles with  $P \approx 100\%$  vs. something like  $2\% \lesssim P \lesssim 20\%$  (Duarte and Siegel, 2010). Conceivably, this would eliminate the hindrance to pre-formation characterizing the higher-entropy (less-structured?) phase, thereby accelerating decay over Chaffin’s node-change acceleration by some factor. Chaffin’s modeling shows up to eight orders of magnitude decrease in half-life (Chaffin, 2005, p. 532) so adding this effect could net the nine needed for U-halos and Po-halos to form simultaneously in a matter of days. Coming at this from the other side suggests the same effect: when variant modeling gets other things right (e.g., energy levels and electromagnetic moments) but drastically overpredicts half-lives, as for extremely short-lived isotopes like polonium-212 ( $t_{1/2} = 299$  ns), an “extended shell model” that incorporates an hypothesized surface alpha clustering “find[s] a great amount of enhancement (three orders of magnitude) in the calculated alpha decay width”<sup>20</sup> (Tonozuka and Arima, 1979, p. 46).

Now suppose that the new ratios for all successive unstable daughters in the decay series (whether uranium or thorium) also exceed the phase-critical value *until the final stable daughter product is reached at which point  $R$  has dropped below this value*, since stable nuclides are presumed to be unaffected by accelerated decay in all essentials. The hypothesized increase in  $R$  during an episode of accelerated decay would push the ratio vs. mass number curve upward, and a just-so increase would put its tail (after the stable isotopes of lead) above the phase-critical value at/near unity (Figure 2). The large unstable nuclei including  $^{238}\text{U}$ ,  $^{232}\text{Th}$ ,  $^{210}\text{Po}$ , etc., would thus be in the hypothetical lower-entropy phase while undergoing accelerated decay. *The ensuing Chain’s End phase change would thus cool each halo from the inside out, one lead nucleus at a time, concurrent with the halo’s formation*, by taking from the immediate environment the latent heat for each newly formed lead nucleus to resume its normal (higher-entropy) state.

Importantly, this idea must assume there would be no heat exchange (no thermodynamical considerations) directly associated with the miraculous turning on/off of accelerated decay, only the heat produced indirectly, when the decay products are slowed to a stop in the rocks, followed by the cooling at Decay Chain’s End occurring naturally during the (miraculous) episode of accelerated decay, as described. In other words, the affected unstable nuclei just find themselves in the lower-entropy state consistent with the supernaturally changed strong force, not unlike like Lazarus found himself undead miraculously, without any consideration of the ther-

<sup>20</sup> Enhancing decay width (from scattering theory), like increasing decay rate, means half-life decreases.

modynamics of his abrupt switch to the much lower-entropy state of being alive vs. dead. Likewise, the cooling effected by the lead's nuclear phase change being a natural outcome under special circumstances is like when the resurrected Lazarus died a second time, and (again) his body would have stunk in the tomb (Jn. 11:39) in keeping with thermodynamics (Second Law) and the local climate.

To quantify the thermal energy involved requires knowing how many alpha particles (alpha clusters) are potentially present within the stable lead-206 "core" of the decaying uranium series nucleus, being in the low-entropy state with quasi-bound alpha particles spilling (or furiously tunnelling) out. Having 42 excess neutrons, about 20 of which form the neutron skin, there remain 41 pairs of neutrons and 41 pairs of protons ( $42 + 4 \times 41 = 206$ ) to form 41 alpha clusters. From the nuclear surface inward (geometrically and energetically), think quasi-bound protons and resonant neutrons with small positive energies, then bound nucleons with increasingly negative energies, filling separate neutron and proton wells per the nuclear shell model for a nucleus in its ground state, as shown (Figure 3) for  $^{238}\text{U}$  with its stable  $^{206}\text{Pb}$  core.

Necessarily, the order of decays<sup>21</sup> is preserved during the episode of accelerated decay which also means tunneling occurs one alpha particle at a time; however, rapidly successive decays might occur.<sup>22</sup> Thinking in terms of a liquid droplet for the nucleus, only the alpha particle *residing on/at the surface*<sup>23</sup> can escape by evaporation, corresponding to the outermost quasi-bound level(s)/orbital. In effect, pre-formed alpha particles that are lower in the quasi-bound line-up, having smaller positive energies (so less unstable in the energy sense), cannot get out and away for lack of access to the surface. Thus, each decay can only be said to have a half-life (quantifying instability in the time sense) once its immediate parent is *in being* at which point the new outermost level corresponds to the new outgoing alpha particle. As previously stated, the general trend through a decay series has  $E_\alpha$  increasing (and half-life decreasing), though there can be hiccups, as apparent from the outermost ring (most energetic alpha particle) of a U-halo corresponding not to  $^{210}\text{Po}$  as last in the chain but to  $^{214}\text{Po}$ . Barring such hiccups, the *increase* in the top-level energy with successive alpha decays, reflected in increasing halo ring radii, derives from the reduced well depth<sup>24</sup> with each decay

21 For uranium-238:  $\alpha, \beta\beta\alpha, \alpha, \alpha, \alpha, \beta\beta\alpha, \beta\beta\alpha$ .

22 Thus, there is no tunneling probability overlap across alpha particles.

23 The conceptual surface of the nucleus per the Liquid Drop Model is not the same as the experimentally-based neutron skin.

24 Where neutrons and protons as spin-antispin pairs ( $n_\uparrow n_\downarrow$  and  $p_\uparrow p_\downarrow$ ) fill separate wells and the neutron well is significantly deeper

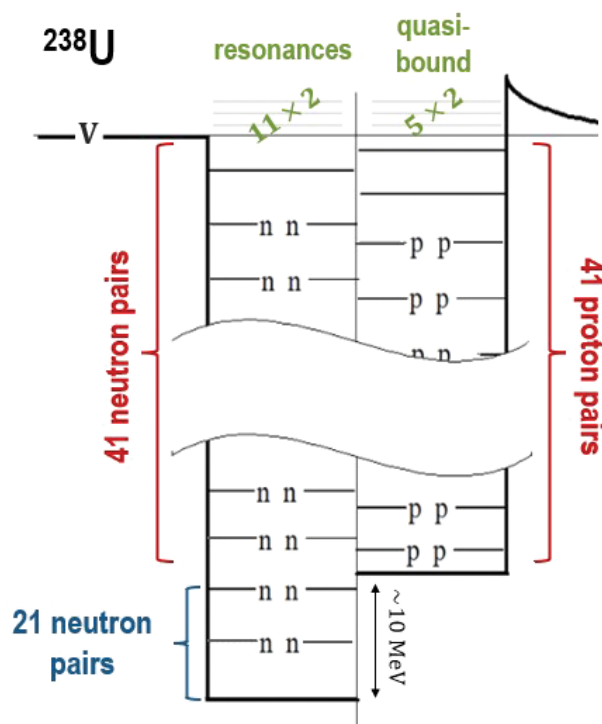


Figure 3. Schematic depiction of uranium-238 during accelerated nuclear decay, hypothesizing as unbound all decay products in the uranium series. From the nuclear surface inward (geometrically and energetically), think quasi-bound protons and resonant neutrons with small positive energies, then bound nucleons with increasingly negative energies, filling separate neutron and proton wells per the nuclear shell model for a nucleus in its ground state, as shown schematically for  $^{238}\text{U}$  with stable  $^{206}\text{Pb}$  core.

as the nucleus gets smaller (mass number decreases)<sup>25</sup> while the half-lives (decay rates) during accelerated decay collapse to within a few orders, if not the same order, of magnitude in *flagrant noncompliance* with Geiger-Nuttall; that is,

$$t_{1/2} \propto \left(10^{\frac{1}{\sqrt{E_\alpha}}}\right)^{aZ} \quad \text{or} \quad \lambda \propto r^c$$

for neutron-heavy nuclides.

25 Nuclear decay differs from ionization where removing an outermost electron only nominally affects eigenvalues because the changed neutron and proton counts that result from decay (alpha or beta) is analogous to changing the atom's  $Z$  (with  $E_n = -\frac{(k_e e^2)^2 m_e Z^2}{2\hbar^2 n^2} \approx -13.6 \frac{Z^2}{n^2} \text{eV}$ ) as well as losing the electron.

where  $t_{1/2}$  and  $\lambda$  are half-life and decay rate respectively,  $r$  is the alpha particle's range in air (or radius in a radiohalo), and  $a, c$  are positive constants for a given medium and parental  $Z$ .

It is an interesting exercise (Figure 4) to place the 146 neutrons and 92 protons for  $^{238}\text{U}$ , by spin-antispin pairs (11), in their respective nuclear shell model energy levels/states, per the usual filling rules<sup>26</sup> (Meyerhof, 1967, p. 56), with the well of neutrons starting deeper enough to top out the same as the proton well for the stable core isotope  $^{206}\text{Pb}$  (with its 124 neutrons and 82 protons), leaving 22 neutrons and 10 protons to occupy resonances or quasi-bound states (for neutrons or protons, respectively) where these 32 nucleons with positive energies (the green boxes) are the 8 alpha particles and 10 beta particles loosed in the uranium-238 decay chain. This suggests which nucleon pairs, having similar energies (a common hybrid orbital?), might organize into as many as 41 bound alpha particles (or alpha clusters), above the 21 neutron pairs (the blue boxes) at the bottom.

Cooling that is commensurate with the 43.7 MeV of heat from friction produced by stopping the eight alpha-particle "bullets" in the uranium series (or 37.5 MeV for stopping six alphas in the thorium series)<sup>27</sup> would thus be about an MeV of latent heat per alpha cluster in lead's nucleus. While about 20% more cooling is needed if the beta decays are included,<sup>28</sup> less is needed if the adiabatic heating assumption is relaxed somewhat (i.e., some of the heat dissipates) suggesting that about an MeV per alpha particle of latent heat is still enough cooling to avoid halo-loss and/or allow halo formation; that is, to keep from exceeding the halo-bearing rock's annealing temperature, recalling that, without cooling, the temperature

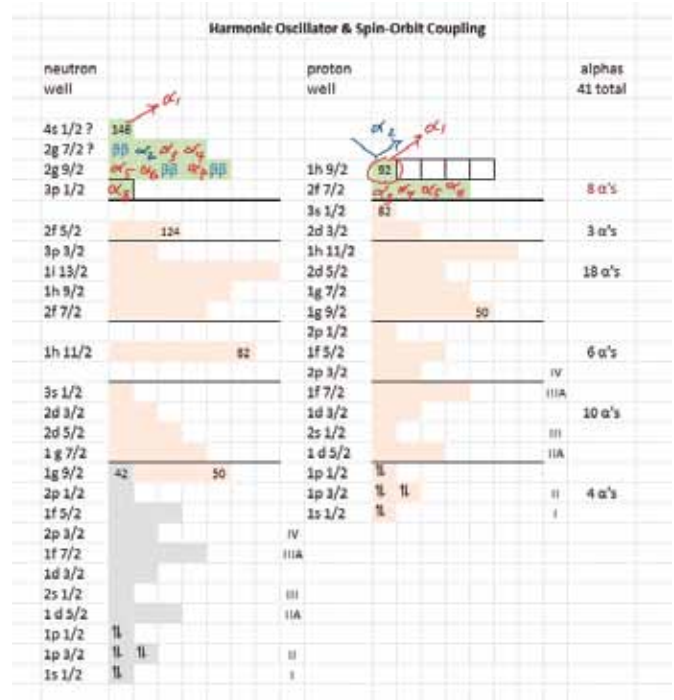


Figure 4. Placing the 146 neutrons and 92 protons for  $^{238}_{92}\text{U}$  by pairs in their respective Nuclear Shell Model levels per the usual filling rules for the Harmonic Oscillator with Spin-Orbit Coupling suggests which nucleon pairs, having similar energies, might organize into as many as 41 bound alpha particles (the red boxes) for  $^{206}_{82}\text{Pb}$ , lying below the 22 neutrons and 10 protons destined to escape (the green boxes) but above the 21 neutron pairs (the blue boxes) on bottom.

26 For the 3-D harmonic oscillator potential with spin-orbit coupling: 1<sup>st</sup> shell has 2 states ( $n=0, j=1/2$ ); 2<sup>nd</sup> shell has 6 states ( $n=1, j=1/2$  or  $3/2$ ); 3<sup>rd</sup> shell has 12 states ( $n=2, j=1/2, 3/2$  or  $5/2$ ); 4<sup>th</sup> shell has 8 states ( $n=3, j=7/2$ ); 5<sup>th</sup> shell has 22 states ( $n=3, j=1/2, 3/2$  or  $5/2$ ;  $n=4, j=9/2$ ); 6<sup>th</sup> shell has 32 states ( $n=4, j=1/2, 3/2, 5/2$  or  $7/2$ ;  $n=5, j=11/2$ ); 7<sup>th</sup> shell has 44 states ( $n=5, j=1/2, 3/2, 5/2, 7/2$  or  $9/2$ ;  $n=6, j=13/2$ ); 8<sup>th</sup> shell has 58 states ( $n=6, j=1/2, 3/2, 5/2, 7/2, 9/2$  or  $11/2$ ;  $n=7, j=15/2$ ).

27 The beta particle travels much farther from the parent nucleus than does the 8000-times-heavier alpha particle. Thus, for the sequential pairs of beta decays in the uranium and thorium chains, the heat produced in stopping the beta particles is largely deposited outside the sphere of the halo. For energetic betas ( $> 2$  MeV), the stopping distance in water is about a centimeter vs.  $90 \mu\text{m} < 0.01$  cm for the largest ring's alpha at 8.8 MeV (for  $^{212}\text{Po} \rightarrow ^{208}\text{Pb} + \alpha$  in the thorium series), using NIST's database at: <https://www.nist.gov/pml/stopping-power-range-tables-electrons-protons-and-helium-ions>

28 Energy totals ( $\alpha + \beta$ ) are 51.7 MeV for the uranium series and 42.6 MeV for the thorium series.

rise for one uranium halo is enormous (thousands of degrees Celsius). While uranium halos, in parenting polonium halos (per the transport model), do thereby lose some of their coolant, so to speak, they also generate commensurately less heat, with a subset of their most energetic alpha particles (the polonium emissions) being displaced to new radio-centers;<sup>29</sup> that is, the uranium radio-center does not fully contain its progeny due to parenting polonium halos. Thus the coolant, or heat sink, is located precisely where it is needed, whether at the radio-center for a U-halo or a Po-halo.

29 The  $43.7 \approx 44$  MeV for all 8 alpha decays divides into 19 MeV for the first four decays ( $^{238}\text{U}, ^{234}\text{U}, ^{230}\text{Th}, ^{226}\text{Ra}$ ), 6 MeV for the escapee ( $^{222}\text{Rn}$ ) decaying in transit, and 19 MeV for the last three decays ( $^{218}\text{Po}, ^{214}\text{Po}, ^{210}\text{Po}$ ).

For comparison to a tentatively analogous phase change,<sup>30</sup> consider sodium chloride's latent heat of de-fusion per formula unit NaCl vs. its lattice energy (the energy released when gaseous ions unite into the lattice) in relation to what might be a corresponding quantity for nuclear material:

$$\frac{+0.2897 \text{ eV}}{-8.02 \text{ eV}} = \frac{T\Delta S}{-28.296 \text{ MeV}}$$

where the lattice energy for the nuclear material is taken to be the alpha particle's binding energy. This gives  $\Delta H = T\Delta S = 1.0 \text{ MeV}$ ; that is, about an MeV per alpha particle. Or, since anion and cation correspond to nucleon pairs for this analogy, the lattice energy for the nuclear material might be the alpha particle's binding energy minus the energy bound up in two deuterons:<sup>31</sup>  $-28.296 \text{ MeV} - 2(-2.225 \text{ MeV}) = -23.846 \text{ MeV}$ . Then the relation becomes:

$$\frac{+0.2897 \text{ eV}}{-8.02 \text{ eV}} = \frac{T\Delta S}{-23.846 \text{ MeV}}$$

giving  $\Delta H = T\Delta S = 0.86 \text{ MeV}$ ; that is, about an MeV per alpha particle. Alternatively, consider sodium chloride's latent heat of melting (de-fusing) per formula unit vs. its latent heat of de-vaporization (half its lattice energy)<sup>32</sup> in relation to two options for the corresponding quantity for the nuclear material:

$$\frac{+0.2897 \text{ eV}}{\frac{1}{2}(-8.02 \text{ eV})} = \frac{T\Delta S}{-5.909 \text{ MeV}} \quad ;$$

$$\frac{+0.2897 \text{ eV}}{\frac{1}{2}(-8.02 \text{ eV})} = \frac{T\Delta S}{-6.865 \text{ MeV}}$$

This being the difference between a saturation value for the binding energy ( $BE$ ) per quad of nucleons<sup>33</sup> and the alpha particle's  $BE$  of 28.296 MeV. For  $^{40}\text{Ca}$  as the largest stable  $4n$  nuclide:  $BE \div \left(\frac{A}{4}\right) - BE_\alpha = 342.05 \text{ MeV} \div 10 - 28.296 \text{ MeV} = 5.909 \text{ MeV}$ ; while for  $^{56}\text{Fe}$  at the top of the binding energy curve:  $BE \div \left(\frac{A}{4}\right) - BE_\alpha = 492.258 \text{ MeV} \div 14 - 28.296 \text{ MeV} = 6.865 \text{ MeV}$ . While these comparisons give a  $\Delta H$  of 0.43 to 0.50 MeV, a hypothetical salt for which the latent heat of vaporization is a smaller fraction of its lattice energy is arguably more analogous to the nuclear material; and having say  $\frac{1}{4}$  instead of  $\frac{1}{2}$  in the above denominators gives a  $\Delta H_{fus}$  of 0.85 to 1.0 MeV; that is, about an MeV per alpha particle.

Certainly, it is not claimed that nuclear material being like a molten salt as to its relative latent heat is a rigorous analogy. Rather, it is a way to get at an order of magnitude value for the latent heat that might be associated with disassembling alpha clusters into nucleon pairs in lead's nucleus—whether  $^{206}_{82}\text{Pb}$  for the uranium series or  $^{208}_{82}\text{Pb}$  for the thorium series—per the proposed first-order phase change occurring at/with that final decay in the series during an episode of accelerated decay. Importantly, the disassembly of lead's arguably 41 alpha clusters, by this analogy, would seem to provide enough cooling to address the heat problem for radiohalos. In other words, the idea merits further investigation (via computer modeling?).

It is admittedly hard to think of a nucleus like  $^{206}\text{Pb}$ , consisting of only around a hundred nucleon pairs (21 + 41 pairs of neutrons and 41 pairs of protons but only 41 paired pairs), as undergoing a phase transition when a material's phase is generally understood to be a bulk property (infinite particle limit:  $\mathcal{N} \rightarrow \infty$ ). In molecular dynamics simulations in which bulk properties emerge for large  $\mathcal{N}$  and the  $\mathcal{N}$ -dependence vanishes, for a small (low- $\mathcal{N}$ ) system, the phase diagram (i.e., the graphical loci of coexistence lines) depends strongly on  $\mathcal{N}$ . For a sodium chloride nanocrystal in the "cluster regime"<sup>34</sup> ( $\mathcal{N} < 500$ ), the internal energy distribution becomes bimodal

30 In contrast with "intermolecular forces" as generally understood, the bond between the nucleon pairs in an alpha particle is very strong, more like an ionic bond. Hence, the analogy, as discussed in Part 1.

31 The binding energy of the deuteron as the spin-antispin nucleon pair  $np$  is seen as comparable to an effective binding energy within the nucleus for  $mn$  or  $pp$  even though such pairs do not exist as entities outside the nucleus. The diproton  $^2\text{He}$  is an extremely short-lived isotope at best while the dineutron has not been observed (though the tetra-neutron apparently has); however, like for  $^8\text{Be}$ , it is thought that a slightly stronger strong force would stabilize  $^2\text{He}$ . Even so, there is evidence for the existence of all three spin-antispin pairings inside the nucleus such that the alpha particle might be seen as  $mn \cdot pp$  or  $np \cdot pn$ .

32  $\Delta H_{vap} \approx T_b S_{gas,1bar}^0 = (1686 \text{ K}) \left( 229.79 \frac{\text{J}}{\text{mol}\cdot\text{K}} \right) \left( \frac{6.242 \cdot 10^{18} \text{ eV/J}}{6.023 \cdot 10^{23} \text{ mol}^{-1}} \right) = 4.015 \text{ eV}$ . This approximate value for the latent heat of vaporization for NaCl is about half the lattice energy  $\frac{1}{2}(8.02 \text{ eV})$  because an ionic gas does not break down further than its formula unit (smallest electrically-neutral cluster) until much higher temperatures.

33 The saturation value is taken to be the binding energy per quad of nucleons for  $^{40}\text{Ca}$  as the largest stable  $4n$  nucleus:  $BE \div (A/4) = 342.05 \text{ MeV} \div 10 = 34.205 \text{ MeV}$ . Or for  $^{56}\text{Fe}$  atop the binding energy per nucleon curve:  $BE \div (A/4) = 492.258 \text{ MeV} \div 14 = 35.161 \text{ MeV}$ .

34 The lead nucleus would thus be a "cluster" of  $\mathcal{N} = 82$  nucleon pairs potentially forming 41  $\alpha$  clusters.

near the melting temperature, meaning the system oscillates between its higher- and lower-entropy phases (Breaux et al., 2004) not unlike the phases in a two-component system. Consider again the alpha decay preformation factor which as a probability “...represents the fraction of the time two neutrons and two protons behave as a single alpha particle” (Duarte and Siegel, 2010). Perhaps alpha particles are transitory in nuclei because the natural state of the nucleus corresponds to such an oscillating two-phase region. The proposed phase change for the lead nucleus, with the latent heat transferred from the surroundings to providing the requisite cooling, would then, perhaps, correspond to a composition of alpha clusters (as for unstable nuclei with  $R > R_{crit}$  during the episode of accelerated decay) resuming the normal composition of paired nucleons but with alpha-cluster oscillations (as for stable nuclei with  $R \leq R_{crit}$  being essentially unaffected by accelerated decay).

One final remark regarding heat, that is, regarding the necessity of its absence—it has been suggested that a surge in the thermal energy in Earth’s interior (core and/or mantle) resulting from accelerated nuclear decay might have triggered Catastrophic Plate Tectonics (Austin et al., 1994; Silvestru, 2012). This argument might seem incompatible with the radiohalo itself which demands for its very existence—including self-consistency with the temperature vs. depth fission track annealing data (Laney and Laughlin, 1981)—a commensurate and concurrent thermal energy absorption. However, accelerated decay also affected smaller nuclei, meaning smaller than those involved in the uranium and thorium chains. Some radioactive isotopes might not experience this phase transition, or at least not experience it to the same extent, because of their smaller size or lower neutron-to-proton ratio, etc. As a result, some accelerated decay, perhaps from isotopes in the middle of Figure 2, might produce excess heat (sufficient to pull this trigger?) even if the ones for heavier isotopes do not. In any case, an episode of accelerated decay being coincident with the Flood geologically, God’s purpose for it morally surely connects to executing His decreed judgment (Gen. 6:5–8) and, perhaps, by triggering its onset.

## Summary

To reiterate, a phase change for the condensed matter comprising large nuclei is proposed as a heat sink during accelerated nuclear decay, being particularly relevant to the formation of radiohalos. The proposed nuclear phase change would occur in  $^{206}\text{Pb}$  nuclei, being the final stable progeny in the  $^{238}\text{U}$  decay chain. With each cascade of decays, the latent heat for this presumed first-order phase transition would be taken from (via heat transfer, generically invoked) and thereby continuously cool the radio-center’s immediate environment wherein the thermal energy is deposited. This was explained in Part I. Argu-

ing by analogy with atomic/molecular systems, the plausibility of providing sufficient cooling (absorbing enough energy) by a phase change was here further explored: latent heat of an MeV per alpha cluster for arguably 41  $\alpha$  clusters in lead’s nucleus is roughly commensurate with the 43.7 MeV of heat produced in stopping the eight alpha particles emitted in the uranium decay series. The lower-entropy phase for large, unstable nuclei during accelerated decay might consist of alpha clusters as compared with primarily nucleon pairings for the normal phase. The phase change would occur with/at the switch from unstable parent isotope to stable daughter in accordance with the dependence of a hypothetical nuclear-phase diagram on the decreased strength of the nuclear force (shallower nuclear potential) for unstable nuclei characterizing an episode of accelerated decay as compared with normalcy. Importantly, the unstable nuclides are assumed to move to the lower-entropy state, and back again, without any thermodynamic effects for the miraculous change in the strong force that turns accelerated decay on, and off, or else there is no solution.

The author hopes to explore the phase behavior of lead’s nucleus by Molecular Dynamics and/or Monte Carlo simulation using a Stillinger-Weber-like potential and a small/finite ensemble of nucleons pairs ( $\mathcal{N} \sim 82$  or 41 pairs of pairs) where the parameter  $\lambda$  (not the decay constant) for the many-body term in the potential characterizing the nuclear strength is related if not equal to the ratio  $R$  of the binding energy per nucleon of the alpha particle to the binding energy per nucleon of the isotope, giving the higher-entropy (liquid) phase if  $R < R_{crit}$  and the lower-entropy (unknown) phase if  $R > R_{crit}$  where  $R_{crit}$  is near unity. Obviously, the trick is just how to model the nuclear force acting between/among nucleon pairs  $n_1 n_1$  and  $p_1 p_1$  as oppositely “charged” molecules (speaking by analogy with molten salts) including the pairwise potential  $V_2$  and the many-body contribution  $\lambda V_3$ . To this end, the author invites help in devising an appropriate model potential.

## References

- Adams, F.C., and E. Grohs. 2016. Stellar helium burning in other universes: A solution to the triple alpha fine-tuning problem. (Cornell University) *arxiv*: 1608.04690.
- Akahane, K., J. Russo, and H. Tanaka. 2016. A possible four-phase coexistence in a single-component system. *Nature Communications* 7:12599; <https://doi.org/10.1038/ncomms12599>.
- Austin, S.A., J. Baumgardner, D.R. Humphreys, A.A. Snelling, L. Vardiman, and K. Wise. 1994. Catastrophic Plate Tectonics: A global Flood model of Earth history. In Walsh, R.E. (editor). *Proceedings of the Third International Conference on Creationism*, pp. 609–621. Creation Science Fellowship, Pittsburgh, PA.
- Breaux, G., R. Benirschke, and M. Jarrold. 2004. Melting, freezing, sublimation, and phase coexistence in sodium chloride nano-

- crystals. *The Journal of Chemical Physics* 121(13):6502; <https://doi.org/10.1063/1.1786921>.
- Chaffin, E.F. 2005. Accelerated Decay: Theoretical Considerations. In Vardiman, L., A. Snelling, and E.F. Chaffin (editors). *Radioisotopes and the Age of the Earth, Volume II*, pp. 527–533. Institute for Creation Research, El Cajon, CA, and Creation Research Society, Chino Valley, AZ.
- Duarte, D., and P.B. Siegel. 2010. A potential model for alpha decay. *American Journal of Physics* 78(9):949; <https://doi.org/10.1119/1.3432752>.
- Jabes, B.S., D. Nayar, D. Dhabal, V. Molinero, and C. Chakravarty. 2012. Water and other tetrahedral liquids: Order, anomalies and solvation. *Journal of Physics: Condensed Matter* 24(28):284116; DOI: 10.1088/0953-8984/24/28/284116 .
- Laney, R., and A.W. Laughlin. 1981. Natural annealing of the pleochroic haloes in biotite samples from deep drill holes, Fenton Hill, New Mexico. *Geophysical Research Letters* 8(5):501–504.
- Meyerhof, W.E. 1967. *Elements of Nuclear Physics*. McGraw-Hill, New York, NY.
- Silvestru, E. 2012. Thermal isostasy—A new look at its potential to advance diluvial geology. *Journal of Creation* 26(1):13–14.
- Tonozuka, I., and A. Arima. 1979. Surface  $\alpha$ -clustering and  $\alpha$ -decays of  $^{212}\text{Po}$ . *Nuclear Physics A* 323(1):45–60.

# Where the Sediments Are

John K. Reed, Michael J. Oard, Peter Klevberg

## Abstract

Confidence in forensic natural history increases when data are simple, observable, and complete. Larger scale often helps. For continental sedimentary rock and marine sediments, the best combination of these factors would be found in assessing their global volume and distribution. Geologists developed estimates long ago, but only in recent decades have database and mapping technology combined to allow reasonably accurate global maps of continental and marine sediment. Just recently, a good estimate of the volume and average thickness of the ocean sediments became available through the GlobSed project. The volume and thickness of the continental sediments is more difficult to describe for several reasons; defining the continent-ocean boundary is one. Defining Precambrian sedimentary basins and their relationship to the Genesis Flood adds uncertainty, but the goal of defining the global distribution of Flood sediments is worth pursuing.

**Key Words:** sediment distribution, marine sediments, sedimentary rock, GlobSed, Macrostrat, erosion, deposition, Flood

## Introduction

A feature of uniformitarian history is an insistence that its interpretation of the past is science—i.e., “historical science” (c.f., Cleland, 2013). Ultimately, this claim is diminished because incomplete data, ad hoc hypotheses, and the depths of time multiply into a weight of uncertainty that science cannot bear. That is why we have always preferred the mixed

question paradigm (Adler, 1965) that acknowledges inherent uncertainties absent a threat to core ideas (Reed and Klevberg, 2015).

Ideas and technologies change, but the fundamental question of natural history is “what can we know about Earth’s past?” followed closely by “how do we know?” Modern geohistory offers inconsistencies even at the level of the

definition of its fundamental principle of uniformitarianism (Gould, 1965, 1975; Reed, 1998; 2010; 2011; 2018; Miall, 2015;). Another problem is the lack of completeness of observed phenomena (e.g., erosion volume, landscapes, strata, faulting) (Reed and Klevberg, 2017, 2018).

A related issue is scale. Only recently have a plethora of observations, database handling, and computer-aided mapping begun to clarify the nature of large-scale phenomena. For sedimentary rock (strata), the most basic, large-scale features are the volume and distribution of sediment bodies and sedimentary basins on a global scale. A related phenomenon

is the depth to basement. For diluvialists, assessing which portions of these strata are diluvial is critical to understanding their work.

If a global flood shaped the face of the Earth, its fingerprints should be visible in these phenomena. With respect to absolute volume, Reed and Oard (2017) demonstrated that it is uniformitarian time, not diluvialism, that has problems—contrary to the hackneyed assertion that there are too many rocks to have been generated in a one-year Flood. The real problem is exactly the opposite—that there are not enough rocks for uniformitarian processes acting over deep time. Issues like this force numerous ad hoc excuses, such as erosion or nondeposition.

But volume and average thickness are only part of the story. The *distribution* of sediments and sedimentary rocks conveys more helpful information. Based on the principle that the youngest features will be the least obscure (at least in outcrops though not necessarily in oil wells), we focus on the accumulations of sediment in the oceans from the GlobSed project, especially the thick continental margin sediments. Complementary smaller-scale data, such as the composition and interior architecture of these sediment bodies; the lateral, vertical, and stratigraphic arrangement of fossils; and the relationship between sediments and mechanisms of erosion, transport, and deposition are subjects for later study.

## Historical Background

It was only in the last century that geologists could empirically begin assessing global sedimentary volume and distribution. Blatt (1970, p. 259) noted, “All published estimates of sedimentary volumes are based on reasonable assumptions but inadequate data.” Early estimates were based on proxies, such as rock and ocean geochemistry (e.g., Clarke, 1924), though it proved a poor proxy (Peters et

al., 2018). Recent decades have seen an explosion in advanced mapping, data processing, and marine seismic data that has allowed more accurate maps of global sediment distribution.

But even those early efforts pointed to major issues, the most basic being the significantly inequitable distribution between continents and oceans, and then, in marine settings, between continental margins and deep ocean basins. While definitions between these regimes can vary by researcher and whether they employ geographic vs. geologic criteria, for the purposes of this paper, we follow the boundary definitions of Straume et al. (2019) in which the continental and marine sediment boundary is the shoreline. An in-depth analysis of this issue is too complex to pursue here, but is acknowledged.

### Harvey Blatt

Blatt’s (1970) estimate of global sediment volume and mean thickness was extrapolated from geologic maps of North America. He defined continental margin sediments by their underlying basement (sialic vs. oceanic) and included those over sialic crust, thus including some continental margin sediments, in his calculation. He estimated the mean thickness for the continents at 1,829 m. Deep marine sediments, estimated from limited data at the time, returned a mean thickness of 244 m. His total global mean thickness was 820 m, close to Clarke’s (1924) 762 m, derived geochemically from comparing sodium in the ocean to that in rocks.

Blatt and Jones (1975) went further, estimating the areal extent of various lithologies exposed at Earth’s surface by a coarse random sampling technique and statistical checks. Of 3,000 random points on the globe, 768 were usable as data points. Based on those, they concluded that sedimentary rocks were exposed on 66% of the globe, give or take 3.5%. They also noted variations in igneous rocks between continents,

based on centers of Cenozoic volcanism (see their Table 1). Estimating percentages of volume by age, they predicted a declining curve of volume-to-age based on erosion and recycling over millions of years: “All workers have agreed that the relationship between sedimentary rock age and its outcrop area is described by a decay curve like that for radioactive minerals” (Blatt and Jones, 1975, p. 1088).

### Alexander Borisovich Ronov

Born in 1913, the Russian scientist Ronov spent his career at the Vernadski Institute of Geochemistry of the Academy of Sciences of the USSR, studying crustal sedimentation and geochemistry. That work was summarized in English in a monograph published by the American Geological Institute in 1983, reprinted from the *International Geology Review* (1982), which was translated from a Russian monograph published in 1980. Sadly, the 1983 monograph is difficult to find outside of university libraries. It compactly, yet comprehensively, discussed sediment distribution, thickness, chemistry, and stratigraphy.

Ronov (1983) also noted the obvious discrepancy between marine and terrestrial sedimentation (Figure 1) and estimated an average global thickness of 2,200 m—based on a continental average of 5,000 m, a deep ocean figure of 400 m, and a continental margin thickness of 2,500 m. His total volume for sedimentary rock (including most of the Precambrian sedimentary rocks) was 1.1 billion km<sup>3</sup> or 11% of the crust. Ronov used the term “stratisphere” for the outer crust, composed of layered sedimentary and volcanic rocks above crystalline basement. Of Earth’s land area, nearly 149 million km<sup>2</sup>, the stratisphere covers 119 million km<sup>2</sup> (46,004,844 mi.<sup>2</sup>), or 80%. The remaining 20% is the exposed crystalline basement of the shields. Blatt and Jones (1975) had estimated that sedimentary rocks covered only 66% of land area. Part of the difference is Blatt and Jones (1975) including part of the

continental margins, but part was simply the data deficiencies of that time and the greater data density studied by Ronov.

Ronov (1983) also evaluated rock composition, noting that Proterozoic rocks were largely terrigenous, with 11% carbonate, 8% volcanics, and virtually no “evaporites.” (Because of numerous uniformitarian problems explaining the origin of huge salt and gypsum deposits, we do not believe they originated from evaporating seawater, but are instead precipitates. We will use the researcher’s terminology with quote marks.) In contrast, he calculated the Phanerozoic as 59% terrigenous, 23% carbonate, 16% volcanics, and having three times more “evaporites” than found in Precambrian rocks. Since Ronov’s work is over 50 years old, more “evaporites” have been found in the Precambrian in Saudi Arabia, Pakistan, and India. Ronov noted that geochemical mass balance estimates for the mass and types of sedimentary rocks do not agree with actual data and suggested changing ocean chemistry through time.

Blatt and Ronov represent the apex of the pre-computer-world understanding of global sediment distribution. Their works were solidly empirical yet suffered from a lack of data and deepwater drilling activity, particularly limiting their understanding of the marine sediments, as well as the challenges of analyzing and mapping massive data sets. Given the absence of today’s computational technology, Ronov’s (1983) work, especially, is impressive for its systematic, quantitative approach. However, their studies are now a half century out of date.

### Modern Estimates of Global Sediments

Refinement in our understanding of global sediment distribution has been attempted since the 20<sup>th</sup> century. Better estimates of continental sediments have been made, spearheaded by efforts like the Macrostrat project (Peters, 2006),

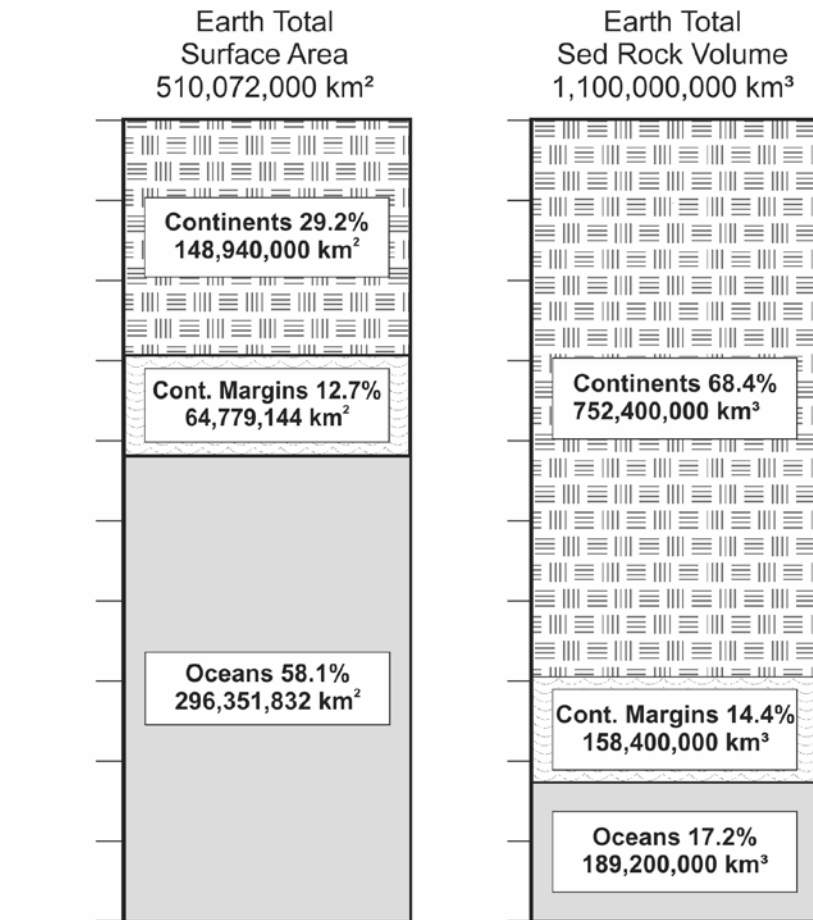


Figure 1. Contrast between surface area of sediment platforms (left) and volume of sediments (right), based on Ronov’s (1983) calculations.

although their assessments of other continents do not match the data-driven analysis of Clarey (2020). Oceanic sediment distributions are much more thorough and accurate, thanks to the truly global picture provided by the GlobSed project (Divins, 2003; Whittaker et al., 2013; Straume et al., 2019).

### GlobSed

We will summarize the important volume and distribution of sediments from the GlobSed project. A rough estimate for the total sediment thickness for the oceans was published by Divins (2003), as version 1 of GlobSed. In version 2, a

better estimate of the sediment thickness in the Australian and Antarctic regions and the area in between was added by Whittaker et al. (2013). The first two attempts contained uncertainties that were addressed by Straume et al. (2019). Earlier uncertainties included the lack of adequate thicknesses where sediments were greater than 1.5 km and poorly resolved areas due to a lack of seismic data. Version 3 of GlobSed (Straume et al., 2019) increased the projected volume of oceanic sediments by an astounding 29.7% over earlier versions. New data for the northeast Atlantic, Mediterranean Sea, and the Arctic and Antarctic conti-

mental margins were largely responsible for this change.

Straume et al (2019) calculated about  $3.37 \times 10^8 \text{ km}^3$  of sediment over an oceanic area of about  $3.63 \times 10^8 \text{ km}^2$  for an average thickness of 927 m. He divided up the oceans into three areas: (1) the continental margins, (2) the deep sea, and (3) the area between the margins and the deep sea (Table I). The continental margins represent 12.9% of the ocean area,  $0.469 \times 10^8 \text{ km}^2$ , with a sediment volume of  $1.43 \times 10^8 \text{ km}^3$  and an average sediment thickness of 3,044 m. The deep-sea area is defined as starting 200 km oceanward of subsurface continent/ocean boundary, which represents 76.9% of the oceanic area or  $2.79 \times 10^8 \text{ km}^2$ . The sediment volume in the deep sea is  $1.13 \times 10^8 \text{ km}^3$  with an average thickness of 404 m. The area between the margin and the deep sea is  $0.37 \times 10^8 \text{ km}^2$ , about 10.2% of the ocean area. It has a sediment volume of  $0.81 \times 10^8 \text{ km}^3$  with an average thickness of 2,189 m.

The thickest marine sediments (Figure 2) are along the Arctic and Antarctic continental margins, the Gulf of Mexico, the eastern United States, the Bay of Bengal, and the Mediterranean Sea.

### Macrostrat

Macrostrat is a research project that collects geological data that characterize the lithology, age, and physical-chemical properties of rocks and sediments of the Earth's upper crust (Peters et al., 2018). It is built on the COSUNA (Correlation Of Stratigraphic Units of North America) charts (Peters, 2006). The COSUNA charts were produced by the American Association of Petroleum Geologists in the 1980s and resulted in hundreds of local to regional *generalized* geological columns, using well and any other data available at the time (Childs, 1985). COSUNA charts show numerous unconformities and missing time because of the emphasis on the age of the strata, based mainly on fossils (Miall,

**Table I. The three divisions of the ocean according to Straume et al. (2019): (1) the continental margins, (2) the area between the margins and the deep ocean, and (3) the deep ocean. The area of the deep ocean is defined as the area 200 km oceanward of the subsurface continent/ocean boundary.**

Province	Area ( $10^6 \text{ km}^2$ )	Sed. Volume ( $10^6 \text{ km}^3$ )	Mean Thickness (m)
Total Ocean	363	337	927
Cont. Margins	46.9	143	3,044
Transition: margin to deep ocean	37	81	2,189
Deep Ocean	279	113	404

2016). Based on Macrostrat data, Peters and Husson (2017) calculated an average depth of continental Phanerozoic sediments of 3,630 m. If Ronov's (1983) estimate (980 m) for continental Precambrian strata is added, they reach a total of 4,610 m. They based this result on North America and the circum-Caribbean region, and extrapolated to the rest of the continental areas, which is a grave weakness in their procedure. They used a little continental margin sediment and the oceanic area around the Caribbean islands. Their estimate is very close to Ronov's (1983) estimate, which was of greater global reach but lower resolution.

### Tim Clarey and Davis Werner

Clarey and Werner (2017, 2018) and Clarey (2019, 2020) are assessing continental sediment thickness using megasequences based on Sloss's (1963) work. He started with the COSUNA data, which he heavily edited, and then gathered his own data across North America, South America, Africa and the Middle East and Europe (Clarey, 2019, 2020) and most recently totals from Asia (unpublished). His data set

was compiled from oil wells, measured sections, and selected seismic data. Many of his data points are from wells on the continental margins that were drilled in the last few decades. He concludes that there is about an average thickness of 3,280 m of sediment for the Phanerozoic across the continents and the continental margins combined (personal communication, 2022). If Ronov's Precambrian total of 980 m average is correct (Clarey believes it to be much less), the average sediment thickness on the continents, including new data from Asia, is 4,260 m. Clarey and Werner also compiled a separate average thickness for just the continental margins across the same five continents, finding an average thickness of 3,820 m on the margins. This is considerably thicker than on the land portion of the continents (personal communication of unpublished data by Clarey and Werner). This value is also higher than the average from GlobSed, and the difference may be because GlobSed included all the continents and because of different definitions of the continental margin.

We believe Clarey and Werner's estimate is more accurate but still needs

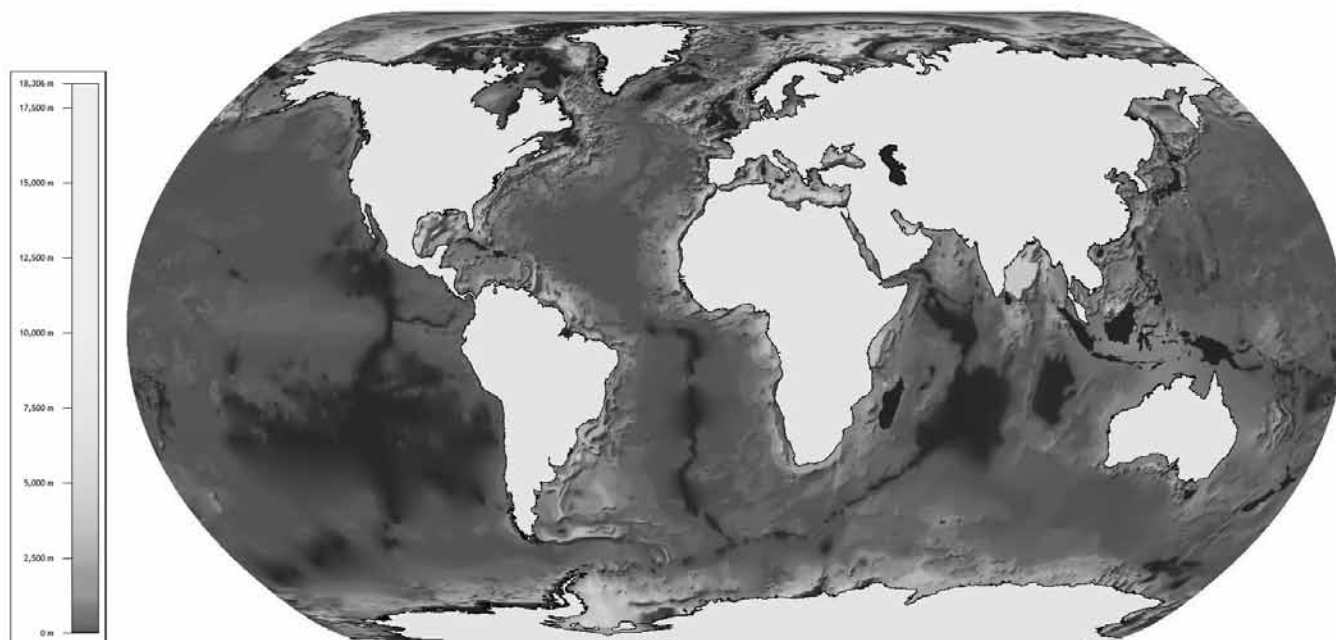


Figure 2. Most recent GlobSed map of distribution of marine sediments. Modified from Straume et al. (2019).

to include Australia and Antarctica. We still need to find the average volume and thickness of the continental sedimentary rocks without the continental margin in order to compare with GlobSed. Their work and ours are still in progress. Clarey and Werner are now compiling stratigraphic columns across Australia (personal communication, 2022). Each megasequence is defined for its area on each continent, then an average thickness calculated for *that* area.

### Contrary Conclusions for Predicted Volume of Strata with Age on the Continents

Sedimentary rocks are most commonly binned by age in both the Phanerozoic and Precambrian. This is the essence of every geologic map, the COSUNA charts, megasequences, and Macrostrat. However, as Reed and Oard (2017) noted, substantive uniformitarian pre-

dictions are often not confirmed in the field. This leads to numerous ad hoc justifications, narrative shifts, and polite silences.

It had been predicted that because of steadily-increasing time for erosion or due to a lack of deposition, the amount of strata on the continent should decrease exponentially back in time. This is a straightforward prediction of uniformitarian geology:

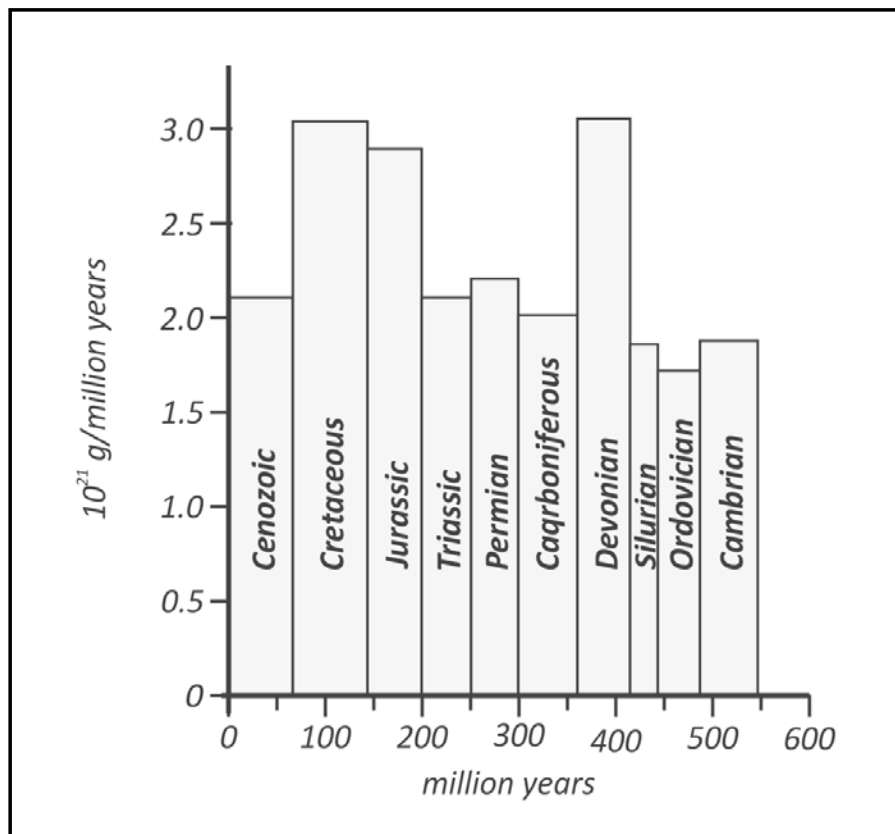
Exponential decrease in surviving quantity with increasing age is a basic prediction of any model in which sediments, once deposited, are subjected to a continuous random probability of destruction. (Peters and Husson, 2017, p. 323)

This makes logical sense, given the proposition of deep time, and, if anything, the effect is understated by uniformitarians relative to observed rates (c.f., Figure 7, Reed and Oard, 2017). Many researchers have advocated such

an exponential decrease the older the age. For example, Blatt and Jones (1975, p. 1088) confidently asserted that, “All workers have agreed that the relationship between sedimentary rock age and its outcrop area is described by a decay curve like that for radioactive minerals.”

However, Ronov (1983) and Ronov et al. (1980) discovered that the *field* distribution of sediments by age ran counter to this accepted wisdom, noting that there was *not* a smooth exponential decrease of sediment volume with older age in the Phanerozoic (Figure 3). Ronov (1983, p. 12) was aware that this ran counter to both uniformitarian prediction and received wisdom:

The scale of the loss may be judged solely by statistics, assuming that the older the sedimentary rocks, the greater the likelihood that they have been eroded. In that case, the relative mass of the sedimentary rocks should gradually decrease from



**Figure 3.** Ronov (1983) compared total sediment mass by stratigraphic periods, showing that there was not a smooth exponential decline in sedimentation, as predicted by many, over time. Instead, mass varied indiscriminately. Contrast with Blatt and Jones' (1975) assertion of exponential decline in quote above. Modified from Ronov (1983, Figure 7).

younger to older. Gregor... recently came to that conclusion, followed by Garrels and Mackenzie.... They established that the relative mass of sedimentary rocks should decrease according to an exponential law, from the present to the distant past.

However, field evidence (Figure 3) showed Ronov (1983, pp. 13–14, emphasis added) something else:

I constructed histograms... in which are plotted the relative masses of the sedimentary rocks assigned to each period of the Phanerozoic.... *Contrary to expectation*, the graphs do not reveal a regular decrease in the relative masses of rocks with increas-

ing time; instead, they show period fluctuations. Thus, I must maintain firmly that globally significant erosion of masses of sedimentary rocks did not take place during the course of the Phanerozoic time, and that the fluctuations were most probably controlled by periodic changes in the intensity of sedimentation. It must be acknowledged... that over the larger time intervals... equal to entire eras... the relative mass of sedimentary rocks tends to decrease.... The decrease is weak in the Phanerozoic interval, but much sharper in the late Proterozoic interval.

The Macrostrat project, limited in scope because of its analysis of North America and the Caribbean, reinforced Ronov's (1983) conclusion that field data do not show an exponential decrease in sediment volume the older the age for the Phanerozoic:

Here we use comprehensive surface and subsurface data in North America as well as regional and global geological maps to show that decreasing sedimentary rock quantity with increasing age is not a prevalent pattern in the sedimentary rock record. (Peters and Husson, 2017, p. 323)

If the Precambrian sedimentary rock is included, there is of course a sharp decline of preserved volume from the Quaternary to the Mesoproterozoic, about 1,600 million years ago, but the main decline is from the Cambrian to the late Neoproterozoic, with little change throughout the Phanerozoic or older than the late Neoproterozoic.

However, Clarey and Werner (2017) and Johnson and Clarey (2021) have drawn opposite conclusions and shown that the volume of sedimentary rocks does decrease significantly back across the uniformitarian timescale. They argue this pattern is real because it was a progressive Flood, starting with minimal coverage early, followed by more and more coverage as the Flood year progressed (Clarey and Werner, 2017; Johnson and Clarey, 2021). At this point, we simply report the different results, which points out the difficulty of not only estimating the volume of strata on the continents but its pattern and age. We hope to address this issue in later papers.

## Discussion

The amount of sediments on the continents and in the oceans is immense. The estimates of the volumes and average thickness will add clarity to the mechanisms for the generation of

those sediments. Twentieth-century studies provided coarse estimates of the volume and thickness of sediments and sedimentary rocks (Blatt, 1970; Blatt and Jones; 1975; Ronov, 1983). Newer, more sophisticated projects show some differences and significantly more clarity for marine sediments because of the GlobSed project (Straume et al., 2019). However, the estimated volume and thickness of strata on the continents varies between researchers, partly because of Macrostrat using only North America and the Caribbean and the variable inputs of marine margin sediments and Precambrian sedimentary rocks. Researchers have obtained opposite conclusions on the widely believed exponential decrease in sediments with age that has been predicted by early uniformitarian scientists.

In a companion paper we will show that the distribution of ocean sediments does not fit well with uniformitarian inferences but is predicted by the Recessive Stage of the Flood (c.f., Schmich, 1980; Walker, 1994). Moreover, continental features, such as large planation surfaces, reinforce the massive erosion of the top of the sediments on the continents (Oard, 2008, 2013, 2014). Insights based on large-scale erosion and deposition during that stage can, in turn, cast light on the earlier processes and stages (Oard and Reed, 2017).

## References

- Adler, M.J. 1965. *The Conditions of Philology*. Atheneum Press, New York, NY.
- Blatt, H. 1970. Determination of mean sediment thickness in the crust: A sedimentologic method. *Geological Society of America Bulletin* 81(1):255–262.
- Blatt, H., and R.L. Jones. 1975. Proportions of exposed igneous, metamorphic, and sedimentary rocks. *Geological Society of America Bulletin* 86(8):1085–1088.
- Childs, O.E. 1985. Correlation of stratigraphic units of North America: COSU-NA. *American Association of Petroleum Geologists* 69(2):173–180.
- Clarke, F.W. 1924. Data of geochemistry. *U.S. Geological Survey Bulletin* 770, Washington, D.C.
- Clarey, T. 2020. *Carved in Stone: Geological Evidence of the Worldwide Flood*. Institute for Creation Research, Dallas, TX.
- Clarey, T.L., and Werner, D.L. 2017. The sedimentary record demonstrates minimal flooding during the Sauk deposition. *Answers Research Journal* 10:271–283.
- Clarey, T.L., and Werner, D.L. 2018. Use of sedimentary megasequences to re-create pre-Flood geography. In Whitmore J.H. (editor), *Proceedings of the Eight International Conference on Creationism*, pp. 351–372. Creation Science Fellowship, Pittsburgh, PA.
- Clarey, T. 2019. European stratigraphy supports a global Flood. *Acts & Facts*, November 27.
- Cleland, C.E. 2013. Common cause explanation and the search for the “smoking gun.” In Baker, V.R. (editor). *Rethinking the Fabric of Geology*. Geological Society of America Special Paper 502, pp. 1–10. Geological Society of America, Boulder, CO.
- Divins, D.L. 2003. Total Sediment Thickness of the World’s Oceans and Marginal Seas. NOAA (*National Oceanographic and Atmospheric Administration*). National Geophysical Data Center, Boulder, CO.; <https://ngdc.noaa.gov/mgg/sedthick/sedthick.html>.
- Gould, S.J. 1965. Is uniformitarianism necessary? *American Journal of Science* 263(3):223–228.
- Gould, S.J. 1975. Catastrophes and steady-state Earth. *Natural History* 84(2):15–18.
- Johnson, J.J.S., and T.L. Clarey. 2021. God floods Earth, yet preserves Ark-borne humans and animals: Exegetical and geological notes on Genesis, Chapter 7. *Creation Research Society Quarterly* 47(2):248–262.
- Miall, A.D. 2015. A new uniformitarianism: Stratigraphy as just a set of “frozen accidents.” In Smith, D.G., R.J. Bailey, P.M. Burgess, and A.J. Frasier (editors). *Strata and Time: Probing the Gaps in our Understanding*, Special Publication 404. Geological Society, London, UK, pp. 11–36.
- Miall, A.D. 2016. The valuation of unconformities. *Earth-Science Reviews* 163:22–71.
- Oard, M.J. 2008. *Flood by Design: Receding Water Shapes the Earth’s Surface*. Master Books, Green Forest, AR.
- Oard, M.J. (ebook). 2013. *Earth’s Surface Shaped by Genesis Flood Runoff*. <http://Michael.oards.net/GenesisFloodRunoff.htm>.
- Oard, M.J. (ebook). 2014. *The Flood/Post-Flood Boundary Is in the Late Cenozoic with Little Post-Flood Catastrophism*. <http://michael.oards.net/PostFlood-Boundary.htm>.
- Oard, M.J., and J.K. Reed. 2017. *How Noah’s Flood Shaped Our Earth*. Creation Book Publishers, Powder Springs, GA.
- Peters, S.E. 2006. Macrostratigraphy of North America. *Journal of Geology* 114(4):391–412.
- Peters, S.E., and J.M. Husson. 2017. Sediment cycling on continental and oceanic crust. *Geology* 45(4):323–326.
- Peters, S.E., J.M. Husson, and J. Czaplowski. 2018. Macrostrat: A platform for geological data integration and deep-time Earth crust research. *Geochemistry, Geophysics, Geosystems* 19:1393–1409.
- Reed, J.K. 1998. Demythologizing uniformitarian history. *Creation Research Society Quarterly* 35(3):157–165.
- Reed, J.K. 2010. Untangling Uniformitarianism, Level I: A Quest for Clarity. *Answers Research Journal* 3:37–59.
- Reed, J.K. 2011. Untangling Uniformitarianism, Level II: Actualism in Crisis. *Answers Research Journal* 4:203–215.
- Reed, J.K. 2018. Changing paradigms in stratigraphy—another new uniformitarianism? *Journal of Creation* 32(3):64–73.
- Reed, J.K., and P. Klevberg. 2015. Battlegrounds of Natural History, Part III: Historicism. *Creation Research Society Quarterly* 51(4):177–185.
- Reed, J.K., and P. Klevberg. 2017. Carol Cleland’s defense of historical science, Part I: Deflating experimental science. *Journal of Creation* 31(2):103–109.

- Reed, J.K., and P. Klevberg. 2018. Carol Cleland's defense of historical science, Part II: Rebuilding historical science. *Journal of Creation* 32(1):84–91.
- Reed, J.K., and M.J. Oard. 2017. Not enough rocks: The sedimentary record and Earth's past. *Journal of Creation* 31(2):84–93.
- Ronov, A.B. 1983. *The Earth's Sedimentary Shell*. American Geological Institute Reprint Series 5, Falls Church, Virginia.
- Ronov, A.B., V.E. Khain, A.N. Balukhovskiy, and K.B. Seslavinsky. 1980. Quantitative analysis of Phanerozoic sedimentation. *Sedimentary Geology* 25:311–425.
- Schmich, J.E. 1980. Continental tilt. *Creation Research Society Quarterly* 17(2):114–117.
- Sloss, L.L. 1963. Sequences in the cratonic interior of North America. *GSA Bulletin* 74(2):93–114.
- Straume, E.O., C. Gaina, S. Medvedev, K. Hochmuth, K. Gohl, J.M. Whittaker, R. Abdul Fattah, J.C. Doornenbal, and J.R. Hopper. 2019. Globesd: Updated total sediment thickness in the world's oceans. *Geochemistry, Geophysics, Geosystems* 10.1029/2018GC00815:1756–1772.
- Walker, T. 1994. A Biblical geological model. In Walsh, R.E. (editor). *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, pp. 581–592. Creation Science Fellowship, Pittsburgh, PA; biblicalgeology.net/.
- Whittaker, J., A. Goncharov, S. Williams, R. Dietmar Müller, and G. Leitchenkov. 2013. Global sediment thickness dataset updated for the Australian-Antarctic Southern Ocean. *Geochemistry, Geophysics, Geosystems*. doi: 10.1002/ggge.20181.

## Book Reviews Needed!

Please share with the CRS community your opinion of creation- or science-related books you've read!

See information on p. 120 about writing a review. To submit a review, please contact Mary Beth De Repentigny, Book Review Editor, at [marybethd4@gmail.com](mailto:marybethd4@gmail.com)





## Notes from the Panorama of Science

### Evolution is Modern-Day Alchemy

Most everyone has heard that evolution is a process for how one species can change into another species, but have you ever wondered where the philosophy behind evolution came from? People will tell you that Charles Darwin is “the Father of Evolution,” but he never saw a single example of one species changing into another, and he did not learn it from books or in a biology class. Where did Darwin get the idea of species-to-species change? Typically, when something changes or undergoes a mutation, it is only the appearance that changes, but Darwin’s proposed evolution, also changed the form of the species. Although this may sound like a new idea, this idea of something changing into something else is *not* a new idea. Ever since the beginning of creation, man has studied nature, and proposed explanations for how nature’s processes work. This search to explain and understand nature was part of the Dominion Mandate given to Adam by God (Genesis 1:28). Adam and his descendants were commanded to have *dominion* over God’s creatures, but somewhere along the way, man’s study of nature was no longer to glorify God, for it had now become a search for wealth, enlightenment, and peacefulness apart from God. It was “this search” that became known as alchemy. Alchemy is said to be the beginnings of chemistry, but the Dominion Mandate given to Adam is the true beginning of the sciences, including chemistry.

Although alchemy is said to be the beginnings of chemistry, it was never the beginning of the science we call chemis-

try today. Contrary to what many people believe, alchemy is not a science, and it never was a method of study. Although modern chemistry is said to have its roots in alchemy, the scientific method as we know it today was never part of alchemy. Today’s modern chemistry, even without the scientific method, is still very different than what alchemy ever was! Alchemy was a philosophy of nature practiced throughout Europe, Asia, Africa, and China (Pereira, 2018). Historically, the defining objectives of alchemy include the “search” for the fabled philosopher’s stone, and the benefits that stone could provide to mankind. Although the fabled philosopher’s stone was never found, it was the “search” for this alleged philosopher’s stone that led to many chemical discoveries and technologies, and some of those technologies are still in practice today. Historically, it would be many centuries after the discoveries of alchemy before today’s scientific method would be put into practice.

The philosopher’s stone is a legendary substance thought to be capable of transforming base metals into more valuable gold or silver. The philosopher’s stone was also believed to be a substance that, when mixed with wine or water, was a cure for disease: an elixir useful for rejuvenation and healing, and one capable of prolonging life to achieve immortality. Some alchemical writers claim that its history goes back to Adam, who acquired the knowledge of the stone directly from God, and others even claim that the stone is what gave the pre-Flood patriarchs their longevity (Patai, 2014).

The legend of the stone has also been falsely compared to the Biblical history of the Temple of Solomon and the rejected cornerstone described in Psalm 118:22 (Salomon, 1743) and Isaiah 28:16.

The concept of the philosopher’s stone can be traced back to Greek philosophy, where according to Plato, the four elements of earth, air, fire, and water are derived from a common source or *prima materia* (first matter), associated with chaos. *Prima materia* is also the name alchemists assign to the starting ingredient for the creation of the philosopher’s stone. The search for this “first matter” persisted throughout the history of alchemy. For many centuries, the search for the philosopher’s stone was the most sought-after goal in alchemy.

### Chemistry and the Bible (McCombs, unpublished)

The practice of alchemy is one of the most ancient lineages and one that can even be traced back to events mentioned in the Book of Genesis. In the beginning, what we call chemistry today was not a science that could be learned from a book; it was a trade or a mastered skill learned from experience. The discoveries that became known were obtained by accident or at least as the result of trial and error mixing, but once mastered they were passed on to future generations. The discoveries made by these early alchemists moved science away from pseudoscience into what would become modern chemistry. Craftsmen found beautiful glazes to decorate and

preserve their wares. Herdsmen, brewers, and vintners used fermentation techniques to make cheese, beer, and wine. Housewives leached the lye from wood ash to make soap. Crafters learned to make glass; leather workers tanned hides. In addition, we see the building of great cities at Babel, Ur, and Kish, and their descendants developed writing, advanced pottery techniques, and the wheel.

This period saw the rise of metal-working and the smelting, refining, alloying, and casting of ores to make brass, iron, and bronze, with the fuel required for the processes coming from the vast deposits of bitumen and asphalts bubbling to the surface in the region. In addition, the people became experts at manufacturing dyes for textiles and paints, advanced tanning processes, glassmaking, and blending perfumes. Although their knowledge was great and their techniques refined, they were only searching for riches, knowledge, enlightenment, and heavenly bliss. The modern-day use of the scientific method did not begin until around the early 17<sup>th</sup> century when the Socratic method and empiricism began to be applied to alchemy, but the search for the philosopher's stone consumed their way of thinking and their physical activities until the 19<sup>th</sup> century.

In fact, all of the previously mentioned discoveries made by early alchemists are also mentioned in the Bible. In Genesis, beginning with Adam, we learn that man had knowledge of husbandry and agriculture; Cain was building cities (Genesis 4:17), and within five generations after Adam, Jubal already had the ability to make musical instruments (Genesis 4:21), and Tubal-cain had the ability to work with brass and iron (Genesis 4:22). The ability to work with brass and iron is a remarkable accomplishment because these metals are not found naturally. Brass is an alloy (or mixture) of copper and zinc metals and

these metals (along with iron metal) only exist in the ground as their metal oxides. The ability to work with brass and iron requires a chemical reaction and the alloy of brass would have been made by the blending of copper metal and zinc metal, but these metals require chemical reactions to make them from their metal oxides. To make these metals, one would need to heat the copper ore (and/or zinc ore) with charcoal and air. Through trial and error, early man discovered that these naturally occurring ores could be converted into their base metal by heating certain rocks with earth, fire, and air. The ability to manufacture brass is amazing. For Tubal-cain to be an artisan of brass and iron, mankind must have already developed the knowledge to identify, locate, and collect mineral-rich deposits, convert these deposits to base metals, create alloys, learn their improved properties, and use these metals for making tools, wares, and for other practical purposes. To master these skills within 5 generations after Adam, with no schools or books or teachers to learn from, is an even more impressive accomplishment. To learn these skills by practice, not by training, would not be normally associated with early man as evolutionists might teach us today about man's early ancestors.

Later in our history, man has made other brilliant accomplishments; he learned how to make bronze (a copper/tin alloy); lead and iron continued to be used for utensils and tools, but as their knowledge increased, many new products and applications were discovered using the chemical materials available on the Earth. Building materials such as plaster and mortar were developed, and we know that Noah used pitch (tar or asphalt) to waterproof the Ark. We read in the Old Testament that lamps using oils for fuel were developed for heat and light. Methods were developed for the tanning of leather and the preservation of animal hides, white

glues and soaps were made from other animal by-products. Pigments and dyes were made for the coloring of textiles, stone, and pottery. Even common glass, medicines, and wine are not a modern-day invention: Job mentioned "glass" during his expository to his friends and Job probably lived during the time of Abraham. Solomon compared a merry heart with good "medicine," and even the production of "wine" requires a chemical reaction called fermentation. Although the post-Flood patriarchs did not know it at the time, they developed many of the technologies still used today, while increasing the knowledge base that will be used in modern chemistry.

We have all heard about St. Augustine the explorer who came to St. Augustine, Florida, looking for the Fountain of Youth; his search for the Fountain of Youth was predicated on a prior belief that such an elixir for immortality existed; that belief came from the philosophy of alchemy and the search for the philosopher's stone. Even though alchemists were unable to find an "elixir" capable of providing immortality, they did discover many "elixirs" capable of curing the ailments of man; we call them "medicines" and some are called natural medicines because they can be obtained from plants. One hundred years ago, it would not be uncommon for your mother or grandmother to make a "tea" or "broth" from leaves of certain plants or trees to cure an ailment, and in fact, this is how "aspirin" was discovered. The active ingredient of aspirin (acetylsalicylic acid), although today manufactured in industrial facilities, was first isolated from plants. There are even known "natural" treatments for some forms of cancer used today.

### **Failure of Alchemy**

Yes, it is true that the discoveries made during the search for the philosopher's stone have benefited chemistry and mankind, but that was not the goal

of the alchemists at that time. Every alchemist's discovery, regardless of how important those discoveries are by today's standards, regardless of how useful they are to mankind in general, every one of those discoveries represents a "failure" to achieve the goal of alchemy! Regardless of what they may have discovered, they "failed" to find the fabled philosopher's stone. Their search failed because what they were looking for could not be found where they were looking for it! They were searching for that first matter without ever seeking the One who created that first matter. They were searching for answers and spiritual enlightenment from the world around them instead of from the One who created that world, just like the people mentioned in Romans 1:25 "*who changed the truth of God into a lie, and worshipped and served the creature (or creation) more than the Creator.*"

Alchemists were seeking truth and enlightenment from nature, and not from God. Even though their search for the philosopher's stone failed, their philosophy became a search for things beyond the physical realm; their search turned into mysticism. According to their new philosophy, they were trying to achieve "unity with nature." Even though they could not find that stone or truth or enlightenment, their guiding philosophy that such a stone existed never changed. Today, there is another popular philosophy very similar to alchemy; it is a philosophy held by many people; it believes that one entity can be changed into another entity, and it believes that this transformation will change the entity into a superior form. Its believers are still searching for that

first matter without searching for the one who created it, and they are still seeking unity with nature. This philosophy is called evolutionism, and their belief remains strong in spite of their failures to find any supporting evidence. Today, evolutionism is a philosophy that through the process of mutations and natural selection, one species can literally evolve into an entirely different species, and because of their achieved "unity with nature," they have solved the question of origins using the environment as the ultimate guiding force in this world.

According to the history of alchemy, the practice of alchemy existed until the 19<sup>th</sup> century, and not coincidentally, the early philosophies of evolution began with Charles Darwin who lived in the 19<sup>th</sup> century. Although Charles Darwin may have been the first to use the "name" evolution, the philosophy behind evolution started much earlier. Alchemy may have some minor similarities to chemistry, but alchemy is not the beginning of modern-day chemistry; more accurately, *alchemy is the beginning of modern-day evolution*. Alchemy just changed its appearance and its name, not its form, because the philosophy of alchemy is exactly the same as the philosophy of evolutionism. The alchemist's search for the philosopher's stone is no different than the evolutionist's search for those alleged missing links or those alleged building blocks necessary for life. Evolution is modern-day alchemy!

Although there are critics that dispute the historical accuracy of the Bible, and although the Bible does not give a complete account of science or history,

it must be noted that everything the Bible does say is totally compatible with known science and completely agreeable with known history! The Bible was never meant to be a complete source of science or history, but if the Bible is correct about the science and history it does contain, then we should believe the rest of the Bible to be true about what it does say about God, who God is, and what He has done, and more importantly, God's plan of salvation to rescue us from the penalty, presence, and punishment of our sins.

**Dr. Charles McCombs,**  
**President of Genesis Ministries, Inc.**  
**and President of**  
**Southwest Florida Bible Institute**

## References

- McCombs, C. (in press). Evolution Hopes You Don't Know Evolution. *Creation Research Society Quarterly*.
- Patai, Raphael. 2014. *The Jewish Alchemists: A History and Source Book*. (Princeton Legacy Library, 236). Princeton University Press: Princeton, NJ. [ISBN 978-1-4008-6366-2. OCLC 1165547198.]
- Pereira, M. 2018. Alchemy. In Craig, Edward (ed.). *Routledge Encyclopedia of Philosophy*.  
Routledge Publishers: Routledge, Milton Park, Abingdon, Oxfordshire, UK. doi:10.4324/9780415249126-Q001-1. [ISBN 9780415250696.]
- Salomon, Glass. 1743. *Philologia sacra: qua totius Vet. et Novi Testamenti Scripturae tum stylus et litteratura, tum sensus et genuinae interpretationis ratio et doctrina libris V expenditur ac traditur*. J. Fred. Gleditschius. [OCLC 717819681.]

## A Doxological View of Grasses, with Special Attention to Matthew 6:28–30 and Luke 12:27–28

Each blade of grass is a soil-rooted witness, giving evidentiary proof of God’s Creatorship (Sherwin, 2005). Furthermore, each blade of grass is a growing doxology, directing us to worship the LORD.

And God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth: and it was so. And the earth brought forth grass, and herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself, after his kind: and God saw that it was good. (Genesis 1:11–12)

Recently Mike Matthews, of Answers in Genesis (and Editor-in-chief of *Answers* magazine), observed the following truth about grasses, calling them “green factories”:

These [*grasses*] are God’s creation. They perform a fundamental biological process—photosynthesis—that still astounds scientists. The thousands of chemical equations [*that describe the grass-housed photosynthesis process*] would fill a wall. Yet every day, these green factories churn out the sustenance of life. They remind me that a lowly sinner like me can glorify my Maker and Life-giver, who gave His life for me. (Matthews, 2016)

Now that is sound science! That is meaningful analysis of what grasses are really here for, revealing details of God’s immeasurably creative glory, simultaneously with recognizing the value of His bioengineering providence.

Why is that important? So that we can better know and appreciate our God for Who He really is! If our hearts are not stirred to worship, we have failed to understand the real value of His creation.

Grass seems so plain, so unexciting—it dominates many parts of the



world (see Job 5:25). But a careful study of grasses, observing the many moving parts within their complicated living systems (and interactions with their environments), leads to an appreciation for their God-designed purposes, programs, and complexities.

Yet it is not enough to learn technical science data—such as the biochemical mechanisms that power the plant photosynthesis pathways, or whether that of that plant uses the C3 version or C4 version of carbon dioxide-to-carbohydrate photosynthesis, or how such vascular plants simultaneously colonize habitat niches both above and below surface soils—although those facts should certainly be researched, analyzed, and appreciated (Urry et al., 2016, pp. 187–211, 783; Johnson, 2020a).

Even so, the ecological and agricultural details—far beyond the scope of this short perspective article—exhibit how God uses growing grasses, which are here today and gone tomorrow (Isaiah 40:7–8), to feed both mankind and many animals.

He causeth the grass [*hâşîr*] to grow for the cattle, and herb for the service of man: that he may bring forth food out of the earth. (Psalm 104:14)

If we, as creatures who owe God glory and gratitude, fail to personalize the lesson that His living creation provides—including doxological lessons from blades of grass—we have failed to be true creation scientists. The ultimate purpose for learning about grasses is to better glorify God and to unceasingly enjoy knowing Him, as the Westminster Confession reminds us (see also 1<sup>st</sup> Corinthians 10:31 and John 10:10).

The leaves of green plants, including grasses, testify that our Creator is clever, capable, careful, and caring (Matthews, 2016; Johnson, 2017). This “hidden in plain view” providence showcases the food chain that begins with photosynthesis, the sunlight-powered carbohydrate-manufacturing of nutritious food for herbivores, who themselves become food for carnivores and/or insectivores (Urry et al., 2016; Johnson, 2020b).

Grass is providentially designed to grow after its top portions are eaten by grazers.

The main growing parts [of grasses] are not at the stem tips, but at the base of the leaves. This means that as the leaves are eaten by herbivores, they simply regrow and replace their lost parts...[with] many [grasses having] a specialized form of photosynthesis which is particularly efficient under high light intensity and high temperature conditions. It is also a system which allows more carbon dioxide to be fixed per unit of water than conventional photosynthesis. (Moore & Turner, 1987, p. 71)

Moreover, grass provides a food-energy foundation for many food chains. Examples of grass-anchored food chains include large grass-grazing herbivores (bovines, sheep, pronghorns, etc.) that are often eaten by humans, cougars, or bears; likewise, smaller herbivores (e.g., rabbits) are eaten by lynx, wolves or foxes (Johnson, 2020a, 2020b). Many other herbivores go unnoticed, however, because they are very small, such as grasshoppers (which include locusts), leafhoppers, and crickets. These tiny herbivores are eaten by insectivores—mammals (aardvark, pangolin, etc.), reptiles (gecko, chuckwalla, etc.), birds (flycatchers, bee-eaters, etc.), and sometimes even by some humans, such as John the Baptist (Matthew 3:4).

Years ago, at ICR, fueled by energy snack bars composed of ingredients that included grasshoppers and crickets, I delivered evening lectures called “Grassland Habitats: God’s Providence in Plain View—Living in Prairies and Pampas, Steppes and Savannas (Grasses, Grazers, Grazer-Grabbers, and Grasshoppers).” Suffice it to say, the opportunities for learning about biogeography and bio-engineering details of grasses—that God has designed, programmed, installed, and maintains in the various grasslands of the world—could be packaged into a college course (e.g., APOL 557, “Grass-

lands and the Genesis Mandate,” an elective in ICR’s *Master of Christian Education* degree program).

And it’s not just above-ground photosynthesis that grasses facilitate, because the *root systems* of grasses, unseen by humans, busily perform many valuable functions—such as providing reciprocal nutritional benefits to legumes (facilitating legume nitrogen utilization and protein synthesis), mineral recycling, benefiting the hydrologic cycle, and abatement of soil erosion (Johnson, 2017; Wei et al., 2022).

In other words, grasses work hard, honoring God by their very existence and operations—regardless of whether any humans “have eyes to see” it or not. *But why is there no emphasis on the doxological aspect of grasses?*

Once again, listen to the insights of Mike Matthews, as he hits the bull’s-eye on what is usually missing from natural science publications, and even from many technical studies in creation-science literature.

First, what’s with the photo on the last page [of *Answers* magazine, October–December 2016 issue]? I’d like to open my heart wide here...

I’m a literature guy. What fires my engines each morning is not the [technical] details of science, as interesting as they are. It’s knowing God better...

For a believer to know Him is to be devoted to Him. It means being so overwhelmed by the perfections (or glories) of His being—and by His creation—that we can’t help but renew and deepen our dedication to serve Him with our whole heart, soul, mind, and strength. The term *devotional* has gotten a bad rap these days. For some reason, it has the connotation of light and fluffy. *The root meaning is just the opposite.* It’s associated with love, loyalty, enthusiasm, worship...

The Almighty God is so glorious that He effortlessly tosses priceless

gems into every nook and cranny of our lives. *Everywhere we look, even lowly blades of grass, the Lord gives us reminders of His grace and majesty.* (Matthews, 2016; *emphasis added.*)

*Finally!* It’s about time that someone emphasized the valuable role of devotional theology—and doxological creation apologetics. (Apologetics is firstly a matter of “sanctifying the Lord God” in our hearts—only secondarily is it a matter of providing witness of God’s truth to those with ears to hear—see 1<sup>st</sup> Peter 3:15).

Yes, Mike, we see countless doxologies in creation, every day, if we “have eyes to see” it. God’s providential care and splendor are ubiquitous (Acts 14:17), so there is no excuse for us to lose our “first love” for Him (Revelation 2:4).

The ultimate reality and focus of all creation is not primarily about people, even though humans are quite valuable—the main reality is about God being the Creator! All of creation, therefore, especially our own lives, can and should be an ongoing doxology for Him (Revelation 4:11).

And that doesn’t mean we flee the technical side of creation studies; rather, we harness it for God! In fact, the Lord Himself encouraged the study of wildflowers and field-grasses, according to Matthew (6:28–30) and Luke (12:27–28).

The apostle Matthew reports the Lord Jesus Christ using an imperative verb that means to intensely learn, to thoroughly study (*καταμαθετε*), i.e., to carefully observe—i.e., what empirical scientists call “research” (Tomkins and Johnson, 2020). Matthew’s verb is related to the Greek noun translated “disciple”—so we should study wildflowers and grasses with the due diligence of a disciple! See passage from Matthew 6 in Figure 1.

But there’s more.

Luke complements Matthew’s record, reporting that Christ also used an imperative verb meaning to intensely

mind, to thoroughly think through (κατανοησατε), i.e., to carefully understand what the data is showing about reality—i.e., what empirical scientists call “analysis” (Tomkins and Johnson, 2020). See passage from Luke 12 in Figure 2.

In short, Christ’s exhortations—preserved in Scripture by Matthew and Luke—obligate us to practice faithful-to-the-details “research and analysis,” so that we can appreciate God’s providence, for the supposedly “simple” wildflowers and field-grasses. Moreover, the photosynthetic (and other) providences

of such “green factories” point to even greater providences—including God’s personalized care for our own lives and futures (Johnson, 2020a).

Accordingly, paying attention to these grassy “green doxologies” can and should encourage us to expect God’s greater providences in our own lives, as higher creatures—being uniquely created with life in God’s own image—plus having our lives salvaged from our sinfulness by the completed redemptive work of His crucified-and-resurrected Son, our Lord Jesus Christ (Psalm 102:18; Ephesians 2:8–10, Luke 10:20).

So, daily, in response to Matthew 6:28–30 and to Luke 12:27–28, we can recognize that (so-called) “simple” blades of grass, plus their underground root systems, are Earth-rooted doxologies, pointing our minds and hearts heavenward.

**James J. S. Johnson,  
JD, ThD, DMin**

## References

- Johnson, James J.S. 2017. Dung beetles: Promoters of prairie preservation. *Acts & Facts* 46(1):21.
- Johnson, James J.S. 2020a. God’s grassroots provision. *Acts & Facts* 49(7):21.
- Johnson, James J.S. 2020b. Food web ecology corroborates Scripture. *Acts & Facts* 49(10):21.
- Matthews, Michael. 2016. Green factories. *Answers* 11(4):86, October–December.
- Moore, Peter D., and Brian D. Turner. 1987. “Savanna Grasslands.” In *The Encyclopedia of Animal Ecology*. Peter D. Moore, editor. Equinox Ltd., Oxford, UK.
- Sherwin, Frank J. 2005. Dinosaurs, grasses, and Darwinism. *Creation Science Update*, November 29; [www.icr.org/article/dinosaurs-grasses-darwinism](http://www.icr.org/article/dinosaurs-grasses-darwinism).
- Tomkins, Jeffrey P., and James J.S. Johnson. 2020. The Gospels affirm the Dominion Mandate for research. *Acts & Facts* 49(2):10.
- Urry, Lisa A., Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece, and Neil A. Campbell. 2016. *Campbell Biology, 11<sup>th</sup> edition*. (Campbell Biology Series.) Pearson, Hudson, NY.
- Wei, Zhang, Thomas M.R. Maxwell, Brett Robinson, and Nicholas Dickinson. 2022. Legume nutrition is improved by neighbouring grasses. *Plant and Soil* 475(1–2):443–455; DOI:10.1007/s11104-022-05379-4.

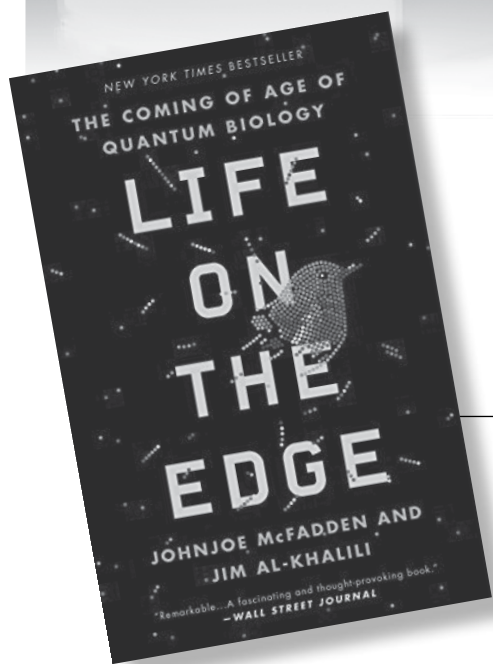
<sup>28</sup> And why take ye thought for raiment? Consider [καταμαθετε = “intensely/thoroughly learn/study”] the lilies [κρινα = “wildflowers”] of the field [αγρου], how they grow [αυξανει = “they grow up”]; they toil not, neither do they spin. <sup>29</sup> And yet I say unto you, that even Solomon in all his glory was not arrayed [περιεβαλετο] like one of these. <sup>30</sup> Therefore, if God so clothe [αμφιεννυσω] the grass [χορτον] of the field [αγρου], which today is, and tomorrow is cast into the oven, shall He not much more *clothe* you, O ye of little faith? (Matthew 6:28-30)

Figure 1

<sup>27</sup> Consider [κατανοησατε = “intensely/thoroughly mind/think through”] the lilies [κρινα = “wildflowers”] how they grow [αυξανει = “they grow up”]; they toil not, they spin not; and yet I say unto you, that Solomon in all his glory was not arrayed [περιεβαλετο] like one of these. <sup>28</sup> If then God so clothes [αμφιεννυσω] the grass [χορτον], which is today in the field [αγρω], and tomorrow is cast into the oven; how much more will He *clothe* you, O ye of little faith? (Luke 12:27-28)

Figure 2

# Media Reviews



## *Life on the Edge: The Coming of Age of Quantum Biology*

by Johnjoe McFadden  
and Jim Al-Khalili

Crown Publishing Group,  
New York, 2014, 353 pages,  
\$18.00

According to *The Times* (UK), *Life on the Edge* explores quantum biology as “the strange and spectacular terra incognita of genuinely new science.” This popular science book gives a detailed description of how quantum mechanics presumably helped mediate the search for a self-replicating proto-enzyme molecule in the proverbial primordial soup. The authors are two academics at the University of Surrey: Johnjoe McFadden, professor of molecular genetics, and Jim Al-Khalili, theoretical physicist. They direct the world’s first doctoral training center dedicated to developing interdisciplinary scientists in the field of quantum biology. McFadden and Al-Khalili realize the shaky foundation their musings are built upon when they warn the reader by saying, “Of course, any scenario involving quantum mechanics in the origin of life three billion years ago remains highly speculative.”

It behooves the readers of *Life on the Edge* to keep this admonition in mind as they read; for using one mysterious thing, such as quantum mechanics, to explain another, such as abiogenesis, simply leads to more ambiguity. A careful consideration of the text reveals that, at times, objective scientific reasoning gives way to faith in quantum mechanics as the god of the gaps for evolutionary theory. This is clearly evidenced when McFadden and Al-Khalili make a statement of unshakable faith in their theory by saying, “Even when contemplating what a challenging job self-replication is without a living cell to achieve the feat, it must have been done billions of years ago, or we would not be here contemplating the problem today.”

Physicist David Griffiths expresses a well-founded cynicism toward invoking quantum mechanics to explain the unexplainable when he says, “In general, when you hear a physicist invoke the uncertainty principle, keep a hand on your wallet.”

The book’s main thesis is that quantum coherence once played the kind of role in the origin of life as it currently seems to play in living cells. In building

their case, McFadden and Al-Khalili first cue the reader in on what quantum coherence is. Mathematically, quantum coherence refers to a property of solutions to the Schrodinger wave equation. Simply put, quantum coherence is being in the wave state that allows a particle to exist in many different places or states at the same time, with different probabilities. As soon as the wave comes in contact with something else, however, it collapses into a single particle at one location. The authors thus describe such “decoherence” as the physical process whereby coherence is lost and the quantum becomes classical.

McFadden and Al-Khalili give a thorough and fascinating account of photosynthesis and catalysis, as well as avian navigation, as life processes in which quantum mechanics may play a role. These examples have nothing to do with producing life from nonlife, however. The authors extrapolate the evidence for quantum effects in living organisms to wrongly infer that such effects could have been in play in the prebiotic world. This overreach is the main problem with their whole premise.

In their effort to overcome the impossible hurdles of obtaining life from non-living materials, McFadden and Al-Khalili favor the RNA World hypothesis, which is basically the idea that primordial chemical synthesis resulted in an RNA molecule that could act as both a gene for encoding, and as an enzyme for making copies of itself. Because various classes of particular RNA molecules known as ribozymes can do one of these jobs or the other, to a limited degree, evolutionary scientists propose that life on earth could have begun in an RNA world, without DNA and enzymes present at first.

However, those who consider the first self replicator to be a ribozyme need to understand the odds against one of these molecules forming by chance alone. The well-known chemist Graham Cairns-Smith gives an estimated probability of 1 in  $10^{109}$  that a starting molecule would convert into RNA. The authors acknowledge that there would need to be at least this number of starting molecules in the primordial soup. But the estimated number of fundamental particles in the entire universe is only

about  $10^{80}$  in comparison. They thus make this remarkable admission:

*“Clearly, we cannot rely on pure chance alone.”*

Here is where quantum mechanics comes to the rescue, as McFadden and Al-Khalili propose it to provide the search engine that could locate the correct configuration of nucleotide bases for a self-replicating proto-enzyme in the early earth. If the particles in the primordial soup were traveling like waves, then a cycle of quantum coherence and decoherence could begin. When, against all odds, the quantum collapse hits the molecular configuration of a self-replicator, then the act of replication would force the system into an irreversible transition into the classical world.

Al-Khalili knows that the key factor in quantum mechanics is that if you want to retain the quantum features, you must keep the wave-like nature undisturbed. But the warmer the environment is, the quicker the quantum effects disappear by decoherence, due to increased jostling of the particles at higher temperatures. Al-Khalili thus remarks that it is almost ridiculously counterintuitive to think

that quantum coherence could persist in the warm environment of cells. And yet it seemingly does. He explains this mystery by saying that life must be doing something special for quantum effects to play a role in living processes.

But herein lies the gap in logic that destroys the whole scheme of obtaining abiogenesis with quantum mechanics: The prebiotic soup would not have any life to keep decoherence at bay! This simple observance makes all the evidence for quantum coherence in living cells moot to explain the origin of life.

In trying to understand the origin of life, the readers of *Life on the Edge* are better off to take their cues from the father of the wave equation himself, Erwin Schrödinger, who says in his book, *What Is Life?*, “We must be prepared to find [living matter] working in a manner that cannot be reduced to the ordinary laws of physics.” Or better yet, we can trust the Bible when it says in the first chapter of Genesis that every living thing on the earth and in the sea was created by the word of the Lord.

**Mary Beth De Repentigny**  
marybethd4@gmail.com

# Instructions to Authors

## Submission

Electronic submissions of all manuscripts and graphics are preferred and should be sent to the editor of the *Creation Research Society Quarterly* in Word, WordPerfect, or Star-Office/Open Office (see the inside front cover for address). Printed copies also are accepted. If submitting a printed copy, an original plus two copies of each manuscript should be sent to the editor. The manuscript and copies will not be returned to authors unless a stamped, self-addressed envelope accompanies submission. If submitting a manuscript electronically, a printed copy is not necessary unless specifically requested by the *Quarterly* editor. Manuscripts containing more than 35 pages (double-spaced and including references, tables, and figure legends) are discouraged. An author who determines that the topic cannot be adequately covered within this number of pages is encouraged to submit separate papers that can be serialized.

All submitted manuscripts will be reviewed by two or more technical referees. However, each section editor of the *Quarterly* has final authority regarding the acceptance of a manuscript for publication. While some manuscripts may be accepted with little or no modification, typically editors will seek specific revisions of the manuscript before acceptance. Authors will then be asked to submit revisions based upon comments made by the referees. In these instances, authors are encouraged to submit a detailed letter explaining changes made in the revision, and, if necessary, give reasons for not incorporating specific changes suggested by the editor or reviewer. If an author believes the rejection of a manuscript was not justified, an appeal may be made to the *Quarterly* editor (details of appeal process at the Society's web site, [www.creationresearch.org](http://www.creationresearch.org)).

Authors who are unsure of proper English usage should have their manuscripts checked by someone proficient in the English language. Also, authors should endeavor to make certain the manuscript (particularly the references) conforms to the style and format of the *Quarterly*. Manuscripts may be rejected on the basis of poor English or lack of conformity to the proper format.

The *Quarterly* is a journal of original writings, and only under unusual circumstances will previously published material be reprinted. Questions regarding this should be submitted to the Editor ([CRSQeditor@creationresearch.org](mailto:CRSQeditor@creationresearch.org)) prior to submitting any previously published material. In addition, manuscripts submitted to the *Quarterly* should not be concurrently submitted to another journal. Violation of this will result in immediate rejection of the submitted manuscript. Also, if an author uses copyrighted photographs or other material, a release from the copyright holder should be submitted.

## Appearance

Manuscripts shall be computer-printed or neatly typed. Lines should be double-spaced, including figure legends, table footnotes, and references. All pages should be sequentially numbered. Upon acceptance of the manuscript for publication, an electronic version is requested (Word, WordPerfect, or Star-Office/Open Office), with the graphics in separate electronic files. However, if submission of an electronic final version is not possible for the author, then a cleanly printed or typed copy is acceptable.

Submitted manuscripts should have the following organizational format:

- 1. Title page.** This page should contain the title of the manuscript, the author's name, and all relevant contact information (including mailing address, telephone number, fax number, and e-mail address). If the manuscript is submitted by multiple authors, one author should serve as the corresponding author, and this should be noted on the title page.
- 2. Abstract page.** This is page 1 of the manuscript, and should contain the article title at the top, followed by the abstract for the article. Abstracts should be between 100 and 250 words in length and present an overview of the material discussed in the article, including all major conclusions. Use of abbreviations and references in the abstract should be avoided. This page should also contain at least five key words appropriate for identifying this article via a computer search.
- 3. Introduction.** The introduction should provide sufficient background information to allow the reader to understand the relevance and significance of the article for creation science.
- 4. Body of the text.** Two types of headings are typically used by the *CRSQ*. A major heading consists of a large font bold print that is centered in column, and is used for each major change of focus or topic. A minor heading consists of a regular font bold print that is flush to the left margin, and is used following a major heading and helps to organize points within each major topic. Do not split words with hyphens, or use all capital letters for any words. Also, do not use bold type, except for headings (italics can be occasionally used to draw distinction to specific words). Italics should not be used for foreign words in common usage, e.g., "et al.," "ibid.," "ca." and "ad infinitum." Previously published literature should be cited using the author's last name(s) and the year of publication (ex. Smith, 2003; Smith and Jones, 2003). If the citation has more than two authors, only the first author's name should appear (ex. Smith et al., 2003). Contributing authors should examine this issue of the *CRSQ* or consult the Society's web site for specific examples as well as a more detailed explanation of manuscript preparation. Frequently-used terms can be abbrevi-

ated by placing abbreviations in parentheses following the first usage of the term in the text, for example, polyacrylamide gel electrophoresis (PAGE) or catastrophic plate tectonics (CPT). Only the abbreviation need be used afterward. If numerous abbreviations are used, authors should consider providing a list of abbreviations. Also, because of the variable usage of the terms “microevolution” and “macroevolution,” authors should clearly define how they are specifically using these terms. Use of the term “creationism” should be avoided. All figures and tables should be cited in the body of the text, and be numbered in the sequential order that they appear in the text (figures and tables are numbered separately with Arabic and Roman numerals, respectively).

**5. Summary.** A summary paragraph(s) is often useful for readers. The summary should provide the reader an overview of the material just presented, and often helps the reader to summarize the salient points and conclusions the author has made throughout the text.

**6. References.** Authors should take extra measures to be certain that all references cited within the text are documented in the reference section. These references should be formatted in the current CRSQ style. (When the *Quarterly* appears in the references multiple times, then an abbreviation to CRSQ is acceptable.) The examples below cover the most common types of references:

Robinson, D.A., and D.P. Cavanaugh. 1998. A quantitative approach to baraminology with examples from the catarrhine primates. *CRSQ* 34:196–208.

Lipman, E.A., B. Schuler, O. Bakajin, and W.A. Eaton. 2003. Single-molecule measurement of protein folding kinetics. *Science* 301:1233–1235.

Margulis, L. 1971a. The origin of plant and animal cells. *American Scientific* 59:230–235.

Margulis, L. 1971b. *Origin of Eukaryotic Cells*. Yale University Press, New Haven, CT.

Hitchcock, A.S. 1971. *Manual of Grasses of the United States*. Dover Publications, New York, NY.

Walker, T.B. 1994. A biblical geologic model. In Walsh, R.E. (editor), *Proceedings of the Third International Conference on Creationism* (technical symposium sessions), pp. 581–592. Creation Science Fellowship, Pittsburgh, PA.

**7. Tables.** All tables cited in the text should be individually placed in numerical order following the reference section, and not embedded in the text. Each table should have a header statement that serves as a title for that table (see a current issue of the *Quarterly* for specific examples). Use tabs, rather than multiple spaces, in aligning columns within a table. Tables should be composed with *14-point type* to insure proper appearance in the columns of the *CRSQ*.

**8. Figures.** All figures cited in the text should be individually placed in numerical order, and placed after the tables. Do

not embed figures in the text. Each figure should contain a legend that provides sufficient description to enable the reader to understand the basic concepts of the figure without needing to refer to the text. Legends should be on a separate page from the figure. All figures and drawings should be of high quality (hand-drawn illustrations and lettering should be professionally done). Images are to be a minimum resolution of 300 dpi at 100% size. Patterns, not shading, should be used to distinguish areas within graphs or other figures. Unacceptable illustrations will result in rejection of the manuscript. Authors are also strongly encouraged to submit an electronic version (.cdr, .cpt, .gif, .jpg, and .tif formats) of all figures in individual files that are separate from the electronic file containing the text and tables.

## Special Sections

### Letters to the Editor:

Submission of letters regarding topics relevant to the Society or creation science is encouraged. Submission of letters commenting upon articles published in the *Quarterly* will be published two issues after the article’s original publication date. Authors will be given an opportunity for a concurrent response. No further letters referring to a specific *Quarterly* article will be published.

### Editor’s Forum:

Occasionally, the editor will invite individuals to submit differing opinions on specific topics relevant to the *Quarterly*. Each author will have opportunity to present a position paper (2000 words), and one response (1000 words) to the differing position paper. In all matters, the editor will have final and complete editorial control. Topics for these forums will be solely at the editor’s discretion, but suggestions of topics are welcome.

### Book Reviews:

All book reviews should be submitted to the book review editor, who will determine the acceptability of each submitted review. Book reviews should be limited to 1000 words. Following the style of reviews printed in this issue, all book reviews should contain the following information: book title, author, publisher, publication date, number of pages, and retail cost. Reviews should endeavor to present the salient points of the book that are relevant to the issues of creation/evolution. Typically, such points are accompanied by the reviewer’s analysis of the book’s content, clarity, and relevance to the creation issue.

### Author Copies:

CRSQ policy is that authors get 10 free copies of the issue containing their article, regardless of the number of co-authors. These free copies must be pre-ordered before the issue goes to press.

# Creation Research Society Membership/Subscription Application and Renewal Form

The membership/subscription categories are defined below:

1. **Voting Member** ..... Those having at least an earned master's degree in a recognized area of science.
2. **Sustaining Member** ..... Those without an advanced degree in science, but who are interested in and support the work of the Society.
3. **Student Member** ..... Those who are enrolled full time in high schools, undergraduate colleges, or postgraduate science programs (e.g., MS, PhD, MD, and DVM). Those holding post-doctoral positions are not eligible. A graduate student with a MS degree may request voting member status while enrolled as a student member.
4. **Senior Member** ..... Voting or sustaining members who are age 65 or older.
5. **Life Member** ..... A special category for voting and sustaining members, entitling them to a lifetime membership in the Society.
6. **Subscriber** ..... Libraries, churches, schools, etc., and individuals who do not subscribe to the Statement of Belief.

All members (categories 1–5 above) must subscribe to the Statement of Belief as defined on the next page.

Please complete the lower portion of this form and mail it with payment to CRS Membership Secretary, 1 W. Firestorm Way #145, Glendale, AZ 85306, or fax for credit card payment to (928) 636-1153. Applications may also be completed online at [creationresearch.org](http://creationresearch.org).

-----

This is a  new  renewal application for the subscription year beginning Summer  2021  \_\_\_\_\_. (Please type or print legibly.)

Name \_\_\_\_\_ Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Postal/Zip code \_\_\_\_\_ Country \_\_\_\_\_

Phone (optional) \_\_\_\_\_ Email \_\_\_\_\_

Degree \_\_\_\_\_ Field \_\_\_\_\_

Year granted \_\_\_\_\_ Institution \_\_\_\_\_

Presently associated with \_\_\_\_\_

I have read and subscribe to the CRS Statement of Belief. Signature \_\_\_\_\_

For foreign orders, including Canadian, payment must be made in U.S. dollars by a check drawn on a U.S. bank, international money order, or credit card. *Please do not send cash.*

Indicate applicable category ☺	Indicate payment ☺			
	Paper**			Paperless‡
<input type="checkbox"/> Voting <input type="checkbox"/> Sustaining	USA	Canada Mexico	Other countries	
<input type="checkbox"/> Regular [per year]	<input type="checkbox"/> \$43	<input type="checkbox"/> \$63	<input type="checkbox"/> \$80	<input type="checkbox"/> \$33
<input type="checkbox"/> Senior [per year]	<input type="checkbox"/> \$38	<input type="checkbox"/> \$58	<input type="checkbox"/> \$75	<input type="checkbox"/> \$28
<input type="checkbox"/> Life member	<input type="checkbox"/> \$500	<input type="checkbox"/> \$500	<input type="checkbox"/> \$500	<input type="checkbox"/> \$500
<input type="checkbox"/> Student* [per year]	<input type="checkbox"/> \$38	<input type="checkbox"/> \$58	<input type="checkbox"/> \$75	<input type="checkbox"/> \$28
<input type="checkbox"/> Subscriber [per year]	<input type="checkbox"/> \$46	<input type="checkbox"/> \$66	<input type="checkbox"/> \$83	<input type="checkbox"/> \$36

\* Student members are required to complete the bottom portion of this form.  
 NOTE: Student members may qualify for the *Future Leaders Sponsorship* program.  
 See the CRS website at [www.creationresearch.org](http://www.creationresearch.org) for details.  
 \*\* Rates for the paper option include postage for First Class Mail International

‡ **PAPERLESS option:** You may opt out of receiving paper copies of the CRS periodicals (*CRS Quarterly* and *Creation Matters*). By choosing this option you may register for access to the Premium Area of the website, where you may view or download electronic (PDF) versions of these publications. Of course, regular members and subscribers may also have access to the Premium Area. Only members, however, will have access to the Members Exclusive Area of the website.

Member/Subscriber	\$ _____ per year
	x _____ years
<b>SUBTOTAL</b>	\$ _____
Optional contribution	+ \$ _____
Life membership	+ \$ _____
<b>TOTAL</b>	\$ _____
<input type="checkbox"/> Visa <input type="checkbox"/> MasterCard <input type="checkbox"/> Discover	
<input type="checkbox"/> American Express <input type="checkbox"/> Check/money order	
Card number	_____
Expiration date (mo/yr)	_____
Phone number (_____) _____	
Signature	_____

**Student Members are required to complete the following:**

School or institution now attending \_\_\_\_\_

Your current student status:  high school;  undergraduate; graduate program  MS  PhD;  other \_\_\_\_\_

Year you expect to graduate or complete your degree \_\_\_\_\_

Major, if college or graduate student \_\_\_\_\_

Signature \_\_\_\_\_

# Order Blank for Past Issues

Cost of complete volumes (per volume): .....members (all categories) – \$18.00 + S/H  
 nonmembers and subscribers (libraries, schools, churches, etc.) – \$25.00 + S/H  
 Cost of single issues (per issue):.....members (all categories) – \$5.00 + S/H  
 nonmembers and subscribers (libraries, schools, churches, etc.) – \$7.00 + S/H

Volume	Number				Volume	Number				Volume	Number			
	1	2	3	4		1	2	3	4		1	2	3	4
23	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	35	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	47	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	36	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	48	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	37	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	49	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	38	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	50	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	39	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	51	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	40	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	52	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	41	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	53	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	42	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	54	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	43	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	55	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	44	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	56	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	45	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	57	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	46	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	58	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
										59	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Add 20% for postage (for U.S. orders: min. \$6, max. \$18; for Canadian orders: min. \$10, no max.; for other foreign orders: min. \$15, no max.) Total enclosed: \$ \_\_\_\_\_

Make check or money order payable to Creation Research Society. Please do not send cash. For foreign orders, including Canadian, please use a check in U.S. funds drawn on a U.S. bank, an international money order, or a credit card.

(Please type or print legibly)

Name \_\_\_\_\_ Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_ Country \_\_\_\_\_

Visa  MasterCard  Discover  American Express Card number \_\_\_\_\_

Expiration date (mo/yr) \_\_\_\_\_ Signature \_\_\_\_\_

**Mail to: Creation Research Society, 1 W. Firestorm Way #145, Glendale, AZ 85306, USA**

## Creation Research Society

**History**—The Creation Research Society was organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a need for an association devoted to research and publication in the field of scientific creation, with a current membership of over 600 voting members (graduate degrees in science) and about 1000 non-voting members. The *Creation Research Society Quarterly* is a peer-reviewed technical journal. It has been gradually enlarged and modified, and is currently recognized as one of the outstanding publications in the field. In 1996 the CRSQ was joined by the newsletter *Creation Matters* as a source of information of interest to creationists.

**Activities**—The Society is a research and publication society, and also engages in various meetings and promotional activities. There is no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund and research center are maintained to assist in such projects. Contributions to the research

fund for these purposes are tax deductible. As part of its vigorous research and field study programs, the Society operates the Van Andel Creation Research Center in Glendale, Arizona.

**Membership**—Voting membership is limited to scientists who have at least an earned graduate degree in a natural or applied science and subscribe to the Statement of Belief. Sustaining membership is available for those who do not meet the academic criterion for voting membership, but do subscribe to the Statement of Belief.

**Statement of Belief**—Members of the Creation Research Society, which include research scientists representing various fields of scientific inquiry, are committed to full belief in the biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution) both of the universe and the earth with its complexity of living forms. We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. *All members of the Society subscribe to the following statement of belief:*

1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.

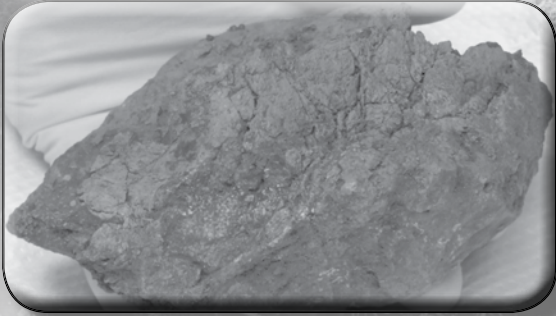
2. All basic types of living things, including humans, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.

3. The Great Flood described in Genesis, commonly referred to as the Noachian Flood, was a historical event worldwide in its extent and effect.

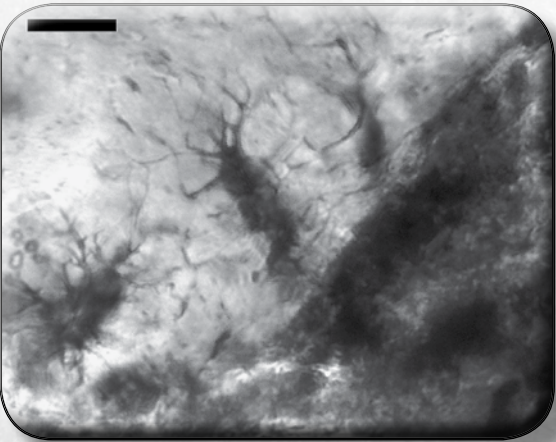
4. We are an organization of Christian men and women of science who accept Jesus Christ as our Lord and Savior. The act of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Savior for all people. Therefore, salvation can come only through accepting Jesus Christ as our Savior.

# iDINO II

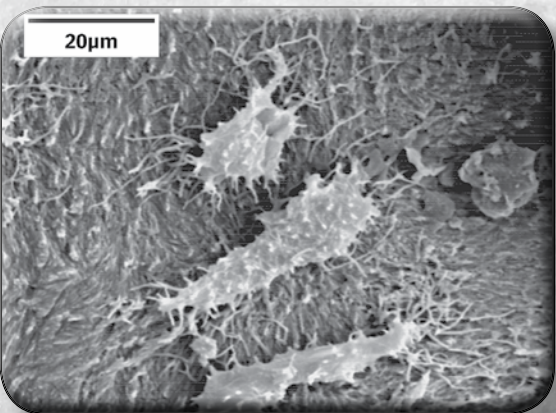
## Investigation of Dinosaur Intact Natural Osteo-tissue



A fragment of the *Triceratops* brow horn. Fragments, such as this one, still contain tissue and cells.



Microscopic examination of tissue extracted from a *Triceratops* horn reveals bone cells still present.



Electron microscope picture of intact bone cells still in tissue extracted from a *Triceratops* horn.

**How can pliable, stretchable tissue survive inside dinosaur fossils for over 65 million years?**

**How can this tissue still contain intact cells and even dinosaur proteins?**

**How can this fragile biological material survive for so long?**

The answer to these questions directly challenges the current, evolutionary-biased, geologic timescale.

The Creation Research Society began its iDINO research initiative for the purpose of studying soft tissue in dinosaur fossils. The first phase of the project detected pliable, unfossilized tissue in a brow horn of a *Triceratops*. Within this tissue were intact osteocytes (bone cells). Some results from the iDINO project have been published in a technical microscopy journal and presented at an international microscopy conference. The Spring 2015 issue of the *Creation Research Society Quarterly* also features a special report of the iDINO project. Plus, to further spread the important information about soft tissue, the Society is developing a video (Echoes of the Jurassic).

The **second phase** of the project (iDINO II) will look more extensively at the process of tissue preservation. Evolutionists have offered various theories of how this tissue could survive for millions of years. iDINO II will methodically investigate these preservation claims, assessing their plausibility.

The iDINO results have already provided a strong challenge to the evolutionary worldview. More extensive and detailed examination may provide even stronger evidence that the age of dinosaur fossils is far less than 65 million years. To this end, the Society continues to seek those willing to fund this project with either one-time gifts or monthly donations.

For more information contact us at (928) 636-1153 or [crsvarc@crsvarc.com](mailto:crsvarc@crsvarc.com).

Also visit <http://tinyurl.com/nphm2c4> for project updates and details.



V 5 9 N 2

