



QUARTERLY

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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

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A Tribute to Dr. Kevin Anderson

(Adapted from Carter, Robert. 2022. Challenging evolution with science: Dr. Robert Carter interviews microbiologist Dr. Kevin Anderson. *Creation* 44(2):21–25.)

Dr. Kevin Anderson earned his Ph.D. in microbiology from Kansas State University. He spent some time as post-doc (courtesy of the NIH) and was a professor of microbiology at Mississippi State University. Prior to his untimely departure, Kevin was the director of the Van Andel Creation Research Center (VACRC). The lab is owned and operated by the CRS and is located on the campus of Arizona Christian University in Phoenix. Kevin left behind his wife, Diane (who also serves as the CRS Administrative Assistant), their three children, and four grandchildren. Dr. Robert Carter was privileged to interview him before Dr. Anderson was called home.

Kevin was a self-professed farm boy from Kansas. He said he was proud of his upbringing but knew early on that farm life was not his calling. Interestingly, he and Dr. Duane Gish (1921–2013) shared the same hometown. This formed a fun bond between them while both were alive.

As a high school freshman, Kevin read Michael Crichton's *The Andromeda Strain*, a fictional story about the discovery of a deadly pathogen from space. He said he was captivated by the scientific process described in the book and decided he wanted to be a microbiologist.

After his undergraduate degree, he received a Ph.D. in microbiology and spent most of his professional career

doing laboratory research on bacteria. This included work on the genetics and ecology of anaerobic bacteria. In 2008, the journal *Structure* published a special report about a bacterial starch degradation system (Koropatkin et al., 2008). His post-doc research was the foundational work that led to much of what was reported in this special issue.¹

Kevin grew up in a Christian home. He said he never went through a rebellious teenage stage nor a crisis of faith. Instead, he told me, “I went through a period of determining whether I professed to be a Christian simply because that was my family heritage or because that was my personal faith.”

He said he entered college as a creationist, but with only a modest understanding of what that meant or any of the science involved. As a college student, he was very focused on learning how to interpret and follow the evidence.

“I never actually encountered anything resembling the ‘acid of Darwinism’ which theistic evolutionist

¹ The first two footnotes of Koropatkin et al. were to a two-part paper: Anderson, K.L., and A.A. Salyers. 1989. Biochemical evidence that starch breakdown by *Bacteroides thetaiotaomicron* involves outer membrane starch-binding sites and periplasmic starch-degrading enzyme. *Journal of Bacteriology* 171(6):3192–3198; Anderson, K.L., and A.A. Salyers. 1989. Genetic evidence that outer membrane binding of starch is required for starch utilization by *Bacteroides thetaiotaomicron*. *Journal of Bacteriology* 171(6):3199–3204.



and physicist Karl Giberson (2008) claims he encountered in his college years, that ‘ate’ away his ‘fundamentalist’ understanding of Adam, Eden, and creation. I have always wondered what classes he took, because as a microbiology major, I never encountered such strong ‘acid.’ It might have had a big impact on my creation views if I had, but of course I never came across anything nearly as persuasive and challenging as claimed by Giberson (2008).”

Kevin took several evolution classes as an undergraduate. He recalled looking at his notes as he prepared for final exams and thinking, “Where is all this evidence everyone keeps talking about?” The material presented in the courses was little more than speculation and extrapolation (with lots of peppered moths (Lightner, 2012) and finches (Tay, 2020) scattered throughout). In fact, he said:

“I was a much stronger creationist upon completion of my postdoctoral training than I was at the beginning of my academic years. I guess I must have been asleep during the five minutes in which they presented the overwhelming evolution evidence that apparently so deeply impressed

many of my peers. Rather, the science information I learned seemed to fit so well with creation and even Genesis.”

When asked how his belief in creation impacted his time in school, Kevin said that his high school freshman biology teacher got annoyed with all his questions and how he constantly challenged evolution.

“I think my great desire to understand the creation/evolution conflict motivated me to learn more about science than most of my academic peers. So, in that regard, it made me a better student because I was motivated to understand the tools and process of science even at an early age.”

It also helped him understand the difference between science, philosophy, and theology, something too many scientists still do not understand.

“My creation beliefs put me in the library studying topics that were not directly related to the classes I was taking but were a very valuable part of my maturing as a young scientist.”

VACRC has a fully equipped and operating laboratory. He was able to leverage his experience in biochemistry and cell biology to perform laboratory work on dinosaur tissue and preserved proteins.

“I certainly would have never guessed that I would be working with dinosaur bones in a laboratory or talking about dinosaur proteins. As the saying goes: to make God laugh, simply tell Him your plans! I’ve had a front row seat for some of the biochemical work challenging the various explanations currently offered by the evolutionist community.”

This work is part of the *iDino* project that was spearheaded by the CRS. The goal is to focus on the biochemistry of protein preservation and degradation. They are examining why the various models that evolutionists have proposed to try to solve their problem do not work.

“The presence of preserved original biomaterial in dinosaur bones has been well established, even though some evolutionists desperately try to offer alternative explanations. I think the main focus for creationists should be the lack of any sound explanation for the presence of this material in fossils—if they really were 66+ million years old as evolutionists and other old-Earthers claim.”

When I asked if he had any faith-affirming encouragement to give to the next generation, he replied:

“This fallen world will try to convince you that science has ‘proven’ the Bible wrong, and that creation is a failed idea. This is simply the rhetoric of people who are willfully denying their Creator and all the evidence that He left for us to discover in His creation [cf. Romans 1:18–32]. Evolutionists rarely allow close examination of their ideas, usually waving off challenges with dismissive claims such as, ‘No real scientist believes in creation.’ This is hardly an inspiring scientific conclusion, as it rests heavily upon everything but the use of science.”

Getting back to his background in genetics, he concluded our interview saying:

“Twenty years ago, evolutionists were literally giddy with claims that the newly published human genome sequence is devastating to those ignorant creationists. As more genome data and analysis was gradually gathered, that giddiness began to subside to the point that it is now almost nonexistent (and even then, usually just among the genetically ignorant). In contrast, creation geneticists have never been so vocal. It is a wonderful time to be a creationist, and even more so, a creation geneticist. The human genome data has been a godsend for us. For example, the concept that

most of it is ‘junk’ (useless) DNA was embraced by evolutionists.

It is now clear that almost all DNA is in fact translated, sometimes into protein, but often into different forms of RNA that regulate the expression of many different protein-coding genes. So, even if only about 2% of the genome codes for protein, the rest of the genome is involved in regulating the cell in other ways. I find it highly ironic (actually, just plain silly) when we creationists are accused of being anti-science. Because people want to equate evolution and science, it’s then assumed that to reject evolution is to reject science. That is hardly the case, since evolution is just one interpretation of the data—and, I would add, a highly flawed interpretation. Science only gives us the tools to gather that data. Scientific discovery continues to confirm creation (such as the genome data). So, we want more science discovery, not less.”

Dr. Kevin Anderson will be remembered by many as a brave and effective warrior for the truth of the Bible and the Gospel.

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Creationeering™: An Integrated Engineering-Business Paradigm for Technological Entrepreneurship from a Biblical Basis

M.F. Horstemeyer, A. Adebayo, M. Jantomaso, J.L. Long, S. Burgess, and A. McIntosh

Abstract

Creationeering™ is a new paradigm, or worldview, that integrates engineering and business practice for technological entrepreneurship from a Biblical basis. This paradigm subsumes “intelligent design” along with other engineering attributes and business practice. Furthermore, Creationeering™ distinguishes itself from “creation science” in that the former includes the “creation process” while the latter is limited to the discovery of existing physical phenomena. The systems engineering steps of Creationeering™ include the following: design, analysis/synthesis, procurement/making, logistics, assembly, performance/function, sustainability, and death/recycling. The business aspects include the following: human personnel, finances, legal, sales/marketing, and management. The eight steps in engineering and the five aspects of business comprise the paradigm of Creationeering™. God’s account of the Creationeering™ process is presented with respect to the creation of the cosmos, and Moses’ account of the Creationeering™ process is presented with respect to the Tabernacle. A brief history is given to explain the loss of the Creationeering™ mandate and recovery from the Reformation and consequential industrial revolution. Finally, a modern example of the common automobile is discussed to bring clarification regarding Creationeering™.

Key Words: Creationeering™, engineering, business, design, Dominion Mandate

1. Introduction

Science, design, engineering, and entrepreneurship are considered separate concepts and/or disciplines. We have programs at universities that train

students in these different areas where Bachelor’s, Master’s, and even Doctoral degrees can be earned that were developed from industry needs. The focused training of students in each of

the distinct disciplines of science, design, engineering, and entrepreneurship leads to an individual’s narrow paradigm when considering aspects of the other disciplines. Currently, there is no holistic perspective that integrates these notions, let alone one that integrates a Christian worldview into the mix.

Theodore von Karman, an aerospace engineer and the first National Medal of Science recipient given by President John F. Kennedy in 1963, stated the following: “Scientists discover the world that exists; engineers create the world that never was.” Hence, science focuses on discovering phenomena in nature using the scientific method, but engineering produces technical innovations, “things,” and processes. Based on von Karman’s definition (2020), we can add a Biblical basis to science and engineering related to the terms ‘creation science’ and Creationeering™. Essentially, Creationeering™ is the process that the Creator used to make everything, and creation science is the analysis of the results of His Creationeering™ process to discover physical phenomena.

The Biblical references that lay a foundation for science and engineering are the following, respectively:

Romans 1:20 (NKJV)—For since the creation of the world His invisible *attributes* are clearly seen, being understood by the things that are made, *even* His eternal power and Godhead...

Proverbs 8:12 (KJV)—I wisdom dwell with prudence, and find out knowledge of witty inventions.

Romans 1:20 specifies the goal of research and discovering things in God’s creation to find out more about the Creator. Hence, the knowledge garnered by research and discovery reveals some aspects of the Creator’s nature, character, and attributes. Proverbs 8:12 indicates that information is revealed to mankind for a creative purpose to invent “things” for human service. Both science and engineering find their roots as a commandment under the Dominion Mandate for ruling and reigning:

Genesis 1:26–28 (NIV)—Then God said, “Let us make mankind in our image, in our likeness, so that they may rule over the fish in the sea and the birds in the sky, over the livestock and all the wild animals, and over all

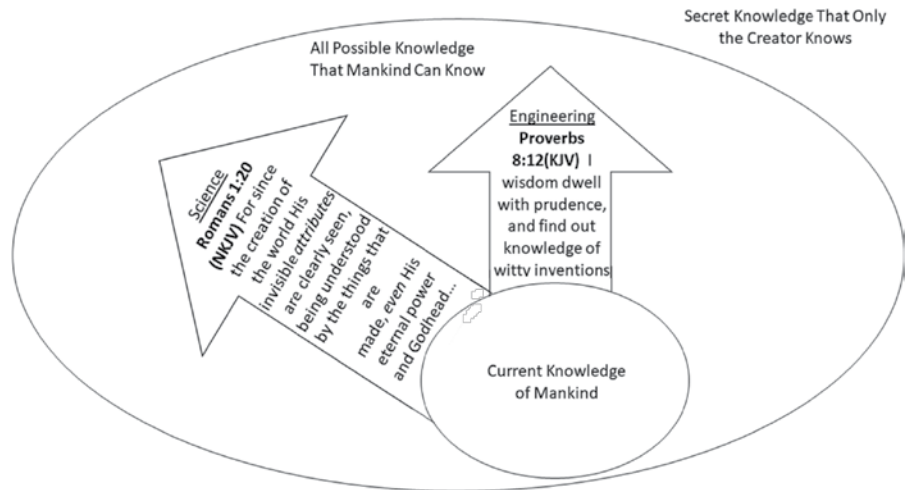


Figure 1. Schematic illustrating how science and engineering arise from a revelation from the Creator as per Proverbs 29:29.

the creatures that move along the ground.” So God created mankind in His own image, in the image of God he created them; male and female he created them. God blessed them and said to them, “Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish in the sea and the birds in the sky and over every living creature that moves on the ground.”

The Biblical basis for creation science and Creationeering™ can be explained from considering a notion that Johannes Kepler, German astronomer and Christian, introduced from the following Bible verse (and illustrated in Figure 1):

Deuteronomy 29:29 (NKJV)—The secret things belong to the LORD our God, but those things which are revealed belong to us and to our children forever, that we may do all the words of this law.

In Deuteronomy 29:29 the “secret things” relates to information that only God will ever know, but the information that He will “reveal” to us is in two categories as illustrated in Figure 1. One

space within the large circle represents all knowledge that He will allow us to have and the space within the smaller circle represents the current knowledge that we have now. We, as Christians, only need to ask for information from God to enlarge the smaller circle as He gives revelation of new knowledge.

It is important to note that while there is no such thing as Christian engineering, there exist Christian engineers who approach the field of engineering from a Biblical perspective. What differentiates a Christian engineer from a secular engineer is that while the latter views the field as a human initiative, the former views the field as a divine initiative. The Christian engineer believes in the existence of a God who fashioned the Earth out of nothing and who created man as an image bearer with the mandate to dominate and steward all of His creation. Therefore, while the motivating factor for a secular engineer will be economic gratification and to glorify self, the Christian engineer is motivated by the desire to serve humanity and glorify God. The Christian engineer sees his or her vocation as a calling and

a form of worship. Creationeering™ is therefore the application of Biblical principles and truth in relating engineering to business.

“Creation Science,” as the community of researchers who conduct scientific research related to the Bible, which has spawned several journals [*Creation Research Society Quarterly*, *Journal of Creation*, etc.], since 1960 has focused on research related to the strict Biblical perspective of a “young Earth.” These researchers are sometimes called Young Earth Creationists (YEC). The term “creation science” probably garnered its title in contrast to “evolutionary science” in the 1960s when Whitcomb and Morris (1961) published *The Genesis Flood*, and Morris (1979) wrote *The Genesis Record*. Since then, the term creation science has represented more than just the Creation as many “creation scientists” have conducted research on the Genesis Flood (Whitcomb and Morris, 1961) as well. As such, the term “creation science” is a bit of a misnomer, today.

Creationeering™ distinguishes itself from “creation science” since it represents the systems engineering approach that God used in making everything, whereas creation science focuses on studying the creation for evidence either of God’s existence or to substantiate the Bible. Typically, creation scientists interpret the Bible literally including the ages of individuals, leading to the conclusion that the Earth is fairly young (6,000–10,000 years) compared to the evolutionary-required time scales (billions of years). Although Creationeering™ in itself does not argue for or against the younger-Earth perspective, the assumption in this writing aligns with a younger-Earth perspective.

Creationeering™ provides a holistic systems perspective that integrates science, design, engineering, and entrepreneurship with a Christian worldview. It also allows for a grander conceptual abstraction than “Intelligent Design” for proof and evidence of the Creator

God. Behe (1996) clearly articulated “irreducible complexity” in biological systems where he described the smallest features in a living system are complex engineering systems. If just one component fails, the whole system fails in a symbiotic manner. Hence, you need an intelligent designer to design such an organism. Creationeering™ subsumes the “irreducible complexity” argument since it covers “systems complexity” at every length scale, including the cosmos.

While science goes as far back as the ancient Egyptians, the first science-based educational enterprise did not arise until Socrates (Grant, 2007, pp. 1–26) in the fifth century BC. Engineering education started in the United States with General Washington’s order in 1778 calling for the establishment of a school of engineering (Grayson, 1979). Modern engineering was based on the United States’ models, although it was formed by morphing several paradigms together from other countries. Marsden (1994) explained that the basic philosophy of an engineering education arose from the liberal arts universities of England, but the engineering curricula was modified from the French models or from professional engineering corporations. Russia initiated shop and manual arts, while Germany led research and graduate education, which led to the secularization of education. Although early developments in the United States were more adaptive than creative, in at least three respects American schools exercised conspicuous leadership. They pioneered the introduction of laboratory instruction for the individual student as an integral part of the curriculum in the provision of distinctive training in the economic and management phases of engineering and in the development of cooperative education. The Accreditation Board for Engineering and Technology, Inc. (ABET, 2012) defines modern engineering in the following way: “Engineering is the profession in which a knowledge of the mathematical

and natural sciences, gained by study, experience, and practice, is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of humankind.” This definition, we believe, is limited and not based on the Bible. As such, an engineering educational system based upon the Biblical frame of reference is warranted.

The engineering part of Creationeering™ includes the following fundamental, independent, necessary, and sufficient eight required steps in the creational process (see Figure 2):

1. **Design:** thinking process that defines the engineering problem, includes ideation of solutions, and creates prototypes related to a product, process, software, or system. In defining the engineering problem, the objectives, constraints, and variables are specified before the solutions are introduced.
2. **Analysis/Synthesis:** computational and/or experimental evaluation of the designed prototype by applying scientific analytic principles, processes, and tools to reveal the properties and state of a product, process, software, or system.
3. **Procurement or Materials Processing:** the “making” of the products as the final “thing” or for the process or system also including the exchange of funds for the products and/or “things.” The key aspect of making the products is the process-structure-property-performance sequence in terms of the information passage to assure that the design is realized within the tolerances (uncertainties associated with the processes of making the products and/or “things”).
4. **Logistics:** the synchronization process of the distribution, transportation, and warehousing of the products and/or “things” where reliability, maintainability, and availability are dynamically changing before the

products and/or “things” can be assembled.

5. **Assembly:** the process of putting components together to make a subsystem and putting subsystems together to make a system.
6. **Performance:** requirements for the life cycle of the product to function properly considering normal and abnormal environments.
7. **Sustainability:** the operation of an engineering system that employs resources to remain after the process and product are completed.
8. **Death/Recycling:** operation of performance afterlife in which it will be decided that the product will be either be thrown away or returned as a new product after undergoing a new materials processing method.

The notion of a business and the system of its integrated parts can be Biblically motivated. Trueblood (1961) discussed the role of a Christian within a company. Walsh and Middleton (1984) claimed that the essence of a business is to fulfill the purpose of God, which is redemption. The *Journal of Biblical Integration in Business* (JBIB) (1995) focused articles on different Biblical aspects of a business. Few, if any, of these articles in the JBIB discussed a Biblical perspective on an engineering business. Other seminal works on integrating Christian philosophy into a business include Novak (1996), Cosden (2006), Stevens (2006), Daniels (2012), and Keller (2012). These authors elucidated the theology of work and a business rationalizing through scriptures that although profit matters for the sustainability of a business enterprise, it is not the main reason of its mission. St. Hill et al. (2013) delineated four main areas of a business:

1. Integrating God’s purpose in the world of bringing God’s kingdom into humanity’s kingdom and the economic, financial, and stewardship associated with it;
2. the role of business in serving people;

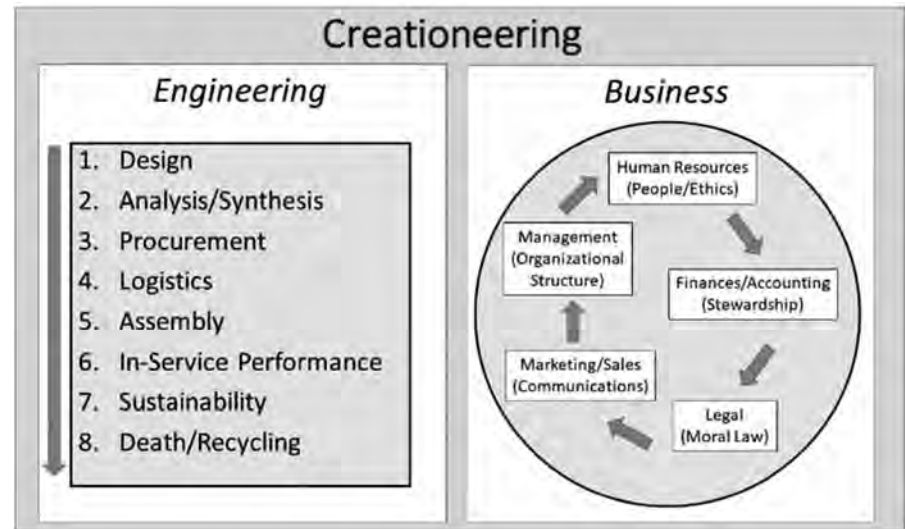


Figure 2. Creationeering™ is defined by integrating two typically separated academic disciplines: engineering and business with a focus on entrepreneurial thinking.

3. the role of business in caring for creation;
4. the role of business in profiting from wealth creation.

The following quote from St. Hill et al. (2013) provides a nice parable for Creationeering™. “‘Give a man a fish; you have fed him for a day. Teach a man to fish and you have fed him for a lifetime’—author unknown. Revised saying, ‘Give a man a fish; you have fed him for today. Teach a man to fish and you have fed him for a lifetime. Teach a man how to establish a fishing business; and you not only feed him for a lifetime but bring benefits to his family and the community.’” As a Creationeer™ operating from a Biblical worldview, we can realize the connection from scientific research through the engineering process into the entrepreneurial corporations to genuinely affect the economic, social, environmental, and spiritual transformation of a culture.

The five fundamental, independent features of a business enterprise or entrepreneurship required to start a business as shown in Figure 2 are the following:

9. **Human Resources:** the hiring, administration, and training of personnel with ethical standards. If the Bible is not used to provide an ethical basis to undergird human relationships, then science, engineering, and entrepreneurship (business) can be self-centered and oriented away from glorifying God to glorifying man.
10. **Finances:** management, accounting, and stewardship of money as a commodity to conduct the goals of the business. A mindset that begins with the premise that everything belongs to God and that man is just a servant of God will lead to financial success that glorifies God.
11. **Legal:** an entity requires compliance to laws related to intellectual property, litigation, investigations, and acquisitions. God is a law-giver and demands obedience to his moral directives.
12. **Marketing/Sales:** the action of communicating and connecting the products with the consumers. Secular marketing has as its goal

Table 1. List of engineering disciplines and their associated examples.

Discipline	Bio-Inspired Example	Historical Man-Made Example	Modern Man-Made Example
Aerospace	birds	airplanes	space ships
Agricultural	garden	tractor	farm bots
Biological	brain	prosthetics	pharmaceuticals
Chemical	trees changing acidity of soil	managing chemical processes	biochemical materials
Civil	beavers making a dam	bridge	building on the moon
Computational	Bible prophecy	analysis	simulation-based design
Computer	human brain	personal computers	cyber-physical systems and data fusion
Electrical	Earth's electrical field	electrical energy	robots
Energy	Sun	engine	nuclear
Industrial	ant hill	assembly line	modern factory operations
Materials	wood as a composite structure	steel	lightweight materials
Mechanical	ram's horns hitting each other	gears	Nature inspired designs
Mining	earthworms	tunnel boring machinery	fracking
Software	Deoxyribonucleic Acid (DNA)	Fortran	Python
Systems	Solar System	car	building

consumerism, whereas Christian marketing focuses on truth, honesty, and meeting genuine client needs.

13. **Management:** an organizational structure to admit the rules, roles, and responsibilities for individuals to operate. God is all about managing His creation and the Creationeer™ recognizes and embraces their role in God's creation.

These five “business” aspects comprise a system of independent, necessary, and sufficient characteristics and originate in the creative process from God as stipulated in the Biblical Genesis account of creation. Creationeering™ is the nexus where these two domains merge, where the eight engineering steps integrate with the five fundamental features of business. Each of the eight engineering and five business features are independent and necessary to each other in the mathematical and logical sense when thinking about first principles. As an abstract whole, they are

sufficient to comprise everything within the Creationeered™ system. In other words, no other concepts other than these thirteen are required to fulfill a Creationeered™ system.

Another thought needs to be distinguished herein regarding the term Creationeering™ and “created.” We distinguish Creationeering™ from “created” in the sense that “created” is an action verb attributed to a single component or element of a component. Hence, “create” is the most general abstraction of the sense of the action. Creationeering™ is related to an engineered system and ownership of property where “property” can be a thing, a material, a structure, a process, software, and/or lands.

It is from here that the notion of “personal property” can clearly be defined. It is certainly the Creator who engineered everything and the potential for the Earth (and/or the Moon, Mars, etc., if needed) to be used. Once a human takes something that God made and

adds value to it, it becomes “property.” Let us consider for example a tree that God made. It is the man that must form it into lumber for a house. The house becomes property for the man. Similarly, God made soil, water, and seeds, but it is mankind that makes it into a garden. Hence, as man engineered the potential from the soil, water, and seeds to make a garden, he added value and the garden has become the “property” of the man.

When the steps of engineering are applied to different categories, mankind has separated them into disciplines. For example, if the engineering process is applied to a bridge, then we would have civil engineering. A more comprehensive list is shown in Table 1.

2. Creationeering™: God's Perspective During the Creation Week

The Creation account can therefore serve as the foundation for engineering

as a discipline because here, we see a Creator-God who laid the foundation for humanity to join in the creational process. In the Creation account, God clearly sets up a hierarchical system of different length-scale engineered systems that interacted with each other in which He designed, analyzed, procured, accomplished logistics, and assembled things for their life performance, sustainability, and death/renewal. Along with the creating process (the business/entrepreneur side), He focused on the human who needed a moral law (legal), a way to communicate with others (sales/marketing), an organized system of living and nonliving entities for life (management), and a method of exchange for commodities (finance). Thus, we see God in this context as the Ultimate Creationeer™ who laid out the process for mankind to be a Creationeer™.

Engineering as a discipline thus garners its foundation in Genesis 1:28 under the Dominion Mandate directly from God our Creator (Morris, 1973). God's first command to mankind was to be a good steward of the Earth's resources.

Genesis 1:28 (KJV)—And God blessed them, and God said unto them, be fruitful, and multiply, and replenish the earth, and *subdue* it: and have *dominion* over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.

Psalms 8:6–8 (KJV)—You made him to have *dominion* over the works of your hands; you have put all things under His feet: all sheep and oxen, yes, the beasts of the field; the fowl of the air and the fish of the sea, and whatever passes through the paths of the seas.

While the Creation account in Genesis is often referred to as the main source of information, there exist more Biblical references regarding the creation. These other Biblical references can help provide rich and robust Bibli-

cal explanations for each of the stages of the Creationeer™ process. The following Bible verse summarizes it well:

Isaiah 45:18 (NIV)—For this is what the LORD says—he who created the heavens, he is God; he who fashioned and made the earth, he founded it; he did not create it to be empty, but formed it to be inhabited—he says: “I am the LORD, and there is no other.”

2.1. Design of the Universe: Step 1 of Creationeer™ process

Design in engineering is a thought process of devising a component, subsystem, system, or process to meet desired objectives while considering the constraints and feasible variables. Although the design process can be slow from a human perspective, because of God's knowledge, He designed everything almost instantaneously from a human-time perspective.

Most often, when we observe an object—the combination of parts and how the different parts each contribute to a complex/complicated function—we intuitively conclude that it was the handiwork of some human designer, which has been argued since William Paley in 1802 (Fyfe, 2002). We immediately recognize complex systems and objects as some contrivance of a sophisticated engineering mind even to the most basic building blocks of life, which has been termed ‘irreducible complexity’ (Behe, 1996). That is the same way we might view the Universe—the combination of various parts with each part contributing to a complex function to meet certain objectives. By observing the extraordinary and unpredictable ways organisms adapt, thrive and survive not only suggests an intelligent designer but elicits some form of intentional design. The sense of order and well-being is suggestive of a well thought-out structure and the Creation account in Genesis provides, in Paley's opinion, the best explanation for this. It

depicts a picture of God as the creator, maker, and overseer, as a skilled builder who values His work (Genesis 1:31). The Creation account portrays God's overflowing goodness through His devotion and care, sequentially ordering the Universe with the final creation of humans, made in the divine image, at the apex. As image-bearers, there is therefore, a transcendental dimension to humankind's existence and that is to have dominion over the Earth just as God does (Genesis 1:26–28). To “subdue” and “have dominion” means for mankind to live productively by using the resources of the Earth. The stewardship of the Earth was given to mankind at this point to prosper life and fulfill the destiny of each person. Some have called this the “Dominion Mandate” (Otabil, 2013), which gave mankind authority over the creation to steward it for its highest good.

Holding firmly to the doctrine of *Creation Ex Nihilo* (creation out of nothing), we see God's *design* from the beginning of Genesis 1. The entire Bible (Old and New Testament) opens up with the sentence:

Genesis 1:1 (KJV)—In the beginning, God created the heaven and the earth.

This opening verse depicts God's majesty, power and unsearchable wisdom, who out of His goodness and love created everything. The whole of creation therefore reflects intelligent design and coherent systems, made from nothing, yet crafted to reflect virtues to be celebrated throughout culture. The systematic ordering of the Universe as seen in the structure of the Creation Week in Genesis 1:1–2:3, portrays a transcendent God, who intelligently sets everything in their proper place, the three days of shaping the void and three days of filling the void, to support each other in conformity to His grand design. Lennox (2011) explains the particular sequence of creative and organizational steps by which God shaped the world

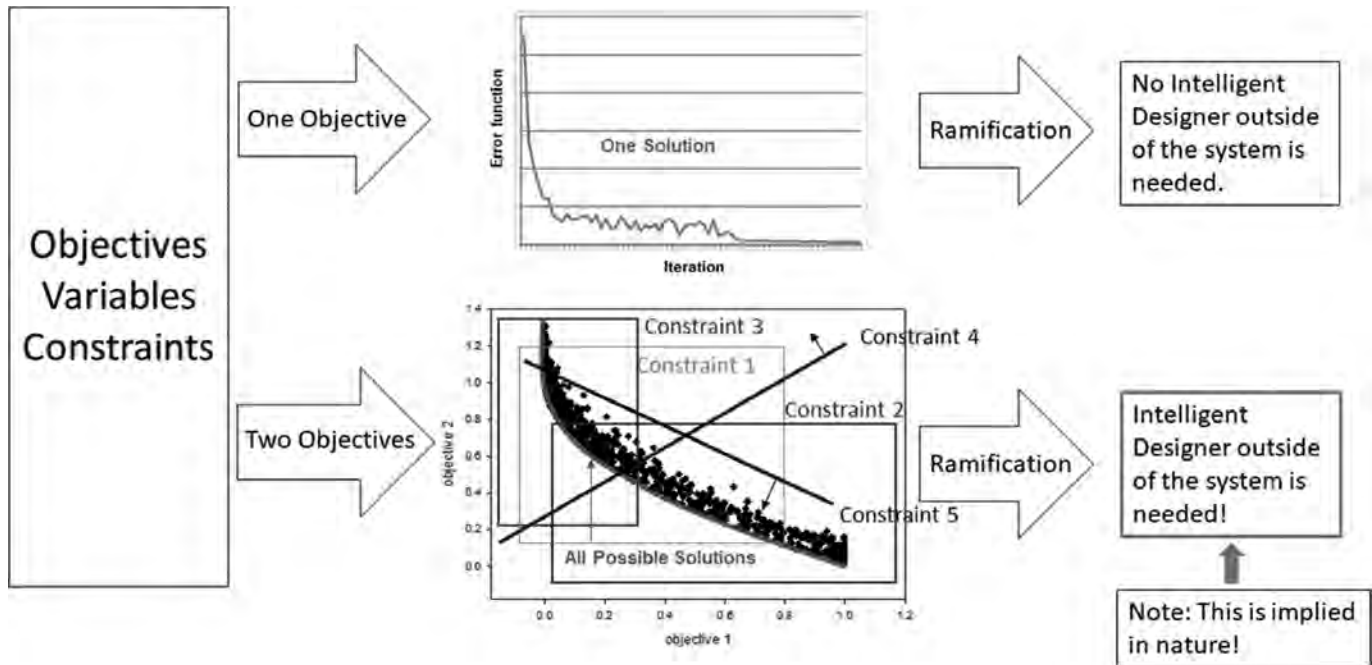


Figure 3. A multi-objective design process demands an intelligent agent outside of the engineered system. Here, the Pareto (1920) frontier is the maroon line that allows for all possible optimal solutions with the most efficient solutions (van den Berg and Friedlander, 2009).

and filled it with living things. Mankind is the most unique of all of God's creation because as image-bearers, we are called to be co-creators. This means that we also possess, at a lesser level, the creative and organizational abilities to tend to and cultivate the Earth.

The design process includes objectives, constraints, and variables that are interrelated in a mathematical equation(s) with metrics that are optimized (c.f., Fang et al., 2005; Johnson et al., 2016). There is a continuum from strong and to weak sensitivities of the variables and constraints on the objective(s), which gives rise to uncertainties related to the solution (Coleman and Steele, 1999). How large the uncertainties are is directly related to the reliability of the solution (Pidong et al., 2017).

An *objective* can be a numerical value or function that can increase or

decrease. For example, a designer may wish to maximize profit or minimize weight. Many mathematical equations can work with single objectives. As Figure 3 illustrates, a simple calculus differentiation can allow a gradient model to easily capture the minimum in the equation, which signifies the optimal solution. When using simple mathematical gradient methods, the designer normally weights the various objectives and sums them to form a single objective. However, Figure 3 also illustrates that a designer can have two or more objectives, which mathematically will introduce what is called a "Pareto Frontier" or sometimes "Pareto Front" (Pareto, 1920). The Pareto Front is the maroon line in Figure 3 illustrating that multiple solutions can satisfy the minimization, meaning they are multiple solutions. However, Figure 3 also illustrates that different constraints

can come into and limit the solution space.

A *constraint* is a condition that must be satisfied for the design to be feasible. Examples include physical laws, limited human capital, funds, user requirements, or bounds on the validity of the mathematical models. Constraints in the mathematical equations can be used directly or can be incorporated into the objective using Lagrange multipliers (Lagrange, 1764, 1811; Rockafellar, 1993) to garner the optimal solution. The different constraints illustrated in Figure 3 limit the solution space and eliminate other possible solutions in the Pareto Front. Constraints complicate the mathematical equations and decrease the number of possible solutions. Some constraints may be very limiting and others may not.

A design *variable* is a parameter that is controllable by the designer but could

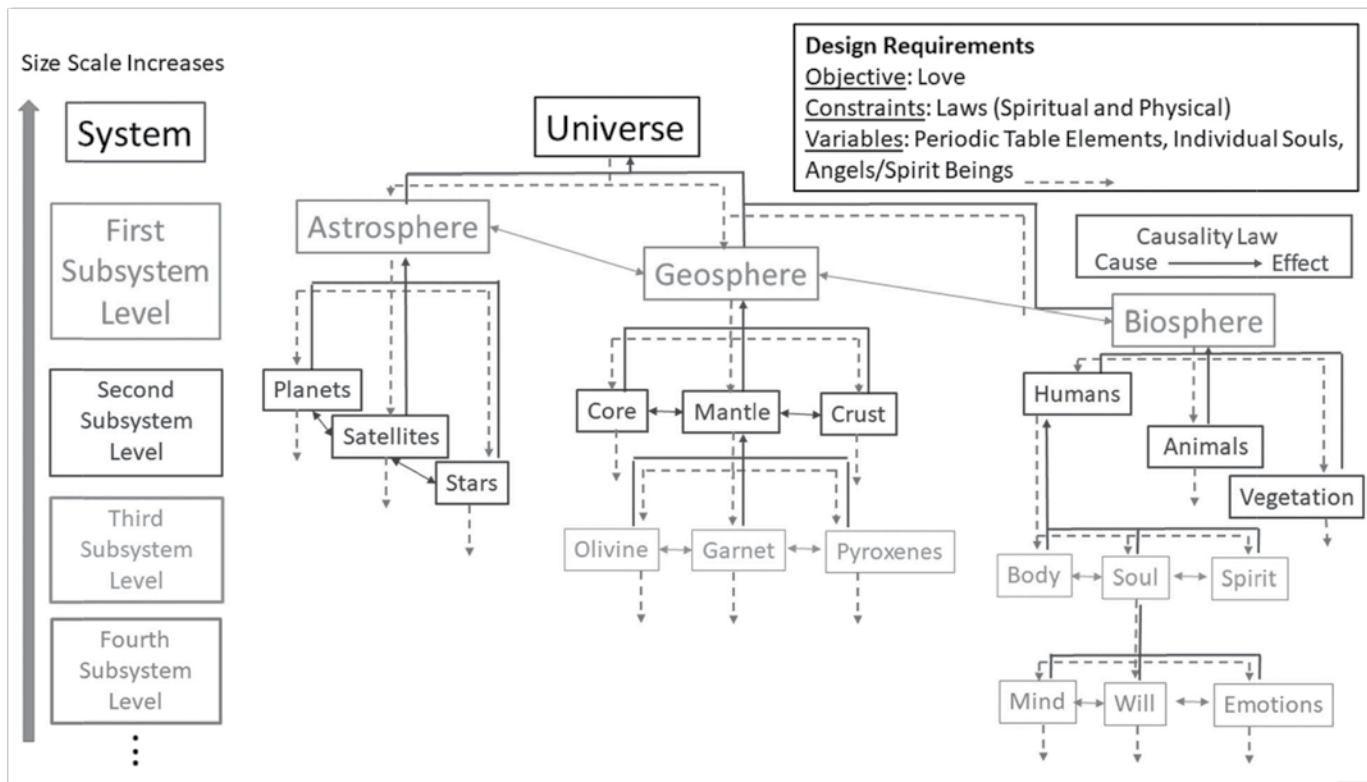


Figure 4. The Creationeer's perspective is that the Universe is a multi-size scale, multi-objective, interactive, complex system including the astrosphere, geosphere, and biosphere.

vary depending on the constraints and minimizing (or maximizing) the solution with respect to the mathematical equations (e.g., thickness or a material type), and is often bounded by maximum and minimum values. In Figure 3, the possible solutions that are admissible after considering the constraints are still many. As such, the solution is typically decided by an engineer in practice. When only one objective is employed in the design analysis, then convergence on a single solution is possible and an engineer is not necessarily required, because the mathematical equation will decide on the optimal solution. However, when more than one objective is included, then, by definition, since multiple answers are possible, it takes intelligence outside of the engineered system to make the decision on

the design, so, hence, an engineer is required. This is consistent at any and every length scale. Hence, evidence for a Creationeer™ at the largest size scale like the cosmos is warranted.

Mathematics is the language by which to describe a design. The designer must choose an equation or set of equations to relate the constraints and objectives to the design variables. They may include complicated finite element analysis (cf., Fang et al., 2005b) and/or reduced order metamodels (cf., Fang et al., 2004, p. 4487). In the context of engineering or Creationeering™, a design is not the "thing" but only a representation of the "thing." Making the "thing," will occur later in the Creationeering™ process.

Reliability relates the probability of a component or system to perform its

required designed functions under the stated conditions for a specified period of time. In the Creationeering™ paradigm, design and hence the reliability of the designed "function" will consider the procurement of the "thing," the logistics of the components of the "thing," the assembly of the "thing," the in-service life performance of the "thing," sustainability of the "thing," and the death or recycling of the "thing." In each step of the Creationeering™ process, the design variables and constraints can be mathematically characterized with respect to their sensitivities and uncertainties on the final solution so that the reliability of the design can be quantified (c.f., Acar and Solanki, 2009).

Figure 4 schematically illustrates the Creationeer's perspective: the Universe is a multi-size scale, multi-objective,

interactive, complex system including trinitarian concepts throughout the cosmos revealing His nature as per Romans 1:20. Whether an entity or “thing” is God-made or man-made, the first step in the Creationeering™ process is to define the system design objectives, constraints, and variables at each size scale. At the grandest length scale of the Universe or in engineering terms “the overall system,” the Creator/Creationeer™ made everything. At the largest length scale is the cosmos, love can be argued to be the overall objective based on Jesus’ statement about the most important thing in Matthew 22:37. The constraints would include the spiritual and physical laws, where the spiritual laws could pass in and out of the space-time-matter cosmos, but the physical laws are bound to the space-time-matter cosmos. The variables would be the elements of the Periodic Table, individual souls that he would create, and the angels/spirit beings.

Figure 4 shows at the first subsystem level that the trinitarian designs include the astrosphere, geosphere, and biosphere. The astrosphere’s objectives, constraints, and variables can be described by the following:

- objectives: to maximize signify seasons for humans and to stabilize environments for humans (Genesis 1:14);
- constraints: obey physical laws, fit geosphere appropriately into astrosphere to meet objectives;
- variables: number and size of planets in the Solar System; number and size of satellites in the Solar System; number and size of stars in the Solar Systems and cosmos; number and size of galaxies; and number and size of galaxy clusters.

The geosphere’s objectives, constraints, and variables can be described by the following:

- objectives: to maximize life giving environment and to stabilize environment for humans (Genesis 1:9–13);

- constraints: obey physical laws, fit into astrosphere appropriately;
- variables: size of Earth, geometry of the Earth (Isaiah 40:22, Psalm 104:5), Periodic Table elements to be used on the Earth for humans to fulfill the Dominion Mandate (Genesis 1:26–28).

The biosphere’s objectives, constraints, and variables can be described by the following:

- objectives: to maximize life for humans, plants, and animals;
- constraints: obey physical laws, fit into geosphere appropriately;
- variables: humans, animals, and plants, geometry of the Earth, food for life, light for life, shelter for life, clothing/protection from environment.

As Figure 4 illustrates, the second subsystem level includes trinitarian designs including the planets, satellites (moons), and stars for the astrosphere; the core, mantle, and crust for the geosphere, and humans, animals, and vegetation for the biosphere. Each of the individual second level subsystems have their own objectives, constraints, and variables. As an example of the third subsystem level for the human, the trinitarian design includes the body, soul, and spirit. Again, each of the individual third level subsystems have their own objectives, constraints, and variables. Finally, for this illustration, a fourth level subsystem under the soul includes the mind, will, and emotions, and each of these includes objectives, constraints, and variables.

In an engineering system, down-scaling provides the requirements as constraints for the lower length scales (see Horstemeyer, 2012). For example, at the highest systems level of the cosmos, the constraints were physical and spiritual laws. Hence, they would also apply to any lower length scale all the way down to Planck’s constant (Planck, 1901) related to quantum effects with electrons.

The multiscale, multilevel, and multi-objective design process also exists in the Scripture, where God, the Master Designer, works with the human designer in the planning and execution of physical structures. For example, in Genesis 6:14–16, the design of the Ark can be considered a marine engineering project where God designed the materials definitions and geometry. In Exodus 26:1–40, we see God providing design instructions for the building of the Tabernacle, which might be considered a civil engineering project. In Exodus 35:30–36:1, God specifically calls Bezalel and Oholiab and fills them with His Spirit and with the skills, intelligence, knowledge, and craftsmanship needed to devise artistic designs. In Job 38:4–6, God himself clarifies that He is the One Who laid out the spatial dimensions of everything in the Creation.

2.2. Analysis/Synthesis of the design

Analysis of information or synthesis of complex disparate information within a design includes the application of scientific principles and methods to assess the feasibility of the design. This includes analyzing the properties and state of the component, subsystem, or system. Careful evaluation and deliberation are fundamental to the analysis and/or synthesis of any design. This may include experiments or modern-day computational tools. The engineer has a challenge of not only meeting technical functions, but also of creating the right aesthetic design (Burgess, 2001). Getting the right balance of form and function is an art as well as a science. The supreme example of the right balance of form and function is observed in the design of flowers (Matt 6:28).

God analyzed His design instantaneously:

Isaiah 41:20—That they may see, and know, and consider, and understand together, that the hand of the

Lord hath done this, and the Holy One of Israel hath created it.

Seeing, knowing, considering, and/or understanding are fundamental to the analysis and/or synthesis of a design.

2.3. Procurement of the materials for the design

Procurement is the process of obtaining and the making of materials along with getting the equipment to make a component, subsystem, or system. Detailed knowledge of the definitions of the materials and the materials processing method are required. For example, components can be made from metals through wrought processes (stamping, forming, forging, etc.), casting, and additive manufacturing processes. Different metal chemistries that make up the metal alloys can be used almost in any of the materials-processing methods, which admits now multiple billions of variations of materials.

The creation account shows God's display of power by calling the Universe into existence out of nothing and shaping the world in a way that supports life and vegetation. The author of Psalm 33 portrays it thusly:

Psalm 33:6–9 (KJV)—By the word of the Lord the heavens were made, and by the breath of his mouth all their host....For He spoke, and it came to be; He commanded, and it stood firm.

While material procurement is a stage in the engineering process, it is important to be careful not to imply that God modeled procuring materials that were pre-existent. In other words, God created "*ex nihilo*," out of nothing. God did not procure materials in creating, because He is infinite and has no limitations, but engineers must because we are finite beings with limited resources. Exodus 25:1–7, however, provides an example of God participating with humanity in creating a physical structure. Here, He instructed Moses to ask the people to make an offering unto Him,

to procure materials for the construction of the Tabernacle, and the people responded generously. This means that despite the limited resources, engineers are still tasked with the responsibility of procuring the best and the right materials for the project life. Procurement, however, comes with its own challenges and hence the need for the fourth stage of the engineering process.

Isaiah 43:1—But now thus says the Lord that created thee, O Jacob, and He that formed thee, O Israel, Fear not: for I have redeemed thee, I have called thee by thy name; thou art mine.

After God brought to man every living creature to name,

Genesis 2:20–22 (KJV)—There was not found a helper fit for him. So the Lord God caused a deep sleep to fall upon the man, and while he slept He took one of his ribs and closed up its place with flesh. And the rib that the Lord God had taken from the man He made into woman, ...

Creating requires analysis of the design and responses from this analysis. This does not imply that God lacked the foreknowledge for the eventual need of a helpmate, but instead models for us the analysis/synthesis stage of creation. In the creation account, we therefore see God as a skilled craftsman or builder, carefully appraising His work and pronouncing it fit for use/purpose:

Genesis 1:31a (KJV)—And God saw everything that He had made, and behold, it was very good

Forming is a materials-processing method in-order to make a structural metal or polymeric component in engineering practice.

2.4. Logistics of the different components and subsystems

After something is designed and analyzed and ready to be made, then logistics is required to piece together all of the different personnel and materials to "systemize" the finalized

design. Logistics can be defined as the selective application of scientific and engineering efforts undertaken during the acquisition process. The objectives of the design, not only of the product for the performance environment, but for logistics can be time efficiency so that each step is coordinated together in time.

Moving materials from one location to another requires logistical wisdom. God in His sovereignty did not have to "worry" about this in creation because He created by His powerful word. However, we as humans cannot do that and thus, we must concern ourselves with the times, seasons, and availability of resources. While we have similarities with God as image-bearers, we also have to understand the dissimilarities, He is infinite and we are not, and this should bring us to a place of humility.

Isaiah 4:5—And the Lord will create upon every dwelling place of mount Zion and upon her assemblies, a cloud and smoke by day and the shining of a flaming fire by night: for upon all the glory shall be a defense.

The Lord logistically organized the military defenses based upon the environmental conditions in-order to reach the transportation goals.

2.5. Assembly of the different components and subsystems

Once the finalized designed parts are ready at hand, then they are ready to be assembled. Assembly refers to a number of parts or subassemblies or any combination thereof joined together to perform a specific function, and subject to disassembly without degradation of any of the parts (Hanifan, 2014, p. 23). Simply, it is putting parts together.

The design of creation models how God assembled the Universe. The atmosphere, biosphere and geosphere are finely tuned according to His design and assembled in balance and harmony to work according to His set purposes (Genesis 1:1–2:3). The orderly way in which the Universe was assembled, portrays

God as a master builder. Engineers must also assemble their projects with conscientious attunement to the requirements of the design. Once a product or project is assembled, it must be routinely evaluated for effectiveness.

Isaiah 40:26—Lift up your eyes on high and behold who hath created these things, that brings out their host by number: He calls them all by names by the greatness of his might, for that He is strong in power; not one fails.

The Lord assembled the host together into a complex, interactive system for life.

2.6. Function or in-service life performance of the engineered system

Once the validated designed “thing” is put together, then it is ready to perform its designed-for function. This entails the real-life performance of the “thing” so that it fulfills its objectives for which it was designed.

Engineers are not only interested in getting a product to market, but in determining how effectively that product accomplishes the goal that it was created for and how it survives through its routine use. The creation account in Genesis 1–2 does not just tell us how the Universe came into existence, but just the ultimate objective for its existence. It places emphasis not only on the processes involved in the creation, but how the cosmos was organized in order to ensure human life thrived and functioned as God intended. Therefore, in creation, God provided everything necessary for that intended purpose.

Genesis 1:31 (NKJ)—Then God saw everything that He had made, and indeed *it was* very good. So the evening and the morning were the sixth day.

2.7. Sustainability of the engineered system

Sustainability means how does the engineered component, subsystem, or

system continue on to the next generation. Sustainability can be thought of as the ability of current generations using resources so as to not compromise the environment or deplete the materials for future generations. To enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life, without compromising quality of life, affects future generations. Ordered sustainability and stability are the characteristics of God’s creation of the Universe. The creation story reveals how God creatively fashions the Universe to provide the right environment suitable for sustaining life and vegetation (Genesis 1:1–2:17). The ordering of the material Universe is such that can allow living organisms to thrive and adapt to new situations. God through His divine providence sustained all things He created so they can continue in the properties implanted in them from creation. So also, the astute engineer must see the need to consider sustainability in the creating systems. Creationers™ create and construct through this entire process in hopes that the cycle can be re-energized for a second and third round. This sustains the creational goals of the product by thinking how it might live on as needs change and new potentials arise. The engineer must apply prudence in ensuring that they are building things that matter and last with long-term repercussions.

Genesis 1:21—And God created great whales, and every living creature that moveth, which the waters brought forth abundantly, after their kind, and every winged fowl after his kind: and God saw that it was good.

The long-term sustainment of life-giving animals was developed at the very beginning. Regarding the Flood of Noah’s day the following verse is appropriate.

Genesis 6:19—And of every living thing of all flesh, two of every sort shalt thou bring into the ark, to keep

them alive with thee; they shall be male and female.

2.8. Death/Recycling of the engineered system

The final stage that an engineer must consider is what to do with the materials once the designed performance of the product is over. Recycling is converting an already existing product or material into a new product. One could consider a system of materials circulation when a materials first objective is over, that there can be a secondary objective of the used product. At this point, the secondary product might need to go through reprocessing to reach its objectives.

Just as death came through the fall (Romans 5) to humanity, it also comes to created products. Ecclesiastes (Eccl. 1:4–7) provides us with descriptions of the endlessly repetitive cycle of seasons and time as it relates to creation. However, through Christ’s saving work, redemption has been achieved through an effective recycling of time, thereby making the believer a new creation (2 Corinthians 5:17). This demonstrates how valuable humanity is to God. This concept can be applied on a much lesser scale to created products/systems. For engineers, it is important to value systems and resources and rather than put them to waste, creatively find new ways of deploying and putting them to use.

Jeremiah 18:1–6 (ESV)—The word that came to Jeremiah from the Lord: “Arise, and go down to the potter’s house, and there I will let you hear my words.” So I went down to the potter’s house, and there he was working at his wheel. And the vessel he was making of clay was spoiled in the potter’s hand, and he reworked it into another vessel, as it seemed good to the potter to do. Then the word of the Lord came to me...

John 6:12 (ESV)—And when they had eaten their fill, He (Jesus) told his disciples, “Gather up the leftover fragments, that nothing may be lost.”

2.9. Human resources (ethics) used in the Creationeered™ system

Since God is interested in people as a key objective in His creation, the stewardship of humans to help fulfill the Dominion Mandate of Genesis 1:26–28 is important. The term “Human Resources” for a business is to recruit, train, develop, compensate, team-build, conduct performance appraisal, communicate worker health and safety issues, and identify methods for selecting staff for the business system.

The first half of the creation account in Genesis (1:1–2:3) provides a cosmic description of God’s activity, while the second half portrays a God of the anthropic principle who providentially ordered the Universe to suit the climax of His creation, making humankind in His own image (Genesis 1:26–27), so that they might alongside with Him rule and dominate the Earth. It provides a picture of a God who is loving, personal, relational, and communal and unlike other creatures, only mankind has and enjoys a special relationship with God; hence, ethics is a given from the very beginning. From the beginning therefore, humanity was tasked with the responsibility of having a loving relationship with God through worship and with the rest of creation through service. As co-creators, humanity was to imitate God’s character and attributes in ruling His creation and developing it to its full potential. Relationship and community are God’s purpose for creation, hence the command:

Mark 12:30–31 — “And you shall love the Lord your God with all your heart and with all your soul and with all your mind and with all your strength. The second is this: ‘you shall love your neighbor as yourself.’ There is no other commandment greater than these.”

Our love for God should translate into how we treat other people. God has bestowed dignity on humans and as Creationeers™, we are to bestow dignity

on those who work with us. We should see them as image bearers who have worth and dignity.

Genesis 1:26–27 (KJV)—And God said, “Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth.” So God created man in his own image, in the image of God created He him; male and female created He them.

2.10. Finances/Accounting (stewardship) used in the Creationeered™ system

Our Creator has expressed his concern through Jesus in humans being good stewards of the resources that the Creator has supplied for us. Finance and accounting can be defined as the management, allocation, and exchange of resources for the business system. The notion of stewardship carries three aspects as illustrated in the following Bible verses: (1) the Creator owns it all; (2) the Creator demands responsibility of the human’s stewardship; (3) rewards from the Creator come when good stewardship occurs.

Psalms 24:1–2 (NIV)—The earth is the Lord’s, and everything in it, the world, and all who live in it; for He founded it on the seas and established it on the waters.

Deuteronomy 8:18 (NKJV)—And you shall remember the LORD your God, for *it is* He who gives you power to get wealth, that He may establish His covenant which He swore to your fathers, as *it is* this day.

Matthew 25:21 (KJV)—His lord said unto him, “Well done, thou good and faithful servant: thou hast been faithful over a few things, I will make thee ruler over many things: enter thou into the joy of thy lord.”

The description of how God created man, in His image and likeness demon-

strates mankind’s worth in God’s eyes. It shows how valuable humanity is to God and as creaturely creators, humanity is called to rule, dominate, and steward the world the Creator made. Genesis 1:28–30 and Genesis 2:15 provides that cultural mandate and while money as a means of exchange was not in existence at the time of creation, mankind was tasked with the responsibility of stewarding creation and everything that existed within creation. It was a calling for man to use his unique abilities to establish a community that will reflect God’s wisdom, benevolence, and creativity and this includes not just the creation of wealth but the proper management of it. Wealth, just as every other thing God has put under our care, must be carefully stewarded towards love for God and love for others.

Genesis 2:11 — The name of the first is Pison: that is it which compasseth the whole land of Havilah, where there is gold.

Finally, Jesus mentioned about counting the civil-engineering cost in designing a tower:

Luke 14:28 — “Suppose one of you wants to build a tower. Won’t you first sit down and estimate the cost to see if you have enough money to complete it?”

2.11. Legal (moral law) of the Creationeered™ system

Most humans have the tendency to believe in moral obligations and responsibilities. Almost everyone (with a few exceptions) believes that it is right to show kindness and wrong to inflict pain on another person. What best explains this tendency/belief? The Creation account provides the best explanation for this: because God is holy, as image-bearers (Genesis 1:28–30), humanity was created with the moral responsibility to be accountable to God hence the feeling of accountability we experience as humans. God through His divine providence in creation directs and regulates the affairs

of humanity in accordance to His goodness, justice, and wisdom for His glory and for human flourishing. So also, the engineer must act within the frameworks of the moral obligation laid out for humanity by God. The Creationeer™ must exercise care in ensuring that their work does not lead to immense human suffering but promotes humanity's well-being in both engineering practice and business acumen. The starting point of any invention must first be the understanding that things have intrinsic value and there are values and norms that must be respected and therefore the Creationeer™ is called to be accountable *for* their invention and accountable *to* the Ultimate Creationeer™.

From an engineering and business perspective, God has made it clear that there are domains to work and other domains where not to spend energy. In the following Bible verse, God expressly told Adam to conduct work in a certain part of the garden but not in another part of the garden.

Genesis 2:16–17 (KJV)—And the LORD God commanded the man, saying, Of every tree of the garden thou mayest freely eat: But of the tree of the knowledge of good and evil, thou shalt not eat of it: for in the day that thou eatest thereof thou shalt surely die.

This substantiates that God has a moral law associated with work from the very beginning. It was further elucidated under Moses with the Ten Commandments, when God referred to keeping the Sabbath with original Creationengineering™ process:

Exodus 20:2–7 (NKJV)—I *am* the Lord your God, who brought you out of the land of Egypt, out of the house of bondage. You shall have no other gods before Me. You shall not make for yourself a carved image—any likeness of *anything* that *is* in heaven above, or that *is* in the earth beneath, or that *is* in the water under the earth; you shall not bow down

to them nor serve them. For I, the LORD YOUR GOD, *am* a jealous God, visiting the iniquity of the fathers upon the children to the third and fourth *generations* of those who hate Me, but showing mercy to thousands, to those who love Me and keep My commandments. You shall not take the name of the LORD YOUR GOD IN VAIN, FOR THE LORD WILL NOT HOLD *him* guiltless who takes His name in vain. Remember the Sabbath day, to keep it holy. Six days you shall labor and do all your work, but the seventh day *is* the Sabbath of the LORD YOUR GOD. *In it* you shall do no work: you, nor your son, nor your daughter, nor your male servant, nor your female servant, nor your cattle, nor your stranger who *is* within your gates. For *in* six days the LORD MADE THE HEAVENS AND THE EARTH, THE SEA, AND ALL THAT *is* in them, and rested the seventh day. Therefore, the LORD BLESSED THE SABBATH DAY AND HALLOWED IT. HONOR YOUR FATHER AND YOUR MOTHER, THAT YOUR DAYS MAY BE LONG UPON THE LAND WHICH THE LORD YOUR GOD IS GIVING YOU. You shall not murder. You shall not commit adultery. You shall not steal. You shall not bear false witness against your neighbor. You shall not covet your neighbor's house; you shall not covet your neighbor's wife, nor his male servant, nor his female servant, nor his ox, nor his donkey, nor anything that *is* your neighbor's.

2.12. Sales/Marketing (communications) related to the Creationeer™ system

Sales and marketing are communications of information from the business system to those outside of the system. In other words, interpersonal communications are key to sales and marketing. If sales and marketing personnel can determine the needs of those outside the business system, help the business to develop technologies to the meet the

needs, and then communicate back to the potential buyers, then seamless communications occurs.

The Creation account in Genesis 1–2 depicts a relational God with formation of relationships as the core of His nature. The account of humanity's creation (Genesis 2:8–25) emphasizes a special relationship between God and humanity and by implication a special relationship between humans. Christianity believes in a God who is both personal and active in the world, Who continues to support and sustain the world He created (i.e., the transcendence and immanence of God). If relationship matters to God, then it must matter to the Creationeer™. Sales and marketing efforts build genuine and lasting relationships rather than simply selling products. The Creationeer™ ought not to be detached from the products and clients but be willing and ready to offer the required support needed to sustain the life of the product.

2.13. Management (organizational structure) of the Creationeer™ system

Management is an organizational structure of the business system. The Creator ordered from the very beginning an ordered, organizational structure that started with the family unit, where the father was the accountable entity of the family unit. The ordering of the material Universe in the Creation account in Genesis 1–2 shows God's care and devotion to the world He created in an organized manner. The Creation account provides a picture of a universe sequentially created with utmost care, and a hierarchical structure, with man, made in the image and likeness of God, at the apex. God's intention from the beginning was that humankind will fill the Earth, this includes filling it with systems, products and processes that create culture:

Genesis 1:28 (KJV)—And God blessed them, and God said unto them, Be fruitful, and multiply, and

replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.

He also charged man with the task of taking care of the world He created:

Genesis 2:15 (KJV)—And the LORD God took the man and put him into the garden of Eden to dress it and to keep it.

A good management structure is therefore key to the success of any system.

3. Creationeering™: Moses' Example of Creationeering™ in the Building of the Tabernacle (Exodus 26:1–40)

There exist various examples of civil-engineering projects in the Hebrew Bible. Two of these projects however stand out: the building of the Tabernacle in Exodus and the construction of the Temple in 1 Kings. There exists significant comparable contrast between the construction of both structures. While both structures were meant to serve as a place of worship for Yahweh, the Temple may have been built more on human initiative and imagination and not God's initiative. Forced labor was used in the construction process, the architects and builders were not Israelites, and the building was more to the glory of Solomon rather than to the glory of God. In contrast, the Tabernacle was God's initiative as He provided the design and directions for the construction, willing and Spirit-filled Israelites carried out the construction work, and the building was ultimately to the glory of God. It is important for the Christian engineer to note that the builders of the tabernacle were not architects but only craftsmen carrying out God's plan (Fretheim, 2010).

The Tabernacle thus stands out over against Solomon's Temple in very significant respects. It clearly shows how

God, the Ultimate Creationeer™, bestows on man the knowledge, skill, and wisdom to be Creationeers™. Bezalel, the main builder, through divine inspiration, acquired three important qualities: skill, intelligence, and knowledge to devise artistic designs (Exodus 35:31) or as Dozeman (2010) put it: wisdom (*hokma*), understanding (*tebuna*), and knowledge (*da'at*). In addition to these qualities, God also inspired him to teach his assistant Oholiab (Exodus 35:34) the skills to do any work of construction. The question we may then ask is how does a person move from current knowledge to future allowable knowledge? As Christians, we believe in a rational God who created the Universe and endowed humanity with the intellectual faculties capable of gaining knowledge by exploring the Universe. Therefore, moving from current knowledge to future allowable knowledge requires humbly trusting in God's grace and sovereignty. Whether the information requested is related to discovering what exists (science) or knowledge for new innovations (engineering) does not matter. In either case, asking for information for discovering something (science) or for creating something new (engineering) requires faith as per Hebrews 11:6.

Deuteronomy 29:29—The secret things belong unto the LORD our God: but those things which are revealed belong unto us and to our children forever, that we may do all the words of this law.

Proverbs 8:12—I wisdom dwell with prudence and find out knowledge of witty inventions.

Hebrews 11:6—But without faith it is impossible to please him: for he that cometh to God must believe that He is, and that He is a rewarder of them that diligently seek him.

A good example of demonstrating each aspect of Creationeering™ as a civil-engineering project as stated earlier is the building of God's Tabernacle described in Exodus 26:1–40 where

Bezalel executed, albeit in a lesser manner, the divine creative role described in the creation account, in the construction of the Tabernacle. Here, we see a God-driven initiative where He used craftsmen to carry out His plans ultimately for His glory. As Christian engineers, we are nothing but craftsmen used by God to show forth his beauty in creation and to bring Him glory. Therefore, a Christian engineer ought to understand that his/her vocation is only valuable if it has both a secular and sacred purpose.

3.1. Design of the Tabernacle

The Spirit of God called and filled Bezalel and Oholiab with the creativity and craftsmanship needed to devise artistic designs. The same power that laid behind the completion of the project, was the same power that laid behind the creation process. Meaning that their intricate craftsmanship reflected God's own work (Fretheim, 2010). The emphasis placed on the design and details of every aspect of the Tabernacle (Exodus 26–27:20) mirrored the orderly and intricate account of creation in Genesis 1. According to Fretheim (2010), the end product of the “construction” in both instances was a material reality that was precisely designed, externally beautiful, and functionally “literate” showing a careful attention to the relationship between form and function (Fretheim, 2010). Therefore, just as God created the Universe, Creationeers™ are called to recreate a world in the midst of chaos that glorifies God and leads to human flourishing. We might add that part of the objective in design is the idea of beauty (or aesthetics) as God added beauty to flowers (Matthew 6:28) in the most brilliant way.

1 Kings 5:18—The inside of the temple was cedar, carved with ornamental buds and open flowers... then he carved all the walls of the temple all around, both the inner and outer sanctuaries with carved

figures of cherubim, palm trees, and open flowers.

3.2. Analysis of the Tabernacle

In any civil-engineering structure, one must analyze the location for many different environmental reasons, foundational reasons, and functional reasons. The Tabernacle was meant to be the place where God met with His people. It was a shift from dwelling on the mountain (Exodus 24:15–18) to dwelling in the Tabernacle. This however does not mean that God can be confined to a single space; instead, it shows that because humans are not just spiritual beings, but thinking and feeling beings, there was a need for tangible place of worship of which the Tabernacle provided. Fretheim (2010) notes that the emphasis placed on the process of making the Tabernacle and its portability depicts the nature of the divine-human interaction which stresses process, not end.

3.3. Procurement of the materials for the Tabernacle

The Israelites were responsible for the provision of the financial resources needed for the construction of the Tabernacle (Exodus 38:21–30). They provided all the materials—precious metals, yarns for embroidery, spices for the anointing oil, etc.—needed for the construction of the Tabernacle as a freewill offering to the Lord (Exodus 35:4–29). The craftsmen worked with all these materials to create something new and beautiful. It is important for the Creationeer™ to understand that every material procured for a project is a product of God's beautiful creation and thus whatever the material is used for must give a new shape to that beauty within creation (Fretheim, 2010).

3.4. Logistics of the different components and subsystems for the Tabernacle

God provided the builders with logistical wisdom to move the different materials from the source to the construction

site. He gave Moses every single detail (Exodus 26:1–31) needed for the construction of the Tabernacle.

3.5. Assembly of the Tabernacle

There were so many different components and subsystems to the Tabernacle that assembling occurred by joining several components into a subsystem and then joining together the subsystems. God provided every detail required for the completion of the Tabernacle. The order, shape, structure, visual appeal, furnishing, etc., were of utmost importance. This reflects a God who is creative, orderly, and intricate as depicted in the Creation account, Who works in and through His creation. The creative abilities of the Creationeer™ to assemble various components and subsystems to create beautiful and functional designs therefore reflects the divine-human relationship.

3.6. Performance/Function of the Tabernacle

The Tabernacle was to serve as the tent of meeting, where God met with the Israelites. Fretheim (2010) stresses that both the Creation account and the construction of the Tabernacle show a careful attention to the relationship between form and function. That is, God's creative work ranges widely across the physical order of things, integrating the world of nature and that which is built with human hands to create property. The completion of the Tabernacle was according to the divine pattern thus corresponding to the divine will, which is to glorify God. For the Creationeer™, new technology should not be pursued just for the sake of it, but for its performance and function—how does it address a need, solve a problem, take care of the poor, ensure human flourishing, and ultimately bring glory to God.

3.7. Sustainability of the Tabernacle

The glory of the Lord sustained the Tabernacle (Exodus 40:34–38), even as

He instructed Moses on how on who were to take care and maintain the tent of meeting.

3.8 Death/Recycling of the Tabernacle

The 'death' of the Tabernacle engineered by Moses was superseded by Solomon's Temple over 440 years later. Moses' Tabernacle moved from place-to-place, but Solomon's Temple was stationary, fixed in Jerusalem.

3.9. Human resources (ethics) related to the Tabernacle

As stated earlier, the Lord Himself appointed the laborers for the construction of the Tabernacle and filled them with His Spirit and the necessary skills required to get the work done. These men and women were willing servants endowed with various gifts to carry out God's plan to His glory (Exodus 36:2). Bezalel who was the project manager and his assistant Oholiab recognized the uniqueness of every craftsman's skills and channeled those skills in the proper place to get the work done. Therefore, the most valued forms of labor are those that recognize other humans as having worth and dignity and are thus treated as such.

3.10. Finances/Stewardship related to the Tabernacle

As mentioned above, the children of Israel were responsible for the financial resources needed for the construction of the Tabernacle (Exodus 38:24–30). Moses, Bezalel, and Oholiab ensured that all the resources were put into adequate use. Even though Moses oversaw the architectural plans, the lead craftsmen were responsible for every aspect of the Tabernacle including its furnishing and the vestments and how resources were allocated.

3.11. Legal/Moral law related to the Tabernacle

The directions and instructions for the construction of the Tabernacle ended

with the Sabbath law (Exodus 35:1–3). The Sabbath law was God’s way of reminding and reaffirming His holiness to the Israelites, it was meant to bring the knowledge of God to them and the intensity of the consequences of being disobedient to God. The penalty for breaking the law was death because profaning the Sabbath was now a capital offense against the sanctuary (Dozeman, 2010). The law therefore gave an ethical shape, able to create order out of disorder. Fretheim (2010) notes that, “the Sabbath brings out the underlying rhythm of creation....and there is a sense in which by involving one’s self in all the joining and weaving of the tabernacle, one is involved in the creation of a new world. Hence the value of the Sabbath as a sign.” Fretheim’s point here is important for the Christian engineer.

3.12. Marketing/Sales/Communications related to the Tabernacle

All that the Lord had instructed Moses, he communicated to the people (Exodus 35) to convince them to build the Tabernacle. This display of both sales and marketing helped the Israelites see the Tabernacle as a place of worship, where the Lord met and communicated with His people. This meant that everything that God’s people did should be a form of worship.

3.13. Management/Organizational structure of the Tabernacle

We can deduce a hierarchical structure from the construction of the Tabernacle. Moses was to oversee the entire architectural design/plan; Bezalel was to serve as the lead-builder (project manager); and Oholiab was Bezalel’s assistant. Furthermore, the responsibility of the Levites was to be under the direction of Ithamar, the son of Aaron the priest (Exodus 38:21–23).

4. Historical Loss and Redemption of the Creationeering™ Model

Now that we have shown that Creationeering™ was initiated by God and followed through by different examples by mankind (e.g., Moses and the Tabernacle), there was a loss of the God-ordained ethics basis with science, engineering, and business practice over time. It was not until the Reformation in 1517 that the renewal of the Creationeering™ model (although the term was not used then) started. Herein, we show that the rise of science and the scientific method in Europe was inseparably linked to the Reformation and the Industrial Revolution, which started in 1760 because of the technological basis from the science arising from the scientific method. Prior to the Reformation, true science based on testable hypotheses did not exist due to an authority-based paradigm from Aristotle all the way through to the fifteenth century.

When Luther pinned his 95 theses to the church door of All Saints Church at Wittenberg on October 31, 1517, it began the lifting of Europe out of darkness, not only in terms of understanding the glorious truth of the Gospel and true salvation, but also in freeing men’s minds to think for themselves. Generations of men and women in Europe had been continually in darkness with little understanding of what the Bible teaches on every aspect of life. Wherever the Bible is honored, it frees men’s minds and lifts man from his imaginations to understand the reality of his true condition. With the liberation of mind brings with it civilization and order in society, and with this true art and science eventually flourish.

In the early part of the sixteenth century, Europeans had no real freedom to think. Literacy was low, and only the rich gentry and monks in monasteries received even a basic education to enable them to read and write and understand the foundation of cultures of the past,

such as Greece and Rome. For those who could afford to go to the universities, they would possibly receive lectures on natural theology based on the Greek minds of twelve hundred and more years before. There had been no revolution in the world of academia since the writings of Aristotle, Plato, Pythagoras, and on to Ptolemy. Though it is unlikely that Luther was anticipating such a major change by his stand against the Pope, it is certainly true that all the changes that ensued after this across Europe can be traced back to this moment.

October 31, 1517, is reckoned by most to be the beginning of the Protestant Reformation in Europe. Undeterred by opposition, Luther continued his attack on the papal system and after a three-day church trial in 1518 when Luther ably defended himself against the Papal envoy sent against him, he slipped away from arrest. Then after increasing opposition against him, he was excommunicated by the Pope in 1521, and appeared before the Diet of Worms before the Emperor Charles V, to respond to attacks from Johann Eck who especially derided Luther, and led the persecution against him. Were it not for the support and intervention of Prince Frederick III, Elector of Saxony, Luther would probably have been murdered on his way back to Wittenberg, but Frederick had masterminded a kidnap by friends to keep him safe in Wartburg Castle at Eisenach, and it was here that Luther wrote much that would encourage others to not seek primarily an outward revolution, but an inner change of heart based on conversion of the soul. His main work in many ways was probably not the 95 theses for which he is most remembered, but his translation of the whole Bible from Hebrew and Greek into vernacular German, which undoubtedly freed the common people to now begin to see for themselves what was the way of Truth. The New Testament was completed and published in 1522, and the full Bible was published in 1534.

Hence, the Reformation in Europe, which sprang primarily from Luther's actions, freed minds to think carefully about the world and the Universe around them. It enabled a new Biblical consideration of non-material reality, reason, and mind, and finally the material Universe.

4.1. Non-Material reality—the overthrow of the “Great Chain of Being”

R.G. Collingwood (1945, p. 3ff.) says in his study entitled *The Idea of Nature*:

Greek natural science was based on the principle that the world of nature is saturated or permeated by mind. Greek thinkers regarded the presence of mind in nature as the source of that regularity or orderliness in the natural world whose presence made a science of nature possible. The world of nature they regarded as a world of bodies in motion. The motions in themselves, according to Greek ideas, were due to vitality or “soul”...

Since the world of nature is a world not only of ceaseless motion and therefore alive, but also a world of orderly or regular motion, they accordingly said that the world of nature is not only alive but intelligent; not only a vast animal with a “soul” or life of its own, but a rational animal with a “mind” of its own. The life and intelligence of creature's inhabiting the earth's surface and regions adjacent to it, they argued, represent a specialised local organisation of this all-pervading vitality and rationality, so that a plant or animal, according to their ideas participates in its own degree psychically in the life processes of the world's “soul” and intellectually in the activity of the world's “Mind” no less than it participates materially in the physical organisation of the world's “body.”

This way of thinking inevitably leads to a dualism since in the worldview of the Greeks, which dominated academic prior to the Reformation, the Creation was not of the original formless matter but only involved deity bringing *form* to what was already existing. In their thinking, *matter itself is not created*, which then leads to matter and bodies themselves being regarded as base. As Hebden Taylor (1968, pp. 89–90) states: ...the Greek idea of the origin of the world is both dualistic and dialectical since pagan immanence thought cannot fully grasp the intrinsic unity and coherence of reality which derives from God's creation of the world.

So, matter is regarded with disdain while mind and thought are abstract and revered. There is no proper Creation account of the physical world, and importantly the Biblical concept of the soul is not present in their thinking. Their idea concerning all life is that it is in a state of progression, the “Great Chain of Being” which significantly influenced later, in post reformation days, the view of Erasmus Darwin, the grandfather of Charles Darwin. Thus Erasmus Darwin in his book *Zoonomia* (1796) wrote that the living ‘filament,’ or living strand, was the cause of all life:

Would it be too bold to imagine, that in the great length of time, since the earth began to exist, perhaps millions of ages before the commencement of the history of mankind, would it be too bold to imagine, that all warm-blooded animals have arisen from one living filament, which THE GREAT FIRST CAUSE endued with animality, with the power of acquiring new parts, attended with new propensities, directed by irritations, sensations, volitions, and associations; and thus possessing the faculty of continuing to improve by its own inherent activity, and of delivering down those improvements

by generation to its posterity, world without end!

This thinking, which is a reflection of the false Greek view of origins, heavily influenced Charles Darwin in the mid-nineteenth century many years later, and shows that the future enlightenment was **not** connected with Biblical thought, but actually was a throwing away of the Biblical worldview, the true cause that allowed experimental science to flourish in the sixteenth and seventeenth centuries. The so called enlightenment of the eighteenth century was actually an ‘endarkening’ of minds which had been freed in the sixteenth century to think for themselves by the Biblical reformation.

It was the Biblical view of the human body and soul—that body *and* soul are made in God's image that gave rise to a sense of dignity of all humanity and a realization that all men and women, whatever station, are made in God's image and to be respected, that a true ethical standard is based on the Ten Commandments, and that the sanctity of life is heavily connected to the God's revelation in the Scriptures. It is when men and women applied the Scriptures to all areas of life that civilized society grew and was established using codes of ethics based on Biblical principles (Mitchell, 2013), and which enshrined the basic and fundamental truth that all men were equal before God (United States Declaration of Independence, 1776) and that there should be justice and equity to all men.

4.2. Mind and reason

Along with dignity and the true recognition that man is more than an animal, came the realization that man's reason is not something that evolved from mud over “millions of years” as Erasmus Darwin (and Charles Darwin after him) would wrongly postulate later (Burgess, 2001; Nevin, 2009, pp. 158–165; Barnard et al., 2011; McIntosh, 2017). That idea came from Greek thinking, which the Reformation had fundamen-

tally overthrown (Deason, 1985), but it seeped back through those rejecting the Biblical testimony. Evolutionary ideas are more closely connected to the medieval “chain of being” thinking that had considerable resonance with classical Greek thinking (Taylor, 1968—see particularly discussion on p. 94, 2nd paragraph). The Reformers had a much firmer grasp of the reality of the creation of all things (including mind) by God and regarded reason and logic as a gift from God to be used in submission to His will—they are an extension of man, and a reflection of His Creator who declares Himself as the ever-existing One to Moses in the burning bush,

Exodus 3:13,14—...and they shall say to me, What is his name? what shall I say unto them? And God said unto Moses, I AM THAT I AM: and He said, Thus shalt thou say unto the children of Israel, I AM hath sent me unto you.

In the New Testament, with the same all-encompassing majesty, Christ is the supreme revelation of the Logos, the Word (John 1:1), and the Christocentric nature of the Reformation is self-evident from the writings of Luther (1535), Calvin (1536), and the torrent of Reformed and Puritan closely argued writing that emerged from then on. Connected with this is the whole concept of information, which has been shown repeatedly by careful scientific investigation to be *not* part of matter (which would be the Greek Aristotelian way of thinking), but is itself a creation transcendent to matter (Gitt, 1989; McIntosh, 2009; McIntosh, 2013, pp. 179–201) and a reflection of the Mind which made all (the Logos of John 1:1). Supremely in creation, man is endued with mental powers that, though not omnipotent, give him the ability to think and reason as the Creationeer™ Himself. The rise to freedom of thought and reason though had been blocked severely by a false church selling salvation to an enslaved people who were made to believe a false gospel of works

presented by a false priesthood that would never save them in the life to come and would further suppress them in life here and now.

The Reformation began to not only show that the Catholic system was hideous and enslaving, but also showed men and women that they were indeed made with minds to think for themselves, which brought us back to the Dominion Mandate of Genesis 1:26–28. As soon as men and women began reading the Bible in their own language, they realized themselves what Truth really is, and that they did not need a priest to tell them what was good and what was evil. They could use their own minds to test all things in the light of Scripture in their own tongue. The true Gospel of redemption, though it does first paint the awfulness of the Fall of man in Eden, nevertheless shows the greatness, of God’s love placed upon man even in his fallen condition, and the freedom that is extended once man comes to Christ:

John 8:36—If the Son therefore shall make you free, ye shall be free indeed.”

There is a strange and deep paradox in Christian thinking concerning Man himself. In his desire to be free in the garden of Eden and yet listening to the lie of the Devil:

Genesis 3:4,5—Ye shall not surely die: For God doth know that in the day ye eat thereof, then your eyes shall be opened, and ye shall be as gods, knowing good and evil.

Adam did not realize that he was already a god, though created, in holy submission to the Creator.

Psalm 82:6,8—I have said, Ye are gods; and all of you are children of the most High. But ye shall die like men, and fall like one of the princes.

Adam had great freedom in his original innocence and was not enslaved. In his desire to be ‘free,’ his whole being, including his mind, became enslaved. And now, in his fallen estate, man is again wrongly evaluating the Gospel, as

though it would enslave him, because he does not realize that he is already enslaved to sin and death. Hence, mankind must see that it is indeed sin and a lie of the Devil that has enslaved not only their bodies (which now must go through death and if unredeemed are in peril of judgment to come), but as a consequence of the Fall, their minds are also enslaved and are thinking wrongly concerning their very existence and why they were made to begin with.

The paradox is that by submitting to Christ as our redeemer, He not only saves our souls from the judgment to come, *but frees our minds to again think correctly*. This is the real jewel often missed in writing today concerning the Reformation. Deason (1985) draws attention to this in his discussion of the new empiricism that would overthrow the dominance of Aristotelian thinking. On pp. 232 and 233, he states:

The parallel that I have drawn between biblical empiricism and scientific empiricism did not go unnoticed in the seventeenth century. The acceptance of science in Protestant countries rested in part on the perceived similarity between inductive study of scripture and inductive study of nature, both in opposition to the deductivism of Aristotle. The new science appeared to follow the lead of the Reformation by turning directly to the original, by-passing the corruptions introduced by the Greek philosophical tradition.

This freeing of the mind to think correctly, not only leads to establishing individual lives again on the rock of Christ from the bottom up, but then flows out into whole communities, which begin to show the care and love for God and to one another instead of selfishness and greed, and all the evils so evident in much of sixteenth-century Europe before the Reformation, and increasingly again in a post-Christian and post-modern Europe.

The freeing of the mind in post-Reformation Europe would also free the mind to think correctly concerning science. As has rightly been stated by Hebden Taylor (1968—see pp. 93–94):

Both Luther and Calvin set themselves against the medieval synthesis which had taken place in Scholasticism between Classical and Biblical modes of thought about reality. They insisted that the Scriptures alone revealed God directly to men. In so doing they stressed the biblical teaching that the Triune God is sovereign over all things. In this great Reformation doctrine of God's sovereignty may be found the key to the Reformation.

By stressing this issue of God being sovereign over all things, they laid the groundwork for approaching the world and reality itself as being rational and intelligible. By so doing, they laid the true foundation for modern science.

4.3. The Universe and the material world

From such a freedom of thought flowed the explosion of interest in the natural sciences, in astronomy, botany, biology, zoology, the beginnings of medicine, and the principles of physics and chemistry (Randell, 1924; Masters, 2003; Mahon, 2004). It is no accident that the sciences did not grow first in the eighteenth century as so many teach incorrectly (implying that this growth was connected with the so called Enlightenment) but in the sixteenth and seventeenth century under the leadership of reformers and the puritans who followed them. These were the days of the Renaissance where true unshackled thinking emboldened by the Reformation threw off Catholic darkness and Papal authoritarianism, rediscovered the freedom of true Biblical thinking and spawned great scientific discoveries, as well as great Music and the Arts.

Great names of this early period were the following:

- Leonardo da Vinci (1452–1519)—Polymath who was brilliant at Mathematics, Engineering, Invention, Anatomy, Painting, Sculpture, Architecture, Botany, Music
- Galileo Galilei (1564–1642)—Physics, Astronomy
- Johannes Kepler (1571–1630)—Mathematics, Astronomy, particularly with respect to planetary motion
- Sir Isaac Newton (1643–1726)—Dynamics; Calculus; Gravity; Reflecting telescope; Light. He wrote perhaps the most influential book in the history of Science in 1687—*Principia Mathematica*
- Sir Robert Boyle (1627–1691)—Chemistry and gas dynamics
- John Ray (1627–1705)—Natural History
- Nehemiah Grew (1641–1712)—Medicine, Botany
- Blaise Pascal (1623–1662)—Hydrostatics, Barometry
- Walter Charleton (1619–1707)—President of the Royal College of Physicians
- Gottfried Wilhelm Leibnitz (1646–1716)—Mathematician, co-inventor of Calculus
- John Flamsteed (1646–1719)—Greenwich Observatory Founder; Astronomy
- Cotton Mather (1662–1727)—Physician
- John Harris (1666–1719)—Mathematician
- John Woodward (1665–1728)—Paleontology
- William Whiston (1667–1752)—Physics, Geology
- John Hutchinson (1674–1737)—Paleontology
- Jonathan Edwards (1703–1758)—Best known as a leading theologian, but also Physics, Meteorology, Immunology
- Carolus Linnaeus (1707–1778)—Taxonomy; Biological classification system
- Jean Deluc (1727–1817)—Geology

- Richard Kirwan (1733–1812)—Mineralogy
- William Herschel (1738–1822)—Galactic astronomy; Uranus
- John Dalton (1766–1844)—Atomic theory; Gas law

Leonardo da Vinci famously stated:

Anyone who conducts an argument by appealing to authority is not using his intelligence; he is just using his memory.

It was notable that in the latter part of the seventeenth century the Royal Society was formed in Britain, which has as its motto “*Nullius in verba*” which translated means ‘on the authority of no one.’ In other words, test all things (as directed by 1 Thess. 5:21). Do not just believe something because someone has said it (Acts 17:11). That is exactly what had happened in pre-Reformation Europe. Where the Bible was honored, it freed men and women to think straight. This humble spirit is typified by the following saying attributed to the brilliant Isaac Newton:

To myself I am only a child playing on the beach, while vast oceans of truth lie undiscovered before me.

and that of Kepler who stated (Tiner, 1977, p. 172):

The World of Nature, the World of Man, the World of God—all three fit together. We see how God, like a human architect approached the founding of the world according to order and rule, and measured everything in such a manner.

This period of immense growth in the sciences led into the nations of Europe coming into great expansion associated with inventions and industry thus leading to the Industrial Revolution. Along with the sciences, the concept of the Protestant work ethic began to take shape, as businesses and companies began to trade between nations and across the world. The Reformation was resisted by many Catholic nations and the wars of the 1500s and 1600s were mainly centered around resisting the

grip of the powerful Catholic Empire in central Europe dominated by France, Spain, the Vatican in Rome, and Austria.

In England the turmoil of the 1500s as monarchs favorable to Catholicism persecuted Christians and burnt them at the stake, eventually gave rise to a time of relative peace and security with the rise of Elizabeth 1st (1533–1603) to the throne. These days established England as a country that in the main would follow Reformed thinking in terms of government independent of Rome. Though it would go through deep difficulties in the civil war of the mid-seventeenth century as Catholic ideas resurfaced, it was essentially never going to return to subservience to Rome. Preaching of the Reformed faith across the land of England increased, and in the eighteenth century true revival broke out in England, Scotland, Wales, and in the colonies of America. But the 1700s were also the days of the rise of the so-called ‘Enlightenment,’ when human reason would be placed above Biblical authority and no longer would be seen as subject to the Lord who had created man. This was particularly noticeable in France where Rousseau, Voltaire, and others trod the path of elevating man to a place without God in his thinking. France, that had never known the full force of reformation and revival and had long been in the grip of Catholicism, suffered the dreadful French Revolution, which killed thousands and caused many good Biblical preachers to flee to other lands. Though France produced great men of science (Pascal, Pasteur, Descartes...), it sadly also spurred on atheistic ideals and much of modern evolutionary thinking finds its roots in such wrong thinking which firmly took route in England in the mid-nineteenth century with Charles Darwin.

The Renaissance of the sixteenth and seventeenth centuries essentially flowed on into the nineteenth century where in England arose some of the finest minds in science, despite the root

of evolutionary thinking also developing in that same century. Notable scientists, many of whom were strong Christian minds, were the following:

- John Harrison (1693–1776)—Inventor of the marine chronometer
- Mikhail Lomonosov (1711–1765)—Russian scientist, poet, artist and historian, founder of Moscow State University. Mikhail Lomonosov first postulated the law of mass conservation in Chemistry, and showed the idea of the existence of phlogiston in the chemistry of combustion was wrong.
- James Watt (1736–1819)—Developed the steam engine and laid the basis of the Industrial Revolution.
- Sir Humphry Davy (1778–1829)—Chemistry
- Michael Faraday (1791–1867)—Electrochemistry, Electrolysis, Electromagnetism, Combustion
- James Clerk Maxwell (1831–1879)—Theory of Electromagnetism, prediction of speed of light. Kinetic theory of gases. Most would put Maxwell, Newton, and Faraday as the three greatest scientists of all time. Even Einstein looked up to Maxwell and built on his brilliant theory of electromagnetism.
- Louis Pasteur (1822–1895)—French microbiologist and chemist noted for discovering the principle of vaccination and pasteurization. He understood that life could not come from non-life and thereby disproved the notion of spontaneous generation.
- Nikola Tesla (1856–1943)—Serbian inventor and engineer who immigrated to USA. The alternating current induction motor was his invention and is used widely today.
- Max Planck (1858–1947)—German physicist awarded the Nobel prize in physics in 1918 for his work in quantum theory.
- Alfred Einstein (1879–1955)—German theoretical physicist, who first understood the direct correspondence

between mass and energy. He is noted for his understanding of the principles of relativity in physics and astronomy. He also immigrated to the USA.

So many more could be listed here, but much of the rise of the scientific achievements was due to a reinvigorated Europe freed from an ideology that smothered original thought, a freedom that flowed inexorably from the Reformation of 1517.

4.4. The danger of the reversal to Aristotelian thinking

It was important 500 years ago for men to throw off the shackles of false ideology when making scientific investigations, and the Reformation in Europe was a decisive factor in doing this. It is similarly important today that the shackles of false ideology are again thrown off to aid thorough unprejudiced scientific inquiry. But what we learn from events that unfolded after the Reformation is that throwing off the Bible, paradoxically puts man back into the shackles of wrong thinking and not only endarkens his soul as regards salvation, but thoroughly undermines even the very definition of what it means to be human. Whereas Catholicism was the battle 500 years ago, evolution versus creation is certainly the battle today, and a naturalistic evolutionary view of origins represents an insidious ideology that is not true science, though it passes itself off as such (1 Tim. 6:20). Rather it is a false ideology overlaying the true science. True experimental science actually undermines evolutionary dogma and shows from all the areas of engineering, medicine, astronomy, biology, botany, and geology that the Biblical worldview is the only one that is consistent with the evidence (McIntosh, 2017; Burgess and McIntosh, 2018).

It is therefore a reformed view of reality, with the Bible giving the framework for studying the world around us that then frees us to think correctly in all walks of life. This has had a tremendous

influence in the culture of the United States of America, which has based its founding values on the Bible.

5. Creationeering™: A Modern Example of a Car

Because of the Reformation and Industrial Revolution, modern technologies were birthed, and the twentieth century admitted the greatest inventions known to man. One of mankind's greatest engineering inventions in the twentieth century was the modernization of the assembly line by Henry Ford. This modern example of a Creationeered™ complex system relates to the automobile. The automobile typically comprises around 30,000 components made of different materials that have gone through different materials processes. Henry Ford helped forge a major invention related to mass-production manufacturing to bring automobiles to almost every household in the USA.

5.1. Car design process

Three different phases exist in the design of a car. The first phase does not include detailed analysis, but the next two phases both include detailed analysis where Design-Analysis are iterated back-and-forth. The first phase, called the "Conceptual Design," albeit operated differently in each corporation, essentially is focused on the "art" of the car. The Conceptual Design includes the following steps (usually): sketching, styling, clay modeling, interior model, ergonomics, surfaces, color/trim, and vehicle graphics. Once Phase-One Conceptual Design is completed, the design is sent to the engineers for analysis. Once the iteration designs are completed for shock, vibration, etc., then the final design phase is related to crashworthiness, where more iterations on the design can arise.

5.2. Car design analysis

Now that the overall car "system" has been conceptualized, analysis of the

whole system, subsystems, and components is undertaken by a group of engineers in "normal" environments. Normal environments reflect the car functioning in its normal operations. Each engineering team will have different roles and responsibilities related to the engineering requirements "downscaled" from the whole system to the subsystems to the components. The second Design Phase, sometimes called the Preliminary Design or Detailed Design, is accomplished by the engineers based on their analysis. Each engineering team will consider the design for manufacturability (procurement), logistics, the assembly of the components and subsystems, its function/performance environments, sustainability of the car, and death/recycling.

Once this Detailed Design phase is finalized, then the cars will be designed for "abnormal" environments. Abnormal environments reflect the scenarios that can occur by accidents. For the car, the worst abnormal environment is a crash. As such, the most important focus in the final design phase is studying the crashworthiness of a vehicle. Once the final design has been experimentally validated, then the components are ready for procurement.

5.3. Procurement of car parts

Because there are approximately 30,000 components in a car, the Original Equipment Manager (OEM), like Ford Motor Company, General Motors Company, etc., having Tier 1, 2, and 3 suppliers is very important. Hence, each component is made a different way.

5.4. Car part logistics

Related to logistics, the automotive supply chain for an Original Equipment Manager (OEM), for example Ford Motor Company, includes the following: dealerships, manufacturers, Tier 1 suppliers, Tier 2 suppliers, and Tier 3 suppliers. Hence, the 30,000 com-

ponents come from these companies, so organizing the scheduling of these components through different corporate bureaucracies is an effort. Logistical scheduling of the supply chain products is very complex.

5.5. Car assembly

Ford's first venture into automobile assembly with the Model A involved setting up assembly stands on which the whole vehicle was built, usually by a single assembler who fit an entire section of the car together in one place. This person performed the same activity over and over at his stationary assembly stand. To provide for more efficiency, Ford had parts delivered as needed to each workstation. In this way each assembly fitter took about 8.5 hours to complete his assembly task. By the time the Model T was being developed Ford had decided to use multiple assembly stands with assemblers moving from stand to stand, each performing a specific function. This process reduced the assembly time for each fitter from 8.5 hours to a mere 2.5 minutes by rendering each worker completely familiar with a specific task.

5.6. Car Performance/Function

The reason that different Ford vehicles exist is because their performance or function is different. For example, the Ford Escort's performance objectives are related to increased gas mileage and lower vehicle cost in contrast to the Ford F-150 truck's performance objectives, which are reliability, ability to pull heavy weights, off-road stability, and lower costs. These different objectives clearly have motivated the completely different designs of these vehicles.

5.7. Sustainability

Each engineering team for each car provides minor adjustments to the next year's version to continuously improve the car's usage. Reports from consumers come back to the design team, who then

start the Creationeering™ process over for the next-generation vehicle.

5.8. Death/Recycling

Each vehicle is designed for a particular lifetime. For example, a Ford F-150 truck will typically meet an objective of 150,000 miles while some will reach a stretch objective of 300,000 miles. However, a Ford Escort can last between 100,000 and 200,000 miles. Because the environmental conditions and road usage are different, ‘death’ of the vehicle will occur at different times.

Vehicle recycling comprises the dismantling of vehicles into separate parts, some for reuse and others for different reprocessing. Approximately 12–15 million vehicles reach the end of their use each year in just the United States alone. The vehicles are shredded, and the metals, polymers, and glass are recovered for recycling, while in many areas, the rest is further sorted by machine for recycling of additional materials. The remainder, known as automotive shredder residue, is put into a landfill. The shredder residue of the vehicles that is not recovered for metal contains many other recyclable materials including 30% of it as polymers, and 5–10% of it as residual metals. Modern vehicle recycling attempts to be as cost-effective as possible in recycling those residual materials. Currently, 75% of the materials can be recycled, with the remaining 25% ending up in landfill. As the most recycled consumer product, end-of-life vehicles provide the steel industry with more than 14 million tons of steel. A car crusher is often used to reduce the size of the scrapped vehicle for transportation to a steel mill.

5.9. Human Resources

Along with managers, the auto industry requires different sets of requirements for the working team. Related to the engineering process, the auto industry requires designers, analysts, materials producers, logistics operators, assem-

blers, and recyclers. There are different roles and responsibilities for the Original Equipment Manufacturers (OEMs), Tier 1, Tier 2, and Tier 3 corporations throughout the whole supply chain.

5.10. Finances

The largest market in the world is the automotive industry, so different jobs related to money are typical of almost any industry. The following positions are needed: accountants, insurance agents, financial planners, ethics, and auditors, etc.

5.11. Legal

Legal issues arise from governmental laws and certification boards. Automotive companies have lawyers that address intellectual property, personnel employment issues, insurance, corporate policies, and immigration.

5.12. Marketing/Sales

As mentioned, the largest market in the world is the automotive industry, so marketing and selling to the different nations/cultures is a key job. For example, crossover vehicles represents the largest market in the USA [<https://www.statista.com/statistics/276506/change-in-us-car-demand-by-vehicle-type/>]. The Volkswagen Golf was the number one car sold in Europe in 2019 [<https://www.best-selling-cars.com/europe/2019-full-year-europe-best-selling-car-models/>] and the number one 2017 vehicle sold in China was the Wuling Hongguang [<https://www.goodwood.com/grr/road/news/2018/4/axons-automotive-anorak-chinas-best-selling-cars/>].

5.13. Management

Ford Motor Company has a fairly low number of management levels as they believe that it provides a faster, efficient, and integrated approach to customer service (Moynihan and Titley, 2000). Their structure is outlined as follows: Chairman, President, Executive Vice-President, and Functional Heads. The

functional heads have the direct relationship with the workers in each of the categories of the personnel structure. Each company is different based on its ethics and human personnel strategy.

6. Creationeering™ and Education

From an educational perspective, when the engineering process and business/entrepreneurship process combine, a modern industrial revolution can arise. Creationeering™ produces three types of students that can address technological issues in the twenty-first century:

1. Those who start new technology companies, who will focus their creative energy on building profitable businesses that lead to human flourishing (creating good products and providing job opportunities).
2. Those who progress up the management chain in a technology industry, who understand the *imago Dei* and will respect the diversity in other people's talents and skills; and
3. Those who lead engineering projects for industry and government labs, who will see their talents as God-given gifts to glorify God and serve humanity.

Hence, Creationeering™ is a paradigm, as a theological and discipline-oriented concept, that will equip students to lead in like manner after their Creator Who leads them into their creativeness.

7. Summary

Creationeering™ is a paradigm, or worldview, that integrates engineering and business practice for technological entrepreneurship from a Biblical basis. It is a paradigm that subsumes “intelligent design” along with other engineering attributes and business practice arising from the Dominion Mandate in Genesis 1:26–28, in which the Creator commanded mankind to “rule” and “reign.” Because of mankind's sin over time, the

Creationeering™ paradigm was lost but regained arising the Reformation, which led the technical industrial revolution in the nineteenth century and the massive increase in technology in the twentieth century.

Creationeering™ distinguishes itself from creation science in that the former includes the “creation process” while the latter is limited to discovery of an existing physical phenomena. The systems engineering steps include the following: design, analysis/synthesis, procurement/making, logistics, assembly, performance/function, sustainability, and death/recycling. The business aspects include the following: human personnel, finances, legal, sales/marketing, and management. The eight steps in engineering and the five aspects of business comprise the paradigm of Creationeering™. God’s account of the Creationeering™ process is presented with respect to the creation of the Cosmos and Moses’ account of the Creationeering™ process is presented with respect to the Temple. Also, a modern example of the common automobile is discussed providing a good example of the Creationeering™ process.

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Towards a More Realistic Young-Earth Ice Sheet Model: A Shallow, Isothermal Ice Dome with a Frozen Base

Jake Hebert*

Abstract

In 1976 M.W. Mahaffy published a simple model for an ice sheet which allowed for time-varying accumulation rates and which did not make the usual steady state assumption that the ice sheet has a constant height. For this reason his model should be of interest to creation researchers, who could conceivably use it to model the rapid growth of a post-Flood ice sheet. This paper explains the theory and assumptions behind Mahaffy's model, as well as mathematician Ed Bueler's clever solution for the case of a shallow ice dome with a frozen base, resting on level ground. The results from the Mahaffy/Bueler solution are compared with the results from Larry Vardiman's ice sheet model, and limitations of the Mahaffy model are discussed, as are the logical next steps in creation ice core research.

Key Words: ice core, ice dome, ice sheet, Larry Vardiman, M.W. Mahaffy, Ed Bueler, Ice Age, computer modeling

Introduction

In 1993 Larry Vardiman of the Institute for Creation Research published an analytical model for the rapid formation of thick ice sheets within the 4,500 years since the Genesis Flood (Vardiman, 1993, 1994, and 2001). Vardiman's model assumed that post-Flood yearly accumulation decayed exponentially from a maximum value just after the Flood to today's "slow and gradual" values. He implicitly assumed that at the center of the ice sheet the downward speed of the surface ice was

proportional to the height of the ice sheet (Hebert, 2021, p. 179). This assumption helped make the math tractable, but as Vardiman himself noted, this was a preliminary effort, and this assumption is not necessarily physically realistic. Hence there is a need for improved young-Earth ice sheet models, so as to make predictions and to compare and contrast those predictions with those made by uniformitarian models. In fact, glaciologists have already devised ice flow models which can be stripped of the usual uniformitarian assumptions and could

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conceivably be used for this purpose. In 1976 M.W. Mahaffy published a quasi-analytical ice sheet model which does not make the typical uniformitarian assumption that the ice sheet is in “steady state,” i.e. that it has a constant height. This paper combines Vardiman’s accumulation model with Mahaffy’s ice sheet model to obtain a more realistic estimate of the manner in which a 3,000-meter-thick ice sheet would grow over time. The results are then compared with results from Vardiman’s model. Limitations of the Mahaffy model are discussed, as are future avenues for creation ice core research. The next four sections provide an introduction to ice core basics. Readers already familiar with this information may wish to skip ahead to the section entitled “The Mahaffy Model.”

Ice Sheet Fundamentals

Glaciologists drill ice cores at geological features called *ice divides*. These features are named for the fact that ice on one side of the divide flows one way, and ice on the other side of the divide flows the other (Figure 1). For a perfectly flat surface, ice is deposited in horizontal layers. Assuming that no shifting of the ice divide during buildup has occurred, ice at the divide itself will flow neither to the right nor left, but will move straight down as additional layers are added. It is also possible for the ice to form a dome around the divide, so that ice flows radially outward from the divide, not just right and left. In fact, in this paper we will be modelling the formation of an ice dome.

If we ignore possible isostatic adjustments, the underlying bedrock is locked in place. So a horizontal layer that reaches bedrock can no longer move downward. Furthermore, stresses on the ice layer will cause it to become thinner over time. If

no melting occurs, the total number of annual layers will equal the number of years since the ice sheet began forming. Nevertheless, identification of annual layers is not trivial. Visibly distinguishable layers may not be present if annual accumulation is too small (Anonymous, 2020), as is the case in east Antarctica (Anonymous, 2021). And even when distinct bands are visible, multiple layers are deposited per year, and the number of these layers can vary from year to year (Alley and Koci, 1988; Alley, 1988). Hence one cannot naively assume each distinct band in an ice core represents an annual layer, as was inadvertently highlighted by creation critic Bill Nye in 2018 (Hebert, 2018). Glaciologists make educated guesses as to how many bands should be grouped together and counted as a year (Alley et al., 1997, p. 26368), guesses that unfortunately are biased by circular reasoning and long-age assumptions (Oard, 2005; Hebert, 2014). Although uniformitarian glaciologists now think they can accurately count back tens of thousands of years with an error of 10% or less (Meese et al., 1997, p. 26413, their Table 2), this was not always the case. Early pioneers (Hammer et al., 1978, p. 5, their Table I) in the field of ice core studies thought an error of less than 10% was only possible for ice less than 200 years old! This earlier, more pessimistic view was likely more realistic.

Ice sheet models usually ignore variations in density, which are very slight even for very thick ice sheets (Cuffey and Paterson, 2010, pp. 12–13). Hence, most ice sheet models assume incompressibility, that the ice has a constant density (Paterson, 1980, p. 12; Cuffey and Paterson, 2010, p. 286).

In the absence of melting or calving (ice breaking off a glacier’s edge), the volume of an ice layer remains constant over time. The layer becomes thinner, with a corresponding increase in the layer’s horizontal surface area, but in such a way that the total volume of the layer remains constant.

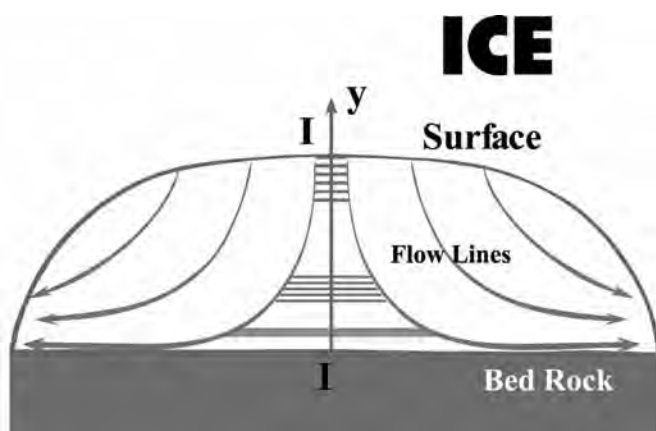


Figure 1. An idealized ice divide. Ice left of the divide flows to the left, and ice right of the divide flows to the right. Ice at the divide location must move straight down. Image courtesy of Michael J. Oard.

Stress Basics

Consider a small cube of ice with length, width, and height of dx , dy , and dz , and whose edges are aligned with the x , y , and z axes (Figure 2). Stresses are applied forces per unit area (units of Newtons per square meter, or Pascals) that tend to change a body’s shape and volume. For a cube of material, these stresses may be applied either perpendicular to or parallel to a cube face. Perpendicular stresses are called *normal stresses*, while parallel stresses are called *shear stresses*.

The effect that a stress has upon an ice parcel depends on both the direction in which the applied force is pointing, as well as where the force is applied. For this reason, two indices are needed to specify a particular stress component σ_{ij} , one to identify the direction in which the applied force is pointing, and a second index to indicate on which pair of opposing cube faces the force is being applied. The first subscript y in σ_{yx}

indicates a stress caused by a force pointing in the y -direction, and the x subscript indicates that the force is being applied to the two cube faces which are perpendicular to the x -axis, i.e., the front and rear faces of the cube in Figure 2. σ_{yx} is a shear stress. Likewise, the normal stress σ_{xx} is caused by a force pointing in the x -direction and applied to the faces that are perpendicular to the x -direction, i.e., the front and rear cube faces. As is demonstrated from these examples, σ_{ij} represents a normal stress when $i = j$, and a shear stress when $i \neq j$.

If the applied force is the same (same size *and* direction) on two opposite cube faces, the resulting stresses will tend to translate (move) the ice parcel through space, but not deform

it. Likewise, if the same shear stresses are applied to both the top and bottom faces, the forces associated with those stresses will tend to translate the cube horizontally, but not deform it. In order for a stress to have a deformational effect on a small cube of ice, the stress must *vary* across the width of the cube.

It is the *difference* in applied normal stresses that tends to compress or extend the parcel. It is fairly obvious that the difference in normal stresses between two opposite faces will tend to extend or compress the cube. Unbalanced shear stresses, on the other hand, tend to (Cuffey and Paterson, 2010, p. 680) deform the parcel (Figure 3).

To calculate the manner in which an ice sheet deforms, it is necessary to sum up the stresses acting on a small ice parcel, much in the same way one sums up forces to find an object's acceleration. For an incompressible fluid of density ρ , this requires the use of a partial differential equation called the Navier-Stokes equation (Bueler 2016, p. 2), which is the stress balance equivalent to Newton's Second Law.

Because an ice sheet deforms so slowly, the acceleration (material time derivative of the momentum, or the time derivative of momentum for a moving parcel) in the Navier-Stokes equation will be zero, and forces will be balanced in all three directions. This is equivalent to solving the following three stress balance equations:

$$\begin{aligned} \frac{\partial \sigma_{xx}}{\partial x} + \frac{\partial \sigma_{xy}}{\partial y} + \frac{\partial \sigma_{xz}}{\partial z} &= 0 \\ \frac{\partial \sigma_{yx}}{\partial x} + \frac{\partial \sigma_{yy}}{\partial y} + \frac{\partial \sigma_{yz}}{\partial z} &= 0 \\ \frac{\partial \sigma_{zx}}{\partial x} + \frac{\partial \sigma_{zy}}{\partial y} + \frac{\partial \sigma_{zz}}{\partial z} - \rho g &= 0 \end{aligned} \quad (1)$$

Strain and Velocity

Normal strain is the fractional change in one of the linear dimensions of a material due to an applied normal stress, and the strain rate is the time derivative of the strain. If u , v , and w are the x , y , and z ice velocity components, it is fairly easy to show that the three normal strain rates (for small deformations) are given by (Cuffey and Paterson, 2010, p. 679)

$$\dot{\epsilon}_{xx} = \frac{\partial u}{\partial x} \quad \dot{\epsilon}_{yy} = \frac{\partial v}{\partial y} \quad \dot{\epsilon}_{zz} = \frac{\partial w}{\partial z} \quad (2)$$

Negative normal strains will compress a parcel, while positive normal strains will expand it. The shear strain rates (again, assuming the deformations are small) are given by (Paterson, 1980, p. 16; Cuffey and Paterson, 2010, p. 680):

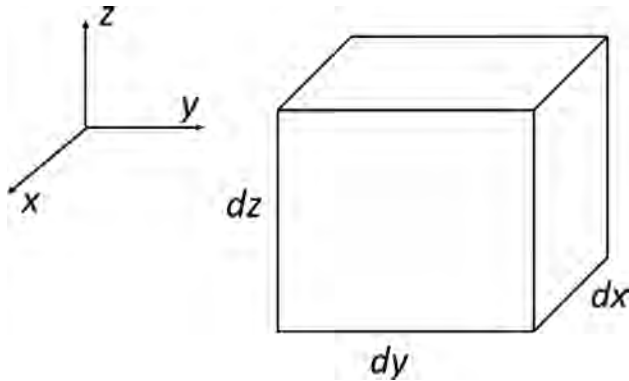


Figure 2. A small cubical parcel of ice.

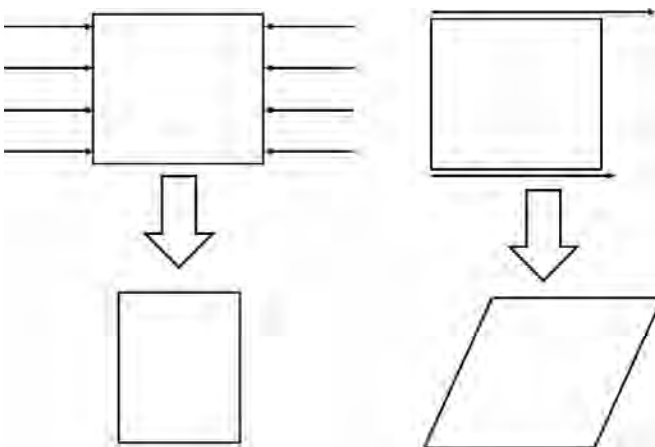


Figure 3. The difference in normal stresses on two opposite cube faces tends to compress or extend the cube, and differences in shear stresses between opposite faces tend to deform the cube.

$$\begin{aligned}
\dot{\epsilon}_{xy} &= \frac{1}{2} \left(\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x} \right) \\
\dot{\epsilon}_{xz} &= \frac{1}{2} \left(\frac{\partial u}{\partial z} + \frac{\partial w}{\partial x} \right) \\
\dot{\epsilon}_{yz} &= \frac{1}{2} \left(\frac{\partial v}{\partial z} + \frac{\partial w}{\partial y} \right)
\end{aligned} \quad (3)$$

Glen's Flow Law

A very important relationship is Nye's (1957) generalization of Glen's experimentally-determined flow law (1955), which gives the relationship between stress and strain in ice, discussed below. Stresses can either change the volume of a body or its shape. Volumetric or hydrostatic stresses are associated with changes in volume, whereas deviatoric stresses or stress deviators are associated with changes in shape (but not volume). Since ice is essentially incompressible, the shape of an ice parcel can change, but not its volume. Hence one might expect that the flow law would be expressed in terms of deviatoric stresses, and that is indeed the case. The "stress deviator" is the part of the normal stress in excess of the mean stress. For an isotropic material, this mean stress is $-P$ (although the hydrostatic pressure P is positive, the stress caused by P is $-P$, since hydrostatic stress is compressive). Hence, the "stress deviators" or "deviatoric stresses" τ_{ij} are:

$$\tau_{ij} = \sigma_{ij} - (-P\delta_{ij}) = \sigma_{ij} + P\delta_{ij} \quad (4)$$

where δ_{ij} is the Kronecker delta, which is defined to be 1 when $i = j$, and 0 when $i \neq j$. Because the Kronecker delta is equal to zero when $i \neq j$, Equation (4) implies that a shear stress is always deviatoric, which makes sense, since shear stresses change a parcel's shape but not its volume. It is only the normal stresses (for which $i = j$ and the Kronecker delta is 1) that can be expressed as the sum of volumetric and deviatoric stresses. As noted earlier, we want to express the flow law in terms of the deviatoric stresses τ_{ij} . Since the ice is already assumed to be isotropic, the strain rates can be expected to be in the same direction and proportional to the stresses (Paterson, 1980, p. 15; Bueler, 2016, p. 6):

$$\begin{aligned}
\dot{\epsilon}_{xx} &= \frac{1}{2\eta} \tau_{xx} \\
\dot{\epsilon}_{xy} &= \frac{1}{2\eta} \sigma_{xy} = \frac{1}{2\eta} \tau_{xy}
\end{aligned} \quad (5)$$

where η is the effective ice viscosity. Analogous expressions hold for the other strain rates. Because the flow law is a physical property of the ice, its mathematical form should be indepen-

dent of the choice of coordinate axes (Paterson, 1980, p. 15). Nye (1957) proposed defining the effective strain rate $\dot{\epsilon}$ and the effective shear stress τ as

$$\begin{aligned}
2\dot{\epsilon}^2 &= \dot{\epsilon}_{xx}^2 + \dot{\epsilon}_{yy}^2 + \dot{\epsilon}_{zz}^2 + 2(\dot{\epsilon}_{xy}^2 + \dot{\epsilon}_{yz}^2 + \dot{\epsilon}_{xz}^2) \\
2\tau^2 &= \tau_{xx}^2 + \tau_{yy}^2 + \tau_{zz}^2 + 2(\tau_{xy}^2 + \tau_{yz}^2 + \tau_{xz}^2)
\end{aligned} \quad (6)$$

Since these quantities are the second invariants of the strain and stress tensors, respectively, they are unaffected by a rotation of the coordinate axes (Paterson, 1980, p. 16), and we can express Nye's generalization of Glen's Flow Law as

$$\dot{\epsilon} = A(T)\tau^n, \quad (7)$$

where $A(T)$ is the temperature-dependent "softness" of the ice (warmer ice is softer than colder ice). The exponent n is normally taken to be 3 for glacial ice. Equations (5) and (6) imply that

$$\dot{\epsilon} = \frac{1}{2\eta} \tau \quad (8)$$

For $n = 3$, Equations (7) and (8) imply that

$$\frac{1}{2\eta} = A(T)\tau^2 \quad (9)$$

Finally, this gives us the relationships

$$\dot{\epsilon}_{xx} = A(T)\tau^2\tau_{xx} \quad \dot{\epsilon}_{xy} = A(T)\tau^2\tau_{xy} \quad (10)$$

with analogous relations holding for the other strain rate components.

Since the ice is assumed to have no rotational acceleration, the torques about any point in the ice must be zero. This condition is satisfied if the stress tensor is symmetric (Cuffey and Paterson, 2010, pp. 675–676), so that $\tau_{xy} = \tau_{yx}$, etc. By Equation (10), the strain rate tensor is also symmetric, with $\dot{\epsilon}_{xy} = \dot{\epsilon}_{yx}$, etc.

The Mahaffy Model

Mahaffy's (1976) ice sheet model does *not* assume the ice to be in steady state. Hence, his model is of interest to creationists. Although Mahaffy considered the more general case of an ice sheet on non-level terrain, we will begin with the simpler

case in which the bedrock under the ice is perfectly flat. We also treat the ice as isothermal, so that the ice softness $A(T)$ is a constant A . Finally, we assume that there is no melting at the base of the ice sheet, so the ice is frozen to the bedrock.

Consider the ice sheet depicted in Figure 4. At a given time, the height h of the ice sheet can vary from place to place, as shown in the diagram. In other words, at a particular time, h is a function of the horizontal coordinates x and y . We will use $H = h(0, 0)$ to denote the height at the center of the ice sheet, i.e. the divide location.

Consider also a thin column of ice with height $h(x, y)$ and having a square base with sides of length 1 meter (Figure 5). We define q_x to be the volume of ice that flows horizontally (in the x -direction) into the column in a time dt .

$$q_x = \int_{z=0}^{z=h} u(\Delta y) dz = \int_{z=0}^{z=h} u(1 \text{ meter}) dz = \int_{z=0}^{z=h} u dz \quad (11)$$

Note that if $q(x)$ equals $q(x+1)$, so that $\partial q_x / \partial x = 0$, there will be no net inflow or outflow of ice (in the x direction) into the column. On the other hand, if $q(x+1)$ is less than $q(x)$, so that $\partial q_x / \partial x < 0$, there will be a net inflow of ice, which will tend to cause the height of the ice column to increase. Likewise, a positive partial derivative corresponds to a net outflow of ice. Similar relationships hold for the y -direction. The net horizontal flow of ice into or out of the column will tend to change the height h , but so will the deposition of accumulating ice, indicated by $\dot{b}$. In general, $\dot{b}$ is a function of both position (x, y) and time t .

Hence, the height $h(x, y, t)$ of the ice is governed by the continuity equation:

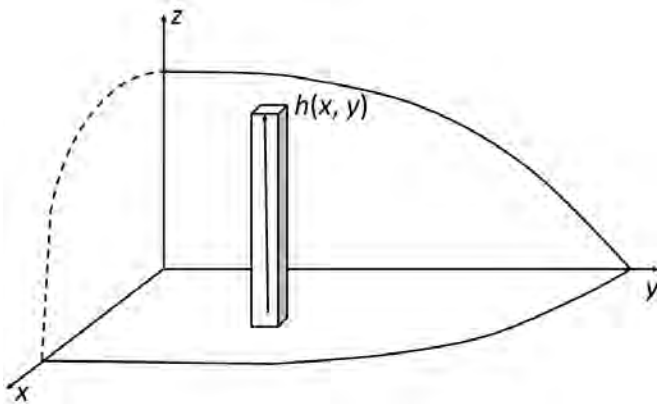


Figure 4. Coordinate system used in Mahaffy's ice sheet model.

$$\frac{\partial h}{\partial t} = \dot{b} - \frac{\partial q_x}{\partial x} - \frac{\partial q_y}{\partial y} \quad (12)$$

Glaciologists have long assumed that the shear stress parallel to the bed is most important when discussing ice flow (Weertman, 1961, p. 954). Hence Mahaffey ignored deformation due to normal stresses, as well as deformation due to shear stresses in the vertical direction. In other words, he assumed that the ice sheet undergoes deformation due only to shear stresses in the x - y plane. This implies that the strain rates are:

$$\begin{aligned} \dot{\epsilon}_{zx} &= \dot{\epsilon}_{xz} \neq 0, \quad \dot{\epsilon}_{zy} = \dot{\epsilon}_{yz} \neq 0 \\ \dot{\epsilon}_{yx} &= \dot{\epsilon}_{xy} = 0 \\ \dot{\epsilon}_{xx} &= \dot{\epsilon}_{yy} = \dot{\epsilon}_{zz} = 0 \end{aligned} \quad (13)$$

Equation (10) implies that the corresponding (deviatoric) shear and normal stresses are also zero. From Equation (4), it follows that $\sigma_{xx} = \sigma_{yy} = \sigma_{zz} = -P$. We also assume that vertical normal stress changes much more rapidly in the vertical direction than do the shear stresses in the horizontal directions:

$$\frac{\partial \sigma_{zz}}{\partial z} \gg \frac{\partial \tau_{zx}}{\partial x}, \frac{\partial \tau_{zy}}{\partial y} \quad (14)$$

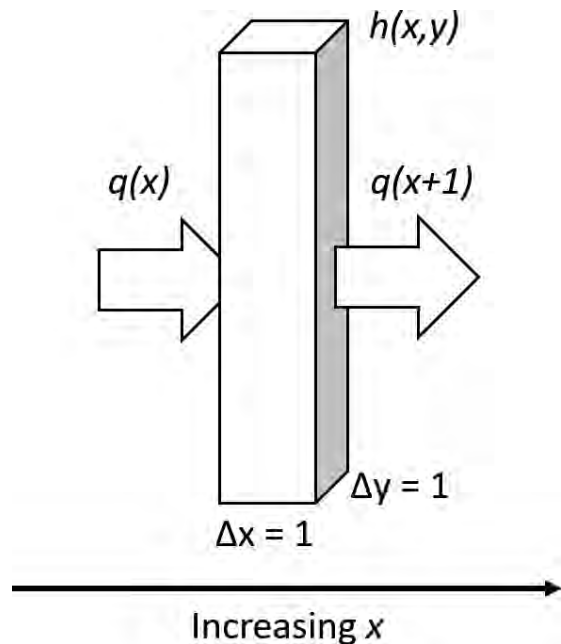


Figure 5. Horizontal fluxes (x -direction only) of ice flowing into and out of a column of ice.

The stress balance equations (1) then reduce to

$$\begin{aligned}\frac{\partial \sigma_{xx}}{\partial x} + \frac{\partial \tau_{xz}}{\partial z} &= 0 \\ \frac{\partial \sigma_{yy}}{\partial y} + \frac{\partial \tau_{yz}}{\partial z} &= 0 \\ \frac{\partial \sigma_{zz}}{\partial z} &= \rho g\end{aligned}\quad (15)$$

Atmospheric pressure is negligible compared to the pressure inside the ice, so we may take the pressure at the surface to be $P(z = h) = 0$ without loss of generality. Integrating the last of Equation (15) and applying this boundary condition give:

$$\sigma_{zz} = -\rho g(h - z) = \sigma_{xx} = \sigma_{yy} \quad (16)$$

We further assume that the slope of the ice at the surface is small in both the x and y directions. This is a reasonable approximation at most locations in the ice, except at the edges, which can have steeper slopes. Also, as discussed later, normal stresses cannot really be neglected at the center of the ice sheet. Nye (1952, p. 86) argued that, for ice sheets with shallow surface slopes, the shear stresses depend mainly on the surface slope and the weight of the overlying ice. For shallow surface slopes, the shear stresses parallel to the ice surface are approximately horizontal, and we can approximate them as

$$\begin{aligned}\tau_{xz} = \tau_{zx} &\approx -\rho g(h - z) \frac{\partial h}{\partial x} \\ \tau_{yz} = \tau_{zy} &\approx -\rho g(h - z) \frac{\partial h}{\partial y}\end{aligned}\quad (17)$$

We have just implicitly made the “shallow ice approximation.” Equation (3) and (10) imply that

$$\begin{aligned}\dot{\epsilon}_{zx} &= \frac{1}{2} \left(\frac{\partial w}{\partial x} + \frac{\partial u}{\partial z} \right) = A(T) \tau^2 \tau_{zx} \\ \dot{\epsilon}_{zy} &= \frac{1}{2} \left(\frac{\partial w}{\partial y} + \frac{\partial v}{\partial z} \right) = A(T) \tau^2 \tau_{zy}\end{aligned}\quad (18)$$

where

$$\tau^2 = \tau_{xz}^2 + \tau_{yz}^2 \quad (19)$$

since all the other deviatoric stresses are zero.

Mahaffy also assumed that $\frac{\partial u}{\partial z} \gg \frac{\partial w}{\partial x}$ and $\frac{\partial v}{\partial z} \gg \frac{\partial w}{\partial y}$. As can be seen from the flow lines in Figure 1, the vertical variations in the horizontal velocities u and v are much greater than the horizontal variation in the vertical velocity w , and this

assumption is justified. After eliminating the partial derivatives of w with respect to x and y , we obtain

$$\begin{aligned}\frac{\partial u}{\partial z} &= 2A(T) (\tau_{xz}^2 + \tau_{yz}^2) \tau_{zx} \\ \frac{\partial v}{\partial z} &= 2A(T) (\tau_{xz}^2 + \tau_{yz}^2) \tau_{zy}\end{aligned}\quad (20)$$

Inserting Equations (17) into Equations (20), integrating twice with respect to z , and making use of the boundary conditions $u(x, y, z = 0) = 0$ and $v(x, y, z = 0) = 0$ yields the following expressions (Paterson, 1980, p. 43) for the horizontal velocity fluxes q_x and q_y :

$$\begin{aligned}q_x(x, y, t) &= -\frac{2}{5} A(T) (\rho g)^3 \alpha^2 \left(\frac{\partial h}{\partial x} \right) h^5 \\ q_y(x, y, t) &= -\frac{2}{5} A(T) (\rho g)^3 \alpha^2 \left(\frac{\partial h}{\partial y} \right) h^5\end{aligned}\quad (21)$$

where

$$\alpha = \left[\left(\frac{\partial h}{\partial x} \right)^2 + \left(\frac{\partial h}{\partial y} \right)^2 \right]^{\frac{1}{2}} \quad (22)$$

is the magnitude of the surface gradient. Since the greatest horizontal fluxes occur deep in the ice, A should be weighted in favor of the values of A deep in the ice. However, since we are treating the ice as isothermal, we do not need to worry about this complication, and we treat A as a constant. If we define

$$\Gamma = \frac{2}{5} A (\rho g)^3 \quad (23)$$

then we may combine Equations (21) into a single expression for the flux vector $\bar{q}$:

$$\bar{q} = -\Gamma h^5 |\nabla h|^2 \nabla h \quad (24)$$

A Clever Solution

Bueler (2016) presents a very clever solution. Note that we can express the continuity equation (12) in terms of the flux vector $\bar{q}$:

$$\begin{aligned}\frac{\partial h}{\partial t} &= \dot{b}(x, y, t) - \bar{\nabla} \cdot \bar{q} \\ \frac{\partial h}{\partial t} &= \dot{b}(x, y, t) + \bar{\nabla} \cdot (\Gamma h^5 |\nabla h|^2 \nabla h)\end{aligned}\quad (25)$$

Bueler (2016, p. 8) draws our attention to similarities between Equation (25) and the 2-D heat equation:

$$\rho c \frac{\partial T}{\partial t} = f + \nabla \cdot (\kappa \nabla T) \quad (26)$$

where f is a heat “source” term, ρ is density, c is specific heat, and κ is thermal conductivity. If we divide both sides of Equation (26) by ρc , the result has the same mathematical form as Equation (25):

$$\frac{\partial T}{\partial t} = F + \nabla \cdot (D \nabla T) \quad (27)$$

where we have defined D and F as

$$D = \frac{\kappa}{\rho c} \quad (28)$$

$$F = \frac{f}{\rho c}$$

The choice of the letter D in Equation (27) is appropriate, because the heat equation is actually a diffusion equation: any localized temperature ‘spike’ will spread out, with the peak becoming shorter and broader over time. Note that the same thing will be true for an ice peak; the ice flows in such a way that the ice peak becomes shorter and broader over time. We can thus treat the flow of the ice as a diffusion problem if we define our position and time-dependent ice “diffusivity” to be

$$D(x, y, t) = \Gamma h^5 |\nabla h|^2 \quad (29)$$

Bueler (2016) describes how Equation (25) may be solved using an explicit, finite difference solution with adaptive time-stepping, and he provides a sample MATLAB code for doing so. I “translated” his code into an IDL (Interactive Data Language) code I named `mahaffy_vardiman_dome.pro`, and used my version to simulate the growth of a large isothermal ice dome with a frozen base. Details and subtleties of the method are given in Bueler (2016).

Test Case

I applied Vardiman’s (1993, 1994, 2001) model for post-Flood ice deposition

$$\dot{b}(t) = \frac{\lambda_H}{\tau} (\Phi e^{-t/\Psi} + 1) \quad (30)$$

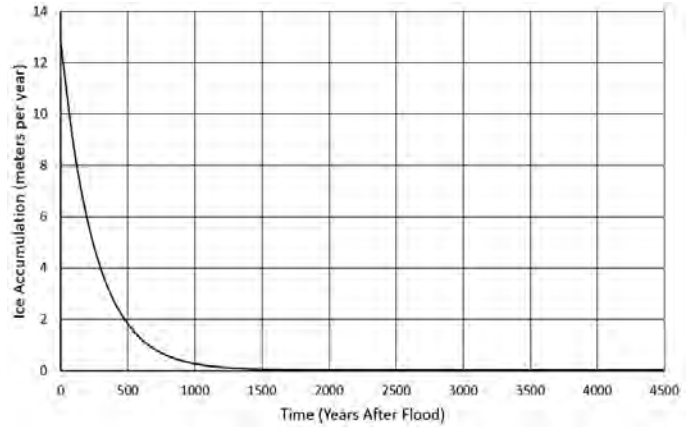


Figure 6. The accumulation rate (meters of ice per year) used in this exercise, calculated from Vardiman’s model using values of $\Phi = 450$, $\Psi = 255$ years, and $\lambda_H/\tau = 0.0284$ meters of ice per year. Although hard to see on this graph, for large times, the accumulation does not go to zero but asymptotically approaches λ_H/τ .

to an isothermal, symmetrical ice dome on perfectly flat bedrock. I chose parameter values relevant to the EPICA Dome C ice core. The accumulation rate is $\lambda_H/\tau = 2.84$ centimeters of ice per year, the present-day ice accumulation at the ice core location (Parrenin et al., 2007, p. 248). The parameter Φ , used to “scale up” the amount of Ice Age precipitation compared to the present-day value, was set at 450. The e-folding time Ψ (the time for the initial post-Flood accumulation rate to drop to 37% of its initial value) was set to 255 years. This produced the accumulation curve shown in Figure 6. The ice softness A was set to $1.0 \times 10^{-16} \text{ Pa}^{-3} \text{ year}^{-1}$ (Bueler, 2016, p. 16). The density of the ice was taken to be 910 kg/m^3 , and the acceleration due to gravity was 9.81 m/s^2 . Note that, although we are using parameters appropriate to Dome C, this exercise is not a realistic simulation of the real Dome C. Real ice sheets are not isothermal (Paterson, 1980, p. 39), and we have not taken into account possible basal sliding or isostatic sinking (Parrenin et al., 2007).

The simulation was run with a starting dome radius R_0 of 1000 kilometers, with 101 grid points in both the x and y directions. Because the horizontal plotting surface was 4000 km by 4000 km, this resulted in a horizontal grid resolution of $\Delta x = \Delta y = 40 \text{ km}$. The large radius was chosen because, in Oard’s Ice Age model, snow is expected to be deposited over large areas in ‘snowblitzes’ (Oard, 2006, pp. 77–81). Thus one would expect accumulation to cover large areas even after just one year of deposition. For each iteration, the ice was allowed

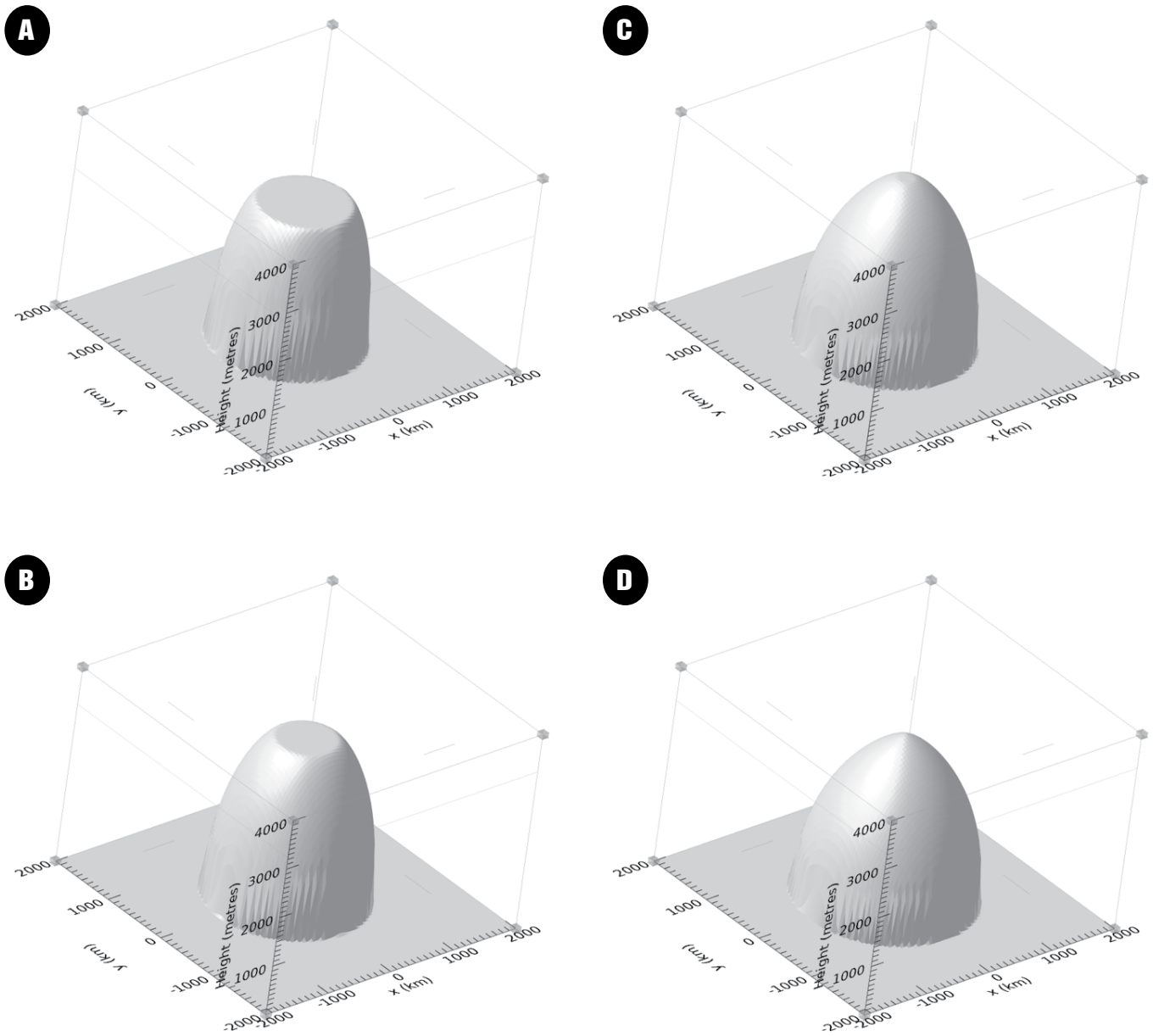


Figure 7. The ice dome calculated from Mahaffy's model using Bueler's diffusive solution for A) 500 years, B) 1000 years, C) 2500 years, and D) 4500 years. The dome height is greatly exaggerated compared to the dome radius.

to fall for all values of x and y such that $x^2 + y^2$ was less than or equal to the fraction $f = 0.85$ of the dome radius for the current iteration. There were two reasons for doing this. First, one would expect continuing accumulation to occur everywhere, except perhaps at the periphery of the ice sheet. Second, and more important, the discrete nature of the horizontal grid implies that the number of pixels along the dome radius is

slightly greater if the radius is parallel to a horizontal axis than at an angle to it. Because the new value of the dome radius was measured along the x or y axis at each time step, this pixilation effect would cause ice deposited along the axes to fall outside the current dome radius if f were set to 1.0. This would result in the dome radius becoming larger and larger, simply due to roundoff error.

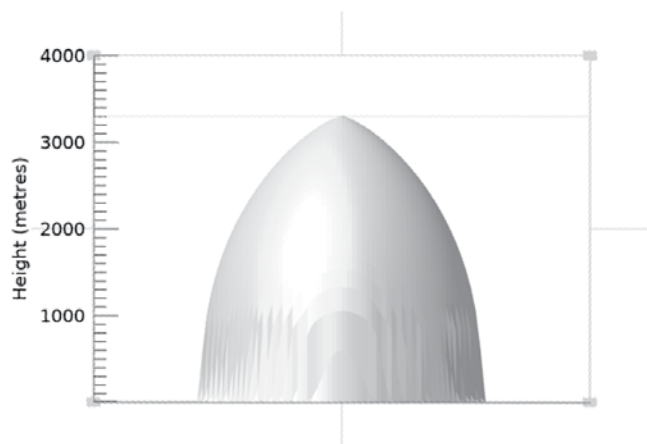


Figure 8. Side view of ice dome at $t = 4500$ years.

The results are shown in Figures 7 and 8. Initially the ice sheet is a perfectly flat circular slab with a starting height equal to the first year's total ice accumulation of 12.8084 meters. Because the slab surface is flat (surface slope of zero) the driving stresses are zero, except at the edges. These stresses cause the slab edge to become rounded as the ice spreads radially outward. After 500 years, the ice divide is 2821 meters high, but much of the slab is still flat. Hence, forming a thick Antarctic ice sheet in the time after the Flood seems feasible, provided that the starting post-Flood accumulation is on the order of 10 meters/year, as suggested by Oard (2021). After 1000 years, the dome has increased in height to 3229 meters and become

a little broader, but the top is still truncated. At 2500 years, the dome is 3336 meters high, with a slightly truncated top. After 4500 years, the height has subsided a little to 3277 meters, but the dome has become slightly broader with a pointed top (Figure 8).

Consistency Checks

My IDL code did not assume the ice dome to be symmetrical about the lines $x = 0$ and $y = 0$, yet one would expect this since precipitation was deposited in circular sheets centered on the origin. That this is the case is encouraging. Also, because the ice is incompressible, the total volume of ice deposited in 4500 years should equal the final dome volume. Summing the total volume of ice deposited over 4500 years and directly calculating the dome's final volume both yield $8.590 \times 10^{15} \text{ m}^3$ of ice, as expected (however, when doing this calculation, one must take into account the discrete nature of the ice "blocks"). Finally, it is encouraging that the final dome has a pointed "peak," with non-zero slope (Figure 8), as this is demanded from theory. Since the driving stresses are proportional to the surface slope, a final slope of zero at the divide location would prevent ice at the divide from flowing outward.

Discussion

The results are highly sensitive to the choices for Φ and Ψ . If the choices of Φ and Ψ are too low, the final dome height is relatively small, considerably less than 3000 meters. If the choices are too large, the dome becomes extremely thick, with a final height of more than 4,000 meters. After much trial and error, I was able to obtain results similar to Vardiman's by using the stated choices of Φ and Ψ . Figure 9 is a comparison of the results from the two models. The actual height of the Dome C ice core is 3273 meters (Parrenin 2007, p. 244). After 4500 years, Vardiman's model yields a final height of 3266 meters, and Mahaffy's model, combined with Vardiman's accumulation model, yields a final height of 3277 meters.

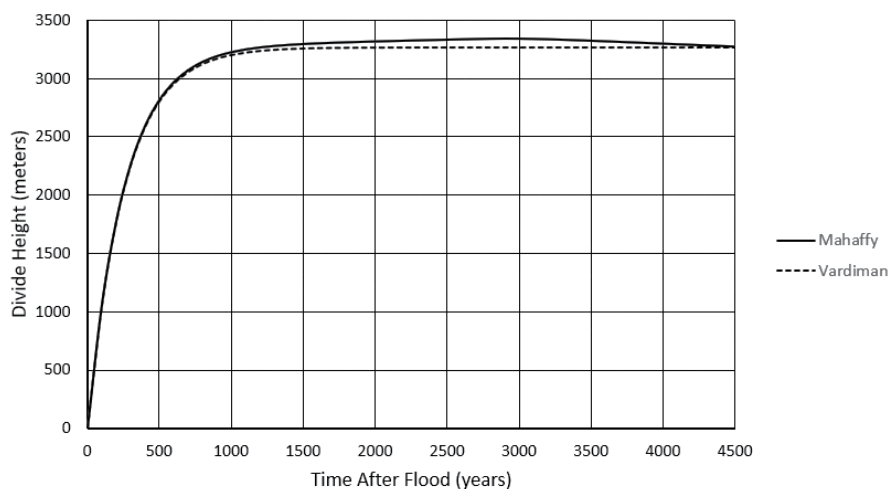


Figure 9. Height of the ice divide H as a function of time, calculated from both Mahaffy's and Vardiman's models and using in both cases the values of Φ , Ψ , and λ_H/τ specified in the text and Figure 6.

Caveats and Future Research

Biblical creationists should be especially interested in ice behavior at the center of the ice sheet, as ice cores are drilled near the center. Specifically, we would like to know the true thicknesses

of annual layers at the center of the ice sheet. Unfortunately, Mahaffy's model ignores normal stresses/strains, but these cannot really be ignored at the center of the ice sheet or at the edges (Paterson, 1980, p. 43). In fact, because it is the surface slope that drives horizontal movement of the ice, in the Mahaffy model $u = 0$ and $v = 0$ at the center of the sheet as long as the slope at the divide remains zero (Figures 7d and 8). As result, horizontal shear at the divide is also zero until the divide slope becomes non-zero, at which point horizontal shear finally causes the ice layers at the divide to begin thinning. Since layer thicknesses depend on normal stresses/strains at the divide location, it may be problematic to use Mahaffy's model to find these thicknesses. However, this may not be a large source of error, as Weertman (1961, p. 953) noted that these normal or longitudinal strains are only important for smaller ice sheets, about 30 kilometers in width. Since the Antarctic and Greenland ice sheets are much larger than this, it may still be possible to use Mahaffy's model to obtain estimates of annual layer thicknesses at the center of a large ice sheet.

Mahaffy's model may be modified to take into account variations in topography of the underlying bedrock, and, to a lesser extent, may take into account variations in ice temperature, by "weighting" the value of $A(T)$ toward temperatures near the base of the ice, since this is where the greatest amount of horizontal flow occurs (Figure 1).

Another logical step is to solve the simple cases of isothermal (infinitely) long ice ridges and isothermal symmetrical ice domes, using the more rigorous Blatter-Pattyn (Blatter 1995; Pattyn 2003) solution, which does not ignore longitudinal stresses. Those results can then be compared with those presented here. A detailed discussion of the Blatter-Pattyn model and its solution is provided at http://websrv.cs.umt.edu/isis/index.php/Blatter-Pattyn_model. Because of symmetry, these simplified problems are two-dimensional, which should help reduce computation times. The freely-available Community Ice Sheet Model (or CISM, Lipscomb et al. 2019) uses the Blatter-Pattyn method, but it is a complicated, modular code, and I have had difficulty getting it to work. Hence, it may be necessary to write my own code to obtain these solutions.

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Researching ‘Sea-Paths’ Near Antarctica and in Psalm 8:8— Are Sea Creatures Actively or Passively ‘Passing Through’ Ocean Currents?

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Abstract

Recent research in coastal seawaters of Antarctica is expanding our data and understanding of ocean currents, what creationist oceanographer Matthew Maury called “paths of the seas” (based upon his study of Psalm 8:8). Philological study of that verse (i.e., Psalm 8:8, numbered as Psalm 8:9 in the Hebrew Bible) adds clarity to what is “passing through” those oceanic sea-paths, plus that verse’s Hebrew verb refers to continually active (i.e., cross-current) movements at sea.

Key Words: Oceanography, ocean currents, “paths of the seas,” Matthew Maury, Psalm 8:8, transgression, fish

Documenting What the ‘Paths of the Sea’ Are

Oceanic sea-paths, better known as ocean currents, were seriously studied and documented by the “father” of oceanography, creationist Matthew Maury, during the 19th century A.D., due to Maury’s appreciation for the mention of “paths of the seas” in Psalm 8:8 (Maury, 1855; Lewis, 1927; Gish, 1993; Johnson, 2015).

For generations Maury’s oceanography data served as the foundation of oceanography (Johnson, 2015). Nowa-

days that empirical science foundation is covered over by accruing oceanographic data. Modern data is acquired with greater precision and depth than was previously possible, facilitated by improved technology for such global research—thanks to satellite-linked robots and even southern elephant seals equipped with GPS-linked data transmission devices.

For example, Swedish researchers have recently reported some newly documented “paths of the seas” (Maury, 1855, page 57)—thanks to some helpful

(and high-tech) southern elephant seals, plus some satellite-linked “glider” robots.

Using state-of-the-art ocean robots and scientific sensors attached to seals, researchers in Marine Sciences at the University of Gothenburg have for the first time observed small and energetic ocean currents in the Southern Ocean.... Two new studies [led by Dr. Louise Biddle and Dr. Sebastiaan Swart] use highly novel techniques to collect rare data in the ocean both under and near the sea ice surrounding Antarctica (www.roadmiz.com).... These papers present for the first-time upper ocean currents of approximately 0.1–10 km in size. These currents, which are invisible to satellite and ship-based data, are seen to interact with strong

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Southern Ocean storms and with physical processes occurring under sea ice. (Eliasson, 2020)

Discovering such huge ocean currents under sea ice near Antarctica's shoreline is obviously very cool research (pardon the pun). In the *Journal of Geophysical Research: Oceans*, Sweden's Dr. Louise Biddle and South Africa's Dr. Sebastiaan Swart report on such seals:

Using instrumented seals, we present the first known observations of submesoscale fluxes [i.e., subsurface-flowing currents] from late austral summer through to spring in and near Antarctic sea ice. Our findings show that these small-scale processes can have a strong effect on the upper ocean and can cause the mixed layer depth to shoal even in the middle of winter. There is also a clear seasonal cycle in the magnitude of the submesoscale activity. (Biddle & Swart, 2020)

The research was focused on underwater currents in Antarctica's marginal ice zone waters. As noted above, nineteenth-century oceanographer Matthew Maury called these currents "paths of the seas," a phrase taken from *Psalms* 8:8.

Yet the energetic subsurface ocean currents were documented under sea ice (during Antarctica's winter), showing that these near-the-surface flowing "rivers" are much more forceful and complicated than previously imagined.

As Christ's bioengineered creatures, seals are amazing cold-water mammals—a fact already well-documented by ICR scientists (Thomas, 2010; Johnson, 2020a).

Recently, 14 southern elephant seals were harnessed with environmental tracking equipment, to act as at-sea research assistants, helpfully collecting underwater measurements (i.e., hydrographic data) in seawaters not far from Antarctica's coastline. This complex data-gathering project thus illustrates how humans, made in God's image, can

design and make continuous environmental tracking (CET) equipment, to learn about Antarctic shorewaters, with the assistance of southern elephant seals, who themselves have built-in (i.e., God-endowed) CET phocid anatomies and physiologies, that help them to fit and to "fill" those same seawaters (Guliuza, 2017; Guliuza, 2019; Johnson, 2020a).

"Using the data collected by the seals, we're able to look at the impact these upper ocean currents have underneath the sea ice for the first time. It's a really valuable insight into what was previously completely unknown in the [eastern Weddell Sea portion of the] Southern Ocean," says Dr Louise Biddle, Department of Marine Sciences, University of Gothenburg. The winter had [been] assumed to be a "quiet" time due to the dampening effect of sea ice on the ocean's surface. However, the two studies show that these upper ocean currents have a significant effect on the ocean during winter. (Eliasson, 2020)

These new oceanography discoveries were published in *Geophysical Research Letters* (Swart et al., 2020) and in *Journal of Geophysical Research: Oceans* (Biddle and Swart, 2020). The research could not have been accomplished without the satellite-facilitated environmental tracking equipment that the Swedish University of Gothenburg research team used, with the help of high-tech equipment-bearing southern elephant seals, plus programmable underwater robots.

Some of the findings by Sebastiaan Swart and his team gives further insight how these observed ocean currents work. Their study highlights that during times when there are no storms and winds are weak, upper ocean currents start to become much more energetic. This energy enhances the rate of ocean mixing and transport of properties, like heat, carbon and nutrients, around

the ocean and into the deep ocean. (Eliasson, 2020)

The data gleaned from sensors, harnessed to navigationally sophisticated seals (Thomas, 2010; Johnson, 2020a), was complemented by robot-acquired data using satellite technology.

"These new ocean robots, so-called gliders, which we control by satellite for months at a time, have allowed us to measure the ocean at unprecedented high resolution." [Quoting Dr. Sebastiaan Swart] ... The glider can dive to 1000 metres and send back information via satellite to the researchers working close to the ice edge.... A deep diving ocean robot deployed in the Southern Ocean in rough weather from the South African Ice Breaker ... spent five months in the ocean to collect data and transfer them to the researchers via satellite. (Eliasson, 2020)

We observe salinity-dominated lateral density fronts occurring at sub-kilometer scales.... Satellite radar imagery shows evidence of 1–10 km eddies and jets in the ocean adjacent to the sea-ice edge around Antarctica. We use field observations of temperature, salinity, and wind speed from autonomous robotic platforms deployed in the sea-ice zone for >3 months. These measurements provide estimates of the surface ocean density fronts which are controlled primarily by lateral variations in salinity. (Swart et al., 2020)

This gives a new twist to the phrase "uncharted waters," because this new research is providing new documentation to the *subsurface currents of the ocean* near Antarctica. This again illustrates that *Psalms* 8:8 was literally referring to the "paths of the sea" (Maury, 1855; Johnson, 2015).

It's good to learn more about the "paths of the seas"—and to appreciate how they all demonstrate how caringly and carefully God has orchestrated the

many moving parts of His creation (Thomas, 2010; Johnson, 2020a).

But that discovery would not surprise Genesis-affirming creationists, such as “Pathfinder” Maury, who intentionally looked to Scripture to understand creation (Lewis, 1927; Gish, 1993; Johnson, 2015). The reverent pioneer oceanographer-meteorologist well knew scientists’ need to study with the Holy Bible open:

I have been blamed by men of science, both in this country [i.e., the USA] and in England, for quoting the Bible in confirmation of the doctrines of physical geography. The Bible, they say, was not written for scientific purposes, and is therefore no authority in matters of science. I beg pardon! The Bible IS authority for everything it touches. What would you think of an historian who should refuse to consult historical records of the Bible, because the Bible was not written [solely] for the purposes of history? (Lewis, 1927, p. 99)

Meanwhile, modern oceanographers and marine ecologists continue to investigate how ocean currents interact with “whatsoever passes through the paths of the seas” (Psalm 8:8b, KJV).

Ocean currents have many profound impacts on marine life, moving not only animals and plants around the ocean but also redistributing heat and nutrients. While some of these impacts have been well known for many decades, there have been major recent developments in this area. Biologists are increasingly collaborating with physical oceanographers. At the same time, methods to accurately predict ocean currents and their variability have improved over a broad range of spatial and temporal scales. Emerging from these initiatives is an understanding of how currents impact the connectivity of marine populations, how they influence the migration of strong

swimmers, including whales and turtles, and how changing currents ... [can] re-shape entire communities ... The impacts of ocean currents in transporting passive drifters and deflecting large migrants has many parallels with the impacts of wind on the transport of insects and seeds as well as the deflection of migrating birds. (Hays, 2017)

This efficiency in moving underwater, at sea, is seen in both fish, such as salmon, as well as in diving seabirds, such as alcids—like puffins and murres—showing Christ’s bioengineering genius as does also the aerial movement-through-fluid wonders of migratory birds (Johnson, 2020b, 2020c, 2021).

Discerning What Sea-Path ‘Passing Through’ Is

So, is Psalm 8:8 referring to ocean-faring animals, such as zoöplankton (such as ciliates and dinoflagellates), somehow “going with the flow” of the sea-paths, passively—or, is that “passing through” a description of sea-faring animals actively swimming cross-current, transgressing (i.e., traveling across) the sea-paths?

Of course, some sea-life (such as zoöplankton) passively drift within oceanic tides, as others quasi-passively take advantage of oceanic currents (i.e., floating, drifting), such as the Gulf Stream, to minimize metabolic expenditures when migrating. However, contrastingly, anadromous fish such as Pacific and Atlantic salmon—are conspicuously famous for aggressively swimming across (i.e., against) ocean currents, in order to intentionally migrate to spawning destinations.

So, what is the original Hebrew text of Psalm 8:8 actually saying about “passing”?

The critical phrase for answering this question is the phrase translated “whatsoever passeth through the paths of the seas” (KJV), so a quick philological review thereof follows below.

The English phrase “whatsoever passeth through the paths of the seas,” in Psalm 8:8 (i.e., Psalm 8:9 in the Hebrew Bible), translates the phrase ‘*ôbêr ’ârîhôt yammîm*, which follows the phrase “and the fishes of the sea” (*ûdegê hayyâm*)—without the Hebrew conjunction meaning “and”—showing that “the fishes of the sea” are *not* a different animal-group category from “whatsoever passeth through the paths of the seas. In fact, the phrase “passes through the paths of the seas,” translating ‘*ôbêr ’ârîhôt yammîm*, because it contains no definite article in the original Hebrew text, is more literally translated as “passing through paths of seas,” i.e., “*moving across* paths of seas.”

The verb “passing” (in Psalm 8:8) is a *pôel* (*qal* active participle), denoting ongoing continuous action. The underlying Hebrew verb is ‘*âbar*, meaning “to pass over” (as in Genesis 33:3; Joshua 3:16 & 4:13), “to transgress” (as in Deuteronomy 17:2 & 26:13; Joshua 7:11 & 7:15; Judges 2:20; 1st Samuel 15:24; Isaiah 24:5; Daniel 9:11; Hosea 6:8 & 8:1), “go over” (as in Numbers 32:21; Deuteronomy 12:10), “come over” (as in Deuteronomy 2:14), “pass through” (as in Genesis 12:6 & 15:17; Exodus 12:12; Joshua 24:17), “pass beyond” (as in Judges 3:26), and the like (Wigram, 1874, pp. 895–899).

The related Hebrew word ‘*êber*—translated “beyond” (as in Genesis 50:10–11; Deuteronomy 3:20 & 3:25 & 30:13; Jeremiah 25:22), and “yonder” (as in Numbers 32:19), and “on the other side” (as in Numbers 21:13), etc.—further indicates that the marine fishes’ positional relationship with the sea-paths involves crossing from one side to another, as if going through an intersection or as if crossing a boundary line (Wigram, 1874, p. 899).

In short, the italicized English words “and whatsoever” (in the KJV) are misleading, not corresponding to any of the original Hebrew text’s words of Psalm 8:8. The King James Bible translators should, of course, be given credit for us-

ing italics to show which English words were supplied apart from corresponding Hebrew text.

In other words, the psalmist (i.e., David, according to the Hebrew Bible's first verse in Psalm 8) is using an active verb participle to describe *how* “the fishes of the sea” behave, as opposed to contrasting the category “fishes of the sea” with some other kind of sea-life (that is somehow “passing through the paths of the seas”).

However, although Psalm 8:8 is referring only to “the fishes of the seas” (*degê hayyâm*), we must not jump to the conclusion that the Hebrew word “fish” (*dag*) equates to (i.e., is definitionally limited to) our English word “fish,” taxonomically speaking, because the Hebrew word is more generalized, i.e., it would include what we call fish, sharks, cetaceans (including orcas, porpoises, dolphins, whales), and likely other sea creatures (Genesis 9:2; Numbers 11:22).

Also, the simple active participial form of the Hebrew verb ‘*âbar* (used in Psalm 8:8) denotes that the “passing” involves *passage across something*, i.e., passing over or through a river, or passage over or through a field of land, as well as an intangible crossing-over—“transgression”—such as transgressing moral boundaries of human behavior, established by God.

Since the context of Psalm 8:8 is seawaters (*yammîm*)—specifically, “paths of seas” (*’ârḥôt yammîm*)—the fishes’ ongoing actions of “passing” within that seawater context is a continuation of activities that *cross sea-paths*, as opposed to continually drifting (passively) within or upon those ocean currents.

Is this cross-current fish migration what we observe at sea? In a word, *yes*.

Animals ranging from *vertebrates*, such as turtles, to *invertebrates*, such as jellyfish, can be equipped with satellite tags and tracked in relation to the local currents.... [For example, consider small loggerhead sea turtles equipped for satellite-

linked GPS tracking.] These young turtles are pelagic, living in the open ocean where they show directional swimming to avoid being carried to unfavorable areas. Adults often migrate thousands of kilometers across the open ocean between coastal breeding and foraging sites. While they have the swimming ability to overcome [ocean] currents, tracking data suggest they do not follow the optimum routes to make the best use of current flows.... [i.e., they cross “the paths of the seas” as they migrate long distances from here to there].

[This waterflow-resisting behavior is likewise exhibited by each] barrel jellyfish (*Rhizostoma* sp.) ... equipped with a tracking tag ... [who show themselves as] surprisingly powerful swimmers and can adjust their swimming direction in relation to tidal flows to help avoid being carried away from coastal zones. (Hays, 2017, pp. R470–R473)

For examples of ocean-faring fish transgressing ocean currents—as opposed to passively drifting within sea currents—perhaps the most famous examples are anadromous Atlantic and Pacific salmon, when spawning (Thomas and Gaskill, 2012; Hays, 2017).

Have you ever been lost and longed for a map and compass? God designed people in His image so that we can create navigational aids. But what if you were a salmon that had to swim to a precise spot hundreds of miles away—all without a guide? Fortunately, migrating salmon use at least three navigational tools that work in synchrony and demonstrate their marvelous design.

How do these fish find their way to the *exact same place* of their birth? By the mid-1980s, experiments had shown that salmon detect and remember the unique water chemistry of their origins. Young salmon “have a flexible system for learning olfactory waypoints at appropriate times and places.” When heading downstream to the ocean, they [smell and] record the water chemistry along the way so that they can later retrace their path in reverse.

Salmon use their extremely precise olfactory senses to zoom in on the exact location of their spawning ground, but they first have to navigate to the general area. In a 1998 experiment, researchers transported hatchery-raised sockeye salmon, some of them blind, several kilometers away from the area of their birth in Japan’s Lake Toya. The sighted fish quickly navigated right back to their place of origin, while the blind fish swam randomly for most of the day. The authors wrote, “It is surprising that the fish identifies his position in open water and the direction of the natal [birth] area with such a high degree of accuracy.” So, the second navigational tool—the primary one for salmon—

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is a polarized light compass. A 2003 study of salmon's polarized light compass stated, "When the sun is lower on the horizon...the position of the sun can be determined unambiguously by the distribution of polarized light." Exactly how the fish determine the distribution of polarized light, measure its angle, and use that information to navigate is not yet known.

But how would salmon navigate at night or under cloud cover? Like any good engineer, the Lord Jesus designed salmon with redundant technologies. Salmon possess a third navigational tool—a magnetic compass. These amazing fish can navigate by comparing their directional heading to a magnetic map of their surroundings. Authors of a 2005 study had a hard time imagining that a single device could do all this. They wrote, "Likewise, a mechanism designed to record tiny changes in intensity can, at the same time, hardly measure the direction of the magnetic field with great precision." However, a 2012 report showed that salmon's magnetic receptors detect both!

Single cells act like compass needles, having a microscopic collection of magnetite crystals at one end. They constantly pull toward magnetic field lines, thereby stressing surrounding detector cells as the salmon turns. According to these authors, the cells in this single system are "therefore not only sufficient to detect the direction of magnetic north but also likely to form the basis of an accurate magnetic sensory system with which to extract positional information." (Thomas and Gaskill, 2012, p. 17)

As the foregoing quotation of biologists Thomas and Gaskill notes, as well as the following quotation of ecologist Johnson, the providential bioengineering that enables anadromous salmon to

return to their "birthplace," across the sea-paths and upstream, is the exact opposite of "going with the flow."

Swimming upstream is not easy—just ask a salmon. Why not just lazily drift along with the current? 'Going with the flow' looks much more attractive and is certainly much more popular. Why struggle so much? That's an important question for a salmon, who must battle its way sometimes hundreds of miles against strong currents in order to reach its spawning grounds. (Johnson, 2011)

Meanwhile, modern oceanographers and marine ecologists continue to investigate how ocean currents interact with sea-life that is passing *through the paths of the seas*. Unsurprisingly, our growing understanding of oceanology likewise continues to corroborate what the Holy Bible teaches about those living sea creatures who—actively and continually—cross through ocean currents as they live out their underwater lives (Johnson, 2020b, 2020c).

Summary

Recent research in coastal seawaters of Antarctica is expanding our data and understanding of ocean currents (what Matthew Maury called "paths of the seas"), building upon the pioneering oceanographic foundation of what creationist Matthew Maury's Psalm 8:8-based empirical studies of ocean currents. Philological study of Maury's keystone verse (i.e., Psalm 8:8) clarifies that the sea creatures therein mentioned are just that, sea creatures—called "fish" in the Old Testament, translating Hebrew text that is not limited in meaning to our taxonomic term "fish" as we now use that term in English. In other words, the sea creatures are what David (as the psalmist who authored that verse) is describing. The continuous actions of those sea creatures (most of which we would classify as "fish," yet some of which could be sharks, dolphins,

whales, and likely also cephalopods like octopi and squids) are reported (by David the psalmist) as "passing through sea-paths"—which refers to the active cross-current swimming of fish (and other sea creatures) whose intentional destination-oriented swimming contrasts with the *passive drifting* of zooplankton. In other words, the "fishes of the seas" (who are mentioned in Psalm 8:8, and are not limited to what are defined by the English word "fish") are continually and actively *passing across ocean currents*, at and below oceanic seawater surfaces, as they swim directionally toward places where they aim at arriving, e.g., as illustrated by the against-the-flow migration of anadromous salmon during spawning season.

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Planations of Rowena Gap Along the Oregon/Washington Border: Support for Flood Erosion of the Cascade Anticlinorium

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Abstract

The Columbia River Gorge has long been an icon of naturalistic geology. Incised through the Cascade Anticlinorium, the Columbia River supposedly exemplifies the antecedent river hypothesis. This assumes the Cascade Anticlinorium was uplifted at the same rate the Columbia River eroded. In addition to generic challenges to antecedence, it fails to explain planation surfaces along Rowena Gap near the eastern entrance to the Columbia River Gorge. As much as 700 meters above the current river, these planation surfaces truncate folded Columbia River Basalts and extend over 40 kilometers north and south of the Columbia River. Due to their planar nature and no evidence of post-erosion faulting, the planation surfaces were eroded at their current elevation. Secular and post-Flood models alike fail to explain them. That much erosion at such elevation can only be achieved during the Genesis Flood.

Key Words: Genesis Flood, denudation, transverse drainages, Columbia River Basalt, Cascade Orogeny

Introduction

River valleys have long been an icon of the naturalistic paradigm. Beginning with the gradualists of the eighteenth century, these valleys have been used to support a secular geology based on

“deep time” and transmutation of organisms (Reed, 2011; Oard and Reed, 2018). Due to the rejection of the Biblical heritage, naturalistic researchers rejected the supernatural and extraordinary for the gradual operation of modern

forces. Despite a renewing acceptance of catastrophes, naturalistic geology has remained steadfast to deep time and uniformitarianism (Reed, 2018). As such, river valleys have remained pivotal in the debate on the antiquity of Earth’s surface.

Despite many geologists’ *a priori* acceptance of naturalism, much evidence favors the Genesis Flood over their uniformitarian geohistory (Reed, 2011). Found across the globe, water gaps are one such challenge. Also called transverse drainages, these landforms are

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river valleys that transect structural barriers such as mountain ranges, defying reasonable naturalist explanation (Oard, 2008). Several secular theories of their origins have been desperately retained, the most common being the antecedent river hypothesis. In it, water gaps are the result of an antecedent stream that “was established before local uplift or diastrophic [tectonic] movement was developed across it [the stream’s course] and that maintained its original course after and in spite of the deformation by incising its channel at approximately the same rate as the land was rising” (Jackson, 1997, p. 27, brackets added). This coerces the conclusion that tectonic and fluvial forces proceeded in equilibrium for extended periods of time (Oard, 2008).

There are few places where this theory has been more touted than at the Columbia River Gorge. Constituting the boundary between Washington and Oregon, the Columbia River Gorge straddles the Cascade Anticlinorium, the most prominent range in a fold belt along the western United States (Cheney, 2014; Cheney, 2016b; Isaacs, 2020) (Figure 1). So strongly has this argument been forwarded that Oard (2018) noted that the “One water gap that potentially could be explained by uniformitarian geology is the Columbia River Gorge...It is possible to claim that the river was antecedent... and the mountains uplifted slowly enough for the river to cut downward.”

Despite its popularity, antecedent stream theory here ignores the extensive high elevation truncation along the Cascade Anticlinorium, such as the erosion surface visible in the region near Mount St. Helens (Isaacs, 2020). Furthermore, the Columbia River Gorge is replete with planation surfaces truncating folds high above the current river. Largely ignored in the uniformitarian literature, these planations support a massive denudation of the region during waning recessional phases of the Genesis Flood.

Structure and Stratigraphy of the Cascade Anticlinorium

The northwestern United States is dominated by a complex fold belt resulting from extensive continental fore-shortening. Four “composite anticlinal structure[s] of regional extent composed of lesser [parasitic] folds” (Jackson, 1997, p. 28, brackets mine; see Figure 2) known as anticlinoria range north-south from the southern tip of British Columbia to the northern regions of California. These include the Coast Range Anticlinorium along the coastline and Eocene metamorphic core complexes in eastern Washington and Idaho, but the most spectacular is the Cascade Anticlinorium, which exceeds 3.6 km in height from the structural base of the Pasco Basin in eastern Washington to the present crest of the Cascade Anticlinorium (Cheney, 2016b). Superposed on the north-south anticlinoria are smaller east-west synclinoria (“composite synclinal structure[s] of regional extent composed of lesser [parasitic] folds.” Jackson, 1997, p. 645, brackets mine), such as the Dalles-Umatilla Syncline in Northern Oregon. Though minor in comparison to the anticlinoria, the overprinted synclinoria cause structural lows across the anticlinoria, producing a characteristic “egg crate” topography of high north-south ridges marked by slightly lower east-west passes (Cheney and Sherrod, 1999; Cheney and Hayman, 2007).

Many of these synclinoria have since facilitated drainage towards the Pacific Ocean, the most prominent case being the Columbia River Gorge. Flowing through the Cascade Anticlinorium, the Columbia River follows the northern limb of the east-west Dalles-Umatilla Synclinorium towards the Pacific Ocean, exposing the Cascade Anticlinorium’s southerly plunge in southern Washington and northerly plunge in northern Oregon due to the Dalles-Umatilla Synclinorium (D-U on Figure 1) (Cheney, 2014). Both the an-

ticlinoria and synclinoria are truncated by an extensive erosion surface. In the region contiguous to Mount St. Helens, folds have been truncated by over 7,850 m, suggesting that a greater volume of rock was eroded from the Cascade Anticlinorium in Washington alone than the water of all the Great Lakes (Isaacs, 2020).

In British Columbia and northern Washington, the Cascade Anticlinorium is dominated by a crystalline core. Farther south, this core is mantled by four major unconformity-bounded sequences (synthems) defining the structural features of the region (Cheney, 2016a) (Table 1). Dated to the Early to Late Eocene, the lowermost sequence is the predominately arkosic Challis Synthem containing interbeds of basaltic to rhyolitic flows and volcanoclastics. The second is the volcanoclastic Kittitas Synthem representing the Late Eocene to Early Miocene. The Walpapi Synthem (Early Miocene to Pliocene) is the final extensive synthem and is represented primarily by the Columbia River Basalts, a series of tholeiitic basalt flows erupted from fissures in eastern Washington and Oregon totaling over 230,000 km² (Reidel et al., 2013). This is sparsely capped by the Pliocene to recent High Cascades Synthem comprised of eruptive and mass-wasting products associated with the Pleistocene cones.

Geology of Rowena Gap

As a gateway to the Pacific Ocean, Rowena Gap is an important physiographic boundary along the course of the Columbia River (Figure 3). After leaving its source in the Rocky Mountains of British Columbia, the Columbia River flows south across the Columbia Plateau in Eastern Washington until it turns west through the Columbia River Gorge, a narrow 130 km-long canyon up to 1,200 m deep, cut through the Cascade Anticlinorium. Approximately ten kilometers downstream the confluence

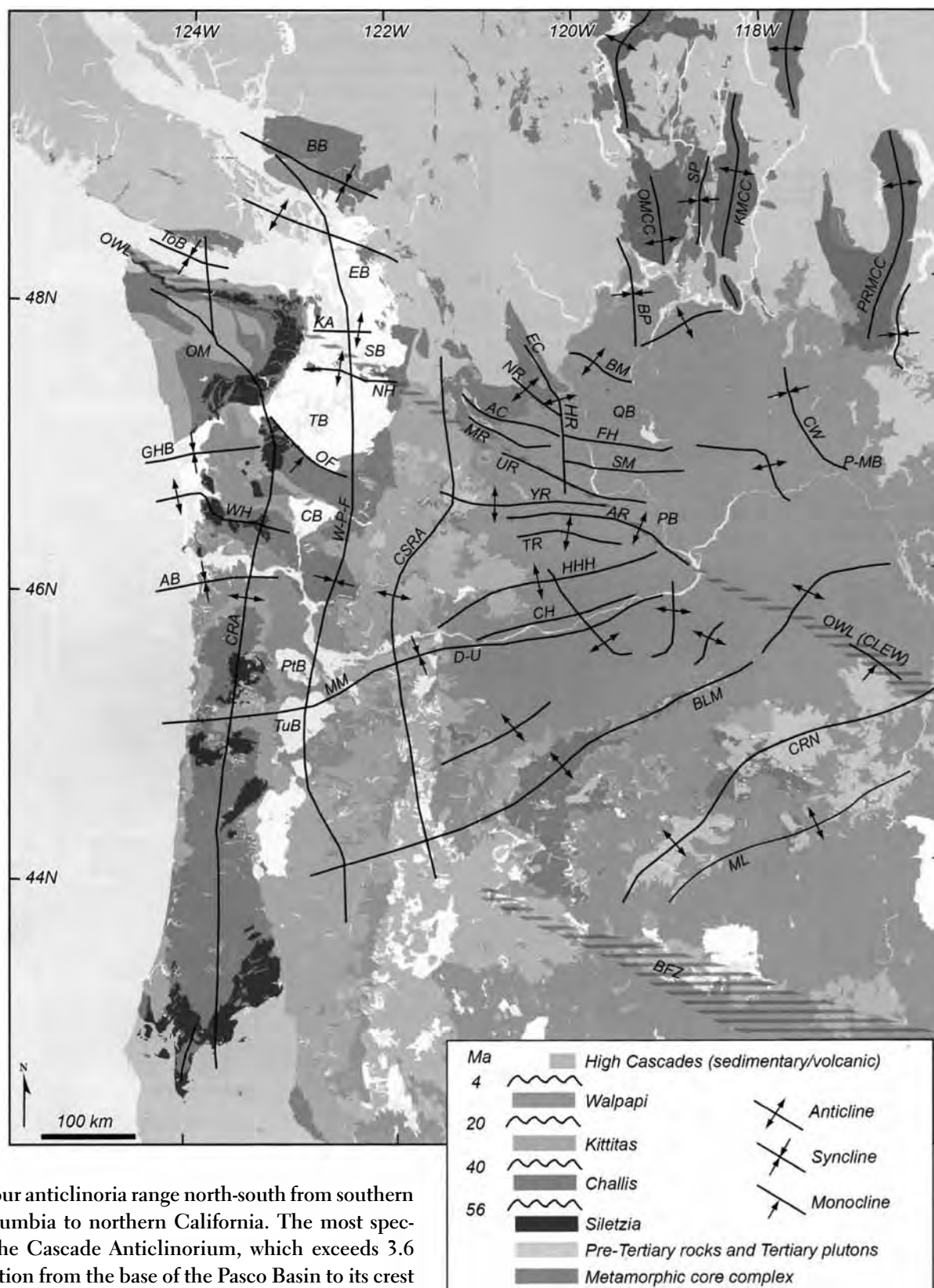


Figure 1. Four anticlinoria range north-south from southern British Columbia to northern California. The most spectacular is the Cascade Anticlinorium, which exceeds 3.6 km in elevation from the base of the Pasco Basin to its crest (Cheney, 2016b). Superposed on the north-south anticlinoria are smaller east-west synclinoria such as the Dalles-Umatilla (D-U) in Northern Oregon. This network of north-south/east-west structures produces the characteristic “egg crate” topography of north-south ridges and slightly lower east-west passes, which facilitates transverse drainages like the Columbia River Gorge. After Cheney, 2016b.

of the Deschutes River, Rowena Gap is the first major constriction along the Columbia River Gorge, which is flanked by rock walls towering over 700 m above the current river.

Incised on the northern flank of the Dalles-Umatilla Synclinorium, the Columbia River Gorge cuts through a complex network of folds. Some north-south parasitic anticlines of the Cascade Anticlinorium only plunge along the east-west Dalles-Umatilla Synclinorium, while others have been rerouted due to later folding overprinted onto the Cascade Anticlinorium. As seen in Figure 4, two anticlines run north-south across the Columbia River between Hood River and The Dalles in northern Oregon. Trending south past White Salmon, Bingen Anticline crosses the Columbia River to west of Hood River where it is displaced eastward. East towards The Dalles, the Ortley Anticline trends from the Columbia Hills across the Columbia River towards Ortley Plateau, which lies over 700 m above the river. These two anticlines are separated by the Mosier Syncline, while to the east the Dalles Syncline (a segment of the Dalles-Umatilla Synclinorium) parallels the Ortley Anticline until it turns west, cutting off the Bingen and Ortley anticlines.

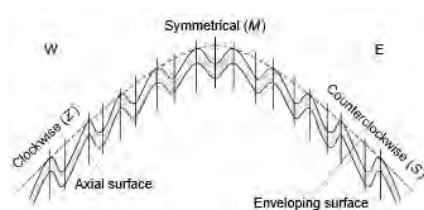


Figure 2. The general structure of a symmetrical anticlinorium, a “composite anticlinal structure of regional extent composed of lesser folds” (Jackson, 1997, p. 28); the inverse of an anticlinorium is termed a synclinorium. Figure after van der Pluijm and Marshak (2004). For further information, see their Chapter 10.

Table 1. The Cascade Anticlinorium is comprised of four unconformity-bounded sequences, termed syntems, composed of a variety of lithologies dated from Early Eocene to recent.

Syntem	Age	Primary lithologies
High Cascade	Pliocene to Present	Alluvial, laharcic, volcanoclastic, glaciogenic, and mass wasting deposits
Walpapi	Early Miocene to Pliocene	Flood basalts with interbeds of volcanoclastics, siliciclastics, and lithics
Kittitas	Late Eocene to Early Miocene	Andesitic and felsic volcanoclastics
Challis	Early to Late Eocene	Primarily arkosic with interbeds of basaltic to rhyolitic flows and volcanoclastics



Figure 3. Starting in the foothills of the Rocky Mountains of British Columbia, the Columbia River flows south across the Columbian Plateau in Eastern Washington until it turns west into the Columbia River Gorge, a narrow 130 km-long canyon up to 1,200 m deep. Approximately 10 km downstream the confluence of the Deschutes River, Rowena Gap is the first major constriction along the gorge with rock walls rising over 700 m above the river. Image from “Kmusser” under license CC-BY-SA-3.0 based on United States Geological Survey data.



Figure 4. The Rowena Gap is dominated by a complex belt of parasitic folds (Bela, 1982). Bingen Anticline trends south across the Columbia River where it is faulted eastward south of the river, while to the east the Mosier Syncline parallels the adjacent Ortley Anticline southwest from the Columbia Hills to Ortley Plateau with an elevation over 700 m above the river. Similarly, the Dalles Syncline (a segment of the Dalles-Umatilla Synclinorium) parallels the Ortley Anticline until it turns west (south of image), cutting off the Bingen and Ortley anticlines.

Table 2. Stratigraphy of rocks exposed along the Rowena Gap. The Simcoe Volcanics are tentatively assigned as postdating the production and unroofing of the folds. Dates from Bela (1982) and Reidel et al. (2013).

Formation	Alleged Age	Occurrence
Grande Ronde Basalt	15.6–16.0Ma	Exposed along anticlinal crests
Frenchman Springs Member (Wanapum)	15.0 Ma	Exposed along anticlinal crests
Roza Member (Wanapum)	14.98 Ma	Limbs of anticlines
Priest Rapids (Wanapum)	>14.98 Ma	Limbs of anticlines
Pomona (Yakima)	10.85–12 Ma	Limbs of anticlines
Post-Folding/Post-Unroofing		
Simcoe Volcanics	4.5 Ma	Limbs of anticlines
Missoula Flood gravels	>15 ka	Local river drainages/terraces

Exposed along Rowena Gap are rocks dated Miocene to recent, the Columbia River Basalts (CRB) featuring most prominently. Because erosion of the folds has incrementally unroofed the strata, anticlines are generally crested by the Frenchman Springs Member of the Wanapum Basalt followed by the Roza Member, Priest Rapids Member, and the Pomona Member of the CRB (Bela, 1982; Reidel et al., 2013). Particularly common south of Hood River and the Ortley Plateau, the volcanoclastic Chenoweth Formation is occasionally overlain by the Simcoe Volcanics, which are here tentatively assigned as post-dating the production and erosion

of the folds (Table 2). Local alluvium and Missoula Flood gravels fill the surrounding river drainages incised into the Grande Ronde Basalt (Bela, 1982).

Secular Paleoenvironmental Reconstructions at the Columbia River Gorge

The Columbia River Gorge has been well studied for over a century, revealing new insights and competing interpretations on the genesis of the CRB, the path of the “ancestral” Columbia River, and the Cascade Orogeny. The work of Tolan and Beeson in the 1980s has formed the basis of modern interpretation. In the introduction to one of their classic studies, they state:

“Flows of the Miocene Columbia River Basalt Group that are found in western Oregon and Washington (Fig. 3) are thought to have entered this area through a broad low that existed astride the site of the present-day northern Oregon Cascade Range.... The area to be discussed in this paper [Tolan and Beeson, 1984] (Fig. 1) is on the northwestern margin of the low, where pre-existing topography, regional deformation, and channel and canyon cutting by the ancestral Columbia River led to the presence of major intracanyon flows within the Columbia River Basalt Group.” (Tolan and Beeson, 1984, brackets mine)

In that paper, they concluded:

“The Priest Rapids Member (Wanapum Basalt) and the Pomona Member (Saddle Mountains Basalt) of the Columbia River Basalt Group both crossed the Miocene Cascade Range into western Oregon and Washington via ancestral Columbia River channels. ... Our work tentatively suggests that the onset of Cascadian uplift in northern Oregon and southern Washington and the incision of the [modern] Columbia

River Gorge may have begun as late as 2 m.y. ago.” (brackets mine)

Summarizing this conceptual history, Tolan et al. (2002) state:

“One constant factor during this 17 million-year history was the presence of a drainage system through this region that was the forerunner of today’s Columbia River system. Results from geologic studies ... have found that the ancestral Columbia River has not always followed its present-day course. The path of the ancestral Columbia River across this region (as well as its major tributaries) has been repeatedly changed due to the effects of flood basalt volcanism, Cascade Arc volcanism, and regional-scale deformation. The present-day path and Gorge of the Columbia River are the end result of this dynamic geologic history.”

Later work identified this alleged paleocanyon beneath the present Mount Hood in northern Oregon, after which the Columbia River Gorge is suggested to have migrated northward following subsequent regional diastrophism. Due to this Columbia Trans-Arc Lowland, Riedel et al. (2013) suggested that the CRB flows were funneled through the ancestral Cascade Range and thus limited the flows to their western transect to the Pacific Ocean. However, this ignores the extensive unconformity at the base of the Walapi Synthem, which indicates that the pre-CRB topography was relatively planar (Cheney, 1997). Furthermore, the CRB flows along the Columbia Trans-Arc Lowland dip towards the axis of the paleocanyon of Tolan and Beeson (1984), indicating that it is not a prior river gorge but instead an east-west syncline (Newcomb, 1967). The slight non-horizontality of flows along the alleged paleocanyon has been understandably overlooked in early geologic mapping, but even the existence of flat-lying CRB stratigraphy is a “structural accident” that “defines a westerly striking syncline between

anticlinal uplifts of the CRBG in the Washington Cascades to the north and the Oregon Cascades to the south” (Cheney, 1997).

The folds along the CRB challenge not only the paleocanyon interpretation of Tolan and Beeson (1984) but also the very existence of the Cascade Range prior to the CRB outpourings. With CRB flows ranging as deep as 4 km beneath the surface in eastern Washington, the Pasco Basin has been interpreted as resulting from ponding of the CRB east of the Cascade axis, yet structural analysis of the basin indicates that the flows dip east from the Cascade Range towards the basin, indicating uplift of the Cascades and/or sinking of the Pasco Basin after the emplacement of most of the CRB flows. Swanson (1997) found that some flows were as much as several km *uphill* of their source fissures, indicating that the Pasco Basin is a *structural* rather than depositional feature. The existence of CRB flows in structural lows and their paucity along structural highs suggest that the current extent of the CRB is a function of structure: the CRB had been preserved in structural lows (such as the Dalles-Umatilla Synclinorium) but removed from structural highs during the truncation of the Cascade Anticlinorium. Thus, the CRB was once more extensive prior to the formation of the ubiquitous erosion surface of the Cascade Anticlinorium.

Planations of Rowena Gap

Flanking the Columbia River, the ridges of Rowena Gap are eroded remnants of several anticlines that currently rise over 700 m above the current river, yet many ridges are planed despite the folds. One such ridge is the Ortley Plateau northwest of The Dalles lying nearly 700 m above the Columbia River. Though a horizontal surface truncating the Ortley Segment of the Columbia Hills Anticline (Figure 5a), the Ortley Plateau correlates to planations on other folds

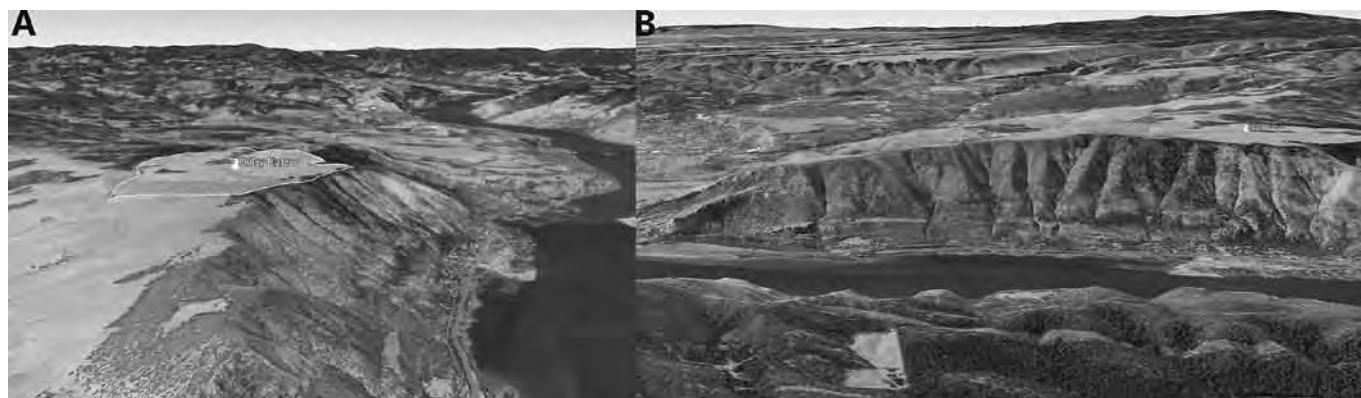


Figure 5. A. Lying nearly 700 meters above the Columbia River, the Ortley Plateau (as seen from the east looking west) is the remnant of a truncated Ortley Anticline. The planar structure and lack of upfaulting implies that the erosional surface was produced at its current elevation. B. The Ortley Plateau correlates to planations on other folds to the south, which produces a plane with slight dips east (left) from Mount Hood, as can be seen from this view looking south. Courtesy of Google Earth.

to the south, which produces a regional surface which dips slightly east from Mount Hood (Figure 5b). To the north, a planation at a similar elevation extends from Coyote Wall on the western limb of the Bingen Anticline northward over 40 km. This planation has been extensively incised, leaving several segments north of the Columbia River. Taken together, the planations correlate to nearly the same elevation across 80 km and produce a triangular shape centering around Rowena Gap.

Antecedence Fails to Explain Planations

The presence of these planation surfaces challenges the antecedent stream theory of the Columbia River. Antecedence is predicated on the assumption that uplift and erosion continue in equilibrium in order to allow the river to incise the mountain, but the erosion that formed these planations truncate folds. If a river eroded an active fold that continued to be uplifted after the river's erosion ceased, the resulting planation surface would be an arc because of the continued uplift, but these surfaces are planar, indicating that the planations were

created at their present elevation *after* folding had largely ceased. Furthermore, these planations correlate to others, tens of km north and south of Rowena Gap, which would force the antecedent river to be eroding at the planations' current elevation across an expanse of over 80 km *at the same time!*

With no evidence that these planation surfaces have been uplifted by faulting, what can the secular paradigm do? Extensively truncated anticlines near Mount St. Helens (Isaacs, 2020) are best explained by flowing water because, "wind lacks the necessary power, while there is no evidence of glaciers forming such an extensive erosion surface." This is also true of the planations of Rowena Gap because glaciers receive their erosive potential due to the force of gravity along a slope, which the planations generally lack. Mass wasting also fails to explain these surfaces because there is no evidence of the colluvium, neither could mass wasting produce 80-km wide surfaces. Even the Lake Missoula Flood could not produce these surfaces, because the flow was restricted to existing basins and valleys and reached a depth of only 300 m through the Rowena Gap (Allen and Burns, 1986). This leaves the

secular model with only the superimposed (superposed) stream hypothesis, which supposes that water gaps were produced by burying the obstruction (e.g., mountain range) under sediment. This would negate the problem of elevation by bringing the river to the planations' elevation, but such a solution would raise more mysteries than answers. Indeed, this model would require that the entire Pasco Basin be buried beneath sufficient sediment in order to raise the elevation of the Columbia River to the height of the planations, a preposterous proposition (Isaacs, 2020). The secular paradigm is further complicated by the Columbia River Gorge incising at an oblique angle through the north limb of the east-west Dalles-Umatilla Synclinorium rather than along its axis. Not only did the river not follow the original valley floor of the Dalles-Umatilla Synclinorium, but it eventually flows towards the axis of the associated anticline paralleling the Dalles-Umatilla Synclinorium instead of following the path of least resistance.

Regardless of which model it relies upon, the secular paradigm is challenged by time. Though generally considered an ally of naturalism, time



Figure 6. A. North of the Columbia River, a planation of slightly higher elevation than Ortley Plateau extends from Coyote Wall on the western limb of the Bingen Anticline northward over forty kilometers. This planation has been extensively incised, leaving several segments of a single planation north of the Columbia River. B. Portion of the planation surface visible east of Mosier, Oregon, across the Columbia River to the north.

is too short for the Columbia River to produce the planations and carve the Columbia River Gorge. Indeed, Tolan et al. (2002) claimed that the Columbia River's course was set over the past 17 million years, but the uplift of the Cascade Anticlinorium after the CRB flows reduces the time to no more than 4 Ma if not less. This may give the secular model

too little time for gradual processes to produce the Columbia River Gorge and associated planations at Rowena Gap.

Planations Support Flood Erosion

Uniformitarian explanations of the planations of Rowena Gap are clearly

inadequate, and these large-scale planation surfaces require a mechanism that could: (1) erode powerfully enough over a broad area to plane folded rocks of various lithologies, (2) erode at an elevation of 700 m above the current river surface. These conditions apparently preclude local catastrophes (uniformitarian or diluvial) such as Ice Age floods. Field

data show that those catastrophes are limited to extant basins. Even the Lake Missoula Flood failed to reach half the required elevation of 700 m.

Therefore, the best apparent explanation is strong runoff currents of the Genesis Flood (Oard, 2001a, 2001b). Based on erosion in the region contiguous to Mount St. Helens, Isaacs (2020) proposed that sheet flow from the uplifting Rocky Mountains truncated the Cascade Anticlinorium, which also would have planed the regional-scale north-south anticlinoria. As sheet flows across the region weakened into channelized flow, the waters began to focus on the present-day Columbia River Gorge. Based on the elevation of the planations and their correlation across the region, these planation surfaces were likely produced while the Floodwater channelized through the nascent gorge, sweeping across the eastern limb of the Cascade Anticlinorium and producing the triangular shape centered at Rowena Gap. How this sheet flow relates to the uplift of the Ochoco and Strawberry Mountains in Central Oregon is yet to be ascertained, but further study of water gaps and planation surfaces should help to further define the relative chronology of tectonic and erosional regimes active through the Genesis Flood in this region.

Conclusions

Though used by eighteenth-century geologists as evidence of deep time, river valleys remain stubbornly inexplicable to secular scientists. The very presence of rivers transecting mountain ranges along water gaps remains anomalous despite the host of explanations set forth by researchers. Of all the water gaps found across the world, Oard (2018) has suggested that the Columbia River Gorge may be the only one conducive to secular models, yet this paper has demonstrated that not even Columbia River Gorge is explained by naturalistic models. Planation surfaces that truncate

anticlines as much as 700 m above the current river and correlate across 80 km of the eastern limb of the Cascade Anticlinorium defies secular explanation. The lack of upfaulting or arching of the horizontal surface indicates the planations were produced at their current elevation, yet no secular model can explain erosion on such a vast scale.

The inability of wind, glacial, and mass wasting processes to explain these features leaves moving water as the only reasonable explanation of the planations, but river antecedence fails to explain why the planations were produced so high above the current river *after* regional folding. Though elevating the river, a superimposed river only compounds the challenge by a preposterous quantity of sediment requiring removal by gradual river erosion. Because the Columbia River Basalts predate the folding of the Cascade Anticlinorium, this leaves less than four million years within the uniformitarian timescale for all of this erosion to occur. If even the simplest of all water gaps cannot be explained by uniformitarian conditions, then how inept naturalistic geology must be! Indeed, it is evident that only the Genesis Flood provides the needed mechanism to produce the observed field data. Receding currents flowing from the uplifting Rocky Mountains near the climax of the Genesis Flood likely funneled through the nascent Columbia River Gorge being incised through the Cascade Anticlinorium, which served to partially impound the receding currents. If this is the case, Floodwaters may have also been diverted south through the drainages along the eastern foothills of the Cascade Anticlinorium in central and southern Oregon, potentially causing similarly extensive erosion. This should leave regionally correlative erosion surfaces and associated deposits, providing clues to better understand the tectonic and erosive forces active across the western United States during the Genesis Flood.

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Catching the Vision: Blind Cave Fish (*Astyanax mexicanus*) as a Model System for Continuous Environmental Tracking and Adaptive Engineering

Jeffrey P. Tomkins, Scott Arledge, Randy J. Guliuzza*

Abstract

A wide variety of fish, amphibians, and arthropods have colonized cave environments deploying complex suites of morphological, physiological, and behavioral traits specifically adaptive to a perpetually dark and resource-scarce environment. Among the many examples of this global phenomenon is the Mexican blind cavefish (*Astyanax mexicanus*) which has become a leading research model for this rapid and repeatable adaptation which is nearly entirely due to developmental phenotypic plasticity. Not only do blind *Astyanax* cavefish (compared to surface morphotypes) exhibit a lack of eye development, but they also display complex enhancements for chemo- and mechano-sensors, altered circadian cycles, modified neural and endocrine circuits, metabolic modifications in both rates and metabolism, epigenetic modifications, and behavioral changes that rely upon all of these complex physical and physiological modifications. These rapid, repeatable, and complex organism-wide system adaptations make little sense in the context of Darwinian evolution involving mutation and natural selection. However, the data fit perfectly with a model of engineered, organism-driven systems of adaptation built into creatures by the Creator that enable them to continuously track and appropriately adjust to specific environmental changes. Given that *Astyanax* have been well-researched and are relatively easily studied, reared, and bred in a laboratory setting, we propose using these fish in creationist research for the study of environmental tracking conferred primarily through phenotypic plasticity.

Key Words: Blind cavefish, Mexican tetra, adaptation, continuous environmental tracking, phenotypic plasticity

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Introduction

It is not uncommon for certain types of animals to deploy unique suites of variable morphological, physiological, and behavioral adaptative traits that allow them to live solely in underground habitats such as caves (referred to as troglobites). These cave-exclusive traits are distinct from those in troglomenes, creatures that live both above-ground and underground or in caves (e.g., bats), or animals that visit caves. Troglobitic creature variants with cave-specific self-adjustments living in perpetual darkness can be found among a diversity of amphibians, fish, various insects, crustaceans, millipedes, and spiders.

There are about 230 known species of dark-adapted cave fish (CF) across the world and over a nine-year period (2011 to 2020), an average of eight new species per year were documented (Maldonado et al., 2020). All of these CF independently originated from surface dwelling morphotypes, indicating that the trait is a consistently repeatable adaptation (Borowsky, 2018). The most heavily studied troglobitic fish is the blind CF *Astyanax mexicanus* which has colonized about 30 different caves in northeast Mexico and has become a model organism for perpetually dark ecosystem adaptation (Gross, 2012).

Astyanax has proven especially useful in studying cave adaptation because the cave-dwelling morphotype lives in close proximity to surface-dwelling morphotypes found in lacustrine or fluvial environments. Genetic studies have yielded evidence of multiple cave invasions (five by the latest count) by surface-dwelling types along with persistent gene-flow among cave-dwelling populations (McGaugh et al., 2020a; Maldonado et al., 2020). However, there is a limited amount of overall genetic variability between the surface and cave variants and their genomes are nearly identical. The two different groups (sighted vs. blind) are referred to as morphotypes and not separate species because of their

nearly identical genomes. In addition, no inactivating mutations have been found in the genes associated with eye loss (Gore et al., 2018). Because of a paucity of correlating genetic variants as being solely causal to the blind CF morphotype, a large amount of research has investigated and fortuitously revealed a diversity of internal systems leading to the overall CF phenotype—bolstering an engineering-based model to explain the operation of adaptable systems in creatures.

The characteristics that describe how organisms adapt to changing exposures are evidence that could be used to support either an engineering-based theory or a Darwinian theory of adaptation. A good theory of adaptation should try to establish objective means of testing its correctness by making unambiguous predictions of how adaptation should be characterized. A new engineering-based model of adaptation called continuous environmental tracking (CET) postulates adaptation will be best explained by the same engineering principles as a human-engineered tracking system (Guliuza and Gaskill, 2018). This model predicts that adaptive changes would be characterized as highly regulated, rapid, repeatable, sometimes reversible, and produce solutions that target and may even anticipate specific environmental challenges. Darwinian theory also makes predictions. Stephen Jay Gould detailed why within evolutionary theory both genetic variation and adaptation “must” be characterized as “undirected,” “copious,” and “small in extent,” i.e., very gradual. Gould adds, “Substantial change might occur as a very rare event, but most alteration must be insensible, even on geologic scales” by which he confirms that, “gradualism may represent the most central conviction residing both within and behind all Darwin’s thoughts” (Gould, 2002). “Undirected” obviously reflects evolution’s non-purposeful, chance-driven outcomes. When populations produce

“copious” potential solutions to environmental problems, then this affords a haphazard “hit and miss” approach to problem solving. The study of *Astyanax* CF and other troglobites provide models to test the accuracy of these contrasting predictions of how adaptation should be characterized.

In the case of *Astyanax* CF, at least 30 different cave populations have been documented as having multiple points of origin from the same surface morphotype and all the cave populations exhibit nearly the same morphological and behavioral traits (Herman et al., 2018; McGaugh et al., 2020b). Rather than invoking the empty term “convergent evolution,” these rapidly emerging and repeatable *Astyanax* CF variants are clearly consistent with an engineering-based model of adaptation that is inherently innate and purposeful. In this review on the subject of *Astyanax* CF, we not only show how exquisitely engineered the *Astyanax* CF adaptive remodeling system is, but the potential of this biological model for creationist research in the emerging field of continuous environmental tracking and adaptive engineering in living systems (Guliuza and Gaskill, 2018; Hennigan and Guliuza, 2019).

Morphological and Sensory Adaptations

The chief and most notable adaptation of interest in *Astyanax* CF compared to the surface fish (SF) morphotype is eye degeneration where the eyes are either extremely small and non-functional or nearly absent, and loss of pigmentation as shown in Figure 1 (Emam et al., 2020). This adaptation is especially intriguing because in contrast to most vertebrates, teleost fish have eyes that experience regenerative growth throughout their lives. The retina in teleosts is maintained throughout the life of a fish by a continuous acquisition of new cells from stem cell sources in two other parts

of the eye structure (Otteson et al., 2001; Emam et al., 2020). However, in blind CF, the considerable resources that would otherwise be partitioned to the development and maintenance of the highly metabolic neural tissue of the eye are effectively partitioned to other necessary systems needed for dark adaptation.

During the initial stages of embryonic development, *Astyanax* CF eyes follow a similar pattern of development as SF, but after just a few hours, eye development arrests and the eyes degenerate through a controlled system of programmed cell death known as apoptosis (Krishnan and Rohner, 2017). This is no simple feat due to the fact that numerous genes are involved in eye development and many of these same genes also contribute to other aspects of development including the neural tissue of the brain. In other words, how is it that eye development is arrested while other types of neural development utilizing some of the same genes proceed either normally or are used to enhance troglodite-specific neural structures? The answer from an engineering-based approach would point to alternative developmental programs for dark versus light adaptation. In contrast, evolutionists have been flustered to some extent while investigating one candidate developmental gene after another because they are constantly looking for a single *broken* system component based on their Darwinian world-view. Nevertheless, important strides have been made in secular CF research despite handicaps that couple to the anti-design presuppositions that dominate biology.

Research guided by a theory of biological design would ask different questions. It would predict and search for a balancing mechanism that clearly must exist for both the timing and location of the expression of many developmental genes in the sighted vs. blind *Astyanax* morphotypes. As it turns out, the initial arresting of eye development observed in the blind CF is a necessary system con-

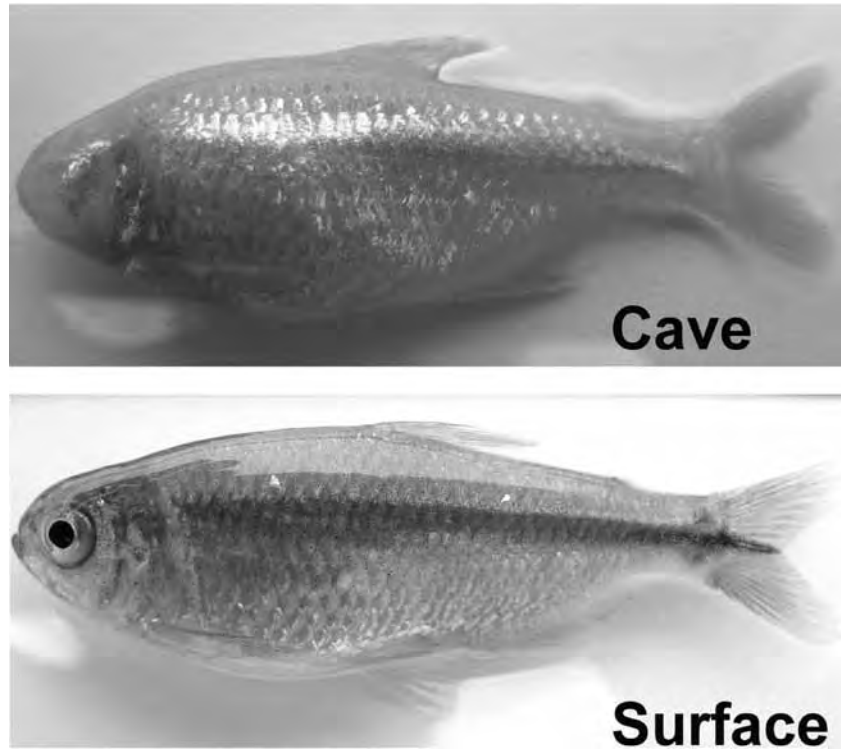


Figure 1. Cave and surface variants of *Astyanax mexicanus* showing the loss of eyes and pigmentation in the cave morphotype. Image credit: University of Maryland [<https://cmns.umd.edu/news-events/features/2545>]. Used in accordance with federal copyright [fair use doctrine] law.

straint. It was at first assumed, due to the anti-design bias of the Darwinian framework, that the initial phase of normal eye development in blind *Astyanax* CF was a waste of the organism's resources, but now it has become apparent that it is a requirement of neurodevelopment. The cells contributing to eye development and brain development are so highly intertwined that they must proceed in concert in the very beginning, but then the system takes a different logic-based pathway depending on whether it is heading towards a sighted or blind phenotype replete with a specified pathway of apoptosis. Programmed cell death (apoptosis) is a universal subsystem of embryo development across the spectrum of multicellular life.

Another major programmed modification of an extremely complex trait in

Astyanax CF is the enhancement of the olfactory system (Blin et al., 2018; Jeffery, 2020; Sears et al., 2020). The *Astyanax* olfactory system is engineered to detect a variety of specified molecules related to foraging for food, communication with other fish, reproduction, and predator avoidance. The sensory organ is positioned in a multi-layered pit on the epidermis of the head. Each olfactory sensory neuron contains a single sensor (receptor) that detects a specific odorant representing only one of a wide array of specialized sensors. Compared to surface morphs, *Astyanax* CF have an olfactory system that is both physically larger and at least twice as sensitive to odorant molecule concentration. This conversion has been shown to be extremely rapid. Observations also support a model of a highly regulated and

automated developmental process. For example, *Astyanax* SF embryos that have had one of their developing eye lenses ablated will develop a larger olfactory pit on the side of the head with the degenerate eye compared to the side with the normal eye (Yamamoto et al., 2003).

Yet another important *Astyanax* CF dark-adapted enhancement as a compensatory mechanism for vision loss involves a form of mechano-sensation through a series of specialized sensors on the skin that are collectively called the lateral line (Yoshizawa et al., 2010; Lloyd et al., 2018a; Maldonado et al., 2020). As in many different types of teleost fish, the lateral lines are comprised of individual sensor organs called neuromasts which are specialized hair cells. Neuromasts have stereocilia (hair-like structures) which project into the surrounding water from the skin and are found in two different sensor configurations. One form occurs as a single organ on the skin surface while the other is found in specialized canals. Both sensor configurations function by decoding signals generated from the perturbation of a gelatinous mix (cupula) that surrounds the base of each stereocilium. Each neuromast type is configured to be sensitive to a specified bandwidth of frequencies. The overall neuromast sensory system is able to detect and neurologically portray a complex hydrodynamic image of the surrounding aquatic environment in the brain of the fish (Tan et al., 2011; Yoshizawa et al., 2014; Yoffe et al., 2020). This accounts for aquarists' observations of how store-bought blind *Astyanax* successfully navigate obstacles.

In research where the lateral line has been ablated, *Astyanax* exhibit impaired prey detection, loss of predator evasion, lack of obstacle avoidance, mating difficulties, and loss of water current detection (Yoshizawa et al., 2014; Yoffe et al., 2020). Compared to surface morphs, *Astyanax* CF exhibit hypertrophy (enlargement) of the lateral line where neuromasts are longer and

more numerous (Yoshizawa et al., 2014; Yoffe et al., 2020).

Another significant part of *Astyanax* cave adaptation that shows notable anatomical and physiological changes from surface vs. cave morphs is in the hypothalamus, a hormone producing organ located in the brain that is a principal regulator of homeostasis (Jaggard et al., 2018; Loomis et al., 2019; Maldonado et al., 2020). For the blind CF, these changes are a key part of the dark-adaptive phenotype influencing overall aggressiveness, sleep-wake cycles, and appetite. These programmed responses in the CF hypothalamus explain behavioral adaptations to darkness and other cave conditions. The levels of hypothalamic dopamine and serotonin in the brain are related to a variety of different adaptive CF behaviors (Elipot et al., 2013; Retaux and Elipot, 2013; Maldonado et al., 2020).

Metabolic and Physiological Adaptations

Interestingly, many of the *Astyanax* CF metabolic and physiological adaptations for dark-adapted cave life can appear quite rapidly while the full phenotype entailing the extreme developmental morphological adaptations seems to take longer, but also starts to develop quickly (see discussion below on "Cave Adaptation—How Fast?"). Researchers have recently documented the rapid emergence of CF metabolic and physiological traits in sighted surface fish raised in the dark for two years. They attribute the changes to phenotypic plasticity (Bilandzija et al., 2020). These dark adapted changes include the following traits: 1) overall decrease in metabolic rate associated with an increase in starvation resistance, 2) upregulation of fat metabolism genes with an increase in triglyceride levels, 3) increase in growth hormone levels, and 4) changes in pituitary and thyroid hormone levels (Bilandzija et al., 2020). Directly related to all of these system level

metabolic effects are major alterations in gene expression related to hormonal signaling, signal transduction, protein metabolism, protein modification, numerous transcription factors, and genes involved in epigenetic modification of the genome (Gore et al., 2018; Bilandzija et al., 2020).

Behavioral Adaptations

Behavioral adaptations to perpetual life in a dark cave for *Astyanax* CF involve changes in sleep and circadian rhythms, social and group (schooling) activity, aggression, feeding, and stress-related activity (McGaugh et al., 2020a). Many of these alterations in behavior are connected to *Astyanax* CF phenotypic plasticity, adaptive deployments in morphology, and metabolism/physiology.

In regards to feeding, *Astyanax* SF forage their food from the surface or the upper layers of the water column, while CF target their food at the bottom or in the lower part of the water column (Borowsky, 2018). *Astyanax* CF also assume a different, more-horizontal, posture during feeding than surface fish which are nearly vertical in their posture (Jeffery, 2020). Many of the feeding differences in CF are facilitated by the mechano-sensory morphological adaptations in the lateral line of the fish discussed above.

Another lateral line-related behavioral shift in *Astyanax* compared to SF is the tendency of CF to swim toward the source of a water disturbance, whereas SF would disperse or flee. This is known as vibration attraction behavior (VAB) and is directly connected to the increased size and number of neuromasts in the head, but not to those of the lateral line (Yoshizawa et al., 2012; Fernandes et al., 2018). This behavior is advantageous for feeding and foraging in the dark. Research has shown that the VAB is directly connected to the mechanosensory function of the neuromasts and the specified sensitivity occurs within a frequency range of 10 to

50 Hz and peaking at 35 Hz (Yoshizawa et al., 2010). Furthermore, it has also been shown that VAB is unrelated to the auditory structure of *Astyanax* which is developmentally the same between CF and SF (Yoshizawa et al., 2010).

Further, CF were discovered to sleep considerably less than the surface morphs (Borowsky, 2018). In the laboratory on a 12-hour light–dark cycle, surface fish tend to sleep for 12 hours while cavefish sleep only three or four hours (Borowsky, 2018). This trait, only documented recently, may be almost universal in cavefishes, having been found in all five independent cave species populations where researchers have looked for it. Circadian rhythms are systems in an organism that not only interface with the solar day–night cycle, but help to regulate many aspects of physiology and behavior. Adaptation to a life in perpetual darkness involves an extreme change in this regard.

Overall aggressiveness is another important behavioral change to cave adaptation for *Astyanax*. Compared to surface morphs in the same regions where cave morphs exist, the CF are considerably less aggressive than SF and essentially shift their overall feeding behavior from fighting to foraging (Elipot et al., 2013; Retaux and Elipot, 2013) although at least one cave population was discovered where this was not the case (Espinasa et al., 2005). Nevertheless, the trait of non-aggression in *Astyanax* CF appears to be the norm and in developing embryos of SF where the eye was ablated, the adult fish still exhibited aggression indicating that the trait was non-eye related and a distinct part of the cave-adapted developmental program (Espinasa et al., 2005). The non-aggressive behavioral trait is likely linked to the hypothalamic changes discussed above and leads to improved efficiency for prey capture and finding food in caves, and has also been shown to improve foraging precision compared to SF (Lloyd et al., 2018a; Lloyd et al., 2018b). This trait is

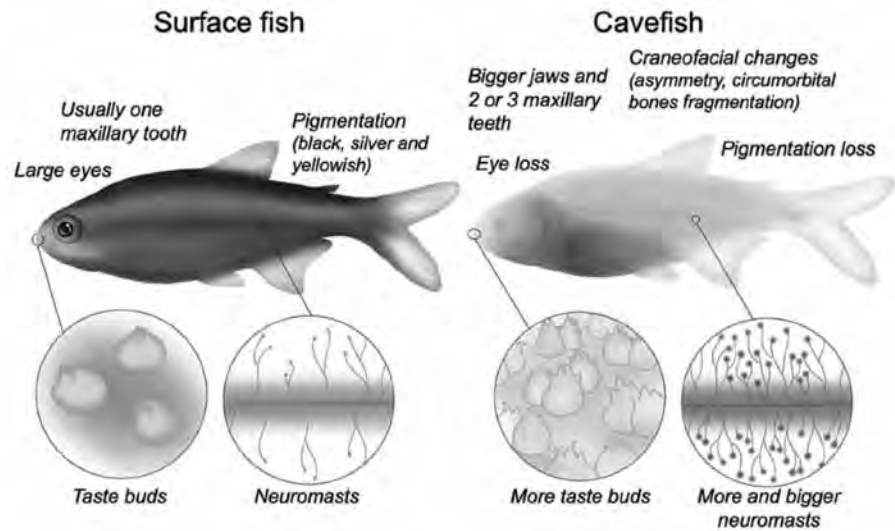


Figure 2. A contrast of morphological differences between the surface and cave morphotypes of *Astyanax mexicanus*. Eye and pigmentation loss are accompanied by bigger and more abundant neuromasts along the lateral line along with an increase in taste buds in the mouth. Image credit: Maldonado et al., 2020. Used in accordance with federal copyright [fair use doctrine] law.

also related to schooling behavior as CF exhibit much less schooling than SF and tend to focus more on individual foraging (Kowalko et al., 2013).

In contrast to SF, the *Astyanax* CF have high appetites and engage in continuous feeding and foraging behavior to facilitate weight gain and fat deposition (especially during periods of food availability) that can be used later during periods of famine (Jeffery, 2020). In contrast to other vertebrates (e.g., humans), the excessive fat accumulation in the enlarged livers of the CF poses no obvious threat as no differences in the health or lifespan have been found compared to SF. In addition, the CF also have lower metabolic rates and increased resistance to weight loss that help them to survive during periods of low food availability (Aspiras et al., 2015).

Genetic Studies Don't Support the Darwinian Model

Evolutionist CF researchers have searched repeatedly for some sort of

mutation that could be interpreted within their Darwinian model as being magically selected by a cave environment to bring forth the *Astyanax* CF phenotype. This hope was recently reiterated in a review on the subject where the authors state, “Another important goal in the field of evolutionary genetics is to trace the origins of mutations necessary for adaptation” (Krishnan and Rohner, 2017). The authors then go on to expound upon the mutation-selection quandary stating, “Do novel mutations originate in the new environment (in this case, the cave) or do they already exist at some low frequency in the founder populations (the surface fish)?” and then the authors go on to speculate as to whether the alleged natural selection for the CF phenotype is direct, indirect, or not at all (neutral model-based evolution). Finally, they have to conclude from the genetic data that there is some complex multigenic adaptive system defying their paradigm, stating, “The strongest genetic argument for the hy-

pothesis that eye loss is adaptive comes from QTL experiments.”

So what are QTL experiments and how have they defied evolutionary expectations? The term QTL stands for *quantitative trait loci*. Given that *Astyanax* CF and SF are nearly identical genetically and readily interbreed, researchers have made crosses and then analyzed the segregating progeny with molecular markers—mapping their genomic locations with various traits related to the CF phenotype. They are QTL because the diversity of traits that make up the CF phenotype are controlled by numerous genes and regulatory elements across the genome. In the statistical output from such studies, certain genetic markers that are significantly associated with a trait (e.g., eye size), will contribute a statistically significant amount of variability to the trait in question. In such a scenario, a major QTL might explain up to 30% of the overall trait variability.

Yet another line of studies performed in a separate field of genetics further discredits the long-standing evolutionary notion that discrete mutational effects underlie *Astyanax* CF adaptation. Several studies have sought to ascertain genetic diversity and the possibility of gene flow (interbreeding) between surface and blind cave populations (Brdic et al., 2012; Herman et al., 2018). The earlier study in 2012 used molecular markers for 11 cave and 10 surface populations and, as expected, found greater diversity among the larger surface populations and less diversity among the cave populations. However, they also discovered a small but significant amount of interbreeding between CF and SF, but nothing directly pointed to a genetic basis for the CF phenotype. How could such different morphotypes not also carry equally extreme mutational differences? The later study in 2018 actually sequenced the genomes of 47 *Astyanax* from three cave populations, two surface populations, and several

outgroups. While this study did little to add to the previous one, it did show that while various CF genomes in different cave systems had unique points of origin based on separate colonization events, the *Astyanax* genomes were overall very similar and nothing distinctly related to conferring the blind CF phenotype could be pinned down.

In contrast to the evolutionarily unproductive nature of QTL mapping and genome sequencing studies, research in epigenetic modifications undergirding cave adaptation in *Astyanax* has been very fruitful, but not in favor of the Darwinian mutation-selection story. In fact, in a recent groundbreaking epigenetic study on *Astyanax* CF, the authors note the Darwinian quandary in their introduction, stating, “recent sequencing of the Pachón cavefish genome and other studies revealed no inactivating null mutations in essential eye development genes” (Gore et al., 2018). In this study, researchers investigated a type of epigenetic modification called cytosine methylation where specified regulatory sections of the genome in and around genes will have a methyl group attached to a cytosine in the genetic code. This site-directed methylation effectively down-regulates or suppresses certain types of gene activity. The research showed that DNA methylation-based epigenetic silencing was an adaptive mechanism in *Astyanax* CF eye degeneration. By performing parallel analyses in both cave and surface morphs, and also in the zebrafish (*Danio rerio*) as another sighted fish, they discovered that DNA methylation confers eye-specific gene repression and also regulates early eye development. These epigenetic data confirm the fact that the overall blind CF phenotype is an inherent system-wide, pre-programmed, adaptive response.

Cave Adaptation—How Fast?

At what speed does dark-adaptive phenotypic plasticity develop in *Astyanax*? As

noted above, metabolic and physiological changes found in blind cavefish can be found within a single generation of dark-raised surface *Astyanax* (Bilandzija et al., 2020). Furthermore, the beginning of morphological changes can also be observed within a single generation of dark-raised surface fish in only a two-year period (Bilandzija et al., 2020). Such immediate changes include an increase in overall retinal thickness of the eyes, thinning of plexiform layers (optical areas of neuronal connection), and specifically a thickening of the nuclear and photoreceptor layers of the retina. The overall body shape of the fish also changed.

In regards to how long the full blind CF morphotype takes to form, the jury is still out on the matter, although evolutionary ideas are quickly being upended in rapid succession. Original Darwinian hypotheses that frame adaptation as a gradual, haphazard or “hit and miss” process estimated the divergence of blind *Astyanax* morphotypes from sighted surface populations at about 3.1 to 8.1 million years ago (Strecker et al., 2004; Ornelas-Garcia et al., 2008). Then about a decade later, several more evolutionary studies came up with much more recent deep-time estimates with one study arriving at a divergence time of about 115,000 to 190,000 years ago (Herman et al., 2018) while another study published about the same time yielded an estimate of 20,000 to 100,000 years ago (Fumey et al., 2018). Clearly, something was amiss in these evolutionary studies that all produced wildly different deep-time estimates.

In 2020, a groundbreaking study was published showing that a recently established population of sighted surface *Astyanax* in a Texas stream had invaded a nearby cave aquifer and had morphed into a blind CF phenotype in less than 100 years (McGaugh et al., 2020b). The authors of this study state, “our results suggest that morphological and behavioural changes accompanying cave colo-

nization can be established rapidly, and this system offers an exciting and unique opportunity for isolating the genetic and environmental contributions to colonization of extreme environments.” The hypothetical deep-time evolutionary models can now be cast aside in light of this recent very pragmatic data. We now have direct evidence that the *Astyanax* CF morphotype can develop within less than 100 hundred years and that as discussed previously, the beginnings of morphological, metabolic, and physiological dark-adapted traits can develop in less than one generation of dark-reared SF *Astyanax* (Bilandzija et al., 2020).

Summary

So why or how would fish end up living in a cave to begin with? It is possible they could have been swept in through a flood or they may have simply colonized the environment with their innate creature abilities as part of the process of obeying the God-given mandate to fill the earth and its ecological niches as engineered by the Creator. Mixes of surface and blind cave *Astyanax* have been found in intermediate zones near the entrances of cave systems along with intermediate morphotypes in the population (Bradic et al., 2012). Furthermore, cave environments do provide some advantages such as a refuge from intense predation, decreased competition with other fish, and a shelter from weather extremes.

In a recent review on *Astyanax* CF, the authors state, “Since the publication of Darwin’s *Origin of Species*, cave animals have been subjects of conjecture about the forces driving evolution” (McGaugh et al., 2020a). But have these cave animals, and especially the well-researched *Astyanax* CF, revealed any evidence of Darwinian selectionism or do the data point to exquisitely engineered systems that track their environments and subsequently deploy

a complete remodeling of the organism to both adapt and strategically position itself to succeed? The data increasingly favor the latter. This trend confirms what Guliuzza (2012) had proposed—that an engineering-based CET model of adaptation would make accurate predictions towards the study of adaptation, facilitating the identification of innate mechanisms controlling the development of cave-specific traits.

Given that *Astyanax* CF have been well-researched in the secular community and are relatively easily studied, reared, and bred in a laboratory setting, we propose using these fish in creationist research for the study of adaptive engineering and environmental tracking in conferring phenotypic plasticity in adaptation.

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Minutes of the 2021 Creation Research Society Board of Directors Meeting

The 58th annual CRS Board of Directors meeting convened from Thursday, 20 May, through Saturday, 22 May 2021. The meeting was held at the new CRS headquarters and laboratory facility in Glendale, Arizona.

The entire board met on Thursday evening to consider preliminary matters. All standing CRS committees met on Thursday or Friday. The entire board met on Saturday to finalize the year's business and planning.

The following board members attended: Jerry Bergman, Rob Carter, Gene Chaffin, Tim Clarey, Danny Faulkner, Don DeYoung, Robert Hill, Mark Horstemeyer, Jean Lightner, Gary Locklair, Michael Oard, John Reed, Ron Samec, Tichomir Teney, and Jeff Tomkins. VACRC director Kevin Anderson and professional staff members Diane Anderson and John Trout were also present.

Only selected highlights of board activities and actions are presented here.

President DeYoung shared with the board a number of letters to the CRS. He noted with thanks that we have many supporters and friends.

The 2020 Board Minutes were approved as published.

160 ballots were received for the 2021 Board of Directors election. All six candidates (Bergman, Chaffin, Horstemeyer, Lightner, Reed, and Tomkins) were elected to a 3-year term on the board.

Recognition was given to Jeff Tomkins as a new board member.

Prior to our board meeting, we completed the move to our new facility in Glendale, Arizona. In addition, we



sold our old facilities in Chino Valley, Arizona.

Don DeYoung, VACRC (lab) committee chairman, shared details of the sale of our old property in Chino Valley, Arizona, and the move into our new facilities. The logistics of the move were challenging. Don commended the work of John Trout in marketing and social media. Don reported on the iDino and eKinds research projects. Research is important and vital to the Society. The lab committee continues to encourage our staff to keep up their good work.

Danny Faulkner discussed the upcoming 2021 annual conference. (There was no conference in 2020.) This will be the Society's 9th annual conference and will be held at Arizona Christian University. He reported that conference participants appreciate the opportunity to network and discuss creation research.

Tim Clarey led a devotion focusing on oil and God's providence and how it demonstrates His care for us. Oil gives us a small inkling of how God provides for us.

Ticho Teney, internet committee chairman, along with Rob Carter proposed that CRS email correspondence be handled using creationresearch.org addresses (eg, president@creationresearch.org) as this will provide continuity when there is a transition and an archive of communication. There was a discussion related to the mission and purpose of the website. We agreed that our intellectual property is underutilized and the website must grow and its organization needs to accommodate active research. The Society has several individuals who are handling technical issues including Craig (IT) and Brandon (website). Brandon will be utilized more during the coming fiscal year (up to 24 hours per week).

Tim Clarey, periodicals committee chairman, shared information relating to the *CRSQ* and *Creation Matters*. As editor, Tim found replacements for several assistant editors and appreciated their help with proofing. Our issue layout assistant, Cindy Blandon, was commended for her work. She will be asked to provide individual .pdf files of each

article for use on the website. A stipend for the assistant managing editor, David V. Bassett, was approved. Jean Lightner was thanked for her work on *Creation Matters*. Jean asked for articles to fill the pipeline.

Mike Oard, publications committee chairman, provided information on book sales. He shared that the Society has stopped producing and publishing our own books, but we continue to sell books produced by others in our bookstore. The committee proposed that CRS authors promote their books using short videos on the CRS YouTube page. Several members will provide assistance for producing the videos.

Rob Carter, membership committee chairman, provided information on the state of the Society. Membership has slowly declined over the past years. The CRS currently consists of 881 sustaining members and 647 voting members. Our marketing assistant, John Trout, has been contacting lapsed members and had some success in retaining many. The committee noted the following price increases effective in 2022: renewals—\$53; seniors—\$48; paperless—\$35; individual subscriber—\$56; institutional subscriber—\$66; life member—\$600.

Gene Chaffin, research committee chairman, provided a brief history of research in the Society. Although no grants were provided this past year, there are a number of on-going research projects funded by CRS grants. The committee will be producing a document regarding research for an upcoming issue of the *CRSQ*.

Gary Locklair, constitution committee chairman, reported that the revised constitution and by-laws were approved. The committee affirmed that a board member's term of service begins at the

first board meeting after their election and expires the day before their fourth board meeting (three years later). The committee proposed that Kevin Anderson be designated as both "laboratory director" and as "Chief Operating Officer" since Kevin oversees day-to-day administrative and operational functions of the CRS. The committee discussed the need for a clearer statement of faith and perhaps a stronger statement to be subscribed by board members. The committee proposed amending Article V, Section 4 (Nomination by Members) of the by-laws to state "10% of voting members" rather than "25 voting members" and "the number of petition signers represents at least 10% of the Society's voting members" rather than "at least 25 of the signers of the petition are voting members in good standing." These changes relate to the petition process of nominating board members. Our goal is to hold board elections earlier with a ballot return date of 1 March. Results of board elections will be reported in *Creation Matters* and the *Newsletter*. Some discussion of advanced planning ensued.

Danny Faulkner, treasurer, reported on Society income and expenses for the year. He indicated that expenses were in line with the Society's income.

Financial Secretary Bob Hill shared the financial status of the Society. The endowments are performing well. He encouraged committees to be conservative in the preparation of their budgets.

The board approved an expense budget of \$331,150 for the coming fiscal year. The board authorized Diane Anderson to withdraw up to \$20,000 of funds without executive committee action.

All committee proposals were approved by the board.

The board submitted the name of Rom Samec as a candidate for the 2022 Board of Directors election. After 23 years of service, Gary Locklair will not seek re-election to the board. After 36 years of service, Don DeYoung will not seek re-election in accordance with the by-laws' age requirement. In addition, Don DeYoung's 22 years as Society president will end as he declined to run for president during 2021–2022.

Board elections resulted in the following:

President – Robert Hill

Vice President – Jean Lightner

Recording Secretary – Gary Locklair

The following officers were confirmed for the first year of their 3-year term:

Financial Secretary – Danny Faulkner

Treasurer – Danny Faulkner

Membership Secretary – Rob Carter

The board had a special recognition for Kevin and Diane Anderson for their years of service and their dedication to the Society, especially during the recent move.

The board had a special recognition for retiring president Don DeYoung as Don will complete his service to the Society before the 2022 board meeting.

The next annual board meeting will be 19–21 May 2022 in Glendale at Arizona Christian University.

Respectfully submitted,



Prof. Gary Locklair, PhD, FCRS
CRS Recording Secretary



Letters to the Editor

The policy of the editorial staff of CRSQ is to allow letters to the editor to express a variety of views. As such, the content of all letters is solely the opinion of the author, and does not necessarily reflect the opinion of the CRSQ editorial staff or the Creation Research Society.

Heart Mountain Detachment Comments

I commend the editorial staff of the *Creation Research Society Quarterly* for the publication of the controversial views of John Matthews (2021a; 2021b) on the Heart Mountain Detachment. Editor Clarey's objections were well-presented, but having these incompatible views freely expressed in the journal is not only good science, it is also evidence of a good Christian spirit. Matthews raises some excellent points about the physics of the proposed process, but this also impinges on the South Fork Detachment, which the editor has researched himself in the field. Clarey asserts the reality of overthrusts in general, provides a modicum of geologic evidence for the Heart Mountain detachment in particular, and argues that reported overthrusts should not be used as evidence against the geologic column.

I have pointed out before (Klevberg, 1999; 2000a; 2000b) the pitfalls of basing conclusions on stratigraphic preconceptions, especially in the absence of field work. Clarey asserted the reality of mapped thrusts despite knife-edge contacts with no offset features, something he might not have done had he seen the "mental-thrusts" up close in the field (Clarey, 2016; Klevberg, 2016). However, that only applies to about 80%

of the alleged thrusts in that area; the others are either obscured or do show some evidence of movement. Evidence of movement is also present where thrusts are not mapped, so mapping of "mental-thrusts" and not of reverse faults must be either from small-scale or uniformitarian stratigraphic bias (Oard and Klevberg, 2015).

Clarey, Oard, and I, along with another scientist, hiked to the Lewis Overthrust in Glacier National Park in 2009. While the strong dolostone above the contact shows much evidence of deformation, the weak sandstone and shale beneath it shows considerably less deformation than would be expected. This suggests the dolostone may have been rapidly lithifying while underlying strata were unconsolidated. Even if plastic during the time of movement, the clastic strata should have developed obvious fabrics for the whole length of the contact, but there is only minor folding. Articles I have read concentrate on small zones of cataclasite and do not address this larger picture, which remains a mystery very similar to Heart Mountain in that respect. From a distance, it looks like a perfect overthrust, but up close it is much more complicated.

Evolutionists Alt and Hyndman propose that the large thrust faults defining the Sapphire block in southwestern Montana rode on magma (Alt and Hyndman, 1986). Considerable mylonite is associated with this block along with granitic intrusions all along the sole and deformation in strata along the edges of the block. Molten rock would make a relatively low-friction and potentially pressurized decollement.

In freshman geology class, the professor set up a glass case with clay layers in it and a crank-handled screw at one end. He demonstrated overthrusting using this model. Creationist David McQueen pointed out that the clay layers had to have lead shot on top of them for this to work. Oard delights in pointing out evidence for thousands of meters of erosion during the waning stages of the Deluge; that would be the obvious substitute for lead shot in the real-world case.

Whether the geologic column fails in the case of Heart Mountain (or the Sun River Canyon or the Lewis Overthrust) remains an open question. No explanation based in stratigraphic preconceptions and ignoring physics is viable. That additional geologic field work and physical analysis are greatly needed on the Heart Mountain Detach-

ment is obvious from the exchange. It just means we need diligent field work and careful analysis of this fascinating geologic feature.

Peter Klevberg

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More on Modeling

In his “Thoughts on the Creation Model Controversy” (*CRSQ* 58(2):137), Ivan Martin mentions my response (*CRSQ* 57(4):292) to Jerry Bergman’s letter (*CRSQ* 57(2):153) on the danger of focusing on model-building *at the expense of* continuing polemics against atheistic science, including evolution. Bergman also observed that much model-building ends up capitulating to naturalist assumptions, by seeking purely natural causes for supernatural events like the Flood. The point of my response, “True Creation Model Must

Be Metaphysical,” was that creationist theoreticians should seriously consider “ways of representing divine causality in theoretical formalisms,” and not, as Martin inferred, that “creation model-building fosters a slide into naturalism.” What I proposed was precisely to avoid that slide by representing supernatural causation within the model, whether this is “attractive in the marketplace of ideas” dominated by the atheistic paradigm, or not. With regard to the Flood, Kenneth Click observes: “Our creation model will never be compelling until adequate

cause, capable of producing catastrophic flood events resulting in earth geology, is identified.” (*CRSQ* 58(2):139) Now for those events to be compressed into 371 days, at the very least there was supernatural acceleration of natural processes, if not direct injection of thermal or mechanical energy at key locations in the mantle. Can creation science eschew theoretical representation of the only possible “adequate cause” of such catastrophic effects?

Larry Rinehart
Dover, PA

Response to Ahlquist and Lightner: An Initial Estimate of Avian Ark Kinds

I thoroughly enjoyed the papers by Ahlquist and Lightner (2019; 2020; 2021) and learned a great deal from them. I have only one objection. They state (2021, p. 124), “it may be at first perplexing that so many species of landfowl differing vastly in size, breeding habits, general ecology, and especially plumage diversity can be derived from a single pair of birds on the Ark.” The reason it could be perplexing is that they were not derived from a single pair of birds on the Ark. Genesis 6:20 seems to indicate one pair, but Genesis 7:3 says, “also of the birds of the sky, by sevens, male and female, to keep offspring alive on the face of all the earth” (NAS translation). This does not make clear whether it is seven individuals or seven pairs, but some translations specify seven males and seven females. This larger number

of birds was pointed out by Johnson (Johnson and Clarey, 2021). This is an example of a *polytypic* baramin in the parlance of Marsh (1967). The baraminology of Galliformes is therefore more complex than that of the carnivores and omnivores that were preserved as single pairs on the Ark.

Peter Klevberg

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Reply to Klevberg: An Initial Estimate of Avian Ark Kinds

I am thrilled that our articles are being read and enjoyed. I want to thank Peter Klevberg for bringing to everyone’s attention the poorly worded sentence. Indeed, I have previously acknowledged the fact that many birds are clean, and more than two individuals of each kind would have been on the Ark. This may have contributed to the fact that the level of the kind in birds is often above the level of the family, based on hy-

bridization criteria (Lightner, 2013, p. 465); various kinds of clean birds may have had a head start with more initial diversity. It is good to keep in mind that some clean animals and birds may have been used for food or sacrifice, so it is unknown how much extra diversity actually contributed to the diversity in today’s birds. Also, as we mention, God certainly provided for these birds in other amazing ways to enable them to reproduce and

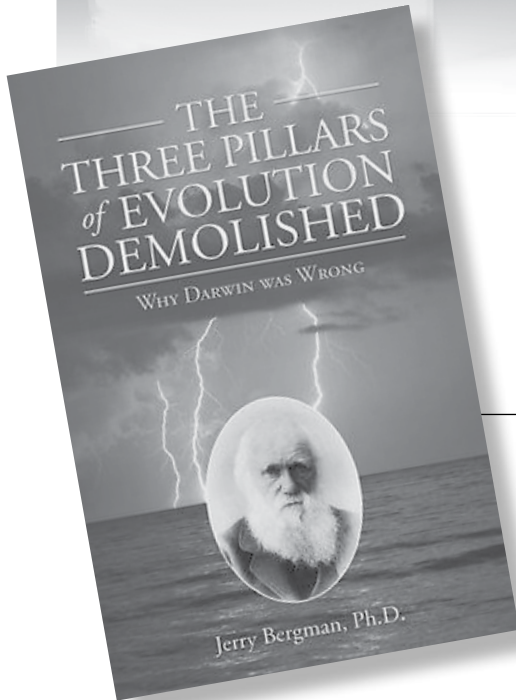
fill the earth with their stunning diversity, beauty, and usefulness to mankind (Genesis 1:22; 8:17; Isaiah 45:18). What a wise and kind Creator we have!

Jean Lightner

Reference

- Lightner, J.K. 2013. An initial estimate of avian Ark kinds. *Answers Research Journal* 6:409–466.

Media Reviews



The Three Pillars of Evolution Demolished

by Jerry Bergman

WestBow Press,
Bloomington, IN, 2022,
357 pages, \$30.00

Jerry Bergman has authored another comprehensive book which summarizes the scientific, rational, and theological problems with the theory of evolution. This book is up to date on the latest conjectures, explanations, and work-around proposals alleged to support evolution.

Evolution as a scientific theory today is supported like a three-legged stool: 1) Origin of life without supernatural intervention; 2) Random mutations as the source of variation; 3) Natural selection as the mechanism on how life evolves. Natural selection was Darwin's central doctrine for how comprehensive

evolution happened. Mutations became the items for natural selection to select in producing evolution.

The problem of how life began, abiogenesis, led evolutionists to consider how the postulated primitive atmosphere (water, hydrogen, ammonia, and methane) produced amino acids, which are presumed to have led to proteins. After many more steps the first life formed and evolution was "off to the races." To anyone with organic chemistry experience, abiogenesis is clearly impossible and Bergman carefully demolishes this pillar of evolution. This is one reason why scientists such as Francis Crick suggested "panspermia" or the transfer of life from outer space to earth to account for life.

The second pillar of evolution theory is a non-stop progression of "beneficial" mutations which fortuitously happen as life generates new species. The enor-

mous difficulty of putting together a series of beneficial mutations to produce a novel species is thoroughly discussed in the book. The well-known (to creationists at least) 99 percent plus of all mutations being harmful or minimally effective, but continuing to mount up to "mutational meltdown" is very well covered by Bergman.

The third pillar of evolution is natural selection which Darwin popularized as analogous to artificial selection of crops and animals. The many contradictions of natural selection are recognized by devote evolutionists and this third pillar is demolished in the book. Deep time, which is also essential for evolutionary theory, is an understood aspect of the three pillars covered in this highly referenced summary.

Theodore J. Siek
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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).

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) 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.

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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

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The membership/subscription categories are defined below:

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2. **Sustaining Member** Those without an advanced degree in science, but who are interested in and support the work of the Society.
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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.
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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.



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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.

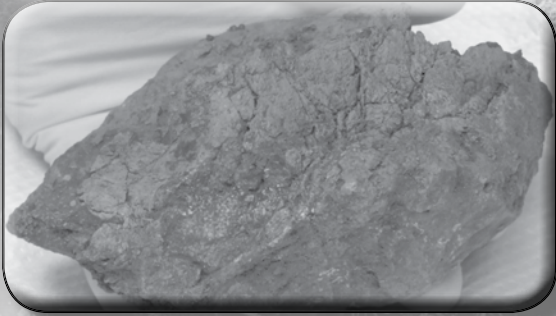
2. All basic types of living things, including humans, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.

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

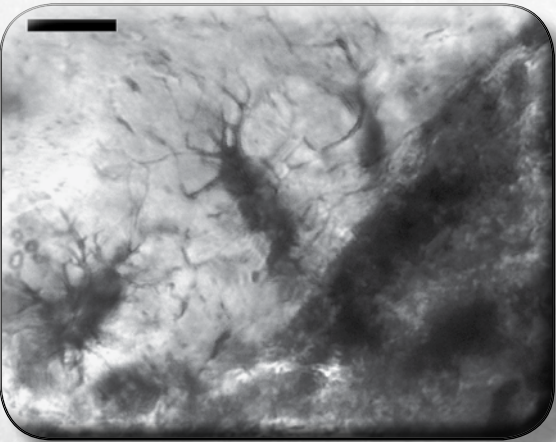
4. We are an organization of Christian men and women of science who accept Jesus Christ as our Lord and Savior. The act of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Savior for all people. Therefore, salvation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

iDINO II

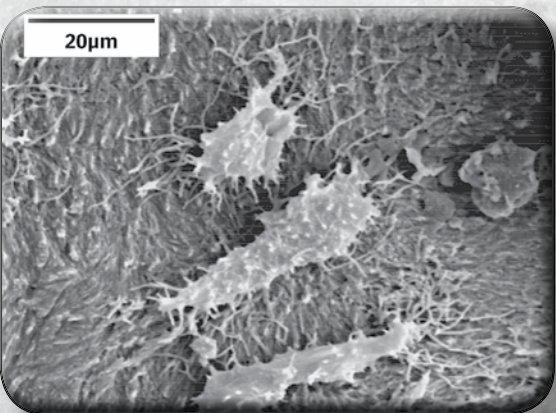
Investigation of Dinosaur Intact Natural Osteo-tissue



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.

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



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