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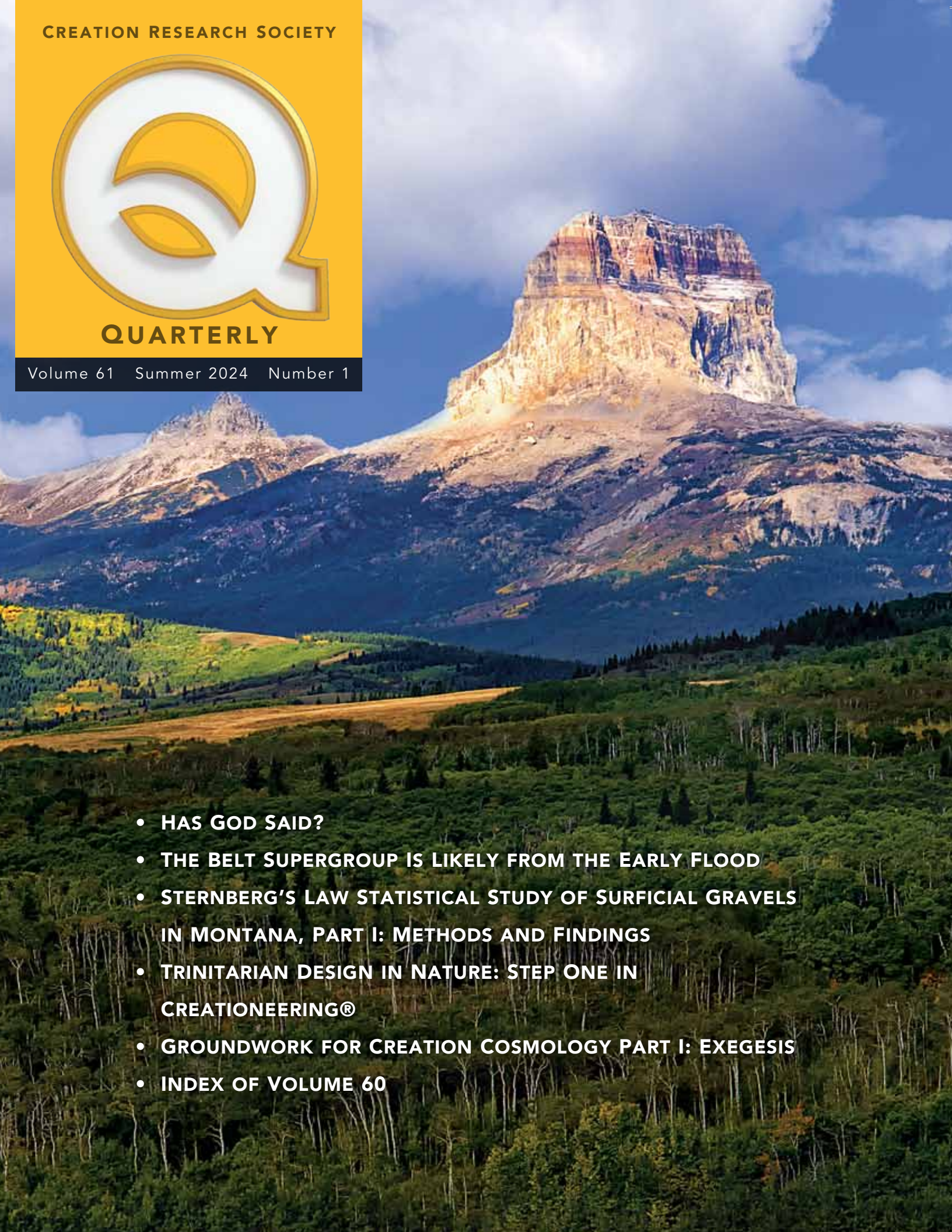

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Haec Credimus

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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Has God Said?

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Abstract

The question of how God works is one which many struggle with. While this is especially true in the case of the issue of creation with respect to Genesis 1, it really is a broader issue relating to any intervention of God into the physical realm, especially with regard to human affairs. While readers of this journal generally assume that God can intervene in the space-time continuum, this study begins with a reminder of why the Christian view is *that He can*. It observes that these interventions are given a generic name of 'miracles,' and then reviews the nature of miracles focusing on examples of Biblical descriptions of events that are presented specifically as miracles by the Biblical author. This is followed by an evaluation of the terminology used in Genesis 1 to describe the original creation event and why Biblically speaking it must be viewed as miraculous.

Key Words: Creation, Exodus, Genesis, miracles, naturalism

Introduction

Genesis 1–11 lays the foundation for the rest of the Bible by introducing key theological principles the rest of the book develops. As such those chapters touch on many of the basic questions each of us wrestles with regarding life—questions such as: Where did the world come from? Why is there so much evil in the world? Is there hope for the future? The cornerstone of that foundation is Genesis 1:1–2:3, a preface, which describes God creating the heavens and the earth (Harbin, 2021, p. 226). However, that account is highly debated even among those who accept the idea that God is the Creator. If God created, how did He do it? The way one understands the Genesis creation accounts depends on one's concept of the universe, both in terms of its structure, and in terms of its origins. The two issues are intertwined and both really involve philosophical presuppositions which determine how one interprets the data. Although fundamental and well-known, the distinctions are often overlooked. As such, a brief review of those distinctions and their implications is worthwhile even for those who affirm God's direct creation. These can be characterized in general as two basic positions.

Naturalism

In terms of structure of the cosmos, the basic question is whether or not there is anything or anyone beyond the physical universe. One view is that the physical is the only reality, which is called naturalism (Kellenberger,

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2007, p. 207). A logical corollary to that concept is that reality is nothing more than a sequence of physical cause-and-effect relationships. Through the centuries, humans have observed such consistency in these cause-and-effect relationships that they have been deemed "natural laws," such as the law of gravity. Because they are so pervasive, a normal human response to any event is to look for a physical cause—what caused this? While ultimately this view jettisons the idea of a Creator, more commonly, He is forgotten in routine matters even by those who strongly accept Him. In practice this eliminates miracles or supernatural events from the onset. As such, in our culture, most people including many Christians who are scientists are essentially practical naturalists. But this is nothing new. It is evident even in the Biblical accounts including Jesus's closest disciples. While they accepted that God could produce miracles, and even saw Jesus performing them, they deemed them unlikely and were often slow to accept them. For example, Matthew describes how before Jesus fed the 5000, His disciples thought only of buying bread (Matt. 15:33). Then, apparently the evening or day after that act, when the disciples were in the boat with Jesus and the lake got rough, they had completely forgotten the event (Matt. 16:7). Even after the resurrection, despite numerous foreshadowings, the first reaction of the disciples was that someone had taken the body of Jesus (Jn. 20:2).

However, having an expectation of a physical cause for an event as a normal response to an event is one thing. To deny evidence that rules out a physical cause is another. While the former is indeed a form of naturalism and really is the foundation of modern science, both Nancy Pearcy and Charles Thaxton (1994, pp. 24–37) and Francis Schaeffer (1976, pp. 130–143) observe that naturalism has its limits. As Schaeffer puts it, "Things go on in a cause-and-effect sequence, but at a point of time the direction may be changed by God or by people" necessitating a God external to "the uniformity of natural causes" (1976, pp. 142–143). Naturalism with that caveat could be termed a working hypothesis—something that one begins with until evidence proves otherwise.[1] However, naturalism can also be a philosophical system or worldview which drives the interpretation and acceptance of data. Lewis distinguishes this philosophical form by capitalizing Naturalism (Lewis, 1972, p. 10). Nash and others call it "metaphysical naturalism" (Nash, 1997, pp. 119–124). Lewis examines this in the context of how inference underlies reasoning and concludes "All possible knowledge, then, depends on the validity of reasoning…Unless human reasoning is valid no science can be true" (Lewis, 1972, pp. 19–20). Nash takes this argument one step further when he states, "unless human reasoning is valid, no arguments by any metaphysical naturalist directed against Christian theism or offered in support of naturalism can be sound" (Nash, 1997, p. 125).

Readers adhering to philosophical naturalism read Genesis 1 through that lens and explain the chapter accordingly. That is, they seek to find physical causes to all physical events. While one may propose a number of ways to argue that Genesis 1 should not be read as showing that God created, none is really coherent and one must still explain the existence or origin of the universe.

1 As such, it is really a method of investigation and should properly be called "methodological naturalism" since it is also practiced by many who reject naturalism as a philosophy. However that term methodological naturalism has been pre-empted by those who see naturalism as a philosophical system who apply it to their system.

Spiritualism

The alternative to philosophical naturalism is that there is a realm beyond the physical, sometimes called the spiritual realm. Because it is not physical, it is not detectable by physical means. However, its existence has been demonstrated (although not "proven") by induction (Ratzsch, 2000, pp. 100–109). This realm is associated with the existence of God and reflects His transcendence.

Regardless of whether one accepts the existence of God, with regard to the origin of the universe there are simply two choices: either it always was, or it came into existence at some time (Gamow, 1971, p. 57). But each choice is fraught with difficulties—mind-stretching difficulties that demand that one accept incomprehensible givens. Yet, the only alternatives are that something or someone came into existence out of nothing by itself, or something or someone always existed (Overman, 2009, pp. 7–11). With regard to the physical universe, today, it is generally accepted that it had a beginning (Ross, 2001, p. 25). But that does not resolve the debate—it merely refocuses it. Did God create it? If the universe had a beginning and God did not create it, what caused it? Many scientists maintain that it simply began with a singularity; that is, it just appeared out of nothing (Hawking, 1996, pp. 49–54).[2] Many

2 While this idea was developed through mathematical models, there are a number of conceptual difficulties. For example, Hawking explains a singularity as a point where the "curvature of space-time is infinite" and cites an example of a black hole, "a singularity contained within a region of space-time." If the Big Bang was a singularity where all matter in the universe appeared and time began, into what did it appear? From where did it come? Hawking states "there must have been a time in the very early universe when the universe was so small that one could no longer ignore the

others, however, argue for a Beginner (Schroeder, 1997, pp. 23–27)[3] usually denoted as God (Blocher, 1984, p. 60), a view which takes Genesis 1:1 at face value: "In the beginning God created the heavens and the earth."[4] Even here, debate rages which may be succinctly characterized as trying to understand "How?" Responses generally fall into three theological categories based on how God relates to the physical universe.

A Tale of Three -isms

Theologians use three basic labels to describe how people understand God to relate to His creation: pantheism, deism, and theism. Historically, orthodox Christianity has been defined as a theistic faith. As defined by Webster's dictionary, the key to this concept is that God "is viewed as the creative source of man, the world, and value and who *transcends and yet is immanent in the world*" (*Webster's Third New International Dictionary,* s.v. "theism," italics added). In other words, God is beyond space and time (transcendent), but can and does intervene in the space-time continuum (immanent). Essentially the concepts of transcendence and immanence form a spectrum, with theism in the middle, a tension that is difficult to maintain especially with respect to our daily routines.

One end of that spectrum emphasizes God's immanence to the exclusion of His transcendence and is labeled pantheism. In this view, God and the cosmos are essentially one, and physical laws are really just acts of God. Patterson succinctly describes it as an identification of the universe with God (Patterson, 1958, p. 114).[5] As such, what we call the physical world is viewed simply as aspects of "that cosmic force" although pantheistic religions differ as to whether there is a god (Ghose, 1967, p. 263). However, the dominant view seems to be that there is a god who is infinite and at the same time there is a finite universe which is identical with that god. To escape that contradiction, the universe is generally deemed an illusion (Corduan, 1993, pp. 92–95). While the term "creation" is generally used, it does not seem to be a concept which is developed or discussed (Smart, 1967, p. 22). In Hinduism, the focus is on Brahman and the other gods with the physical being a manifestation of Shiva's dance (Capra, 1984, pp. 230–233). Buddhism seems to evade the concept of both gods and creation. K. Sri Dhammananda observes that "Buddhism does not pay much attention to theories and beliefs about the origin of the world." He goes on to argue that "if the first cause can exist though uncreated, there is no reason why the other phenomena of the universe must not exist without having also been created" (Dhammananda, 2002, pp. 166–168).

At the other end of the spectrum, deism is a theological position that basically eliminates the immanence of God. As Berkhof expresses it, deism argues

> At the time of creation, He [God] imparted to all His creatures certain inalienable properties, placed them under invariable laws, and left them to work out their destiny by their own inherent powers. Meanwhile He merely exercises a general oversight, not of the specific agents that appear on the scene, but of the general laws which He has established. The world is simply a machine which God has put in motion and not at all a vessel which He pilots from day to day. (Berkhof, 1941, p. 167)

In other words, deism deems that the transcendent Creator God does not (or cannot) intervene in space-time history. Rather, in the creation process He utilized physical laws (physical cause-and-effect relationships which He established) which may not be violated. What is not clear here is the source of those physical laws. Were they absolutes which constrained God, or were they embedded in the physical materials as they were created and thus instituted by God?

In the middle of the spectrum, theism, the Christian view, understands God as both transcendent and immanent. In other words, while God is close to His creation, and supervises it and intervenes within it, at the same time the creation is separate from God. The question at hand is, what does it mean that God can intervene in our world? Specifically, how and when does God intervene?

God and the World

In terms of God's relationship to the world, Biblical data suggests two seemingly contradictory perspectives producing a tension point for Christians. Psalms such as 104 and 147 describe God's relationship with nature.

small-scale effects of the other great partial theory of the twentieth century, quantum mechanics." Again, the question is, did it always exist, and if not, where did that first particle appear from? What was external to this "small" particular universe? Coming down to the present, if the universe is finite, what is external to it? If infinite, what does that mean?

3 From a philosophical or theological perspective, one is driven in some manner to something or someone which has always existed.

4 Unless noted otherwise, all Bible citations are from the NASB translation.

5 Patterson goes on differentiate a view where "God is not to be identified with the universe, rather he includes the universe within himself. He is more than the world, yet the world is not external to him." This view is labeled panentheism (1958, p. 115).

Some passages are readily understood as God utilizing regular physical mechanisms to provide the needs of the created order. For example, Psalm 147:8 states that God is the One who provides rain:

> Who covers the heavens with clouds,
> Who provides rain for the earth,

This description easily fits our modern concept of "natural processes" as part of the rain cycle (Halpine, 1956, pp. 49–50). Consequently we readily accept that the writer shows God's control utilizing figurative language. The passage goes on to describe how the precipitation lands on the Earth providing moisture to the soil, which is absorbed by plants giving sustenance so that the cells divide, and the plant grows (Mader, 2001, p. 571). Herbivores eat the grass as food. Continuing with the psalmist through the food chain, one reads that ravens serve as scavengers who "clean-up" eating a wide variety of foods including carrion (Mader, 2001, p. 423). This expands God's intervention to the entirety of nature.

Other passages such as Psalm 104 are more difficult. Psalm 104:2–3 stress God's transcendence:

> Covering Yourself with light as with a cloak,
> Stretching out heaven like a *tent* curtain.
> He[6] lays the beams of His upper chambers in the waters;
> He makes the clouds His chariot;
> He walks upon the wings of the wind;

In the same psalm, verses 27–29 stress His immanence to the point where God is portrayed as actually providing or withholding food for individual animals personally:

> They [the animals] all wait for You
> To give them their food in due season.
> You give to them, they gather *it* up;
> You open Your hand, they are satisfied with good.
> You hide Your face, they are dismayed;
> You take away their spirit, they expire
> And return to their dust. (Kidner, 1975, pp. 367–373)

Our understanding of science suggests the idea that God's involvement in these processes includes that somehow He has set up the cosmos so that it is an exquisitely designed, extremely complex, self-functioning system. This presents God's involvement as minimal and indirect, and is sometimes termed providence (Dorman, 2001, p. 87; see also, Lewis, 1972, pp. 180–187).[7] In some regards, this could be viewed as a divine "butterfly effect."[8] A slight nudge in a specific place causes a slightly greater evaporation rate, which increases the relative humidity a fraction resulting in a slightly greater rate of precipitation in a location determined by another nudge or two which barely shifts high-altitude winds resulting in a rain shower in a given location. This increased precipitation promotes a bit more growth of grass sufficient to fatten a herd of cattle just a little more, and so on. As a result, while God "did it," it was more obviously a result of physical cause-and-effect relationships. This is an enticing perspective since it highlights the intricate interrelationships of the physical universe. It also presents a very high view of God as a creator who designed such marvels that make our jaws drop as we perceive them. But it would seem to be a truncated view of the situation if these intricate relationships are viewed simply as a divine chain of dominoes following an initial nudge with all the actual interactions determined by physical relationships, which might be called determinism. Moreover, as such, we easily miss the nudges and wonder, how is *God* providing the rain? How is *God* feeding the beasts? And if the rains don't come, how can I pray expecting *God* to answer my prayers?

But the Bible also describes God performing actions which seem counter to the normal physical cause-and-effect processes we observe regularly. In the OT especially, God's actions can be overt, although their presentation is often understated, allowing the evident abnormality of an event to demonstrate its supernatural source. Other times, especially when referring to multiple examples, a variety of terms are used to describe these divine actions, including: wonders, signs, powers, and works (Lockyer, 1961, pp. 15–16). Today, we popularly use the term "miracles" to describe these super-normal interventions collectively.

Scripture suggests that God uses both indirect and direct methods for super-normal intervention. At times, God seems to direct a natural process to accomplish a given end. This differs from the previously noted process of providence which is deemed more general and self-perpetuated. Rather, behind the scenes so to speak, God ini-

6 A common Hebrew practice is changing the pronoun from second to third person or vice versa (Bratcher, 1991, p. 227).

7 Dorman (2001) characterizes the idea of providence as God "also sustains and governs the world."

8 According to Jamie Vernon, the phrase "butterfly effect" is taken from a question that meteorologist Edward Lorenze posed when he asked, "Does the flap of a butterfly's wings in Brazil set off a tornado in Texas?" (Vernon, 2017, p. 130). Wikipedia attributes the concept to earlier mathematical studies, with the role of a butterfly coming from a short story written by Ray Bradbury in 1952 (https://en.wikipedia.org/wiki/Butterfly_effect). Lorenze's question was to illustrate how small changes in initial conditions produce unpredictable results in complex systems, but the phrase has been popularized to emphasize the "outsize significance of minute occurrences."

tiates a process with a strong nudge at the proper time in a perfectly planned direction with the key being that it is intended for a specific outcome with regard to the human audience. In these cases, the perception of divine intervention derives primarily from the timing which produces a specific result in conjunction with a human request or a divine declaration. An example of this might be the situation in Joshua 10:8–11 where the Amorite army was fleeing from Israel down the descent of Beth-horon. The text appears to describe God's intervention as a severe hail storm (literally "large stones from heaven").[9] A naturalist might assume that the storm "just happened" to precipitate at the exact location and time the Amorite army was passing, thus allowing the Israelites to defeat it. However, while there is no prophetic declaration prior to the event, the author asserts that God "threw" the stones.

Typically, God seemed to use prophets to announce an upcoming specific action to ensure that the human audience did not miss the source and significance of the action. While utilizing natural processes, these actions were intended to demonstrate His sovereign control over space-time history. While similar to the previous example, the divine action was both more specific in terms of what was done as well as the expected human response (Harbin, 2005, pp. 267–274). An example is the case when Elijah prayed both to stop rain and to bring rain. First Kings 17:1 reports that Elijah declared to King Ahab that there would be no rain until he said so. This initiated a three-and-a-half-year drought, which the context indicates was to draw the nation back to God (1 Kgs. 18:21). In terms of background, the rains in Israel tend to be seasonal. In the fall and winter, weather systems coming out of the northwest bring moisture from the Mediterranean. This moisture-laden air is lifted by the central highlands of Israel and through adiabatic cooling produces precipitation (Halpine, 1956, pp. 88–99). In contrast, dry winds out of the Arabian desert to the east and southeast tend to keep Israel rain-free during the summer months. After Elijah's announcement, apparently the summer winds prevailed continually for over three years. In contrast, to end the drought, Elijah proclaimed to Ahab "the roar of a heavy shower" (1 Kgs. 18:41) after which he went up on Mt. Carmel and prayed. After several sessions of prayer, Elijah's servant reported seeing a small cloud "coming up from the sea," that was coming in from the northwest. Soon the clouds blackened the sky, the winds arose, and the rains came (1 Kgs. 18:43–45). While the subsequent rain followed a normal weather pattern, the proclamation prior to the event followed by intense prayer demonstrated divine intervention.

Another example of this type of intervention might be the division of the Red Sea when the Israelites crossed. As described in the book of Exodus 14:1–12, following the Passover, the nation of Israel left Egypt, and by God's direction camped on the edge of the Red Sea where it was caught between the advancing Egyptian army and the sea (Harbin, 2005, pp. 131–133). After declaring the upcoming event to the people (14:13), Moses "stretched out his hand over the sea" (14:21). The text then describes the event as a situation where God "swept the sea back by a strong east wind all night and turned the sea into dry land, so the waters were divided" (14:21).[10] In this report, the text clearly describes God directing a physical process (a strong east wind) to produce a physical result (pushing the waters apart so that Israel could pass through).

These cases are situations where God intervened by directing physical causes and we still call them miracles. A second and more spectacular type of miracle involves an intervention that circumvents natural processes.

A key example of this also involves Elijah. Bracketed by the declaration of no rain for years and the subsequent drought ending rain noted above, Elijah confronted Ahab's pagan prophets. Here the challenge was not to bring rain, but to bring fire, specifically to ignite a burnt offering to their god. After the prophets of Baal and Asherah had failed for hours, Elijah prayed and intense fire came down out of heaven incinerating the wood and sacrifice, the

9 The verse describes the stones twice. First they are called "great stones from the heavens" (אֲבָנִים גְּדֹלוֹת מִן־הַשָּׁמַיִם), and then they are called specifically "hailstones" (יִנָּבֵא דְּרְבָּה).

10 One suggestion that has been proposed derives from the work of D. Nor and N. Paldor, two oceanographers. In the early 1990's, they noted that prior to the dredging of the Suez Canal, the north end of the Gulf of Suez contained an underwater sand bar with an average depth of about 7 meters that stretched from shore to shore (about 7 kilometers). When they modeled this structure both mathematically and then with a wind tunnel they found that a 40–45 knot wind blowing steadily for 10 hours would separate the waters above the reef for a width of about a kilometer. When the wind stopped, the waters being held back by the strong winds would return in the form of a wave in a matter of minutes (Harbin, 2005, pp. 131–133; see also: Nor and Paldor, 1992, pp. 305–314). Whether or not this sand bar had been in existence when Israel left Egypt is open to question. It is interesting that Joel McQuitty (1986) earlier had placed the location of the crossing in that particular location based on his identity of the three geographical landmarks mentioned in Exodus 14:2.

water which doused it, and the stone altar on which it was laid (1 Kgs. 18:39).

Miracle Categories

Scholars use different terms to differentiate the two categories of divine intervention. For example, Corduan describes "direct nonmiraculous interventions" and "direct miraculous intervention." Both are in contrast to providence which is indirect. The difference is that the nonmiraculous would be a congruence of various "natural and unsurprising processes" in such a way that their cumulative effect would be "unusual." He calls these "constellation miracles." In contrast, he describes "violation miracles" a situation where a "law of nature" has been violated (Corduan, 1997, pp. 103–105). For the sake of simplicity, I tend to label the direct miraculous type as "Class A" miracles as illustrated by Elijah, and the fire from heaven and the first type as "Class B" miracles as illustrated by Elijah and the rain.

Just as rain is natural in the post-Flood world, so are periods of a lack of rain, or droughts even in the Bible. In Egypt, the annual flooding of the Nile provided agricultural fertility; as noted above, in the land of Israel, such was the result of rainfall. Consequently, lack of rainfall produced famines. At Sinai, God warned the nation of Israel that He would use drought and subsequent famine as a means of judgment on the nation (Lev. 26:19–20). Still, while judgment might be inferred, few famines are specifically noted as judgments. Moreover, the reader finds occasions where a specific drought-famine event is noted with no indication in the context of a judgmental purpose. Such is the case in Genesis 12:10 where the text observes that Abram went to Egypt because of a famine in the land. Since Abram had just obeyed God and was now in the land where God sent him, one hesitates to see this as a sign of judgment. Moreover, there is no indication that this was viewed as even a "Class B" intervention.

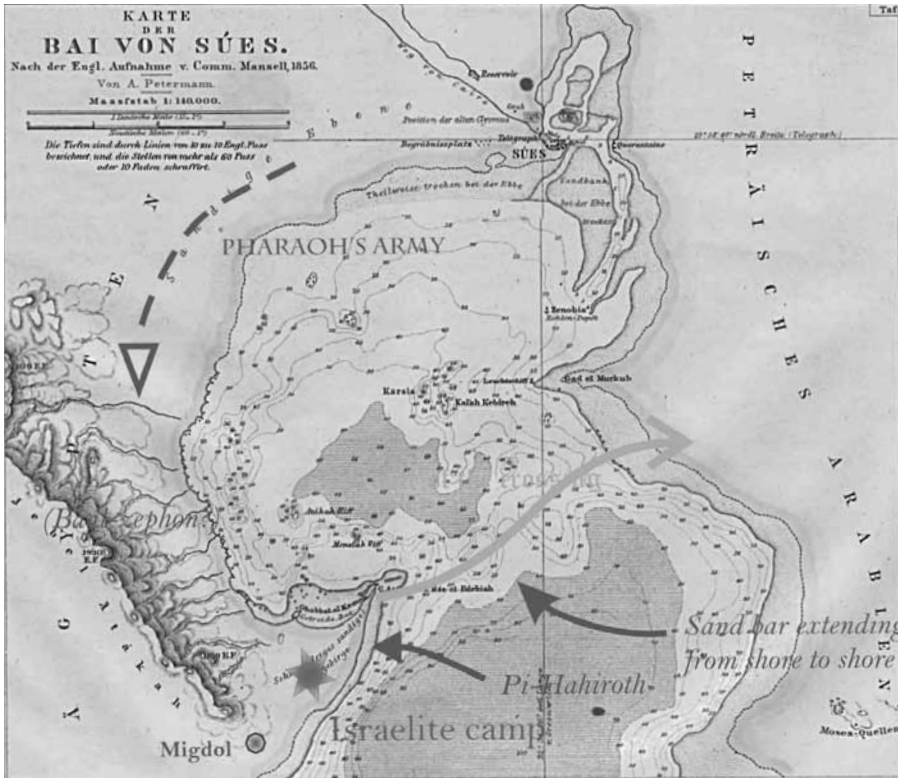

Figure 1. Possible Red Sea Crossing: This 1856 nautical navigation chart shows the location of the underwater ridge over which the Israelites may have traveled with the east wind God provided that pushed the waters away. Possible locations for the landmarks given in the Exodus text are also noted.

In contrast, fire descending from heaven to totally annihilate a sacrifice, and the water poured on it, and the altar on which it stands would unquestionably be unnatural. While a reader might seek a naturalistic cause such as lightning, the context highlights the extended period of drought and the fact that the event took place on a day with no clouds. Clearly this would be a violation, thus meriting a "Class A" designation.

The case of the Red Sea crossing is somewhat more complicated. In the events leading up to the crossing, God directed Moses and Israel to change direction and go to a specific location, camp, and await further directions. When Pharaoh learned that they were camping on the bank of the Red Sea he prepared his chariots and headed out in pursuit. He appeared to have the Israelites cornered, but as Pharaoh's chariots drew close to the Israelite camp, the angel of God stood as a pillar of cloud in front of the Egyptians blocking their path (clearly direct divine intervention in itself). Then God told Moses to act. At God's direction, Moses lifted his staff, held it over the Red Sea, and the wind picked up out of the east and blew all night pushing the water of the sea aside and left it standing on either side of a path which led to the other shore. In the morning, the nation crossed. When Moses lifted his staff again at God's direction, the

wind stopped and the two standing waves that Israel had passed between crashed together wiping out Pharaoh's forces. While the combination of the timing, and the location suggest that the crossing itself might fit into the "Class B" category (see Figure 1), the year-long process leading up to this specific action culminating in the sudden unexplained death of a specific segment of the Egyptian population suggests a very complicated "Class A" scenario.

The Nature of "Class A" Miracles

While the Exodus event incorporated physical systems, more often the miracles specifically named in the Bible have no apparent physical cause. A prime example is when Jesus raised Lazarus from the dead. Today, according to the London Health Sciences Centre, under certain circumstances a person who is apparently dead as a result of cardiac arrest might be resuscitated by either CPR or electrical shock—*if* the resuscitation process begins within a short time following the cardiac arrest (London Health Sciences Centre website, accessed 31 August 2023). However, in Lazarus's case, he had been dead for four days (John 11:39). In this situation, where the blood would have coagulated and the flesh started to decay, no physical cause could restart the heart and cause the person to start breathing again. This type of miracle evidently involves direct intervention of God to produce a physical effect through a spiritual cause (e.g., the work of the Holy Spirit). They are more clearly miraculous because they are more dramatic—and more difficult to understand (Purtill, 1997, pp. 63–64). If this event were portrayed by Hollywood, it is likely that the sound track would include powerful music and visual effects during a 2–3 minute exhibition of Lazarus gradually coming to life to heighten the drama. In the actual situation, it seems more likely that when Jesus called out, Lazarus took a deep breath, opened his eyes and sat up, then stood and exited the tomb. In essence, the miracle itself would be understated.

The concept of direct divine intervention is even more evident in John's description of what he calls Jesus' first miracle, turning the water into wine (John 2:1–10). Producing wine from water is actually a natural process although it requires a number of steps and a relatively long period of time. As described by biologists and winemakers, a grapevine (at least three years old) draws water from the soil, and then, in the leaf, photosynthesis processes light, the water, and carbon dioxide into carbohydrates (sugars), and oxygen. As they grow, the grapes collect the sugars. Then, when ripe (about four months after the blossom), the grapes are picked. Vintners squeeze the grapes, gather the juice, and allow it to ferment naturally changing the sugars to alcohol. Today, with the addition of yeast to accelerate the transformation, that process takes about one to three weeks. The wine is then generally aged for a period of time before it is served. In all, the natural process of turning water to good wine (generally considered an "aged" wine) is one that takes several months at a minimum (https://winefolly.com/deep-dive/how-is-red-wine-made, accessed 14 August 2023).

According to John's description, Jesus directed the household servants to fill six water pots (each with a capacity of twenty to thirty gallons) with water. When they were full, Jesus directed the servants to draw some of the liquid out and allow the headwaiter to taste it. When he did, the headwaiter pronounced it good *wine* (John 2:10). In other words, the freshly converted water—now wine—now had all of the characteristics of a good, aged wine although it was only minutes old.[11]

Biblical Miracles

We have cited several examples of events we view as miraculous in the Bible. Popularly, we sometimes think of the Bible as a book full of miracles, yet the text really only records approximately 166 specific miracles during the period from Abraham to the early Church, a period of a little over 2000 years.[12] And of those, almost 85%

11 A similar observation could be made of the creation of Adam and Eve. As described in Genesis 2, both had all of the characteristics of sexually mature adults, i.e., what might be described as the appearance of a twenty-year old, when they were moments "old." While sometimes labeled as "apparent age," a better perspective is that upon completion of God's work, they were complete, fully functioning systems. While we wonder what life might have been like prior to the Fall, it seems likely that without the Fall, Adam and Eve would have lacked any appearance of aging beyond their mature state at the point of their creation so that at a physical age of 200 they would have an "appearance of youth" of one tenth of that age.

12 These numbers are based on my count and delineation looking just at the historical context beginning with the call to Abraham in Genesis 11. While overall this would average a miracle every 12 years or so, if one looks outside of the three periods of miracle clusters (see note 13), it is more like a miracle every 85–90 years. This list does not include the events recorded in Genesis 1–11, that is, Creation and the Flood. I use the term "pre-historic" advisedly primarily because Adam and Eve were not created until the sixth day, there were no humans to observe the creation process, and thus they could not provide eye-witness testimony or historical records. As such the creation account must have been given by God. While we may (and should) accept the account as accurate as the testimony of God Who cannot lie, we do

are clustered in three periods totaling approximately a hundred years.[13] The reality is that most of the Bible reflects "normal" life as evidenced by Gideon's poignant question of the angel of the Lord—"where are all of His miracles…?" (Judg. 6:13).

In general, in the Bible, even for individuals who beheld them, miracles were rare events in a mundane life of routine physical existence. When miracles did occur, the first reaction of Biblical characters tended to be that there must have been a "natural" explanation. Despite having been visited by an angelic being who burned his sacrifice with his staff, when Gideon put out the fleece and God responded supernaturally he hesitated to accept it as a genuine miracle from God. His immediate response was to reverse the criteria for a redo—just to make sure. Even more significantly, as noted above, there is the first Easter morning. We have no idea of how many occasions, right up to the night before He died, that Jesus indicated to His disciples that He was going to die, but that He would be resurrected. Setting the stage He performed many miracles in front of His disciples, including resurrecting Lazarus. It is then interesting how His disciples reacted after they found the empty tomb. They assumed that He was still dead and supposed the body had been stolen—a naturalistic perception (John 20:1; Luke 24:11; Mark 16:11). Even when the risen Jesus met with them, it was difficult for them to accept the fact, especially for Thomas (Matt. 28:12; John 20:25). The overall conclusion is that, in general, people who lived in Bible times largely expected a non-miraculous world, perhaps one of the reasons they were so quick to turn from following God.

God's Work in the Creation Event

The foundation we have laid indicates that while God has interacted directly in the physical realm even after the Fall, producing what we call miracles, those interactions were relatively rare. Genesis 1:29 indicates that God set humankind in control of an extremely complex system that He had designed and set into motion. In that context the human race was expected to use physical processes to manage this physical world. If prior to the Fall, humans were working in direct communion with God, then it may be that miracles were not needed or at least did not carry the weight they did historically.

It is then suggested that the reason for miracles after the Fall would be for God to more directly guide mankind in specific directions. They would also serve to remind humans, who were prone to forget that God existed, that God still had sovereign control—especially during the three cluster periods as God developed the redemption process. We noted that the first cluster period was the Exodus-wandering-Conquest event. The text indicates that during that approximately fifty-year period, Moses composed the Pentateuch which incorporated the account of God's creation as part of the background behind His redemption of Israel from Egypt. While this clearly provided Israel a solid theological background to its deliverance and a rationale for the Torah which was being taught and written at Sinai and beyond, that redemption was a precursor to the eventual redemption of the world by Jesus Christ. As such, we share with Israel awesome wonder at the greatness of God in His creation of the cosmos and realize that the God who could create such a marvelous universe could surely save it. At this point we want to briefly survey that pre-historic Creation sequence within the context of our understanding of how historically God's people saw Him intervene.[14] While there is much in Genesis 1 that could be addressed exploring the nuances and implications of God's interactions with the physical world, for our purposes we

not know when the account was originally transcribed, whether by Moses at Sinai, or by one of his ancestors who passed that written record through subsequent generations. Although Genesis 5:1 uses the term book, it may just be referring to the genealogical list which follows. It would seem that the earliest Biblical event which may be clearly dated historically would be the birth of Abraham, although even that has some margin of error because of different calendars (Harbin, 2005, p. 90). As such, both of those global events involving very complex divine interactions over time (the Creation and the Flood) may be deemed as pre-historical, that is, before records of the past written by eye-witnesses or taken from eyewitness accounts (Bebbington, 1979, pp. 1–9). However, the Biblical data does place strong limits on their antiquity invalidating deep time.

13 The three periods which contain miracle clusters are the time of the Exodus and Conquest, a period of approximately 50 years with 47 miracles specifically listed, and the ministries of Elijah and Elisha which lasted an estimated 30 years with 30 specific miracles. The third period is the active ministry of Jesus which lasted about 3½ years coupled with the post-resurrection work of Jesus (46 miracles listed) and the ministry of the early Church through the book of Acts which covers perhaps 25 years from Jesus' ascension to the death of Paul (16 listed). It is true that John records that Jesus did "many other signs" or miracles than those he specifically recorded (John 20:30). As such it seems likely that each of the cluster periods included more miracles than recorded. Likewise, it seems likely that more miracles occurred outside of the cluster periods than the 27 cited. It is clear, however, that the general expectation for daily life was non-miraculous.

14 While it would be desirable to do a similar study of God's role in the Flood of Noah, space does not allow that, so it must remain for a separate study.

will only look at several salient points regarding His methodology as presented in the text.

A common observation, often combined with the observation that the Bible is not a book of science, is that while Genesis describes God as the Creator, it does not describe how He did it. This is a true statement. However, that is because its purpose is not to provide physical cause-and-effect processes, the matters of science. There seem to be two reasons for this. First, the purpose of the OT is to remind the nation of Israel, and subsequently the rest of mankind, that while God created a good world, something happened to it. As a result, God would need to intervene by providing to Israel, and the rest of the world, a Redeemer in the person of God's Messiah. Consequently, the fact that God was the Creator is by itself adequate explanation. Second, as we will see, physical cause-andeffect processes are not provided because they were not used.

This is evident from the start. In the Hebrew, Genesis 1:1 appears to be an independent sentence which introduces the main thought of the section which is that God created all of space-time. The noted Hebrew scholar Umberto Cassuto (1978, p. 20) expressed it as "at the commencement of time…. God created the heavens and the earth." While a crucial bedrock for all theology, in terms of literary structure the rest of the chapter builds on this crucial statement showing that while God followed a process, it was not one of physical cause and effects. An important aspect of verse one is the verb אָרָב, which is translated "created." This verb is only used to describe action by God, most commonly in describing His creation of the universe and its contents. It "can be used for creating something out of nothing, but that idea must come from the context and not from the inherent meaning of this word" (Ross, 1988, pp. 724–728). As used in this chapter, it shows up in three situations: the creation of the entire cosmos (v.1); the creation of the "every living creature that moves" (v. 21); and three times regarding the creation of mankind (v. 27).

Following the introductory summary statement, verse 2 then sets the stage for the creation process. Cassuto translates its opening as "As for the earth, it was…" explaining that the next three clauses describe the world at that point of the creation sequence (Cassuto, 1978, p. 21). It was תֹהוּ וָבֹהוּ (*tōhû wābōhû*) or "formless and void;" it was covered in darkness; and the Spirit of God hovered over it. While much more could be said regarding these three conditions, we will just observe that together they provide the setting for God's work. Mathews characterizes the first phrase that the world was *tōhû wābōhû* as it being "uninhabitable and inhospitable to human life." However he points out later that based on how that phrase is used in the prophets we should not conclude that this was a negative situation pointing to a world under God's judgment, but rather that it denotes specific physical medium for creative change (Mathews, 1996, pp. 130–132). Cassuto (1978, p. 23) suggests that it describes the "unformed material from which the earth was to be fashioned." Similarly DeRemer (2007, p. 71) characterizes it as "without structure" and "without occupants." The darkness suggests a medium awaiting the artist, while the Spirit hovering or moving over it suggests the artist beginning to work. The impression then is, at this point the physical world on which we now live was like a blank slate awaiting God's creative genius, which will be displayed in the rest of the chapter. Isaiah 45:18 reflects this concept when it says, "He fashioned the earth and made it; He established it; He did not create it to be empty, but fashioned it to be inhabited" (my translation).

That creative process is described as a six-day creation sequence using a variety of verbs citing a series of ten declarations of God. The first seven declarations (verses 3, 6, 9, 11, 14, 20, and 24) contain verbs that are in the jussive mood, which is used to "express a command, a wish (or a blessing), advice, or a request" (Gesenius, 1910, p. 321).

These commands decree that something physical should come into existence, or that something physical should produce something else that is physical. For example, Genesis 1:3 reads: "Then God said, 'Let there *be* light;' and there *was* light" (אוֹר וַיְהִי־אוֹר וַיֹּאמֶר אֱלֹהִים יְהִי). The key here is the two forms of the verb 'to be' (italicized). The first is a statement that directs that light should exist. The second form of the verb 'to be' is an imperfect tied to what is called a "*waw* consecutive" (the *waw* is translated here as "and"). This typically reflects narrative structure, but here it also describes the resulting state, which might be translated as "and light existed."[15] The eighth declaration of God in Genesis 1:26 is a cohortative where God expresses a self-directive (first person plural) regarding the creation of mankind ("Let Us make man in Our image").[16] The last two declarations give commands to mankind. Verse 28 is the dominion declaration where mankind is man-

15 A "waw consecutive" is a Hebrew grammatical structure often used in narrative literature where the general purpose conjunction ו (a "waw") is attached to a verb in the imperfect state. This transforms the sense of the verb from an uncompleted action (often viewed as future) to one that is completed (Gesenius, 1910, pp. 132–133).

16 Gesenius describes a cohortative as laying "stress on the determination underlying the action, and the personal interest in it (Gesenius, 1910, p. 319). The use of the plural here is deemed significant, but lies outside the focus of the present study.

dated to fill and rule the Earth. Verse 29 might be called the diet declaration where God decrees that the entire plant kingdom is to be used by mankind and the animal kingdom for food.

Following the example of light instantaneously existing, the general pattern throughout this chapter suggests instantaneous fulfillment of God's jussive declarations. Based on our foundational discussion, we would suggest they reflect Class-A miracles. A common expression of fulfillment is the phrase "it was so" (וַיְהִי־כֵן, literally "it was thus") which shows up six times.

However, several cases seem to include physical cause-and-effect processes as part of working out of the declaration. At first glance, these appear to be at best Class-B miracles where God utilized physical processes to accomplish the task at hand.

For example, on Day Two, the directive is "Let there be an expanse in the midst of the waters" using the same jussive form of the verb to be. However, the result is described that God "made the expanse." This is a very difficult term and commentators struggle to explain it (Cassuto, 1978, p. 31). The word translated as expanse is רָקִ֔יעַ (*rāqîaʿ*) which can be translated as "expanse" or "firmament." Because of how the noun is used in other passages where it can describe a metal plate which has been beaten or stamped out (Payne, 1999, p. 862), some argue that the writer is describing an actual "firm heavenly dome" (Gunkel, 1997, p. 108). Consequently it is often translated as firmament. Mathews (1996, p. 149) points out that "there is no evidence, however, that the author conceived of it as a solid mass, a 'firmament' (AV) that supported a body of waters above it." Rather, as shown by later uses in this chapter, the "expanse" is phenomenological in terms of what a human standing on Earth would see. These would include looking up at the Sun, Moon, and stars (1:14–17) and birds flying (1:20). As such, the expanse would be the atmosphere, and the waters "above" the expanse would be the clouds which produce rain (Mathews, 1996, p. 150).

We see a similar pattern in the second half of the Creation Week. On Day Four, God said "Let there be lights in the expanse of the heavens. . ." (1:14). In this section verbs describing the outcome might seem to suggest processes: "God made the two great lights;" "God placed them in the expanse;" "God created the great sea monsters;" "God created man" (Westermann, 1984, p. 128). But that understanding derives from our human experiences where "made" implies manufacture, "placed" suggests physical movement, and "created" is understood to represent a physical working out of an idea much as David describes the heavens as "the work of [God's] fingers" (Ps 8:3).

Since each of these creation "acts" begin with the declaration "Then God said," it would seem that the understanding was that God created these in the same manner as noted in 1:3; that is, He spoke and "it was so." In other words, the stress is on the result as a final state. Not only is the process God used irrelevant, apparently there was no process.[17] God spoke and it existed in a fully functioning completed state.

However, that completed state was not static, but one which was highly dynamic from the beginning. While beyond the scope of this study, when created every living creature likely would have been in an adult state and in motion. This produces several interesting matters for speculation, especially for Days Three, Five, and Six, such as how many different copies and variations of each "kind" instantly appeared globally in appropriate ecological niches? All in all, the result is a realm of living creatures that is of incomprehensible complexity.

The Matter of Time

Given the infinite capacities of the Creator God demonstrated through the declarations which instantaneously produced fully functioning highly complex systems, could not God have completed the entire cosmos instantaneously as Augustine suggested (Augustine, 2002, pp. 271–273)? This raises the difficult and controversial matter of the description of Creation as a six-day process. Whether one takes the view that a "day" is a literal 24-hour period or an abstract long period of time, there is a problem with the word "day." For example, in either case, if physical light[18] came into existence

17 This statement must be qualified at certain points with regard to the creation of mankind and the placing of mankind in the garden. In Genesis 1:27–28, the final result of making man in the image of God is that there were two individuals, male and female. However, Genesis 2:5–25 seems to amplify the sixth day (Ross, 1988, pp. 117–119) adding several nuances. For example, Genesis 2:7 specifies that the man was "formed of dust from the ground," which apparently served as a typological step to emphasize the physicality of mankind. Likewise, Genesis 2:21–22 specifies that the woman was fashioned from a rib removed from Adam, again serving typologically to emphasize the unity of the two. Similarly while Genesis 2:8 states that God "planted" a garden, it would seem to be that He filled a region with mature plants, not that He planted seeds. The focus is on a completed, fully functioning system.

18 Presumably Genesis 1:3 refers to what we know as the entire electromagnetic spectrum, although for the original audience the understanding would be what we call visible light. Subsequently in the following verses, the reference would be to the visible portion of the spectrum as opposed to darkness, the absence of light. Regardless, this raises a conceptual question regarding how God IS light (1 John 1:5,

immediately upon God's declaration, there is difficulty in explaining how the creation of light and separating it from darkness correlates with "one day" (or more properly "Day One"). Likewise, in either case, there is difficulty in understanding how physical light exists (Day One), giving life to plant life (Day Three) if the physical light emitters are not brought into existence until Day Four.[19]

Part of the problem is that there is a presumption that God's labor was constrained by time. The Biblical evidence indicates, and thus our understanding of God is, that He is outside of time—in fact that time is something that God created.

So if God spoke and the final product resulted, then why does the text use "days" to describe the creation? Here I would give two preliminary thoughts. First, the Bible hints that aspects of the creation were intended to serve as guidance for mankind. For example, while the concept of day is delineated in verse 5 (evening and morning), the idea of time delineation defined by the Sun, Moon, and stars is not described until verse 14. There we read that the various heavenly lights (the Sun, Moon, and stars) were intended to serve not only to separate the light from darkness, but to "be for signs and for seasons and for days and for years." This indicates that there are both social and theological aspects to creation that need to be teased out a bit more (see Seiss, 1972, and Bullinger, 1967, for interesting speculation).

Second, the material God gave Moses we include as Genesis 1–Numbers 9 not only became the foundational national document for Israel preparing it for its march to the Promised Land which begins in Numbers 10, it provided the nation which was going to produce the Messiah with mankind's first divinely directed corporate worship system (Harbin, 2024, p. 136). Thus, the six-day creation process followed by a day of rest becomes the model for the Fourth Commandment in Exodus 20:11. There, God tells the Israelites that they were to observe the Sabbath because in the creation process God rested on the seventh day. This builds into the human calendar a portion of life which must be offered to God. This is indicated by the differentiation between time markers such as days, months, and years which are measured by the astronomical bodies, and the seven-day week which is both arbitrary and unique to the Israelite culture (Hallo, 1977, pp. 12–13; see also Sarna, 1989, pp. 14–15).

Conclusion

The extremely compressed discussion of the Creation given in Genesis 1:1–2:4 raises matters which we have not been able to address in this brief study. The basic problem that tends to be overlooked is that when one looks at an event and attempts to describe a process which led up to the situation at hand, any number of possible processes may be given, some more feasible than others—with feasibility determined by one's world view. As noted, this material cannot be described as history as we understand it (Long 1994, pp. 27–38). Rather, it seems best to be described as a deposition—the testimony of the One who did it. The bottom line seems to be that this text describes God creating through a sequence of verbal declarations which expressed directives that various aspects of the cosmos should exist (focusing on the Earth and culminating in the creation of mankind), and they existed. These declarations tell the reader several vital items including: there is a Creator who created the entire cosmos; the Earth and its contents were judged as very good; we as human beings were created by Him; and while created beings like the rest of life on Earth, we have been given a very heavy corporate responsibility. However, as the creation account continues, we read about what happened to that "very good" creation (Harbin, 2021, pp. 223–233). Today we live in a culture that seems to echo the question with which the Serpent challenged Eve in the garden, "has God said…?" May we not be deceived.

see also Revelation 1:23 and 22:5), but that light as we know it is created.

19 This may not be the problem it is presented as being. If God created all of the vegetation in one day, the fully mature plants could have easily handled a couple of days in physical darkness. As a gardener in a climate with significant winters I have learned that I can place my potted patio plants in an unlit, windowless shop for a few days without problems. In fact, this may be a corroborating datum to a literal six-day creation. Again, we get stuck in the matrix of physicality.

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The Belt Supergroup Is Likely from the Early Flood:

Evidence for Precambrian Sedimentary Rocks from the Flood

Michael J. Oard

Abstract

The Belt Supergroup represents one of the thickest sections of Precambrian sedimentary rocks in world. It contains rare features, such as molar-tooth structures, syneresis cracks, and "stromatolites." The rocks were deposited in an intracratonic basin thought to be at least 25 km deep, which could have originated as an impact crater. It is conventionally dated as Mesoproterozoic, about 1.4 Ga. Correlation of formations across the Belt Basin is difficult. The sediment originated predominantly from the west, but since there is no obvious source to the west today, there is much speculation on the land mass that once existed to the west. The place of the Belt Supergroup within Biblical Earth history points to the Flood, especially given the generally conformable contact between the Belt rocks and the overlying Cambrian Flathead Sandstone, a universally accepted Flood rock. Thus, the Belt rocks likely were deposited very early in the Flood. Some of the Belt rocks imply tremendous catastrophism very early in the Flood.

Key Words: Belt Basin, Belt Supergroup, molar-tooth structures, Noah's Flood, stromatolites, syneresis cracks

Introduction to the Belt Supergroup

Belt sedimentary and metasedimentary rocks outcrop in western Montana, northern and central Idaho, northeast Washington, and adjacent Canada over an area of 197,000 km^2 (Link et al., 2021, p. 294) (Figure 1). They are called the Belt Supergroup in the USA and the Purcell Supergroup in Canada. Researchers often simply call the rocks the Belt-Purcell Supergroup. A *supergroup* in geology is two or more groups, while a group is two or more formations. A *formation* is "A body of rock identified by lithic characteristics and stratigraphic position…" (Neuendorf et al., 2005, p. 250). I will refer to the rocks as sedimentary rocks in the

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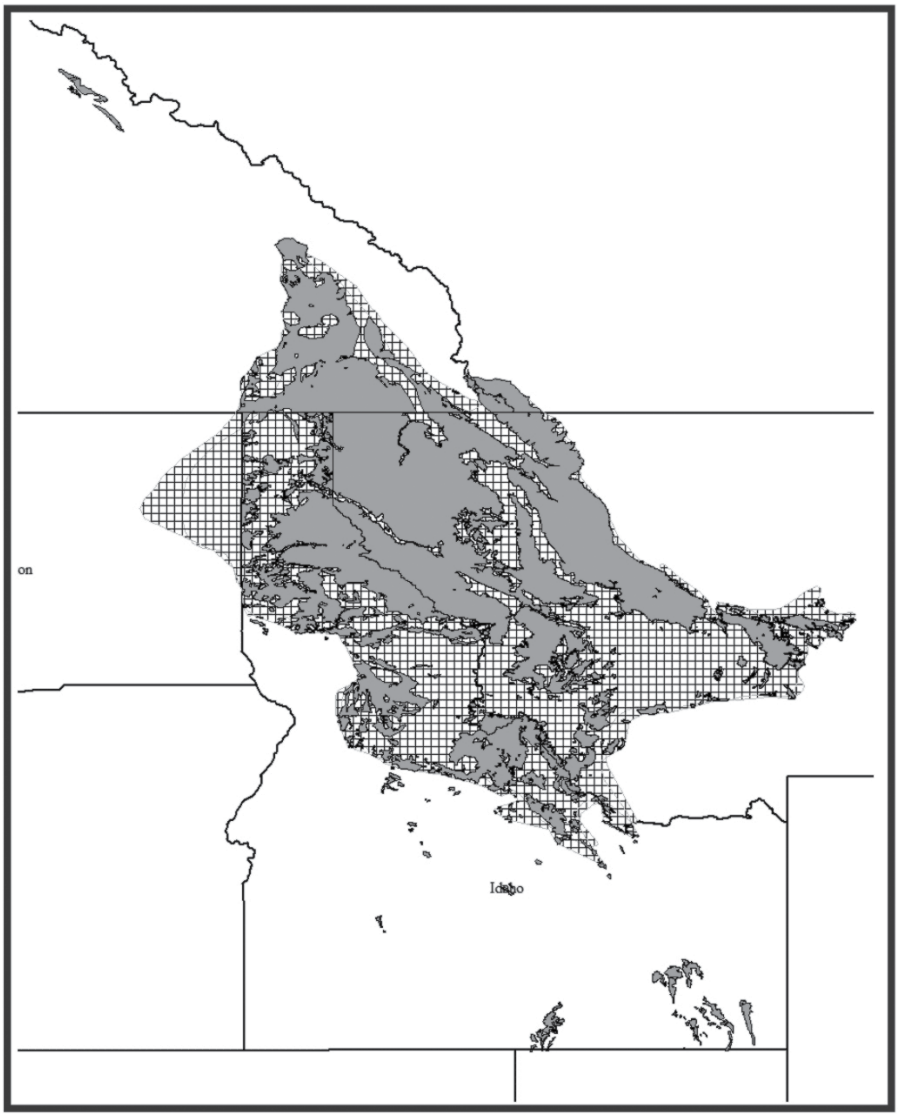

Figure 1. The area of the Belt Supergroup (courtesy of John Reed). The solid gray area is from maps while the hatched area is the total extent. The claimed Belt rocks from southeast Idaho are just rocks correlated to the same age as the Belt Supergroup.

Belt Supergroup, although many experienced a low degree of metamorphism.

The Belt Supergroup occupies what is called the Belt Basin that represents one of the thickest Precambrian sedimentary basin in North America (McFarlane, 2015). The supergroup is thickest in the west and southwest and thins toward the northeast (Duke and Lewis, 2010). The maximum depth of the rocks today is 20 km west of Missoula, Montana (Harrison et al., 1974). However, the bottom of the sedimentary rocks is not seen and the top has been greatly eroded. So, the original thickness was probably on the order of 25 km. However, numerous thrust faults may have caused duplication in the estimated thicknesses as well.

Rocks in the Belt Basin contain several unusual features, such as molar-tooth structures (MTSs) (Figure 2), found only in the Precambrian, abundant syneresis cracks, ripple marks, and classical "stromatolites." Raindrop imprints may also occur in the highest formations (Link et al., 2021, p. 299). It is important to understand the Belt-Purcell Supergroup's place within Biblical Earth history, since it contributes important information to that history.

The Belt Supergroup is composed of four groups and about 25 formations (Hyndman and Thomas, 2020, p. 29). The groups, starting from the lowest to the highest, are: (1) the Lower Belt, (2) Ravalli, (3) Piegan, and (4) Missoula. The Lower Belt is the thickest at about 12 km (González-Álvarez and Kerrich, 2012). Within the groups, different regions have different formations. The formations have been weakly to moderately metamorphosed with the metamorphic grade generally increasing from east to west (Slotznick et al., 2016) and areas of high and low metamorphism within this general trend (Duke and Lewis, 2010). The rocks are composed of argillite, quartzite, siltite, and less than 1% carbonate, conglomerate, and mafic sills and dikes. Argillite is a weakly metamorphosed shale, quartzite is a weak to moderately metamorphosed sandstone, and siltite is a weakly metamorphosed siltstone. There are also diabase sills in the Belt rocks (see below).

The Origin of the Belt Basin

Uniformitarian scientists don't have a consensus explanation for the origin of the Belt Basin: "The origin of the Belt Basin is not well understood, but it formed through crustal stretching, or extension, and was located well within the supercontinent" (Hyndman and Thomas, 2020, p. 25). Sears and Alt (1989) once thought it was a meteorite impact basin, but they later changed their minds and believe it is a rift, (Sears et al., 1998; Sears, 2016). An

Figure 2. Weathered molar tooth structure, Belt Supergroup.

impact basin is still considered one of four possible origins, however (Sears et al., 1998; Elston et al., 2002).

A *rift* is considered a subcontinental, deep crack in the crust (Neuendorf et al., 2005, p. 555), but this does not fit the 500-km-diameter Belt Basin. And the rate of subsidence is debated; some geologists believe the basin subsided rapidly (see below) while others believe it slowly subsided over millions of years. The subsidence rate is claimed to be about the same as the sedimentation rate, a special condition that seems unlikely. Kidder (1988) states: "Most of the Belt Supergroup consists of shallow-water sediments deposited in a basin in which subsidence and sedimentation were closely balanced." The reason researchers believe that deposition was shallow was because the supergroup has numerous "mudcracks" (Figure 3), ripple marks (Figure 4), and "stromatolites."

The paleoenvironment of the Belt Basin is widely debated with some researchers thinking that it was a large lake with braided streams (Retallack et al., 2013; Winston, 2016), while other researchers think it was marine (Harrison, 1972; Pratt, 2001; Adam et al., 2017; Pratt and Ponce, 2019). It is still not resolved (Maliva, 2001). Winston (1990, 2016) further believes the sediments were laid down by sheet floods.

Two Sub-basins

The Belt Basin has been subdivided into two sub-basins: (1) the main Belt basin in the north and (2) the Lemhi sub-basin in east-central Idaho and southwest Montana (Burmester et al., 2016). Doughty and Chamberlain (1996) believed the Lemhi sub-basin sedimentary rocks are equivalent to the Lower Belt Group. They are estimated to be 15 km thick of mostly quartzite (Burmester et al., 2016), but Bookstrom et al. (2016) claim the Lemhi sub-basin is 20 km thick. The divide between the two sub-basins is not distinct.

The Beaverhead Mountains, southwest Montana, are considered the northeast part of the Lemhi sub-basin, but the sedimentary fill is confusing. Lonn et al. (2016) have mapped what seems like a giant 10 km high fold that has been greatly eroded, leaving behind the steeply dipping limbs.

The Belt sediments are very colorful, often alternating green and red (Figure 5). Pratt and Ponce (2019) think the color changes are diagenetic, formed during compaction and lithification, as shown by color changes in the same bed and alternating colors between beds. Slotznick et al. (2016) believe the colors formed by changing redox conditions with the differential presence of reduced and oxidized iron minerals.

Mafic Dikes and Sills

Very few volcanic tuff layers occur in the Belt Supergroup (Moe et al., 1996; Aleinikoff et al., 2015). However, there are abundant mafic dikes and sills in the Lower Belt sedimentary rocks (Doughty and Chamberlain, 1996; Sears et al., 1998; Link et al., 2021, p. 295). These dikes and sills are 5–300 m

in thickness and trend generally NW-SE or NNW-SSE (Rogers et al., 2016). Some dikes or sills can be traced up to about 200 km. Either way, the dikes and sills occurred after the sedimentation they intruded into.

Figure 3. Presumed mudcracks that are likely syneresis cracks.

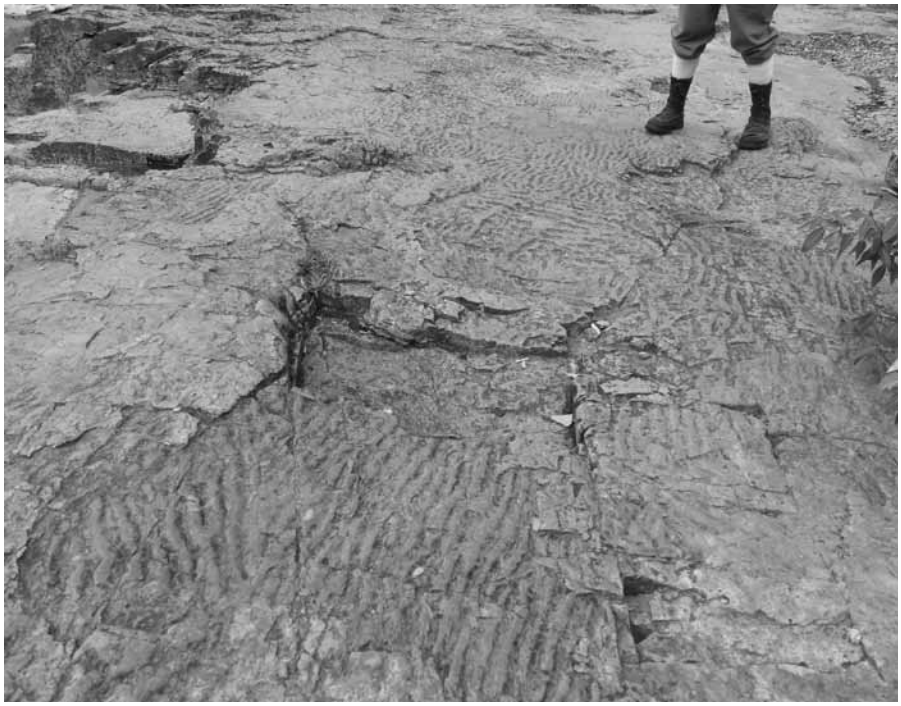

Figure 4. Ripple marks on different bedding planes, Belt Supergroup, Glacier National Park, Montana.

Little Deformation Until Basin Filled

Little deformation occurred within the Belt sedimentary rocks without an appreciable break (Elston et al., 2002). Disconformities and paraconformities are difficult to detect and angular unconformities rare (Harrison, 1972; Pratt, 2001). It is as if the basin subsided and filled quickly: "Although there is little evidence for normal faults growing during deposition, the formation of the main Belt basin was initiated with stunning rapid subsidence" (Link et al., 2021, p. 246). These authors contradict themselves when they later on claim that subsidence occurred at the same rate as sedimentation (Link et al, 2021, p. 295), which is very unlikely, unless both the subsidence and sedimentation were both extremely fast.

After deposition, some of the strata was uplifted forming many structural features, such as folds and faults. In addition, the Lewis and Clark tectonic zone seems to be where much of the faulting was concentrated (White, 2016). This fault zone is about 80 km wide and stretches from northeast Washington, southeast to beyond Helena, Montana (Hyndman and Thomas, 2020, pp. 32–34). The faults are mostly strike-slip with one fault traced a whopping 240 km. No one knows the total horizontal displacement but it is estimated to be over 30 km with the strike-slip offset toward the left looking across the fault (left-lateral fault). Seismic activity still occurs within this fault zone.

Uplifted exposed metamorphic rocks commonly occur at the surface by erosion. Much of the rock is a metaquartzite, a metamorphic sandstone. The broken-up quartzite rocks have been well rounded by the action of water and spread in all directions from the Belt Basin. Quartzite rocks have been spread up to 1200 km east northeast into central Saskatchewan and southwest Manitoba (Oard et al.,

Figure 5. Typical purple (right) and green (left) colors of the Belt strata, sometimes with sharp boundaries.

Figure 6. Well-rounded quartzite boulder with percussion marks from the top of the Gravelly Mountains, Southwest Montana.

2005). They have been found on the tops of mountains in the area (Figure 6).

During the "Sevier Orogeny" in the late Mesozoic, the Belt Supergroup is claimed to have been thrust eastward about 220 km, followed by 26 km of extension during the "Laramide orogeny" (Maclean and Sears, 2016). But Bedrosian and Box (2016) claim the amount of thrusting is questionable. In fact, thrust faults were not recognized in the Belt Supergroup for a long time (Harrison et al., 1980). The faults now labeled as thrust faults were once considered normal faults. The thrust faults include the Lewis Overthrust that put Precambrian dolomite over Cretaceous shale in Glacier National Park. Chief Mountain, standing alone a little east of the Lewis thrust, is an erosional remnant of this overthrusting.

The Uniformitarian Date of the Belt Supergroup

The dating of the Belt Supergroup has varied. Early on, it was dated at 740 Ma (Moe et al., 1996). In 1968, this was increased to ~1450 to 900 Ma and has since been revised to ~1450 to 1200 Ma based on paleomagnetism (Evans et al., 2000). Current dates are 1,470–1,400 Ma, based on U-Pb dating, which puts it in the early Mesoproterozoic, which ranges from 1,600–1,000 Ma. Over the years, there have been various other dates that have been rejected or later classified as the date of a metamorphic event (Evans et al., 2000; Aleinikoff et al., 2015). Some dates were rejected because they were discordant or because of lead loss in zircons (Evans and Zartman, 1990; Sears et al., 1998).

The Belt Supergroup is believed to lie on Paleoproterozoic 2,500–1,600 Ma igneous and metamorphic rocks, but the basement rocks do not outcrop in the Belt Basin, except in the southeast (Doughty and Chamberlain, 1996). It is believed that the Mesoproterozoic Deer Trail Group overlies the Belt Su-

pergroup in northeast Washington (Box et al., 2020). The Neoproterozoic to early Cambrian Windemere Supergroup overlies the Deer Trail Group and deposited in a rift from Utah north well into Canada (Link et al., 2021). It was once believed that the Deer Trail Group overthrust the Belt Supergroup, but their contact is now believed to be depositional. It may be possible that the Dear Trail Group and the Windermere Supergroup are just younger Belt rocks.

Phanerozoic sedimentary rocks lie on top of the Belt Supergroup in many areas but have been eroded in most others. The basal Phanerozoic Flathead Sandstone (Figure 7) is correlative with the Tapeats Sandstone in the Grand Canyon that overlies Precambrian igneous and metamorphic basement and the tilted Precambrian Grand Canyon Supergroup. This sandstone is about 30 to 100 m thick, coarse grained with quartz pebbles, has few interbeds, and has been deposited over about half of North America on basement rocks (Clarey, 2020, p. 196).

What uniformitarian process would deposit such an even thickness of coarse-grained sandstone over half of North America? Such deposition is exactly what we expect in the early Genesis Flood as one type of sediment was deposited over large areas. Furthermore, the formations on top are generally conformable showing little if any erosion, again precisely what we expect during deposition from Noah's Flood—of one type of sediment deposited on another in quick succession.

The Flathead Sandstone is dated around 500 Ma, which is about a billion years younger than the Belt Supergroup. The contact is often a massive erosion surface below the Flathead Sandstone called the Great Unconformity, the origin of which is a major uniformitarian mystery. The Great Unconformity lies near the bottom of Grand Canyon, but is seen at the tops of the mountains in Wyoming. This mysterious surface is found on nearly every continent.

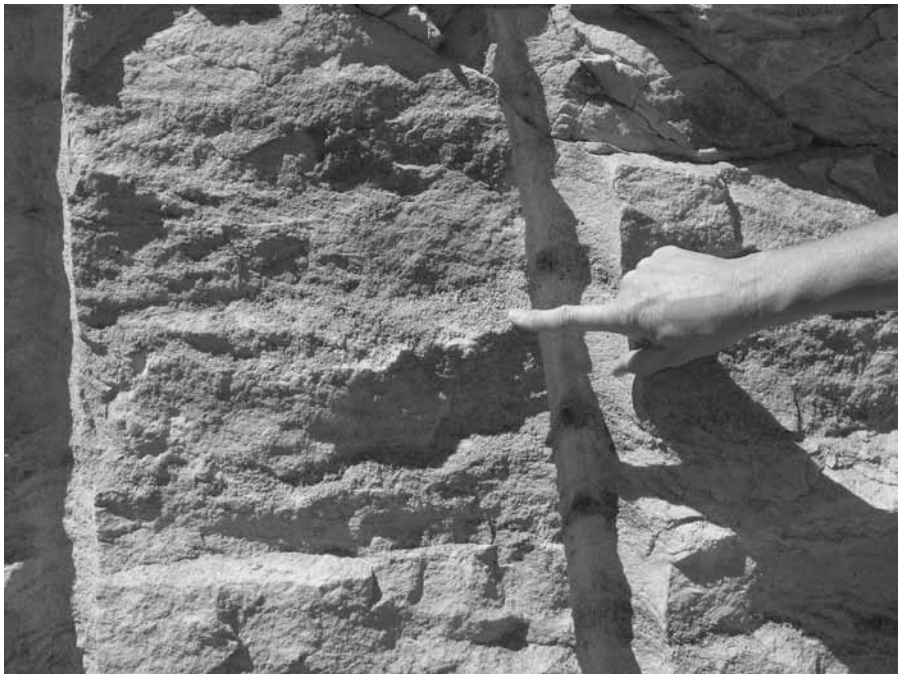

Figure 7. The Flathead Sandstone at Cody, Wyoming.

"Molar-Tooth" Structures

One mysterious feature of the Belt Supergroup is the existence of "molar-tooth structures" (MTSs) (Figure 2), networks of interconnected vertical and horizontal mostly microcrystalline calcite sheets or ribbons and occasional spheroidal objects found in fine-grained clayey carbonate sediments (Smith, 2016). MTSs obtained their name from the Belt-Purcell sedimentary rocks in 1885 for a variably weathered surface of intricately crinkled calcite sheets that reminded the researcher of the corrugated surface of an elephant molar tooth (Smith, 1968). They are about 5 mm to a few cm wide, intricately folded or fragmented by compaction of the sediment and about up to a meter long before compaction. It is possible that MTSs are interconnected in a 3-D network (Bishop and Summer, 2000; Bishop et al., 2006). The calcite is composed of 5–15-micron equant, microspar crystals that are mostly pure and uniform (James et al., 1998). Microspar is re-crystallized micrite, which is fine-grained calcite.

The sediments associated with these structures contain a high amount of carbonate and are cemented by calcite (Bishop and Summer, 2006). Smith (2016, p. 78) states that "MTSs are most abundant within fine-grained, dolomitic cycle tops." Dolomite requires hot water to form (Oard, 2022a, 2022b), which may be a clue as to the origin of MTSs. It is believed that the process that formed MTSs occurred rapidly because the sediment had not yet compacted (Bishop et al., 2006; Pollack et al., 2006). The origin of MTSs is enigmatic with no modern analogs.

Researchers also believe that MTSs formed in shallow water, but within a Biblical model, this need not be the case. MTSs must satisfy three main

Figure 8. Typical domal stromatolites in limestone, Belt Supergroup, Glacier National Park, Monana.

conditions: (1) void space must be created, (2) subsequent precipitation of microspar then takes place, and (3) they are ubiquitous in the Precambrian with very few, if any, reported in the Phanerozoic (Hodgskiss et al., 2018). There is one claim of MTSs in the late Cretaceous of northern Brazil (Rossetti and Góes, 2000).

There are at least 10 processes suggested for their origin. One popular hypothesis is that molar-tooth structures originated by seismic shaking of partially consolidated sediments (Fairchild et al., 1997; Pratt, 2001). Syneresis cracks (see below) would be formed at the same time. They are similar to sediment-filled cracks, except molar-tooth structures taper up and down and are predominantly filled with calcite.

A second popular hypothesis is that molar-tooth structures formed by gas bubbles and expansion cracks in poorly consolidated, shallow carbonate sediments (Furniss et al., 1998; Frank and Lyons, 1998). It is possible that passing waves at the water surface (Bishop et al., 2006) or internal waves (Oard, 2013b) caused expansion cracks. Then the voids were filled with calcite exceedingly fast. The gas likely formed from the decay of organic matter and/or hot temperatures (Boudreau, 2012). Although not completely understood, it appears that researchers are mostly settling on gas expansion that immediately fills with precipitated fine-grained calcite (Pollack et al., 2006; Kuang, 2014; Kriscautzky et al., 2022). However, the gas mechanism satisfies only one of the three main conditions. Organic matter decay can reproduce the gas for the void spaces, but does not account for the precipitation of microspar nor the temporal restriction of MTSs to predominantly the Precambrian (Hodgskiss et al., 2018).

Many conventional researchers claim that molar-tooth structures ended in the mid Neoproterozoic before there were organisms to bioturbate the sediments (Shields, 2002). The origin of MTSs in the Precambrian could be due to changes in ocean chemistry such as a decrease in $CaCO_3$ saturation and/or an increase in the concentration of precipitation inhibitors (Shields, 2002). If the Precambrian sedimentary and metasedimentary rocks are from the Flood (Oard et al., 2023), what is it about the Precambrian in the early Flood that caused such unique features as molar-tooth structures that are rarely, if ever, found in the Phanerozoic or today?

"Mudcracks" Are Syneresis Cracks Formed Under Water

"Mudcracks" are very common in the Belt Supergroup (Figure 3). This is one reason why researchers assume that sediments in the Belt Basin were deposited in shallow water that was occasionally exposed. However, most researchers are leaning away from these features as being true mudcracks. They ascribe them to various underwater processes, collectively called syneresis cracks (Schieber, 1990). *Syneresis cracks* are defined as "…fissures that develop in a suspension where waters are expelled from the clay-water system by internal forces; they may resemble mud cracks in the sediments" (White, 1961, p. 561). Some reserve the definition of syneresis cracks to the sediment/water interface, but this need not be the case, since shrinkage cracks can occur within the sediments (Tanner, 1998). The shrinkage cracks in the Belt are mostly ascribed to syneresis cracks, since there is no supporting evidence of subaerial exposure (Pratt, 1998).

Crinkle cracks are one form of syneresis cracks, although Winston and Smith (2016) do not believe they are syneresis cracks. But that is more of a definition problem. Crinkle cracks are widespread in the rock record, including the Green River Formation. They

are about 5 mm wide and 0.5 to 5 cm deep and those in the Belt Supergroup are filled with sandstone. Crinkle cracks are believed to be caused by waves in the water causing cracks to form in mud from a passing wave (Winston and Smith, 2016). They were shown to occur from passing waves in mud along the Louisiana coast (Winston and Smith, 2016).

There are several ways to form syneresis cracks, such as underwater compaction of clay flocs (White, 1961), clay dewatering by increased salinity (Burst, 1965; Harazim et al., 2013), intrastratal compression (Plummer and Gostin, 1981), seismic shaking (Pratt, 1994, 1998, 2002; Pratt and Ponce, 2019), and intrastratal volume reduction (Winston and Smith, 2016). Because of the interplay of many possible factors in forming shrinkage cracks, there does not appear to be any single feature diagnostic of whether cracks are subaerial or underwater by syneresis cracking (Plummer and Gostin, 1981; Tanner, 1998). Many of the cracks in the Belt Supergroup were filled from below (Pratt and Ponce, 2019), evidence against subaerial exposure.

In the Flood, we would expect numerous earthquakes that cause waves on top of the Floodwaters and tens of thousands of internal waves (Oard, 2013). We would also expect rapid sedimentation, compression, and dewatering of sediments. Salinity changes likely were very large. All of these could produce numerous syneresis cracks. There also could be true mudcracks during Briefly Exposed Diluvial Sediments (BEDS) because of oscillations in the height of the Floodwater (Oard, 2011).

Figure 9. Stromatolites in Figure 8 that have transitioned into carbonate laminations, Belt Supergroup, Glacier National Park, Montana.

"Stromatolites" and Microfossils in the Belt Supergroup

"Stromatolites" are fairly common in the Belt Supergroup, having been

Figure 10. Stromatolites in dolomite, Belt Supergroup, Glacier National Park, Montana.

recognized as early as 1906 by Walcott (Rezak, 1957). Stromatolite-rich layers extend laterally up to about 100 km (Pratt, 2001). Domal stromatolite alternate with planar stromatolites in places (White, 1984). At one location, I observed domal stromatolites in limestone (Figure 8) that transitioned laterally into planar laminations (Figure 9). How can planar laminations, claimed to be stromatolites, be distinguished from sedimentological planar laminations?

Furthermore, many stromatolites are in dolomite (Horodyski, 1977; Pratt and Rule, 2021), for instance, as shown in Figure 10. Since it takes hot water to form dolomite, whether primary or secondary dolomite, it is doubtful such stromatolites are biological.

Klevberg and Oard (in preparation) also question whether these claimed stromatolites are truly biological and grew in situ.

Most microfossils in the Belt are in the Helena Embayment in the east-central Belt Basin, for instance the Chamberlain Formation (Adam et al., 2016, 2017) or in Glacier National Park (Horodyski, 1993; Retallack et al., 2013).

Difficult to Correlate Formations

It is difficult to correlate most of the strata across the Belt Basin:

> Despite this well-recognized coarse stratigraphic architecture, more detailed stratigraphic correlations between different parts of the Belt Basin have been challenging, in part due to facies changes and local stratigraphic nomenclature. (Slotznick et al., 2016, p. 224)

Winston (2016) believes the Revett Formation is an exception in that it can be correlated long distances in the basin, but even this formation presents difficulties (see below).

Because of the difficulty of correlating formations, miscorrelation has occurred, for instance in the Lemhi sub-basin (Burmester et al., 2016). Revett Formation quartzite in western Montana grades laterally to argillitic silt-to-clay couplets and coarse quartzite beds. The Burke, Revett, and St. Regis Formations cannot be separated, and the whole section is simply called the Grinnell Formation in Glacier National Park (Winston, 2016, p. 31). The Belt Supergroup rocks in the Highland Mountains south of Butte, Montana, had been assumed to be from the Missoula Group but now are believed to be from the Ravalli Group (McDonald and Lonn, 2014).

Paleocurrent Directions Mainly from the West

Paleocurrent directions are obtained by a variety of methods, including the orientation of scour marks and flute casts, sediment thickness patterns, paleomagnetic properties, cross-beds in sandstone, and imbrication in conglomerate. The paleocurrent directions in the Belt Supergroup indicate flow was predominantly from the southwest and west (Harrison, 1972; González-Álvarez et al., 2006; Sears and MacLean, 2016). This indicates that the source of Belt sediments was to the west of the Belt Basin. This has long presented a major puzzle:

> Some of the main problems puzzling to students of Belt rocks concern the character of the source areas and the conditions of weathering, transport, and deposition that provided such a great thickness of fine-grained sediment, most of which was deposited in shallow water. The sheer monotony of the series implies a remarkable relative stability. (Harrison and Campbell, 1963, p. 1425)

Some believe that a continent lay to the west: "Stratigraphic, sedimentologic, and isotopic evidence strongly suggest that the Belt basin was bordered on the west (present-day coordinates) by a continental mass…" (Evans et al., 2000, p. 1297). What is to the west, but Washington, Oregon, and the Pacific Ocean? Washington and Oregon are supposed to be mostly an amalgamation of exotic terrains plastered onto North America by plate tectonic activity well after the Precambrian (Coney et al., 1980), so researchers do not have a good source for the sediments.

Some paleocurrent directions differ from the general flow from the west. The southwest part of the Belt Basin, the Lemhi sub-basin, has paleocurrent directions generally from the south (Burmester et al., 2016). Paleocurrent directions in the southeast Belt Basin are quite variable, ranging from the north to the east and to the south (Schieber and Ellwood, 1993). The top of the Belt, the Missoula Group, has paleocurrent directions from the south and east (Bedrosian and Box, 2016).

To aid them in their search for a source, geologists mostly use U-Pb dates on zircon crystals in the sand particles within the sandstones (Jones et al., 2015). From this they look upcurrent, hoping to find the source terrain for the sediment. Unfortunately, there is no source for the particular dates on zircon crystals that came from the west and southwest. This has caused much speculation about the continent that was supposed to lie to the west of the Belt Basin during supercontinent formation.

Speculation on the "Missing" Western Half of the Strata

Therefore, uniformitarian scientists have claimed that the western half of the Belt Supergroup is "missing" and once existed on some other continent after the "Columbia supercontinent" broke up (Ross et al., 1992; Duke and Lewis, 2010). After this supercontinent broke up, parts re-amalgamated into the "Rodinia supercontinent." Box et al.

(2020) believe the western part of the Columbia supercontinent is now located in Australia or eastern Antarctica. Based on zircon U-Pb dates on other continents, some researchers believe Antarctica was just west of the Belt Basin (Goodge et al., 2008). However, other geologists think it was Siberia (Sears, 2007, 2012). Some think the missing Belt rocks are in south-central Australia (Ross et al., 1992). Zheng-Xiang et al. (1995) believe the missing strata could be in southeast China.

Based on paleocurrent directions generally from the south in the Lemhi sub-basin, Jones et al. (2015) believe the source terrain is in the southwest United States, mainly the Yavapai province. Ultimately, there is no consensus.

Dolomite in the Belt Supergroup

Not a high percentage of carbonate rock exists within the Belt-Purcell Supergroup, and much of the carbonate is dolomite. For instance, the Piegan Group carbonates are dolomite (Slotznick et al., 2016). Even some "stromatolites" are in dolomite. If the dolomite is primary, precipitated directly from solution, the water requires temperatures greater than 100°C, but probably well over that temperature (Oard, 2022a, 2022b). Burns et al. (2000, p. 53) state: "Only at temperatures over about 100°C, well beyond those expected for synsedimentary dolomite formation, can dolomite be readily precipitated in experiments" Morrow (1982, p. 6) corroborates:

> The absence of a widely accepted theory concerning the chemistry of dolomitization is due primarily to the difficulty in precipitating dolomite from appropriate solutions at temperatures less than 100°C.

It is known that dolomite much more easily precipitates at higher temperatures, higher Mg/Ca ratios, and high Mg supersaturation (Burns et al., 2000). Stoichiometry and ordering increase in hot water.

Just recently, Kim et al. (2023) claimed that dolomite can form at ambient temperatures due to thousands of supersaturation/undersaturation cycles. However, this "solution" has many problems (Oard, in press), one of which the experiment on the micron scale was run at a temperature of 80°C. Moreover, it is an unrealistic mechanism for the huge dolomite formations in the rock record

Since geologists do not think the Belt rocks were deposited in hot water because of their uniformitarian assumption, they simply assume that the dolomite was formed by replacement (dolomitization) from limestone (Tucker, 1982). If the dolomite is widespread, in order for thick dolomite to be formed by replacement, several conditions must be met. Tremendous fluid flow (Warren, 2000) with a "pumping mechanism" and enough available Mg must occur. Not only that, the fluid flow must flush out the extra Ca liberated during dolomitization (Boggs, 2009), and the porosity and permeability must allow the fluid flow. The amount of available magnesium would have to be huge (Jones and Rostron, 2000), and the pump and fluid flow must continue for an extended period of time, since it is estimated that 1,000 units of fluid flow are needed to dolomitize one unit volume (Given and Wilkinson, 1987), and 350 kg of Mg are needed to dolomitize 1 m^3 of limestone with a porosity of 7% (Jones and Rostron, 2000). Of course, the fluid flow of magnesium ions decreases away from a potential source—one of the many problems with dolomitizing a huge limestone formation. Such dolomitization needs to occur in the subsurface where temperatures are higher, but porosity and permeability are often reduced by compaction with depth. This is one reason why it supposedly would take millions of years for dolomite to form, according to uniformitarian reckoning. How reasonable is such a replacement process, even given millions of years?

There is actual evidence that replacement formed some dolomites, but it is limited. For instance, a close analysis of a 1,600 m-thick carbonate in eastern Spain showed massive dolomite near faults (Yao et al., 2020). It is assumed that hot Mg-rich water issued from the faults to dolomitize the limestone, which is reasonable. Further evidence of replacement is provided by observations that certain beds are selectively dolomitized, limestone stringers exist within dolostones, and the dolomite ends abruptly. Such fault-transported dolotimizing fluids would have been hot. Based on fluid inclusions in the affected rock, the temperature of dolomitization for a Cambrian dolomite in the Western Canadian Sedimentary Basin was 124º–181°C (Koeshidayatullah et al., 2020). Based on a dolomite from northern Spain, Lapponi et al. (2014) determined that hydrothermal dolomitization occurred at temperatures of 80–120°C. So, it appears hot water temperatures are also required for replacement dolomite.

When Was the Belt Supergroup Deposited in Biblical Earth History?

How do these unique Belt rocks fit in Biblical Earth history? Many creation scientists place these rocks prior to the Flood, either during Creation Week or between Creation Week and Noah's Flood (Dickens and Snelling, 2008; Humphreys, 2014; Dickens, 2018; Dickens and Hutchison, 2021). This begs the question of how such a large volume of sediment was deposited in a very deep "hole" before the Flood? It implies massive erosion, transport, and deposition over at least a regional scale. One possibility is rapid erosion on Day 3 as the continents or a supercontinent emerged

Figure 11. The Belt LaHood Formation contact with the Flathead Sandstone near the top of the Bridger Mountains (Peter Klevberg is pointing at the contact). The strata are generally dipping about 70° east.

out of the waters below. I do not think this likely because the Creation was one super-miracle, and Genesis 1:9 says that the dry land appeared within the waters under the heavens that were gathered into one place.

However, objective evidence that the Belt rocks were deposited in the early Flood does exist (Oard et al., 2023). The contact between the Belt Supergroup and the Cambrian Flathead Sandstone, a Flood rock, is commonly conformable, indicating no significant break between deposition of the Belt rocks and obvious Flood rocks. The lack of a significant unconformity between the Belt and Phanerozoic rocks imply that the Belt rocks are from Noah's Flood, as well as the erosion, transportation, deposition, and subsidence implied by the basin.

The Flood rocks on top of the Belt could have been very thick before erosion. Elston et al. (2002) claim that a thickness of 8 km of Paleozoic carbonates and Mesozoic clastics accumulated in southeast British Columbia on top of the Belt rocks.

However, some researchers have claimed the contact is disconformable and with a low angular unconformity in spots (Harrison et al., 1974; Harrison and Cressman, 1993). Deiss (1935) claimed that he has found eight locations with angular unconformities, supposedly justifying about a billion years of missing time. But, Deiss (1935) acknowledged that many geologists cannot really see such an unconformity, disconformable or otherwise, between the Belt Supergroup and the Flathead Sandstone because the relationship is rarely angular. Campbell (1960, p. 573) reinforces this lack of an angular unconformity: "The angular discordance between the Precambrian and the Cambrian beds at these locations is so slight that it was not detected." So, the areas with a slight angular discordance are the exceptions and could be due to local erosion or slight movements within the strata.

I have seen a few of these contacts and they look conformable, for instance at the top of the steeply east-dipping Bridger Mountains northeast of Bozeman, Montana, USA (Figure 11). Lonn et al. (2016) report no significant angular unconformity between the Belt Rocks and overlying Paleozoic rocks in the Lemhi Range of central Idaho. Bedrosian and Box (2016, p. 309) summarize:

> We infer that any deformation of Belt strata in the study area prior to Paleozoic deposition was local and minor, as Cambrian strata are only known to depositionally overlie the youngest formation the Belt Supergroup (Harrison et al., 1992), indicating little if any folding and erosion prior to Paleozoic deposition.

The big picture indicates continuous sedimentation from the Belt Supergroup upward into the Paleozoic. This is the main reason I place at least the top of the Belt Supergroup as early Flood.

The catastrophic activity that formed the Belt rocks is characteristic of other features that can be placed in the very early Flood, such as impacts (Oard et al., 2023) and the opening of great rifts in the continental crust that quickly filled with basalt and sediments. One major rift in North America is the Midcontinent Rift (Figure 12), which is about 2200 km long, the width ranging from 40 km in Kansas to 150 km over Lake Superior, and up to 30 km deep (Reed et al., in preparation)! Many other deep basins and rifts occur on the continents, and it is reasonable to include these within very early Flood catastrophism.

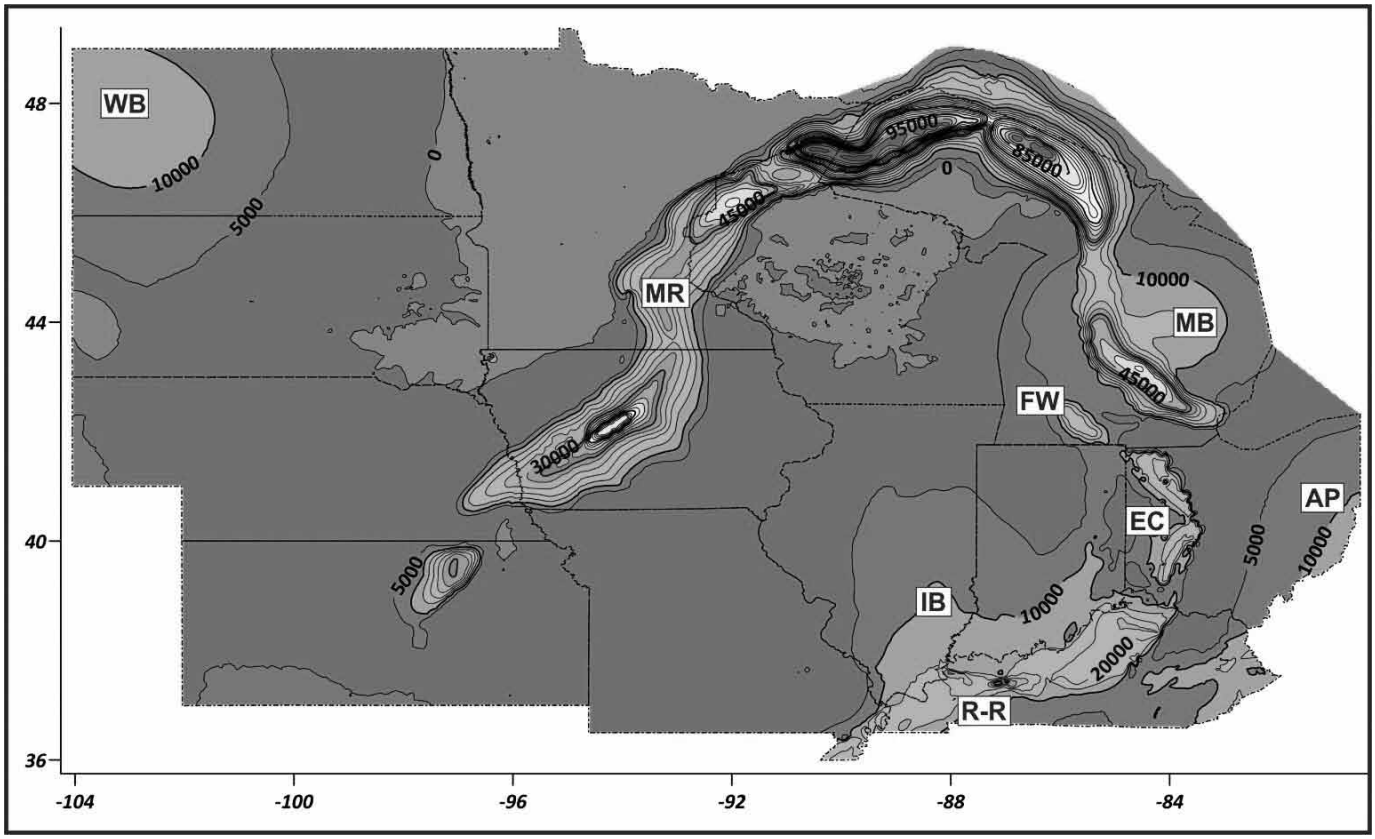

Figure 12. The Midcontinent Rift showing depths greater than 95,000 feet in the Lake Superior area with other rifts south of Michigan (courtesy of John Reed).

Questions Still Remain

Many unusual features of the Belt Supergroup remain to be explained by the Flood. The stromatolites likely are not truly biological (Klevberg and Oard, in preparation), and dolomite is an indication that many of the rocks were laid down in hot water. I currently have no explanation for MTSs and syneresis cracks.

The source of the Belt sediments is also a mystery. The sediments predominantly came from the west and appear to have been deposited rapidly, as indicated by no deformation within the strata. This implies massive erosion and transport. But there is no source to the west. Could it mean that another continent existed before Noah's Flood to the west, being part of a pre-Flood supercontinent? Or, could the erosion come from an uplifted Pacific Ocean basin? What could generate so much sediment so quickly? Since the Belt Basin seems to be a deformed impact crater, could another impact to the west pulverize a great volume of rock and transport it east to quickly fill up the Belt Basin? The Belt rocks present many mysteries, and unfortunately, I do not have many answers. But they also do contain clues to catastrophism in the early Flood.

Conclusions

The Belt sedimentary rocks are mysterious for both uniformitarian and creation scientists. In order to solve these mysteries, we need to first place the Belt Supergroup into Biblical Earth history. The lack of evidence of a significant unconformity at the contact with the Belt rocks and the Flathead Sandstone indicates that some of the Belt rocks are early Flood, possibly even in an impact crater. But, more research needs to be done to test this hypothesis. A further deduction is that some Precambrian sedimentary and metasedimentary rocks, are from the early Flood. This helps us to better understand the catastrophism of the early Flood and will help in formulating a more sophisticated Flood model.

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Groundwork for Creation Cosmology
Part I: Scripture

Andrew Repp*

Abstract

Today's rich cosmological data sets require integration into a Biblical framework. The light-travel time issue is the most obvious difficulty involved, but it is by no means the only one. This article seeks to lay the groundwork for such integration by considering three Scripture passages: Hebrews 11:1–3; 2 Peter 3:5–7; and Romans 8:18–23. It notes that an accurate understanding of origins requires explicit inclusion of supraprovidential (i.e., miraculous) action, but that we should limit such action to what the Genesis record specifically warrants. It further suggests that in cosmology we can restrict this supraprovidential action to the Creation Week; that is, miraculous events connected with the Deluge did not affect the Universe as a whole. Finally, it suggests that there is no warrant for assuming that the physical effects of the Fall included changes in the actual laws of physics themselves.

Key Words: cosmology, entropy, exegesis, faith, the Fall, miracles

Introduction

Cosmology and light-travel time—two issues with significant overlap—are areas of weakness in young-Earth creationism (YEC). The YEC literature has extensively explored potential solutions to the latter (see references in Repp, 2022), and the author hopes to evaluate these solutions in a future series of articles.

However, even apart from light-travel time, a significant amount of cosmological data still requires integration into a YEC framework. These data include the cosmic microwave background (CMB), the CMB anisotropy spectrum, the baryonic acoustic oscillation, the environmental dependence of galaxy properties, and main sequence turnoffs in star clusters (all noted by Upton, 2011). They also include jets from active galactic nuclei, which can be ~10^6 light-years long (noted by Taylor, 2005). None of these observations seem to fit naturally into a young-Earth/Universe position. Nor is this list at all exhaustive; the natural timescale for many astronomical processes is, due to the vast distances involved, orders of magnitude greater than 10^4 years.

To construct a Biblical framework for this data, it is helpful first to lay some groundwork; the author intends to attempt this in a series of three papers. This article (the first) examines three relevant passages (not including

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Genesis 1, which future papers will discuss in detail). The second will attempt to justify several working assumptions. The third will list some of the relevant observational data. The hope is that the three articles together will provide a foundation for building a comprehensive creationary understanding of cosmology.

All Scripture quotations in this article are from the English Standard Version (ESV).

Opening Considerations

As believers, we recognize the Bible teaches that the entirety of Scripture is God-breathed (*plenary inspiration*—2 Timothy 3:16–17), that this inspiration extends even to the individual words of the original (*verbal inspiration*—Matthew 5:18; Proverbs 30:5), and that Scripture is therefore *inerrant* (Psalm 119:96, 138). The Chicago Statement on Biblical Inerrancy expresses this teaching of Scripture as follows:

> We affirm that the whole of Scripture and all its parts, down to the very words of the original, were given by divine inspiration….
>
> We affirm that Scripture in its entirety is inerrant, being free from all falsehood, fraud or deceit.
>
> We deny that Biblical infallibility and inerrancy are limited to spiritual, religious or redemptive themes, exclusive of assertions in the fields of history and science. We further deny that scientific hypotheses about earth history may properly be used to overturn the teaching of Scripture on creation and the flood. (Articles VI, XII)

Scripture also teaches its own *perspicuity*: despite the fact that it contains "some things that are hard to understand, which the ignorant and unstable twist" (2 Peter 3:16), it is nevertheless true that what God designed to communicate is understandable, so that Scripture is indeed *revelation* (Deuteronomy 29:29; 30:10–14; Psalm 119:105, 130; Acts 17:11). The Westminster Confession of Faith usefully summarizes the teaching of Scripture on this point:

> All things in Scripture are not alike plain in themselves, nor alike clear unto all; yet those things which are necessary to be known, believed, and observed, for salvation, are so clearly propounded and opened in some place of Scripture or other, that not only the learned, but the unlearned, in a due use of the ordinary means, may attain unto a sufficient understanding of them. (I.7)

However, at least since the time of the Christ, Scripture has been misused in service of false conclusions—either with deliberate intent to deceive (as when Satan tempted Christ, Matthew 4:6) or with various degrees of misunderstanding (as the Judaizers, Acts 15:1, 5).[1] Today such conclusions include the empirically falsified theories of geocentrism (e.g., "Geocentricity," 2020) and Flat-Earthism (e.g., "Biblical Flat Earth." n.d.). To safeguard against such, it is absolutely vital to employ a consistent grammatical-historical hermeneutic. Such a hermeneutic pays proper attention to genre, context, and figures of speech; it incorporates all available linguistic and archeological data; and it carefully compares Scripture with Scripture.

Under the umbrella of this hermeneutic, two considerations are helpful when relating Scripture to cosmology. First, we must beware of unwittingly adding to God's words. Given that some things in Scripture are "hard to understand" (i.e., "all things in Scripture are not alike plain in themselves"), and since God's inspiration extends to the very choice of words, we safeguard ourselves by not going beyond what those words specifically teach: "Every word of God is flawless; he is a shield to those who take refuge in him. Do not add to his words, or he will rebuke you and prove you a liar" (Proverbs 30:5–6). God has chosen precisely what to reveal, so that if a word or statement is unclear—even after comparing Scripture with Scripture—we must be content to leave it as such.

In particular, we must recognize cases in which Scripture gives us accurate phenomenological descriptions of nature, but without specifying details of the underlying processes and structures.

James Holding, a creationist, emphasizes this aspect of Scripture[2] in responding to the charge that the word "firmament" (Genesis 1:6) implies the existence of a solid dome above the Earth. We must, he says,

> realize that the inspired author of Genesis was allowed to use the only terms available to him in his language to describe natural phenomena, but was *not* allowed to offer anything more than the vaguest, most minimal descriptions of those phenomena, thereby leaving nearly everything unsaid about their exact nature. Genesis 1 was perfectly designed to allow that interpretation which accorded with actual fact, for it "says nothing more than that God created the sky or its constituent elements" while remaining "*completely silent*" about what those elements were. (1999, p. 45, emphasis in the original)[3]

As Younker and Richardson (2015) detail, the basic meaning of רָקִיעַ (*rāqîa'*)—the word in question—is "*expanse*," as Holding (1999) demonstrates,

1 In 2 Peter 3:16, the "twisting" of Scripture results from lack of understanding by the "ignorant and unstable."

2 Holding uses the term "equivocal" to describe the ambiguous language, but without the negative connotations often carried by that word.

3 Holding lists Aalders (1981, p. 61) as the source of the quoted statements.

there is nothing in the context of the Genesis usage to imply *solidity* of this expanse. Unfortunately, it seems that the translators into Greek read their own cosmological ideas into this word, yielding στερέομα (*steréoma*), which propagated into Latin as *firmamentum* and into English as *firmament*.

What is to keep us from making a similar mistake? Simply this: given that we believe in verbal inspiration, we must be careful not to press the wording of Scripture beyond what it actually implies. We have here a case in which Scripture provides an accurate description of a natural phenomenon, but it uses language that does not reveal the precise underlying nature of that phenomenon.[4] Furthermore, if the language does not do so, then it follows that God did not intend in these passages to reveal the precise nature of the expanse; rather, His purpose was to reveal (among other things) that He created it by His Word on the second day—and this fact is, of course, completely clear (perspicuous) in the text.

Thus, while Scripture is always consistent with scientific truth, we should not necessarily expect it to provide shortcuts letting us circumvent the process of scientific investigation. In the case under discussion, Scripture tells us that God created an expansive sky, but the exact nature of that expansive sky is revealed only through careful observation. Holding provides one reason for this state of affairs:

> The modern critic demands accommodation from God at the cost of confusion for all who lived before…. The most efficient option for the inspired text, therefore, was to make no explicit statements about subjects such as cosmology, which is exactly what we find in the Bible. (Holding, 2013, ellipsis added)

Another reason is surely the fact that God does not do our work for us; quite the contrary—it is His part to set up problems which give us the privilege (and joy) of discovery (cf. Proverbs 25:2). Scripture focuses on revealing what we, in our finitude and fallenness, would *not* discover on our own. Therefore, in describing natural phenomena, God not infrequently uses language which admits multiple understandings:

> terms left precisely undefined, served until such time as our own understanding was sufficient to comprehend the wonders of God's creation. It is singularly unfortunate that men of ancient times and even up unto the present day have imposed their own concepts of what is true upon the Word of God. (Holding, 1999, pp. 50–51)

As an example, creationists disagree on whether Biblical references to the stretching out of the heavens actually describe the expansion of the Universe. However, what is indisputable is that no one *predicted* the expansion of the Universe on Scriptural grounds. Scripture is *consistent* with Hubble expansion, but any actual reference to the expansion appears (if at all) only in hindsight. What Scripture *does* clearly teach is the phenomenological fact that the heavens are expansive, as well as the theological implication—namely, God's absolute sovereignty and transcendence.[5] But many potential cosmologies—whether expanding or static—are consistent with a visually expansive sky, and thus these Scriptural references do not decisively discriminate among them. The question of whether or not the Universe is expanding is one to be settled by observation.

Given, then, the existence of such language, we should beware of drawing overly hasty cosmological conclusions, especially from statements incidental to the main point of the passage. And we should of course completely repudiate "Bible-code" type readings which attempt to mine irrelevant passages for cosmological information; besides bypassing the task of investigation God has set before us, doing so is simply bad hermeneutics.[6]

Second, we should note that the language Scripture uses to describe the natural world is often figurative. For instance, Job 38:4 mentions "the foundation of the earth," and 1 Samuel 2:8 refers to "the pillars of the earth;" both metaphors evoke a visual image of the Earth resting on some external support. However, Job 26:7 declares that God "hangs the earth on nothing," implying suspension (rather than support) through some non-material means. In this case the language is non-specific *by* being figurative: both expressions cannot at once be literally true, yet clearly Job is not being inconsistent: these expressions are pictorial means of stating, on the one hand, that God is responsible for the stability of

4 Note that, as Holding (1999) also states, "Seely confuses adaptation to human finitude with accommodation to human error—the former does not entail the latter" (p. 45). The fact that certain Scriptural statements are non-specific does not imply that they are erroneous.

5 Thus it would be incorrect to say that the "true meaning" lay hidden until the 20th century (or some time yet future). The true meaning is precisely what God intended to reveal through the language He chose—in this case, expansiveness, sovereignty, etc.—and that meaning was readily accessible to the original audience.

6 A reviewer expressed concern that the above analysis could serve as a "back door to compromise." But the safeguard against such compromise is precisely the careful exegesis advocated at the start of this section. Since Scripture is verbally inspired, a careful analysis of its wording will enable us to discern both where it speaks and where it is silent. Where it is silent, we too must be silent, and where it speaks we must not back down.

the Earth and, on the other, that He employs no visible means in doing so. To determine which (if either) of these figures captures actual geophysical information, we must do the hard work of scientific investigation.[7]

We find another example in Judges 5:20: "From heaven the stars fought, from their courses they fought against Sisera." Attempting to draw cosmological conclusions from this statement could lead us to infer that stars exert some sort of astrological influence—a conclusion which Scripture elsewhere repudiates (e.g., Deuteronomy 18:9–11). Instead we recognize the presence of figurative language expressing the fact that the very forces of nature (perhaps a flash flood produced by a storm, v. 21) fought for Israel that day.[8] As Matthew Henry states, "Those whom God is an enemy to, the whole creation is at war with" (1708/1999, p. 117). And though this passage is poetry, which excels in the use of figurative language, figures of speech are common in narrative as well.

Such examples serve as reminders not to press Scripture beyond its wording in context, given that its primary purpose is, first, to provide us with the correct worldview in which to understand our observations, and second, to give us information we could not discover for ourselves (such as the timing and sequence of creation). We are thus encouraged to dig into Scripture, for it means what it says. But we must be careful not to go *beyond* what it says, and we should not expect it to provide shortcuts circumventing the process of scientific work.

With these facts in mind, we now consider three specific passages, namely, Hebrews 11:1–3; 2 Peter 3:5–7; and Romans 8:18–23.

Hebrews 11:1–3: Faith

This passage reads as follows:

> [1]Now faith is the assurance of things hoped for, the conviction of things not seen. [2]For by it the people of old received their commendation. [3]By faith we understand that the universe was created by the word of God, so that what is seen was not made out of things that are visible.

The first verse describes faith as "assurance" and "conviction," suggesting that this faith is not a blind leap in the dark.[9] Romans 1:20 speaks even more directly, stating that the evidence God provides leaves us without excuse (*anapologētous*, literally "apologetic-less"). Thus, we have sufficient grounds for our faith in the testimony of God's Word; examination of the whole of Scripture reveals that it points to both *a priori* grounds (e.g., its self-attesting nature and presuppositional necessity) and *a posteriori* grounds (e.g., the testimony of the created order and historical miracles).

But though the evidence is *sufficient* to leave us without excuse, it does not *force* belief upon us, given that the subject matter is "things hoped for… not seen." For this reason, the second verse states that the Old Testament believers were commended for their faith. Thus our response—whether faith (assurance, conviction) or unbelief ("suppress[ing] the truth," Romans 1:18)—determines whether or not we are commended.

The third verse applies this truth to the creation of the Universe, declaring that "things that are visible" (using the source of our word *phenomena*) are insufficient for deducing how "what is seen" came about. In other words, without faith in the testimony of Scripture we will inevitably reach false conclusions about origins. In particular, since creation occurred by God's command, there will be many aspects of the Creation Week which are inexplicable in terms of present-day processes.

Care in terminology is helpful here: it is tempting to speak of "natural processes" vs. "divine action," but this language lends itself to punctuated deism—because natural processes themselves reflect continuous divine action (John 5:17; Colossians 1:17; Hebrews 1:3). It is perhaps better to speak of *providential* action (God's ongoing sustaining of the Universe, which manifests itself in natural laws) and *supraprovidential* action (such as the creative action from which God rested on the seventh day).

Thus, this passage teaches, first, that to reach accurate conclusions about creation we must have enough confidence in God's Word to trust its plain statements—even when uncorroborated by direct observational evidence. Those who exhibit such trust receive commendation; those who do not will reach false conclusions. Second, in describing creation we must explicitly include supraprovidential acts. Some of these acts will be analo-

7 A reviewer noted that the first set of metaphors might refer to the mantle at the bases of the continents (with "earth" meaning "land")—and that may well be the case. However, these bases would still not be literal pillars (i.e., the language is figurative), and, more to the point, it is "the hard work of scientific investigation" which has elucidated the nature of these bases. In these passages, Scripture communicates precisely what it was designed to communicate, but not more.

8 Or it might refer to angelic intervention.

9 Louw and Nida (1996), citing this verse, define ἔλεγχος (here rendered "conviction") as "evidence, normally based on argument or discussion …'evidence that what we cannot see really exists'" (p. 672); likewise BDAG (again citing this verse), "the act of presenting evidence for the truth of someth[ing], proof, proving" (Bauer et al., 2000, p. 315). Neither is consistent with faith as a blind leap.

gous to providential processes (e.g., trees growing up out of the ground in Genesis 2:9), but they will presumably exhibit causal discontinuity as well (e.g., the aforementioned trees lacked parent trees). And while providential processes were also operative during Creation Week, they are insufficient for an accurate account of God's creative work. Third, since these supraprovidential actions occurred through God's spoken word, we presumably can look to Genesis for a record of them (though that record need not be exhaustive).

2 Peter 3:5–7: A List of Supraprovidential Episodes

This passage reads as follows:

> 5For they deliberately overlook this fact, that the heavens existed long ago, and the earth was formed out of water and through water by the word of God, 6and that by means of these the world that then existed was deluged with water and perished. 7But by the same word the heavens and earth that now exist are stored up for fire, being kept until the day of judgment and destruction of the ungodly.

In context, Peter is addressing the mockery of certain scoffers; they dismiss the possibility of Christ's return because it has not yet happened and in fact shows no sign of happening. Instead, they argue that "all things are continuing as they were from the beginning of creation" (vv. 3–4). In essence they use the observable regularity of nature (providential processes) to argue against the prospect of future supraprovidential intervention.

In response, Peter recounts two past supraprovidential episodes, noting that the scoffers "deliberately overlook" (v. 5) these data to draw their conclusions. Verse 5 describes Creation, the first such episode, and specifies water as the material out of which and through which the Earth was formed. The mention of water clearly alludes to Genesis 1. Creationists disagree on whether the initial use of "water" in Genesis ("face of the waters," 1:2) refers to actual H_2O; most argue that it does (e.g., Humphreys, 1994), whereas others consider it a figure of speech for fluid in general (e.g., DeRemer et al., 2007). However, the reference to water in this passage (2 Peter 3:5) specifically applies to "the earth" (not "the heavens"), and thus the specific allusion is more likely to Genesis 1:9–10, which focuses on the shaping of the earth itself. The main point of verse 5 in any case is that the creation of the world was a supraprovidential episode accomplished by the word of God.

Verse 6 specifies a second such episode, the Deluge. The agents of the Flood ("these," plural) seem to be both water and the word of God, since each of these antecedents is singular. And unlike the first episode (and the third in v. 7), the scope here does not explicitly include the heavens; rather, the Flood affected "the world"[10] which "was deluged with water" and thus perished. This silence presumably does not preclude cratering and other solar system effects (accelerated radiometric decay?), but it seems we have in this passage no warrant to expect cosmic results from the Flood judgment on our planet.

Verse 7 turns from the past to the future, describing a third episode—"the day of judgment and destruction of the ungodly." We note that "the same word" responsible for Creation and the Flood is now "storing up" and "keeping" the present heavens and Earth for judgment; thus the Word which created is also that which conserves, as Christ upholds the Universe (Hebrews 1:3). We should then not be surprised to find a unity between creation (supraprovidential) and providence, although that unity is Personal rather than mechanistic.

Thus this passage delineates three supraprovidential episodes which were (or shall be) at least planetary in scale,[11] which occurred (or shall occur) via the Word of God, and which those who operate with naturalistic presuppositions deliberately overlook. It follows that secular science will inevitably mishandle origins (and the Flood) by failing to account for God's supraprovidential work. However, the passage seems to give no indication that the Flood impacted astrohistory as it did geohistory—or at the very least we can say that the text is consistent with a Deluge event affecting only the surface of the Earth, or only the inner Solar System, etc.

Furthermore, we note that the Fall is absent from this list, although the significance of that absence is not clear, since the passage does not claim to be exhaustive. A reviewer suggested that the omission might be due to the fact that the Fall did not involve water (as did both Creation and Deluge). However, the third episode involves fire, not water—and since this eschatological episode is central to Peter's appeal in this chapter (see vv. 4, 8–14), it seems unlikely that the presence of water was a determining factor for inclusion/exclusion. Perhaps we can at least conclude that the direct physical effects of the Fall did not exceed those of the Flood, since otherwise it would

10 Although the Greek word is *kosmos*, its semantic range differs significantly from that of the English cognate "cosmos." In the New Testament it refers most often to unregenerate human society. The ESV uniformly renders it as "world," with the exception of 1 Peter 3:3, where it is translated "adorning" (corresponding to another English cognate, "cosmetics").

11 The other miraculous events recorded in Scripture seem to have been much more localized.

have been most fitting to mention it in this context.

Furthermore, this conclusion is consistent with Genesis 3, which describes the Curse in biological rather than physical terms. This is not at all to deny that the Fall had physical effects—it most certainly did. The question is the mechanism by which those effects occurred—whether God directly changed the system of physical laws (analogous to the biological changes imposed in Genesis 3), or whether the physical effects occurred more indirectly. If our deduction is correct that the Flood had no cosmological effect, and if our further deduction is correct that the Fall's direct physical impacts did not exceed those of the Flood, then we would have little if any Biblical warrant for proposing major, cosmic changes to the actual laws of physics (e.g., a reduction in the speed of light) as a result of the Fall. This, however, brings up the issue of thermodynamics; the universal entropy increase described by the Second Law of Thermodynamics seems closely linked to the Fall, and the next section of this article explores this issue.

Romans 8:18–23: Entropy and Hope

This passage reads as follows:

> [18]For I consider that the sufferings of this present time are not worth comparing with the glory that is to be revealed to us. [19]For the creation waits with eager longing for the revealing of the sons of God. [20]For the creation was subjected to futility, not willingly, but because of him who subjected it, in hope [21]that the creation itself will be set free from its bondage to corruption and obtain the freedom of the glory of the children of God. [22]For we know that the whole creation has been groaning together in the pains of childbirth until now. [23]And not only the creation, but we ourselves, who have the firstfruits of the Spirit, groan inwardly as we wait eagerly for adoption as sons, the redemption of our bodies.

Verse 19 tells us that creation (the *whole* creation, v. 22, not just the Earth) is eagerly longing for the "revealing of the sons of God;" this revealing (in context of verses 18, 21, and 23) refers to the eschatological glorification of believers. The reason creation thus eagerly awaits is the fact that it "was subjected to futility." It seems clear that the thermodynamic fact of continually increasing entropy—a fact grounded in both observation and statistics—is a mathematical formulation of this futility. Left to itself, the Universe is destined for a heat death of maximal entropy, that is, ultimate futility.

However, this subjection occurred "not willingly." Since inanimate creation has no literal will, the phrase seems to imply a fundamental incongruity with the nature of creation. It is incongruent with the nature of creation in that the most basic physical laws are *conservation* laws, implying that the innate nature of creation is to endure; the Second Law is in this regard a striking exception. Note also the analogy between the experience of creation (vv. 19–20) and the experience of believers (v. 23): believers groan because they "have the firstfruits of the Spirit," whereas the status quo—including our entire struggle against sin (vv. 1–17)—is incongruent with believers' nature and destiny as spiritually regenerate persons. "Beloved, we are God's children now, and what we will be has not yet appeared" (1 John 3:2). In the same way, it seems, creation groans because its current subjection to futility is alien to its nature. We might also note that verse 21 seems to use stronger language than verses 19–20: "bondage" rather than "subjection," and "corruption" rather than "futility."

In any case, a clue to the identity of the one "who subjected it" appears in the statement that this one did so "in hope." We cannot say that Adam sinned "in hope;" therefore, the one "who subjected it" must be God Himself. He is the One who subjected the whole creation to futility, but He did so looking to a future when "the glory of the children of God" would bring freedom to "the whole creation." Thus this passage teaches that, via the glorification of the children of God, the creation will (in the eschaton) be released from its subjection to futility.

What then is the relationship between Creation, the Second Law, and the Fall? It seems almost self-evident that the Second Law was operative in the original creation. By this law the Sun radiates light and heat, oxygen diffuses into blood cells, digested food passes into our bloodstream, etc. Statistical mechanics shows that the Second Law reflects the simple fact that disorderly configurations vastly outnumber the orderly, so that a transition from order to disorder is virtually certain. But if the Second Law operated from the beginning, how could creation's subjection to futility be contrary to its nature and purpose? And would God call "very good" (Genesis 1:31) a Universe doomed to a heat death?

Here we must enter the realm of speculation. One possibility is that there existed an entropy-reversing law which was revoked at the Fall. But this proposal faces multiple difficulties. First, man had dominion over the biosphere (Genesis 1:28), not the Universe; thus it is unclear why the Fall would alter the laws of physics throughout the entire cosmos. The Curse of Genesis 3, in being limited to the biosphere, is appropriately restricted to man's domain.[12] Second, superluminal propagation of causality

12 Again, this is not to deny indirect but far-reaching physical effects as a result of man's sin.

is physically problematic due to special relativity. This is *not* to suggest that God is bound by His own laws but simply to recognize a fundamental aspect of time itself, namely, that if causality propagates faster than light, there will exist reference frames in which the effect precedes the cause. Thus, if an entropy-reversing law had been revoked throughout the Universe at the Fall, there would be reference frames in which the revocation would occur *before* the Fall (before the effect's cause)—which would be counterintuitive at the very least. Third, as noted before, it seems unlikely that such a far-reaching, fundamental, cosmic change would *not* be mentioned in 2 Peter 3. Fourth and most seriously, if the subjection to futility indeed refers to the Second Law, then this passage indicates that the Second Law (existent in the original creation) was imposed *in hope*. Hope refers to the future, not to the present. (As verse 24 declares, "Hope that is seen is not hope.") An existing counter-law would not be hope but sight. Thus it seems that the mechanism for entropy reversal, while contained in the original creation (which was "very good"), would not have been operative until sometime in the future.

Hence, at this point we have (tentatively) deduced the following: in this passage it is God (not man) who subjected the creation to futility; this subjection (and thus the Second Law) was in place even before the Fall; God imposed this law in consideration of a future liberation; and the agency of this liberation was contained in the original creation but not yet operative.

On this side of the Fall, of course, we know what *shall* liberate creation, namely, the revealing of the sons of God in their glory (vv. 18–21), i.e., the glorification of believers. But perhaps we can also speculate further about what would have happened had man not fallen. We know that Christ is the Last Adam—glorified because of His obedience to death, with redeemed humanity to be glorified in Him (Hebrews 2:9–10; Revelation 3:21). Is it too far-fetched to conjecture that an obedient Adam would eventually have been glorified—and in him all humanity—to become agents of entropy-reversal throughout the Universe?

What if the provision for entropy-reversal *was* the human race? If this is the case, it would constitute an additional reason that God did not pronounce Creation "very good" until the final piece (mankind) was in place. The original hope of creation would still have been "the glory of the children of God." The Fall of man would have taken the temporary subjection to futility and turned it into a downright bondage to corruption, since Adam (the first human "son of God," Luke 3:38), had become subject to death as well: "You are dust, and to dust you shall return" (Genesis 3:19). It would also explain why 2 Peter 3 omits the Fall from its list of supraprovidential episodes, since no change in the laws of physics would have occurred; instead, the one who (with his descendants) was designed to be the renewer of nature would have disqualified himself from that role. It would also explain why, no matter how far into the distant Universe[13] we peer, we see no hint of entropy-reducing natural laws. Reversal of entropy is not to be found in the past but in the future. It is only now in these last days (Hebrews 1:2) that the Last Adam has appeared as a life-giving Spirit, whose image believers shall bear (1 Corinthians 15:45–49; 1 John 3:1–3).

Admittedly, the previous paragraphs contain much speculation; the author believes it to be well-grounded and plausible speculation, but it remains firmly in the realm of conjecture. What we *do* know from these verses is that redeemed humanity (in the Last Adam) will in some way be God's eschatological instrument for entropy reversal.[14] Additionally, we conclude against the existence of any lawlike entropy-reversal mechanism before the Fall, and thus we should not presume any such mechanism when building cosmological models.

Conclusion

What, then, may we conclude from these three passages? First, and most emphatically, this: if we consider only observable phenomena apart from Scripture, we will inevitably reach false conclusions about the origin of the Universe. Thus, in describing the week of Creation (whether verbally or mathematically), we must explicitly include supraprovidential activity while taking into full account the observed phenomena.

Several ancillary considerations now arise. On the one hand, we should not expect to find obvious "smoking guns" of God's creative action, because the same Word which describes creation also teaches that we grasp this truth not by observation but by faith.[15] Yet this presents a quandary: if observation is insufficient to constrain our understanding of Creation Week, how do we avoid losing ourselves in untrammeled speculation? Surely the solution lies in the fact that Biblical faith is always grounded in God's revelation, and thus we can presumably trust that Genesis provides enough

13 And thus, the author believes, back into Creation Week.

14 And this reversal will be permanent and/or continual: we have no reason to envision multiple "rewindings" of creation.

15 This fact should temper hopes of finding unambiguous indicators of cosmological youth. The Universe, one might say, is a "finished product," with no exposed plumbing or unfinished walls.

information for accurately understanding the observational data within a Biblical framework. It follows that, in modeling this supraprovidential activity we should beware of overstepping the clues provided in the opening chapters of Genesis.

Second, it is likely that Creation Week was the *only* supraprovidential episode affecting the entire cosmos. In particular, Scripture seems to give no warrant for extending the Flood episode beyond the near-Earth regions of space,[16] nor does it seem to give us grounds to postulate cosmic changes in the laws of physics at the Fall. In particular, it is virtually certain that the Second Law of Thermodynamics was in place during Creation Week, and it is likely that there was no "counter-Second Law" revoked at the Fall. From the beginning, entropy-reversal was a *future* hope, not an ongoing process. Whatever might have happened in an alternate unfallen history, Scripture teaches that in the actual world it is the redeemed and glorified children of God who, in Christ, will one day release creation from its bondage to corruption.

In any case, through our observations God has revealed a variety of cosmological data, and these data demand integration into a Biblical framework. The passages above provide confidence that He has also revealed, in His Word, the additional data necessary for an accurate (though not exhaustive) understanding of origins—including the origins of these observed phenomena. The challenge is to slight neither Scriptural nor observational data. Unfortunately, our error-prone finitude, exacerbated by the noetic effects of sin, yields many opportunities to err in either direction. Nevertheless, since our Lord has revealed both types of data, it is our responsibility to proceed in the attempt—humbly recognizing our limitations, yet confidently trusting that in time He will glorify Himself by leading us to an increasingly accurate understanding of these matters.

16 Cosmologically speaking, the Solar System would certainly be near-Earth.

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Trinitarian Design in Nature: Step One in Creationeering®

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Abstract

A multiscale hierarchical structural analysis of the universe employing an Integrated Computational Materials Engineering (ICME) methodology reveals that a trinitarian design occurs in nature that is premised upon Romans 1:20 wherein God revealed His nature in the things that He created. The first step in the creationeering® process includes systems engineering design that downscales to the lowest-length scales. We show that the universe can be viewed into multiple length scales of distinctive design volumes in which certain designed volumes illustrate a trinity. In particular, the lowest-length scales defined in nature as subatomic or atomic particles reflect the divine "substance" that makes the Godhead one and the higher-length scale, geometric forms differentiate the *hylomorphic structures* between the Father, Son, and the Holy Spirit in the Trinity. Since God is a trinity, we would expect that He would have revealed it in nature based on 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. We validate this premise of God being a trinity and that He demonstrated this idea in nature as 57 different trinities are quantified.

Key Words: Constraints, Design, Creationeering®, Integrated Computational Materials Engineering (ICME), Objectives, Trinity, Variables

Introduction: Creationeering®

Creationeering® (Horstemeyer et al., 2022) is a paradigm that integrates engineering and business practice for technological entrepreneurship that derives from the Dominion Mandate in Genesis 1:26–28, in which the Creator commanded mankind to "rule" and "reign." Creationeering® distinguishes itself from creation science in that the former includes the design and creation process while the latter is limited to discovery of existing physical phenomena. Because the design and the creation stages are different from each other by definition and practice, a more holistic word to describe God's process that comprises both design and creation is creationeering®. The engineering systems steps include the

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following: design, analysis/synthesis, procurement/making, logistics, assembly, performance/function, sustainability, and death/recycling.

In the creationeering® process, one thinks that the engineer will focus on optimizing the design by maximizing the mathematical equations that includes the objectives for the performance environment. The design phase of some thing or process takes time for analysis of the design and is distinctly different from the "making" of the thing or process. We use the term Creationeer® as distinct from Designer and Maker, because the "designer" just designs and the "maker" just makes things. However, the Creationeer® does both the designing and making of things and processes. Albeit, some might argue that when the term "Creator" was first used, it was meant to be both designer and creator, but technically in engineering, these are two distinct actions and require two different jobs and associated people.

In terms of the design and analysis of the different steps in the creationeering® process (procurement, logistics, assembly, life-cycle performance, sustainability, and death/recycling), the creation science community has focused mainly on the life-cycle performance or function of the particular designed volume. Since the Creationeer® procured the materials, applied logistics, and assembled all of the entities during the Creation Week, one can understand why the community has focused on the life-cycle performance or the function of the particular system, subsystem, module, or component. However, the universe is not static and thus the procurement, logistics, assembly as well as the life-cycle performance, sustainability, and death/recycling are currently dynamic processes and are still in motion and are changing. As such, the Creationeer® not only designed and established the first version of each of the systems, subsystems, modules, and components but also designed the future versions of each entity with their dynamic, correlated creationeering® steps.

We focus particularly on design in this paper, not the creation aspects. This is key to understand, because when we read about the Creation Week in the Bible, it shows the creation schedule and interactions, not the design timing nor design interactions.

Romans 1:20 specifies the goal of research and discovering things in God's creation to find out more about the Creationeer®. Hence, the knowledge garnered by research and discovery reveals some aspects of the Creationeer's nature, character, and attributes.

> 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 indicates that information is revealed to mankind for a creative purpose to invent "things" for human service.

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

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 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."

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. For example, Behe (1996; 2002) and Behe et al. (2009) described "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 entire 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, and the wholeness of systems engineering (Blanchard et al., 1990).

We now make a note the multiscale hierarchical systems design that incorporated the trinitarian aspects. First, the Trinity of the Godhead as will be discussed next has each person of the Godhead as distinctly different but still God in essence (Erickson, 1998) as illustrated in Figure 1. We note

that the difference between the Father, *Son*, and Holy Spirit as three persons are related to geometric forms and spatial locations with different agency and *expression*. As such, the larger-length scales discussed below can be thought of different geometric forms and at different spatial locations. The oneness of the Trinity is defined not only in purpose, but also in essence, where essence in our context can be the atomic structure, since atoms make up everything in the universe and the protons, neutrons, and electrons are all identically the same, making them the same essence. More on this later.

From the multiscale viewpoint, we will show in nature that there are exact corollaries to this trinity, and some much less than that but still incorporating the "three" that comprise the "one." We also note that by categorizing different length scales per the Integrated Computational Materials Engineering (ICME) paradigm (Horstemeyer 2012; 2018) in terms of their "performance" or function, *objectives are related to particular geometric structures that define the length scale. For example, a car would represent a "system" but one length scale smaller would be the "subsystem" like the chassis for example. Further down in size or length scales would be an engine cradle, which would represent a "component." We also note that we present the information in terms of downscaling, like going from the car to the chassis to the engine cradle.* In this writing, we associate the trinities with 13 different length *(size)* scales. To be sure, there are more length scales and probably more trinities that the authors missed. Each length scale appears to illustrate nature's trinities. As stated, the trinities *described* in this paper may not be comprehensive as others might be able to discern others in nature. However, this writing is still the first effort to quantify the trinities in nature in the context of the systems engineering ICME analysis methodology and creationeering® process.

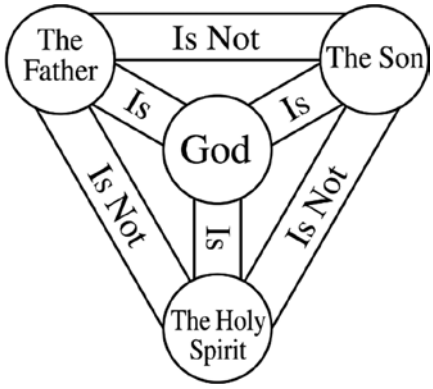

Figure 1. The Trinity within the Godhead illustrating that the Father, Son, and the Holy Spirit are individually God with the same essence, but They are not each other, and are distinct aspects of the Godhead.

Trinity Within the Godhead

The trinity in the Godhead is illustrated in Figure 1, which shows that the Father, *Son*, and the Holy Spirit are individually God as the same essence but are not each other as distinct aspects of the Godhead. **A** distinguishing aspect of Christianity from other religions (Judaism, Islam, Hinduism, etc.) is the notion of the divine Trinity. Early church history tried to communicate the essence of the Trinity. Although not using the word trinity, the concepts were explained by Justin Martyr (100–165 A.D.) (Martyr et al., 2003) and Irenaus (180 A.D.), who was a disciple of Polycarp, who was a disciple of the Apostle John. Tertullian (155–220 A.D.), a lawyer and priest from Carthage, North Africa, living in the Roman Empire described the Godhead as the Father, Son (Jesus), and Holy Spirit (Momigliano, 1971) and was the first to use the term "trinity" (Fortman, 1999) with the sameness represented by "substance." For more clarification, the Nicaean creed was defined in Nicaea, Turkey (325 A.D.) and later modified in Constantinople, Turkey (381 A.D.) (von Hefele, 1894). Athanasius (350 A.D.) provided the modern orthodox view of the Trinity (Erikson, 1998). Augustine (415 A.D.) of Hippo Regius in Numidia, Roman North Africa compared the Godhead to the human mind with three parts: memory, understanding, and will (Sanlon, 2014). Cappadocian theologians argued that there are three persons (Father, Son, and Holy Spirit) but they are indistinguishable and inseparable in their "essence" or "substance" or "being" (Erikson, 1998), which was based specifically on the image of God. Another aspect is that each component of the trinitarian Godhead could also be named God, so the triuneness can be represented as the whole by each component. Erickson (2002) stated that the nature of God is an organism, meaning a unity of essence with distinct parts.

The Biblical basis for the Godhead Trinity is clear from several verses.

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

The word for God is "Elohim," and the subject-verb conjugation is singular in the Hebrew language, but there is something peculiar about the word Elohim. In the Hebrew language, the singular word for God is "El" and like anything in the Hebrew language, when the "ah" suffix is added, it is not singular but means two. Hence, "Ellah" can mean two-gods or two aspects to God. However, when the suffix "im" is used in the Hebrew language, it means three or more. Several rabbis that we have asked about this conundrum was answered by the notion that God has many aspects or attributes so the "im" suffix means that many characteristics and names for God are represented in the name Elohim. However, a different interpretation can mean "trinity" or "three-in-one God."

> Genesis 1:26 (KJV)—let us make man in our image…

In Genesis 1:26, God is speaking and saying to make man in His image as a trinity. In other words, the Godhead is a trinity and thus each person needs to be a trinity since it is after His image. Consistent with Genesis 1:26 is the following.

> Genesis 2:7 (KJV)—and God breathed into man and man became a living soul

The body of man was first assembled (Step 5 in the creationeering® process) out of the dust of the ground but required an immaterial entity to make it "alive" as a soul per Genesis 2:7. Also note that "breath" is what made the man to "live." Hence, the spirit part of man was also created here. The logistic step in the creationeering process showed that the dirt was procured and the body was assembled first and then the spirit and soul were added at the same time as God breathed into the body. It is the spirit part of mankind that gives him life. As such, we have a trinity represented as man in Genesis 2:7, which is a body, soul, and spirit. Thus, Genesis 2:7 complements Genesis 1:26 where both God and man are clearly only one unit in the image of each other as trinities. Another New Testament verse that describes the trinity is the following:

> Romans 5:1 (KJV)—Therefore being justified by faith, we have peace with God through our Lord Jesus Christ

Here, the phrase "Lord Jesus Christ" represents the trinitarian Godhead. The word for "Lord" represents the Father; the word "Jesus" obviously represents the human manifestation of God; and the word "Christ," which means anointed one is demonstrative of the Holy Spirit.

Next, we show how the Father, Jesus, and Holy Spirit are each separately referred to as God in the *Bible*. We just illustrate the points by an Old Testament and New Testament verse. However, there are many more references that we did not include. We encourage the reader to conduct a more thorough review in order to remove any doubt, if the reader has a doubt.

Father Is God

The Father part of the Godhead is revealed in both the Old and New Testaments. The reader can think that the Old Testament is the New Testament concealed, but the New Testament is the Old Testament revealed. In the Old Testament one example is the following:

> Deuteronomy 6:4 (KJV)—Hear, O Israel: The Lord our God is one Lord.

Interestingly, the word "Lord" is Yahweh in both places and "God" is Elohim. In other words, it can be translated that "Yahweh our Trinity (Elohim), Yahweh is One."

> 1 Corinthians 8:6 (KJV)—But to us there is but one God, the Father, of whom are all things, and we in Him; and one Lord Jesus Christ, by Whom are all things, and we by Him

This verse can be translated that One God (Theos), the Father (Pater)… and the One Lord (Kyrios, which was translated in the Old Testament as Yahweh) Jesus (the human manifestation of God) Christ (Christos or Anointed One pertains to the Holy Spirit). Hence, the Father part of the Godhead is clearly used as God in this New Testament verse.

Jesus is God

Now that we have shown in the scriptures that the Father is God, we need to show that Jesus is God. The following verse is a statement from arguably his closest disciple John, which clearly delineates Jesus as God.

> John 1:1–3,14 (KJV)—In the beginning was the Word, and the Word was with God, and the Word was God. The same was in the beginning with God. All things were made by him; and without him was not anything made that was made….. And the Word was made flesh, and dwelt among us, (and we beheld his glory, the glory as of the only begotten of the Father,) full of grace and truth.

Here, the disciple John designates Jesus as God from several perspectives: (1) Jesus is referred to as the Word of God as if in Genesis when the Father spoke that Jesus obeyed his words to accomplish His task, (2) John equivocates the synonym for "word" meaning Jesus be equal to the Father, (3) Everything was creationeered® in conjunction with Jesus being there at the beginning with the Father, thus validating the Trinity described by Elohim in Genesis 1:1; and (4) John says that the part of the trinitarian Godhead that came into the space-time-matter continuum was Jesus.

Another verse in which Jesus is made synonymous with God is the following:

> Philippians 2:10–11 (KJV)—that at the name of Jesus every knee should bow, of things in heaven, and things in earth, and things under the earth; And that every tongue should confess that Jesus Christ is Lord, to the glory of God the Father.

The Apostle Paul writing Philippians refers to Jesus as God several times here: (1) everything in the cosmos will bow its knee to Jesus showing submission to the greatest authority, which equals God, and (2) all living things shall verbally state that "Jesus is Lord" referring to the ultimate reality of a "Lord" being the authority over everything.

One final verse in which the disciple John referred to Jesus as God is the following:

> John 8:58 (KJV)—Before Abraham was, I am.

Here, the disciple John quotes Jesus' declaration, where Jesus Himself is stating that He Himself is God. Jesus

knew that the Jews in His audience knew that Abraham was the "father" of the Jews, but He was meaning several things: (1) Jesus existed before Abraham in time, so He (Jesus) was more important than Abraham and was indeed God, (2) Jesus referred to the "I am" of the burning bush in Moses' time, saying that He was God who delivered the Israelites out of Egypt. The Jews listening to Jesus were immediately offended because they understand the Abraham and Moses references, and this statement was one claim that led the Jews before Herod to have him crucify Jesus since He claimed to be God.

Finally, the following verse in Colossians is self-evident.

> Colossians 2:9 (KJV) For in him (Jesus) dwelleth all the fulness of the Godhead bodily.

Holy Spirit Is God

The third Person of the Trinity is often not discussed as God. In some sense, if Christians either ignore or dismiss the Holy Spirit, they are in essence believing and living like a deist. Yet, there are clear scriptures that the Holy Spirit is God just as is the Father and Jesus. The disciple Luke wrote in Acts that the Holy Spirit was equal to God in the following verses:

> Acts 5:3–4 (KJV)—But Peter said, Ananias, why hath Satan filled thine heart to lie to the Holy Spirit, and to keep back part of the price of the land? Whiles it remained, was it not thine own? and after it was sold, was it not in thine own power? why hast thou conceived this thing in thine heart? thou hast not lied unto men, but unto God.

Here, Peter said to Ananias that he lied to the Holy Spirit who is God.

King David wrote about the omnipresence of the Godhead coming from the Holy Spirit:

> Psalm 139:7–8 (KJV)—Where can I go from your Spirit? Where can I flee from your presence? If I go up to the heavens, you are there; if I make my bed in the depths, you are there.

Only God is omnipresent; hence, the Holy Spirit is God.

Reconciling the Godhead Oneness in Unity

How can each part of the Godhead be different and be the same? The thesis of this paper is that it depends on the length scale of the discussion. For example, when Jesus was baptized in human form, the Father spoke, and the Holy Spirit came down like as a dove. These three dissimilar and distinct expressions of the Godhead were represented by the macroscale levels of geometric agency. However, the oneness or unity of the Godhead occurred not only by the agreement of the communication and actions of the separate words of the Father, the action of Jesus' baptism, and the Holy Spirit's motion like as a dove, but also in the spiritual dimension of the "essence," or "substance," or "being" (Erickson, 1998) of each at a lower length scale being the most fundamental dimension that spans cosmic space-time-matter and also in the third heaven (the domain outside of the space-time-matter cosmos—2 Corinthians 12:2). The examples in nature give credence to the differences at one length scale but the sameness at a different lower-length scale that is more fundamental. Before we proceed forward with nature's examples of a trinity, let us discuss the Biblical passages that describe the differences between the Father, Jesus, and the Holy Spirit.

God the Father, God the Son, and God the Holy Spirit Are Different Agencies of the Godhead

Now that we have established that the Father, Jesus, and Holy Spirit have been identified each distinctly as God, we now share some scriptures to show that they are distinct agencies with different roles within the Godhead from each other as illustrated in Figure 1. Within the trinity the difference is that the Father, Jesus, and Holy Spirit are together at the same essence at the same time, but not necessarily in the same space. One good example is when Jesus was baptized, where the voice of the Father spoke and the Holy Spirit descended upon Jesus like a dove. Although the Godhead is the trinity of the Father, Son, and Holy Spirit, each is distinctly taking up different space within the Matthew 3:16–17 verses.

> Matthew 3:16–17 (NKJV)—When He had been baptized, Jesus came up immediately from the water; and behold, the heavens were opened to Him, and He saw the Spirit of God descending like a dove and alighting upon Him. And suddenly a voice *came* from heaven, saying, "This is My beloved Son, in whom I am well pleased."

The examples in the following sections sometimes do not align exactly as the Godhead Trinity, but are very close, while other examples are exact representations of the trinitarian Godhead. For example, we will mention a trinitarian process instead of an "entity" in which the different processes occur at a different time but are in the same space. A specific example is when God formed the structure of the universe and Earth in Days 1–3 of the Creation Week.

In contrast to the trinitarian nature of the Godhead, modalism has been an issue in some denominations which states that God the Father, Jesus the Son, and the Holy Spirit are all one at the same time, and have no distinctions between each other at any time. Sometimes it has been called the "Jesus Only" doctrine. The Athanisian Creed (Athanasius, 350 A.D.) states that we are not to "confound" Jesus and Father or vice versa, but modalism confounds

them as one time and space. Hence, modalism does not have any distinct differences between the Father, Jesus, and the Holy Spirit.

Jesus Is Not the Father

The following *Bible* verses, though not comprehensive as more than these can be shown, illustrate the distinctness, roles, and agencies of the Father and Son part of the Godhead.

> Mark 14:36 (ESV) And he (Jesus) said, "Abba, Father, all things are possible for you. Remove this cup from me. Yet not what I will, but what you will."

Here, Jesus is in the Garden of Gethsemane just before He dies and He uses two terms for the Father part of the Godhead: (1) Abba, which is the Aramaic term for father, and (2) Pater, which is the Greek term for father. In maybe Jesus' trial and torment, He expresses the Father's name in two different languages, Aramaic and Greek, the language of the people. The distinction between the Father and Son are clear in Their roles. Jesus' makes the comments of the possibility of His will being different than the Father's will, which makes clear the distinction in Their agency.

Jesus Is Not the Holy Spirit

Jesus in His final lengthy discussion with the disciples makes a clear distinction of the roles and agency of His own work versus the work of the Holy Spirit.

> John 14:16–17 (ESV) And I will ask the Father, and he will give you another Helper, to be with you forever, even the Spirit of truth, whom the world cannot receive, because it neither sees him nor knows him. You know him, for he dwells with you and will be in you.
>
> John 14:25–28 (ESV) These things I have spoken to you while I am still with you. But the Helper, the Holy Spirit, whom the Father will send in my name, he will teach you all things and bring to your remembrance all that I have said to you. Peace I leave with you; my peace I give to you. Not as the world gives do I give to you. Let not your hearts be troubled, neither let them be afraid. You heard me say to you, 'I am going away, and I will come to you.' If you loved me, you would have rejoiced, because I am going to the Father, for the Father is greater than I.
>
> John 15:26 (KJV) But when the Helper comes, whom (Jesus) will send to you from the Father, the Spirit of truth, who proceeds from the Father, he will bear witness about me.

Here, Jesus had to personally leave the Earth so that the Holy Spirit could come and indwell the followers of Jesus. Hence, the roles are very different. The Son part of the Godhead, Who was perfect and without sin, had to die and take the place of a human in God's court of law to legally take the place of every human because of man's sin. However, the Son part of the Godhead could not indwell another human. It had to be the Spirit part of the Godhead, which also was the legal earnest entity that guarantees for humans the everlasting relationship with the Godhead in heaven.

> Ephesians 1:11–14 (ESV) In him (Jesus) we have obtained an inheritance, having been predestined according to the purpose of him who works all things according to the counsel of his will, so that we who were the first to hope in Christ might be to the praise of his glory. In him you also, when you heard the word of truth, the gospel of your salvation, and believed in him, were sealed with the promised Holy Spirit, who is the guarantee of our inheritance until we acquire possession of it, to the praise of his glory.

The Holy Spirit Is Not the Father

Jesus in his final lengthy discussion with the disciples makes a clear distinction of the roles and agency of the Father part of the Godhead versus the Holy Spirit.

> John 16:13–15 (ESV) When the Spirit of truth comes, he will guide you into all the truth, for he will not speak on his own authority, but whatever he hears he will speak, and he will declare to you the things that are to come. He will glorify me, for he will take what is mine and declare it to you. All that the Father has is mine; therefore I said that he will take what is mine and declare it to you.

The clear distinction in these verses describe the line of authority that goes from the Father to the Son and then to the Holy Spirit. Also, the line of glorification goes from the Holy Spirit to Jesus to the Father part of the Godhead.

Creationeering® Design in the Integrated Computational Materials Engineering (ICME) Paradigm

Now that we know the essence of the Godhead is a tri-part being and given that He wants to reveal His character, nature, and attributes per Romans 1:20, we now pursue the examples that He has left us in nature related to His trinitarian design. A clear engineering process is given in Genesis 1 during the Creation Week as God employed a process to create the structures in terms of a trinity, resulting in the trinitarian nature of the substances that filled the voids. As will be discussed, Genesis 1:1 states that God created the basic elements of the universe in terms of time, space, and matter. Genesis 1:2 then documents the unfinished, created state of the time-space-matter continuum and lays out an outline for

Table I. Trinities expressed in the two three-day sets of activities during the Creation Week.

Structure		Substance	
Day 1 (Genesis 1:1–5)	Separation of Light/Dark	Day 4 (Genesis 1:14–19)	Light Givers
Day 2 (Genesis 1:6–8)	Separation of Waters Above/Below	Day 5 (Genesis 1:20–23)	Animals of Water and Sky
Day 3 (Genesis 1:9)	Separation of Land/Waters	Day 6 (Genesis 1:24–29)	Land Animals and Mankind

the trinities that will be exposed in the rest of the Creation Week.

> Genesis 1:2 (NIV)—Now the earth was formless and empty, darkness was over the surface of the deep, and the Spirit of God was hovering over the waters.

Basically, the Earth or the matter did not have form or structure at different length scales and even if structures were in place, the space was empty and had nothing in it. What happens next is illustrative of the Creationeer® developing a process to create the trinitarian structures in the first three days following that with filling the empty space with trinitarian things in corroboration with each day of creation. Tables I and II summarizes the processes related to the first three days of trinitarian structure where God distinctly separated the three main structures (light/dark, waters above/below, and land/water) in their associated creation day along with the *Bible* verses. Table I also shows how Days 4–6 aligned with Days 1–3 in terms of filling the empty spaces that now had structure. Day 4 is related to Day 1 in that God made the light providers. Day 5 is related to Day 2 in that God made the animals of the water and sky. Why did God make the structures to give form in three days and why did God make all of the substances in three other days? We assert that he wanted to show his trinitarian nature and the creationeering® process.

As explained in Horstemeyer (2012, 2018) and Horstemeyer et al. (2022), the ICME multiscale engineering process progresses from the top and goes down in creationeering®. Hence, the engineering goals and requirements are defined at the largest system level first by the objectives, constraints, and variables at that level. Once the largest-length scale is designed in terms of its materials, processing method, and function, then these are pushed down to the next-length scale as constraints. And so on. *This is called "downscaling."*

God's Systematic Creationeering® of Multiscale Design Volumes with the Trinitarian Design Constraint

Figure 2 schematically illustrates the Creationeer's *downscaling* perspective in terms of the universe being a multisize scale, multi-objective, interactive, complex system including trinitarian concepts throughout the cosmos revealing His nature as per Romans 1:20. *We discuss the trinities starting at the largest-length scales and then proceed down to the smallest-length scales.* We also note that Figure 2 is not comprehensive of all of the trinities discussed in Tables II-7, but it illustrates the point related to different revealed trinities in nature. Note also that there are 57 trinities either expressed directly in the *Bible* or indirectly in nature as counted in Tables II-7. Finally, the lowest length scales represented by Leptons, subatomic particles, protons, neutrons, electrons, and atoms can be found in anything in nature and thus represent the "sameness" of the basic "essence" that is spoken of in the sameness of essence like that of the Trinity.

Fundamentals of Creationeering® Everything in the Cosmos

In the context of the engineering goals, The Creationeer® defined the objectives, constraints, and variables with a focus on a life-thriving environment for the "created love beings." Love can be argued to be the overarching objective *that was to be maximized* based on Jesus' statement about the most important thing in Matthew 22:37. However, there are really two objectives to maximize in His statement: (1) love God, and (2) love people.

> Matthew 22:37 (NKJV)—you shall love the Lord your God with all of your soul, all of your might, and all of your strength and love your neighbor as yourself.

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 within 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. Hence, from *an engineering* design perspective then, God was trying to maximize the love between the "Creator Love Being" and the

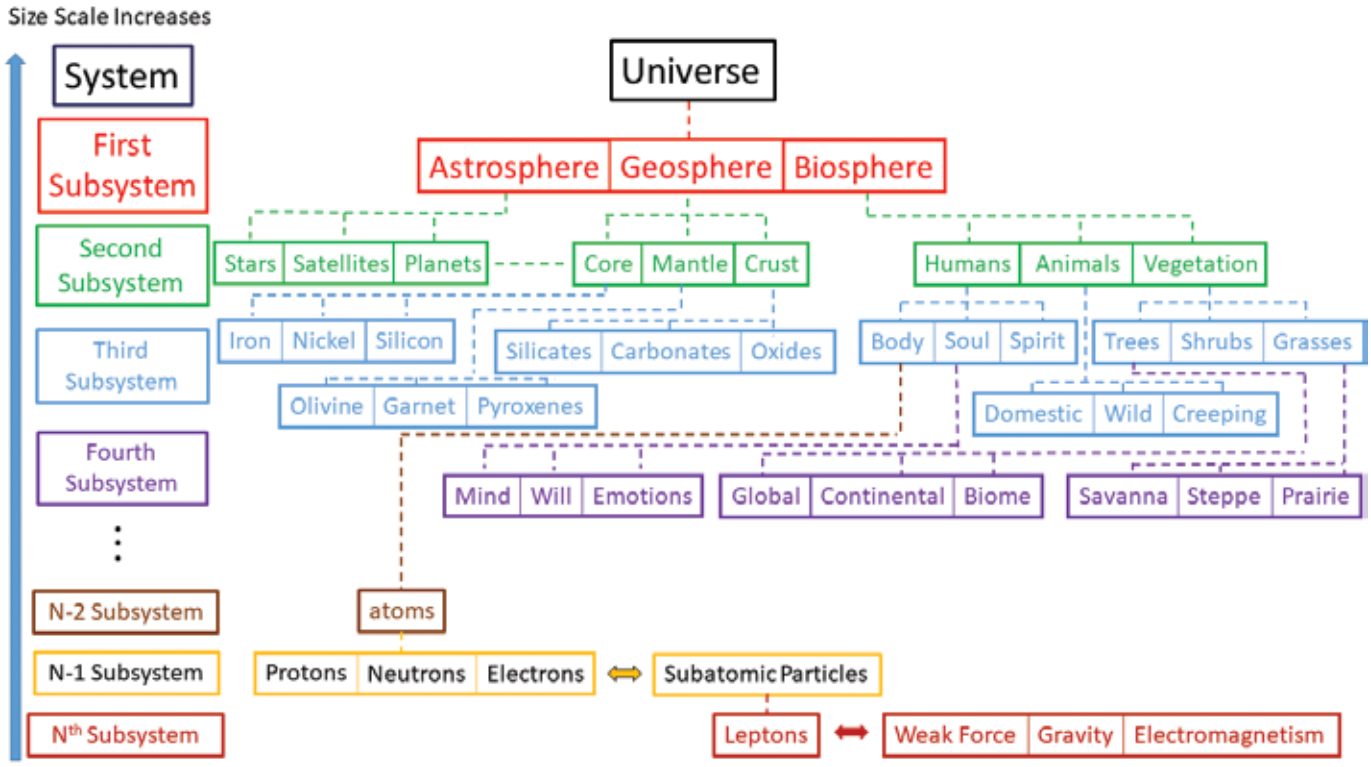

Figure 2. The Creationeer's perspective is that the Universe is a multi-size scale, multi-objective, interactive, complex system including the astrosphere, geosphere, and biosphere. Creationeering® Step 1 is the systems design phase related to each size scale.

"Created Love Beings" and the interplay between "Created Love Beings" with the constraints of the laws in the space-time-matter universe. However, it is *the design* variables in which some the trinities *were expressed* as will be discussed. In other words, God chose in the *design variable* space different reflections of Himself at many different length scales (see Figure 2) in order to communicate with different created love beings who would think and *study the* universe within their domains of learning.

Table II summarizes the three fundamental processes that God used in creationeering® everything in the universe. First, in the ICME context, one must consider the materials of choice and the method to process the associated materials based on

Table II. Three trinities in the Bible related to creationeering® fundamental processes related to the design and making of everything in the universe.

Overall Number	Trinitarian Name	Component 1	Component 2	Component 3
1	Creationeering®	Materials	Processing Method	Function
2	Formed Structure	Separate Light/Dark	Separate Water/Sky	Separate Land/Water
3	Filled the Void with Substance	Created Light Providers	Created Animals of Water and Sky	Created Land Animals and Mankind

Table III. Twelve trinities related to the creationeered® fundamental aspects of the physical universe.

Overall Number	Trinitarian Name	Component 1	Component 2	Component 3
4	Universe	Space	Time	Matter
5	Time	Past	Present	Future
6	Space	One Dimension	Two Dimensions	Three Dimensions
7	Matter	Solid	Liquid	Gas
8	Kinematic Motion	Displacement	Velocity	Acceleration
9	Continuum Point	Mass	Momentum	Energy
10	Light	Red	Yellow	Blue
11	Fire	Fuel	Oxygen	Heat
12	Heat	Radiation	Conduction	Convection
13	Corrosion	Anode	Cathode	Electrically Conductive Medium
14	Life	Water	Spirit	Blood
15	Universe	Astrosphere	Geosphere	Biosphere

the ultimate function or functions of design and structure. The two other processes summarized in Table II are those related to designing and making the structures and then filling the voids with substance associated with those structures. Genesis 1:2 states that after God made the space-time-*matter* continuum that there was no structure nor substance to it, so He sets the stage of the days of the Creation Week as shown in Table I.

> Genesis 1:2 (NKJV)—The earth was without form (no structure) and void (no substance)…

Table III summarizes nine fundamental aspects of the physical universe. Romans 1:20 states that God designed after His own image and nature, and Genesis 1:1 validates this point as He (as a Trinity) created the trinity of the space-time-matter continuum universe (Morris, 1979). *Although some theologians would disagree, one* can think of Genesis 1:1 *as* where He first created time, space, and matter. The phrase "In the beginning" comes from one Hebrew word "*bereshith*," which means "time" as in temporal time. The Hebrew word "*shemayim*" translated "heavens" relates to "space" based on the root "*mayim*." And the Hebrew "*erets*" translated "earth" relates to "matter." Thus, the very first verse of the *Bible* can be translated "a tri-une God created the space-time-matter universe. In our universe, we cannot have matter without time and space. We cannot have space without matter and time. And we cannot have time without matter and space. Space, time, and matter are different from each other like the Father, *Son*, and the Holy Spirit, but we cannot have one without the other two. Just as space-time-matter can express the universe, so the Father, *the Son*, and the Holy Spirit express the Godhead.

Morris (1979) also explained that "time" is a trinity. All time will have been future; all time will have been past; and all time will have been present. The future is like the Father, since we cannot see him; the past is like Jesus, since we saw him: and the present is like the Holy Spirit, since we experience Him now. The past, present, and future time are all different, but their essence is time just like the Father, Jesus, and the Holy Spirit are different but the essence of each is God.

Space is a trinity as well. In one dimensional space, we know that something exists although we cannot see it, like the Father. In two dimensional space, we see something like a picture on a wall and that represents Jesus, since we have seen him. In three dimensional space, we experience things, like the Holy Spirit. One, two, and three dimensional space are all different but their essence is space. Similarly, the Father, Jesus, and the Holy Spirit are different but in essence each is God.

Matter is also a trinity. Depending on the temperature, pressure, and volume, the universe has expressed three types of matter: solid, liquid, and gas. A gas is like the Father, because we cannot see it. A solid is like Jesus, because we can handle it. A liquid is

like the Holy Spirit, because they both flow. A solid, liquid, and gas can all exist at the same time, called a triple point. One can see this example of cyclohexane (cyclohexane, 2022). Just as the essence of a solid, a liquid, and a gas of the same element is made of the same atoms, so the Father, Jesus, and the Holy Spirit are made of the same God substance or essence at the same time.

The next fundamental trinity mentioned in Table III is that of kinematic motion. Motion comprises three parts (displacement, velocity, and acceleration) of which they have the same essence but are different and yet each can be called kinematic motion. Displacement is the measurement of motion in terms of length. Velocity is the measurement of motion in terms of length per time and is the mathematical time derivative of displacement. Acceleration is the measurement of length per time square and is the mathematical time derivative of velocity. (And some people do not know the purpose of calculus!) This trinity is a trinity of the truest sense, since it represents identically the Godhead trinity all at the same time.

Associated with motion is the notion of a continuum point or element in which conservation laws are appropriated that define a continuum point: mass, momentum, and energy (see Table III, Number 9). In a particular volume, defined as a continuum point, one must have equilibrium, balance, and stability, which are defined by three laws of science that are intimately tied together. The three laws of conservation of mass, momentum, and energy have associated mathematical equations that distinguish themselves from each other but are also tied together as one in a continuum point in which the parameters that make up each of the three laws are intertwined: density, volume, temperature, pressure, and velocity.

Another fundamental trinity shown in Table III is light, which comprises all colors of which there are only three basic, independent colors from which all others derive: red, yellow, and blue. Each color is a wave defined by frequency, amplitude, and shape, but each also is different in that each color has different frequencies (and hence different periodicities) when all combined make white light. Red has a frequency of 400–480 x 10e12 Hz; Yellow has a frequency of 510–530 x 10e12 Hz; And blue has a frequency of 620–670 x 10e12 Hz. Light is the visible part of the electromagnetic spectrum, which has a frequency range much greater than the visible light range: 3 Hz to 10e18 Hz. We note in terms of the trinity that red is light, yellow is light, and blue is light. Also, they are distinct from each other but have the same essence since they are waves with frequency, amplitude, and form.

Table III presents another trinity of fire, which exists when fuel, oxygen, and heat simultaneously exist. Essentially, a combustible material like paper or wood exhibits rapid oxidation upon a heat source that ignites into the fire. The flame is the visible portion of the fire.

Regarding how heat transfers there are three modes that operate at the same time: radiation, conduction, and convection. Similar to a continuum point in continuum mechanics, there are three distinguished modes that have associated mathematical equations. Radiation transfers heat by means of temperature to the fourth power. Convection transfers heat by means of temperature to the second power. And conduction transfers heat by means of temperature to the first power. Although the temperature is the key observable parameter, its mathematical expression is different in terms of the power-law level.

Table III, Number 13, is corrosion which is essentially the deterioration of a material by an electrochemical reaction in which a metal (or polymer) converts to a more chemically stable oxide. Corrosion finds its identity in three interacting components: anode, cathode, and an electrically conducting medium. Metals typically have the most electrochemical potentials although some polymers experience the same behavior. In an electrochemical reaction, an anode is a positively charged electrode by which the electrons leave a source and thus become oxidized. An electrode that is negatively charged is the cathode in the subsystem. To have an electron move from the anode to the cathode, a medium between them is required. Each component has their distinct role and yet demand each other without each other's existence for corrosion to be present.

Life is also a basic fundamental entity in the cosmos since it is demanded by the design and making of the created love beings. Life has three components that are actually mentioned in the *Bible*: water, spirit, and blood.

> 1 John 5:7–8 (NKJV)—For there are three that testify: the spirit, the water, and the blood; and the three are in agreement.

Clearly, water is the basic entity that is searched for when life is examined on other planets and nothing living can live without water. The word for spirit (Greek *pneuma*) basically means breath and clearly a created love being needs to breathe to live. Also, blood is required for the created love being to live.

> Leviticus 17:14 (NKJV)—For *it is* the life of all flesh. Its blood sustains its life.

When we compare water, breath, and blood, we note that the only commonality is oxygen. In other words, oxygen is the only common denominator of the three entities mentioned for life. As such, we can conclude that *life is the oxygen in the water, breath (air), and*

Table IV. Six trinities related to the Astrosphere in the creationeered® design of the universe.

Overall Number	Length Scale	Trinitarian Name	Component 1	Component 2	Component 3
16	1st Subsystem	Heavens *(Shemayim)*	Sky	Outer Space	God's Throne
17	2nd Subsystem	Galaxy	Gas	Dust	Stars
18	3rd Subsystem	Solar System Light Providers	Stars	Satellites	Planets
19	4th Subsystem	Stars	Hydrogen	Helium	All other elements
20	4th Subsystem	Atmosphere	Nitrogen	Oxygen	Argon
21	5th Subsystem	Cloud	Dust	Water	Free Air

blood. Hence, the trinity of life is such that water, breath (air), and blood are distinct from each other but, in fact, have the same essence of oxygen.

As an aside from the natural aspects of life being associated with water, breath, and blood, spiritual life is also associated with these three entities. Jesus' life is associated with water baptism, breath of life, and His blood at His death for the remission of sins.

> Matthew 3:16 (NKJV)—When He had been baptized, Jesus came up immediately from the water
>
> John 20:22 (NKJV)—And when He had said this, He breathed on *them,* and said to them, "Receive the Holy Spirit."
>
> 1 John 1:9 (NKJV)—…blood of Jesus Christ His Son cleanses us from all sin.

Interestingly, the Holy Spirit, who brings the life of God to a created love being, has been represented by water, breath (wind), and blood as well.

> John 7:38 (NKJV)—He who believes in Me, as the Scripture has said, out of his heart will flow rivers of living water.
>
> John 3:8 (NKJV)—The wind blows where it wishes, and you hear the sound of it, but cannot tell where it comes from and where it goes. So is everyone who is born of the Spirit.
>
> Hebrews 9:14 (NKJV)—how much more shall the blood of Christ, who through the eternal Spirit offered Himself without spot to God, cleanse your conscience from dead works to serve the living God?

The final topic mentioned in Table III is that of the universe which comprises the astrosphere, geosphere, and biosphere. Each of the three distinct components are made up of atoms as well as the universe as a whole unit. Yet, each of the three components are distinct in purpose and as such were designed with different objectives, constraints, and variables by The Creationeer®. Figure 2 shows that the universe is made up of a trinity with its first subsystem, which includes the trinitarian design of the astrosphere, geosphere, and biosphere. Just as the Father is not the Son, and the Son is the not the Spirit, and the Spirit is not the Father, so the astrosphere is not the geosphere, the geosphere is not the biosphere, and the biosphere is not the astrosphere. However, as the Father, *the Son*, and the Spirit make up God as one, so the astrosphere, geosphere, and biosphere are made of atoms and make up the universe as one unit or system.

Multiscale Trinitarian Design of the Astrosphere

The astrosphere was creationeered® over several days during the Creation Week. Day 1 included the basic materials and energy for all of the cosmos, Day 2 included the heavens that were creationeered® by separation of the waters beneath from the waters above, and Day 4 included the Sun, Moon, and stars. Table IV summarizes six different trinitarian design entities found at different length scale within the astrosphere.

The astrosphere is a subset of the trinity "heaven" described in the Bible. Morris (1979) explained the trinity found in the word "heaven," which comes from the Hebrew word "*shemayim*." Recall that the "*im*" suffix in the Hebrew language means three or more. Although the English translations used the word "heaven" instead of "heavens." Could this mean that heaven is a trinity similar to the word "*Elohim*" for God? Let us examine this further. The first heaven is where the birds fly in the atmosphere of the Earth's geosphere (Genesis 1:20–23). The second heaven is where the stars reside (Genesis 1:14–19). The third heaven is where God's throne exists as described by the Apostle Paul where Jesus entered

into the presence of the Father. Hence, only the first two heavens are within the space-time-matter continuum of the universe, and the third heaven is outside of the universe. We note that just as the Father, *Son*, and the Spirit are not each other but God, so the first, second, and third heaven are not each other but are called "heaven."

> Gen 1:20 (NKJV)—And God said, "Let the water teem with living creatures, and let birds fly above the earth across the vault of the heaven."
>
> Jeremiah 4:25 (KJV) …all the birds of heaven fled
>
> Isaiah 13:10 (KJV)…for the stars of heaven and the constellations thereof shall not give their light….
>
> Gen 1:14–17 (NKJV)—Then God said, "Let there be lights in the firmament of the heavens to divide the day from the night; and let them be for signs and seasons, and for days and years; and let them be for lights in the firmament of the heavens to give light on the earth;" and it was so. Then God made two great lights: the greater light to rule the day, and the lesser light to rule the night. *He made* the stars also. God set them in the firmament of the heavens to give light on the earth,
>
> 2 Cor 12:2 (KJV) I knew a man in Christ fourteen years ago (whether in the body, I cannot tell or whether out of the body, I cannot tell; God knows) such a one caught up to the third heaven.
>
> Hebrews 9:24 (KJV) For Christ is not entered into the holy places made with hands, which are the figures of the true; but into heaven itself, not to appear in the presence of God for us.

Table IV shows a 2nd subsystem in terms of gases, dust, and stars making a galaxy. Each galaxy is made up of the trinity of gases, dust, and stars, but the type, amount, and stereology of the gases, dust, and stars are different within each galaxy thus giving each galaxy a uniqueness within each galaxy supercluster.

One can think of the solar system as a designed 3rd subsystem under the astrosphere as per Figure 2 (and Table IV) comprising the stars, satellites, and planets, which were created on the 4th Day of the Creation Week. Each of the stars, satellites, and planets are made from elements of the Periodic Table at a lower-length scale yet are distinct from each other at their macroscale. The unifying oneness of these entities is what could be called "light providers" (see Number 18 in Table IV). We note that Genesis 1:14–19 emphasizes a different trinity with respect to the Earth, when it states that God created the Sun (a star) and the Moon (a satellite) from the reference frame of the Earth (a planet).

A 4th subsystem within the astrosphere mentioned in Table IV is that of stars, which are made of three elements: hydrogen, helium, and a third element that can be almost any other element found in the Periodic Table. Each star has a life of its own, but basically is made of these three distinct elements of the Periodic Table. When a star is divided into its most basic structures, there are atoms as the unifying oneness in a star.

Another 4th subsystem mentioned in Table IV is the atmosphere made of nitrogen, oxygen, and argon. Nitrogen is not oxygen which is not argon. However, all three elements form the atmosphere.

A 5th subsystem within the atmosphere is a cloud comprising dust, water, and free air. Dust in the air allows water to condense upon it and as it grows it forms a cloud. We note that although oxygen was recognized as giving "life" to things, it is also the common denominator of these three components of a cloud. For example, the chemical make-up of dust includes a silicate or carbonate, which chemically have oxygen. The chemical make-up of water is two parts hydrogen and one part oxygen. Finally, free air in the atmosphere includes 21% oxygen. Hence, the same essence of each of these quantities is oxygen and yet the dust, water, and air are distinctly different from each other.

Multiscale Trinitarian Design of the Geosphere

Table V summarizes the nine different trinities found at three different length scales within the Earth's geosphere. At the 1st subsystem level, the three components of the geosphere (Earth) are the core, mantle, and crust, which are made of the basic elements of the Periodic Table but are distinct from each other at the mineral length scale. Each of these three different components of the Earth have the same material chemistries at the lowest length scales but because of the temperature, pressure, and volume, each expresses themselves differently at the mesoscales in terms of a mineral. In essence, the Earth is a trinity as well with the three distinct components having same chemical make-up.

The Earth's core is at the center of the Earth and can be considered at 2nd subsystem in the design of the Earth. We really do not know the composition of the Earth's core. However, we have surmised that a trinity of Periodic Table elements comprise the Earth's core. First, because of the magnetic field that arises, we know that iron exists. Second, the whole core cannot be just iron because the density would be too much; hence, we suspect that nickel makes up some portion of the Earth's core. Finally, the third projected element is silicon as most planets (and the mantle and crust) are made of silicon-based alloys. Hence, just like the Father, *the Son*, and the Spirit are distinct from each other but are indeed God, so iron, nickel, and silicon are

Table V. Seven trinities related to the Earth in the creationeered® design of the geosphere.

Overall Number	Length Scale	Trinitarian Name	Component 1	Component 2	Component 3
22	1st Subsystem	Geosphere	Crust	Mantle	Core
23	2nd Subsystem	Core	Iron	Nickel	Silicon
24	2nd Subsystem	Mantle	Olivine	Garnet	Pyroxenes
25	2nd Subsystem	Crust	Silicates	Carbonates	Oxides
26	2nd Subsystem	Crust	Sedimentary Rocks	Metamorphic Rocks	Igneous Rocks
27	3rd Subsystem	Olivine	Magnesium	Iron	Silicate
28	3rd Subsystem	Garnet	Divalent Cation	Trivalent Cation	Silicate
29	3rd Subsystem	Igneous Rocks	Aphanitic	Phaneritic	Pegmatitic
30	3rd Subsystem	Sedimentary Rocks	Erosion of pre-existing rocks into Smaller Pieces	Transport of Eroded Smaller Pieces	Deposition of Eroded Smaller Pieces

distinct from each other although they are all elements of the Periodic Table.

The geosphere's mantle is between the core and crust and is also a 2nd level subsystem that the Creationeer® designed and made comprising three minerals named olivine, garnet, and pyroxene. Each of these minerals changes crystallographic form as a function of the radial distance from the center of the Earth because the pressure and temperature changes, which in turn change the density thus morphing the crystallographic structure. However, the elements within each mineral are identically the same.

The final 2nd level subsystem that the Creationeer® designed and made was the Earth's crust, or outer layer, comprising three mineral classes with the names of silicates, carbonates, and oxides. Silicates make up approximately 90 percent of the Earth's crust and are based on silicon that joins with other elements. Calcites are composed of calcium and carbon and make up approximately 4 percent of the Earth's crust. Oxides are another class of minerals found in the Earth's crust making up the remaining part of the crust.

Another trinity in the Earth's crust are three rock types: sedimentary rocks, metamorphic rocks, and igneous rocks. Sedimentary rocks like limestone and sandstone were laid down by water from the Genesis Flood. Essentially, the catastrophic nature of the world-wide Genesis Flood broke down so many of the pre-Flood rocks like the silicates, calcites, and oxides into small particles that they were released during the Floodwaters moving over the continents. Metamorphic rocks are those that exhibited phase transformation due to high pressures and temperatures. These also occurred during the Genesis Flood and previously on Day 3 of the Creation Week. Igneous rocks are those that were formed deep in the Earth by solidifying as they cooled and moved to the surface.

Four different 3rd level subsystems of the Earth's geosphere mentioned in Table V include the following trinities. Olivine is made up of magnesium, iron, and silicate. Garnet is made of divalent cations, trivalent cations, and a silicate all in one. Igneous rocks are made of three solidified forms: (1) Aphanitic: fine-grained less than 1 mm, higher hardness material, (2) Phaneritic: grain size ranging from 1 to 10 mm with an intermediate hardness level, and (3) Pegmatitic: grain sizes greater than 1 cm with lower hardness value. The final trinity at the 3rd subsystem level is that of sedimentary rocks which incorporates three distinct processes to form: (1) erosion of pre-existing rocks into smaller pieces, (2) transport of eroded smaller pieces to a location, where (3) deposition of the eroded smaller pieces occurs.

Multiscale Trinitarian Design of the Biosphere

Table VI summarizes the twenty-four different trinities found at different length scales within the Earth's biosphere. At the 1st subsystem level, the

Table VI. Twenty-four trinities related to the creationeered® biosphere.

Overall Number	Length Scale	Trinitarian Name	Component 1	Component 2	Component 3
31	1st Subsystem	Biosphere	Humans	Animals	Vegetation
32	2nd Subsystem	Life Sustenance	Food	Clothing	Shelter
33	2nd Subsystem	Vegetation	Trees	Shrubs	Grasses
34	3rd Subsystem	Trees	Global	Continental	Biome
35	5th Subsystem	Apple	Core	Fruit	Skin
36	3rd Subsystem	Grass	Savanna	Steppe	Prairie
37	5th Subsystem	Shamrock	Leaf 1	Leaf 2	Leaf 3
38	2nd Subsystem	Animals	Water	Sky	Land
39	3rd Subsystem	Land Animals	Domestic	Wild	Creeping Things
40	3rd Subsystem	Sky Animals	Birds	Bats	Insects
41	4th Subsystem	Insect	Head	Thorax	Abdomen
42	5th Subsystem	Chicken Egg	Yolk	Albumen	Cuticle
43	2nd Subsystem	Humans	Body	Soul	Spirit
44	3rd Subsystem	Human Soul	Mind	Will	Emotions
45	4th Subsystem	Emotions	Pleasures/Affections	Pain/Anger	Passions/Desires
46	4th Subsystem	Conception	Man	Woman	Baby
47	4th Subsystem	Brain	Cerebrum	Cerebellum	Brain Stem
48	5th Subsystem	Voice	Frequency	Harmonics	Intensity
49	5th Subsystem	Spoken word	Voiced sound	Resonance	Articulation
50	5th Subsystem	Music Chord	Note 1	Note 2	Note 3
51	7th Subsystem	Software	Application Programs	Utility, Device Drivers	Operating Systems
52	7th Subsystem	Codons	Nucleotide 1	Nucleotide 2	Nucleotide 3
53	8th Subsystem	Nucleotide	Nitrogen Base Unit	Phosphate Base Unit	Sugar
54	9th Subsystem	Sugar	Glucose	Fructose	Sucrose

three components of the biosphere are a trinity (Number 31 in Table VI) of living organisms (Figure 2): vegetation (Day 3), animals (Days 5 and 6), and humans (Day 6) that reside on the geosphere all of which require another trinity at the 2nd subsystem level of food, clothing, and shelter as sustenance (Number 32 in Table VI).

Genesis 1:29–30 (NKJV)—Then God said, "Behold, I have given you every plant yielding seed that is on the surface of all the earth, and every tree which has fruit yielding seed; it shall be food for you; and to every beast of the earth and to every bird of the sky and to everything that moves on the earth which has life, I have given every green plant for food;" and it was so

Psalm 104:13–15 (NKJV)—He waters the mountains from His upper chambers; The earth is satisfied with the fruit of His works. He causes the grass to grow for the cattle, And vegetation for the labor of man, So that he may bring forth

> food from the earth, And wine which makes man's heart glad, So that he may make his face glisten with oil, And food which sustains man's heart.
>
> 1 Kings 10:11–12 (NKJV)—Also the ships of Hiram, which brought gold from Ophir, brought in from Ophir a very great number of almug trees and precious stones. The king made of the almug trees supports for the house of the Lord and for the king's house, also lyres and harps for the singers; such almug trees have not come in again nor have they been seen to this day.
>
> Isaiah 60:13 (NKJV)—The glory of Lebanon will come to you, The juniper, the box tree and the cypress together, To beautify the place of My sanctuary; And I shall make the place of My feet glorious.

Vegetation can be thought of as a 2nd subsystem trinity (Number 33 in Table VI) of trees, shrubs, and grasses per Genesis 1:11. Here vegetation is the first sign of "life" that God created as a 2nd subsystem within His design providing food, oxygen, and regulating water quality for life.

> Genesis 1:11(KJV)—Then God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth: and it was so.

A 3rd subsystem within the biosphere are trees (Number 34 in Table VI). There are three types as determined by the location in which they live: global, continental, and biome level (Cazzolla et al., 2022). A tree is considered vegetation that distinguishes itself from a shrub or grass, because it is a perennial plant with an elongated stem (trunk), usually supporting branches and leaves, and is usually larger than shrubs and grasses. Because it is larger, a tree demands more water than a shrub or grass and thus lives in a different space than a shrub or grass although existing of the same substance at the same time, similar to the Godhead. An example of a fruit from a tree that expresses a form of the trinity is an apple (Number 35 in Table VI as a 5th subsystem), which comprises the core, fruit layer, and skin. Although each subscale quantity identified as the core, fruit, and skin look different, they are made of the same atomic essence and represent the apple at the same time. Joshua (2017) argued that there are no great natural descriptions of the trinity and mentioned that the apple is a bad example of the trinity since it does not identify itself as each component does. The counterargument is related to what length scale that is being discussed. If we talk about the level of the skin, fruit, and core, then Joshua (2017) is correct; however, if one were to talk about the particle, atomic, or molecule length scales, then Joshua (2017) is not correct and the apple, indeed, represents a true trinity.

Similar to trees growing in different regions, so grasses (Number 36 in Table VI) live in different regions, and as a 3rd subsystem are categorized as such: savanna, steppe, and prairie (Dixon et al., 2019). Grasses are considered flowering plants that require less water (rain) than trees or shrubs. Savannas are typically near the equator and are associated with hot, dry regions. Steppe grasses are typical for cooler climates, and prairie grasses are typical for intermediate climates. One example of a grass is clover in which three leaves together are called a shamrock, representing a trinity (Number 37 in Table VI) of sorts as presented by Saint Patrick (Thurston and Attwater, 1956). Each leaf is spatially different from each other leaf but are of the same substance at the same time.

Another 2nd level biosphere trinity (Number 38 in Table VI) is that of animals, created on days in which they presented in the *Bible* where they live: water (Day 5), sky (Day 5), and land (Day 6).

> Genesis 1:20–23 (NKJV)—Then God said, "Let the waters abound with an abundance of living creatures, and let birds fly above the earth across the face of the firmament of the heavens." So God created great sea creatures and every living thing that moves, with which the waters abounded, according to their kind, and every winged bird according to its kind. And God saw that *it was* good. And God blessed them, saying, "Be fruitful and multiply, and fill the waters in the seas, and let birds multiply on the earth." So the evening and the morning were the fifth day.
>
> Genesis 1:24–25 (NKJV)—Then God said, "Let the earth bring forth the living creature according to its kind: cattle and creeping thing and beast of the earth, *each* according to its kind;" and it was so. And God made the beast of the earth according to its kind, cattle according to its kind, and everything that creeps on the earth according to its kind. And God saw that *it was* good.

The trinity of land animals (Number 39 in Table VI as a 3rd subsystem) created on Day 6 can be described as domesticated animals (cattle), insects (creeping things), and beasts (wild animals) in the *Bible*. The trinity of sky animals (Number 40 in Table VI as a 3rd subsystem) can be described as birds, bats, and insects. A 4th subsystem defines an insect by it having a head, thorax, and abdomen (Number 41 in Table VI). A 5th subsystem under land animals is a chicken egg (Number 42 in Table VI) which comprises a yolk, albumen, and cuticle. Each of these different animals, although distinguishable by intermediate length scales, are made of the same atoms for each distinguishing part of the trinity.

The created love being (human) has many layers of trinities embed-

ded at different length scales (Day 6 of the Creation Week). A 2nd subsystem level under the biosphere is a human comprising a body, spirit, and soul as illustrated in Figure 2 (Number 43 in Table VI) (Genesis 2:7).

> Genesis (2:7)—And the Lord God formed man (body) of the dust of the ground and breathed into his nostrils the breath of life (spirit); and man became a living soul.

The body is the house (or temple) of the spirit and soul. The spirit is what gives life to the created love being and allows the connection and communication with God through the Holy Spirit. The human soul is a trinity (Number 44 in Table VI) comprising the mind, will, and emotions. The human mind can be thought of as the intellect, which admits the ability to think and acts as software for the brain, which is alternatively the hardware that allows the software to run its program. The human will or volition is the ability to make decisions by acting on information received through the human senses, the spirit of the human, emotions, or the mind. Human emotions range a broad spectrum but the notion here is based on feelings or states of feelings like pleasures/affections, pain/anger, and passions/desires. Let us consider the following example of a boiling pot of water accidently spilling on someone. The emotion of pain will immediately cause the mind to provide the will with information to remove oneself from the boiling water. Although each aspect of the soul meaning the mind, will, and emotions immediately acted as one unit to provide an action for the human. On the other hand, a man may intellectually think about a particular woman to be his wife, thus deciding to marry her after which feelings of affection arise within the man. Again, the trinitarian nature of soul reveals the oneness of the mind, will, and emotions in this example.

The next subsystem down in length scale is "emotion" which is made of pleasures/affections, pain/anger, and passions/desires. Down a different length scale path another 4th subsystem in the human is conception made of man, woman, and a baby. At the same 4th subsystem level is the brain comprising the cerebrum, cerebellum, and brain stem (Number 47 in Table VI).

Several 5th subsystem level trinities were created downscaled from different upper scale trinities and are also shown in Table VI. Voice is composed of frequency, harmonics, and intensity. A human's spoken word is made of voiced sound, resonance, and articulation. A music chord is made of three different notes but joined together as one. These three different 5th level subsystems were created for humans alone.

One lower-length scale subsystem in the human under the "brain" intermediate length scale is the trinity of software (Number 51 in Table VI) which is made of an application program, utility or device driver, and an operating system. Software is a conception of humans and cannot be found anywhere else in the cosmos.

The following lower-length scale subsystems are found in all living systems. A 7th subsystem (Number 52 trinity in Table VI) can be a codon, which is a sequence of three nucleotides in a deoxyribonucleic acid (DNA) or ribonucleic acid (RNA) molecule. The trinity of a codon is a code that messages for an amino acid, which in turn makes up proteins, which in turn make up organs. Each codon is made of the same three elements of the Periodic Table but in a dissimilar, distinct order thus illustrating their oneness and threeness at the same time. The next length scale down from a codon is an 8th level subsystem called a nucleotide, which comprises a nitrogenous base unit, a phosphate group, and a sugar all tied together as one unit. One can note that each nitrogenous base unit, a phosphate group, and a sugar are made of the same protons, electrons, and neutrons although having a differing amount of each. The next length scale down from a nucleotide is a 9th subsystem called a sugar, which comprises glucose, fructose, and sucrose, which are structural isomers of each other.

The Smallest Length Scales in the Physical Universe Illustrate Different Trinities

Table VII summarizes the three different trinities found at the lowest-length scales and are found in everything in the space-time-matter continuum cosmos. Because we really do not know how many subsystems exist, we define the largest number as an arbitrary "N." As such, we then work backwards starting with "N-2" subsystems and finish with the smallest known entity to mankind currently in physics known as a subatomic particle.

The "N-2" subsystem level is an atom (trinity Number 55 in Table VII) which is made of protons, neutrons, and electrons. The final lowest-length scale is what physics calls a particle (Number 57 in Table VII) and is the "Nth" subsystem. A particle comprises quarks, leptons, and bosons and these three make up everything in the cosmos whether they be anything in the astrosphere, geosphere, and biosphere.

Discussion

The early Church fathers spoke and wrote about defining the unity or oneness of the trinity by using words like "essence" or "substance" or "being" (Erickson, 1998) with the assumption of unity of action. Brower and Rea (2005) argued that Christian orthodoxy requires that properties of the Father, Son, and Holy Spirit be instantiated by the divine essence assuming Aristotle's hylomorphic structure. One

Table VII. Three trinities related to the creationeered® nature of the smallest entities currently known to mankind. Although we counted different length scales herein, we use the generic mathematical representation as the N^{th} subsystem since there are probably more that the authors are not aware of.

Number	Length Scale	Trinitarian Name	Component 1	Component 2	Component 3
55	N-2 Subsystem	Atoms	Protons	Neutrons	Electrons
56	N-1 Subsystem	Subatomic Particle	Quarks	Leptons	Bosons
57	N^{th} Subsystem	Lepton Force	Electromagnetic Force	Weak Force	Gravitational Force

main weakness of nature's trinities is that God, Who is a spirit, is able to move in and out of nature's cosmos, whereas nature's trinities are bound within the space-time-matter cosmos, albeit by definition. When the Christian forefathers spoke of the Godhead having the same essence, substance, and/or being, we translate that herein to represent the smallest length scales (atoms and subatomic particles). The higher length-scale, geometric forms are what distinguish each of the parts of the trinities, and this is consistent with Aristotle's hylomorphic structure. In other words, the same basic lower-length scale "substance" makes up the different hylomorphic structures at a larger length scale.

All of the examples herein lead to the mathematical *logic argument for* the trinity in the context of the ICME multiscale approach as the following: x is God if-and-only-if x is a larger length scale hylomorphic structure whose "substance" is some divine essence *called z*; hence, x is *the higher length scale and z is the lower length scale. We assert that* x is the same God as w and y if-and-only-if x and w and y are each hylomorphic structures whose "substance" derives from the same divine *lower length scale* essence z. *If* x's "substance equals z" *and* is the same "substance" as w's and y's *substance that equals z, then x, w, and y form a trinity.* Also, numerically exactly only one God exists if-and-only-if there is an x such that x is God and every person of the Godhead is the same God as x. Then (as Christians assume) there are three as x, w, and y (and only three) Persons that share the same divine essence, z, then we arrive directly at the central trinitarian claims without contradiction. For in that case, there will be three distinct Persons; each Person will be God (and will be the same God as each of the other Persons); but there will be exactly one God.

Summary

If God revealed His nature, character, and attributes like Romans 1:20 states, then one would expect that God, who is a trinity, would express Himself in nature as a trinity. From the understanding of multiscale aspects of ICME *engineering process in which downscaling is first conducted (as in this writing)*, we clarify the mystery of the trinity by showing the fundamental "essence" or "substance" that unites the Godhead, although three distinct Persons are mapped to the atomic and subatomic level as the main "essence" or "substance" with different higher, geometric length-scales as nature's trinities. In fact, 57 different trinities at multiple length scales are illustrated in this writing. Although there might be more that the authors missed, the ones represented herein are clear demonstrations and have explanatory power of trinitarian nature of the Godhead.

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Sternberg's Law Statistical Study of Surficial Gravels in North Central Montana—Part I: Methods and Findings

Peter Klevberg

Abstract

In the 150 years since Sternberg's Law of downstream fining was published, causes and complications have proliferated with research in many fluvial environments. The basic relationship is a first-order differential equation expressing an energy relationship, and the geologic causes and effects that fall under its umbrella are diverse. Grain size distributions of sands provide indications of modes of deposition, but gravels do not. However, while competence is seldom a limiting factor for sands, it is for gravels. The study area includes the low-relief Great Plains and the high relief of the Rocky Mountains. Island mountain ranges complicate this somewhat, but stream courses are sufficiently simple for Sternberg's Law. Most of the study area exhibits features generally believed to have resulted from Ice-Age glaciation. Catastrophic evidence in the form of planation surfaces is also present. Thus channelized flow, transport by ice, and sheet flow are all candidate processes for transport of gravel. Predictions of grain size distributions from these processes are compared with results from statistical analysis of 5,839 sieve analysis reports. The results indicate a complex history for the surficial gravel deposits.

Key Words: Central Montana, geostatistics, grain size distribution, gravel, paleohydrology, Sternberg's Law

Background

Gravel is one of the most important building materials in modern society, being the chief ingredient in concrete and the standard for structural fill to support buildings, roads, and other structures. It has therefore been researched for many years, with a wealth of data produced. Size-based terminology is shown in Table I, and terms that may be unfamiliar to some readers are included in the glossary.

While the stream power to transport fine sediments such as clay and silt is very low, coarse sediments require significant stream power. Laboratory

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Table I. Particle Sizes.

Category	Size (mm)		Size Description
Boulder	305 & up		melon and bigger
Cobble	76	305	baseball to melon
Pebble	4.76	76	pea to baseball
Sand	0.075	4.76	copy paper thick to pea size
Silt	0.002	0.075	1/3 size of red blood cell to thickness of one sheet copy paper
Clay	0.002 & down		1/3 size of red blood cell and smaller

Sizes per ASTM D2487; Wentworth Scale somewhat smaller.

research has centered on sand, and empirical equations have been developed to relate grain size and grain size distribution to current speed and stream power (Klevberg, 2019). Gravel is too large to be easily investigated in the laboratory, so most research is based on observed flood events. Since gravel requires greater stream power or current strength, i.e., *competence*, than sand and fines, it has been of special relevance to catastrophic versus

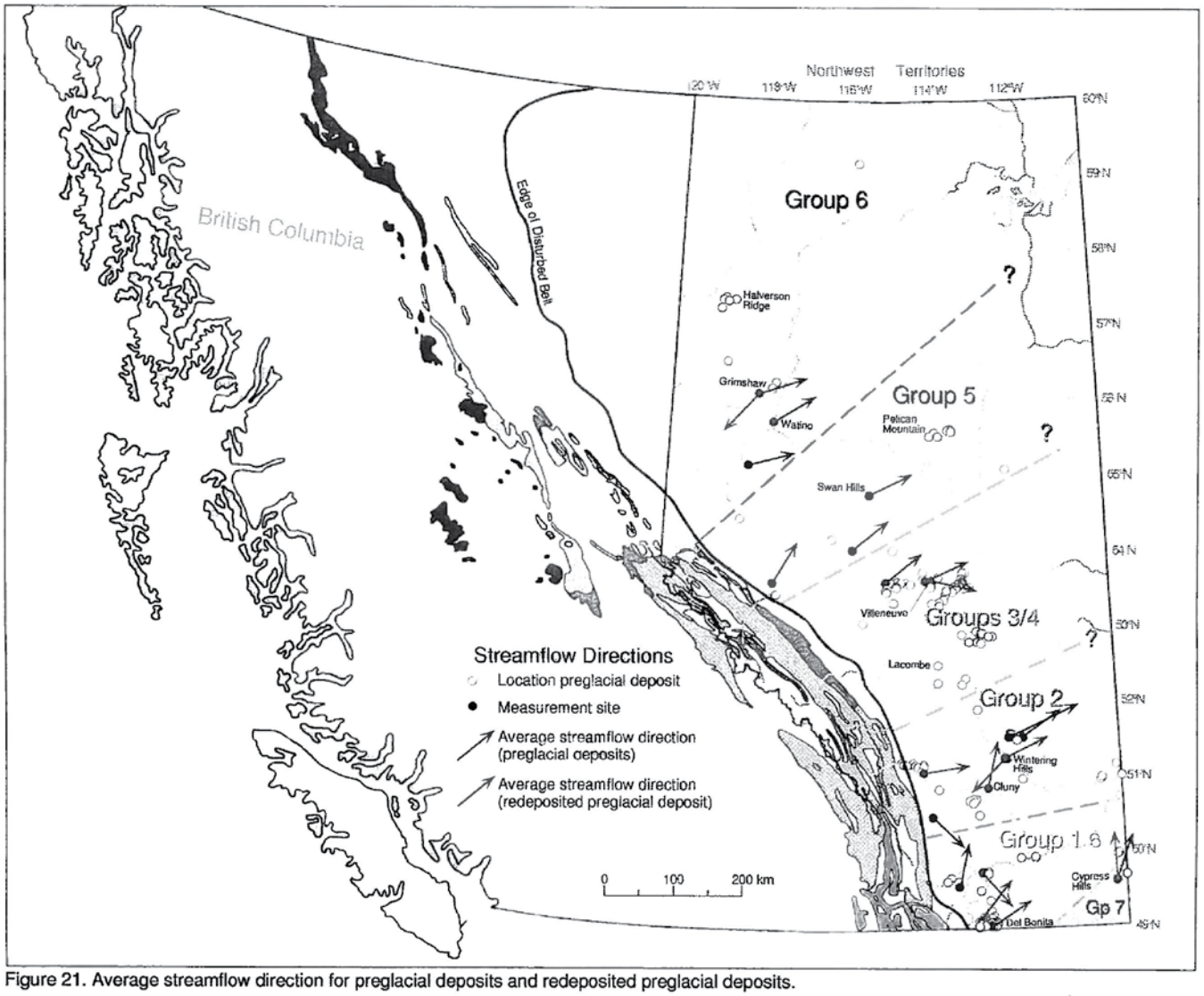


Figure 21. Average streamflow direction for preglacial deposits and redeposited preglacial deposits.

Figure 1. Figure 21 from Edwards and Scafe (1996). Slightly lighter gray arrows pointing back toward Rocky Mountains are inferred post-depositional paleocurrent directions which they interpret as redeposition of pre-glacial gravels. Slightly darker gray arrows pointing away from mountains are original flow directions inferred from lithologies identified in Rocky Mountains (shaded areas).

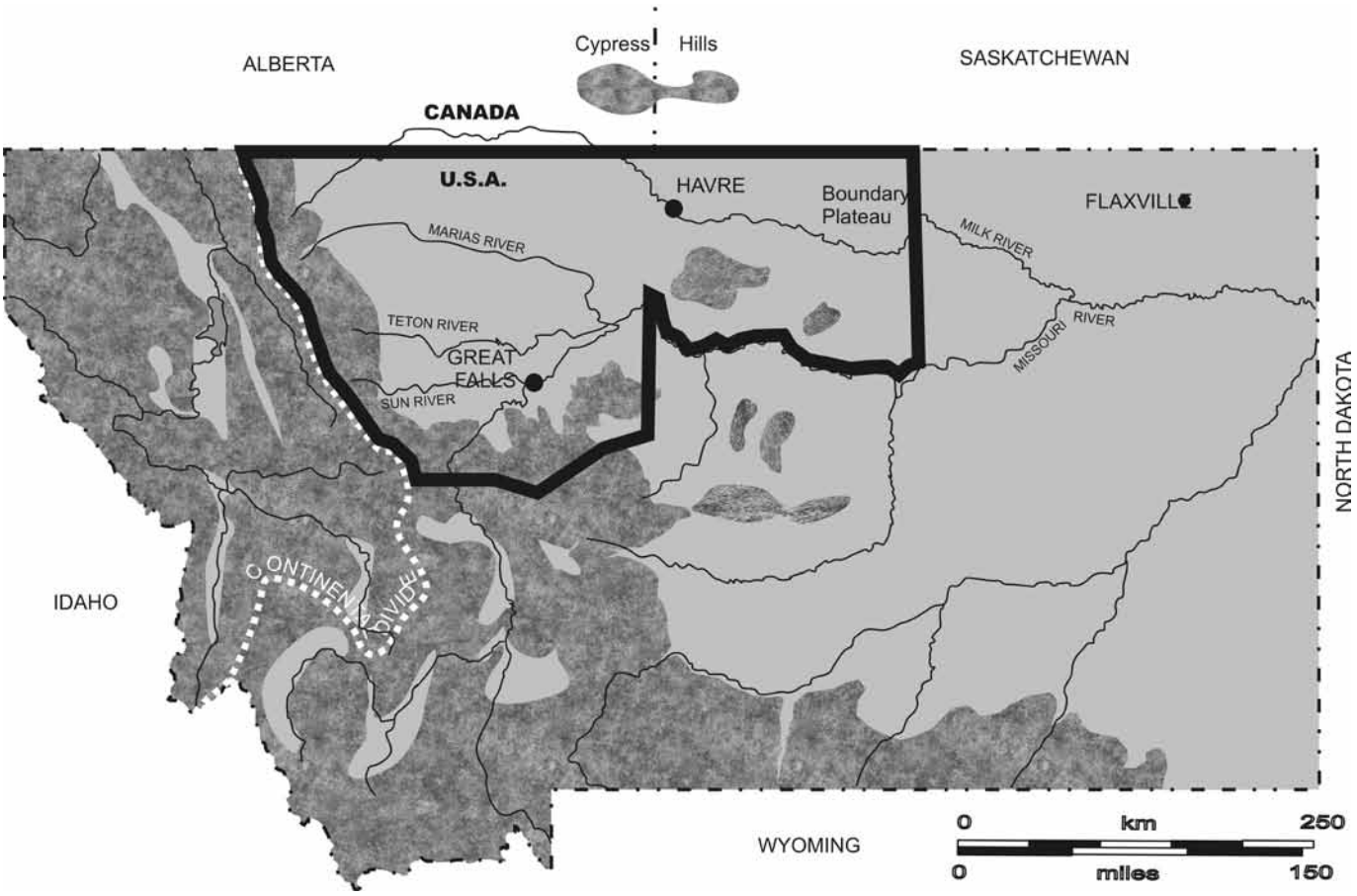


Figure 2. Study area in North Central Montana indicated by outline.

uniformitarian debates. Stream *capacity* relates to the total mass flux capacity of sediment and can be large even if competence is low. The Mississippi River is a fine example, "too thick to navigate, too thin to cultivate," carrying a heavy load of clay, silt, and fine sand but incapable of moving gravel.In addition to the paleohydrologic study of the Cypress Hills and Flaxville Formations by Klevberg and Oard (Klevberg and Oard, 1998; Oard and Klevberg, 1998), the Alberta Geological Survey has done extensive study of pre-glacial gravel deposits (Edwards and Scafe, 1996). They found it prohibitively expensive to run enough samples of statistically valid size (ASTM D75) to ascertain paleocurrent paths, so they relied on lithology as the primary criterion to trace provenance. They carefully excluded glacial deposits in their study, which required field observation and judgment. Source areas were quite consistently from the mountains to the southwest, though what is interpreted as glacial redeposition in the opposite direction was observed in some deposits (Figure 1). Apparently, no comparable study has been completed for Montana. Figure 2 shows our study area, which coincides with the Montana Department of Transportation (MDT) Great Falls and Havre Districts. The study area is approximately 250 miles (400 km) from west to east. It is dominated by a few major streams flowing quite consistently from west to east: the Milk, Marias, Teton, Sun, and Missouri Rivers (Figure 2). More than twenty years ago, we were assisted by Beverly Oard and Krista Koljonen, who photocopied thousands of sieve analysis reports from these MDT offices. Klevberg used a few of the data from the Boundary (Turner) Plateau (Figure 2) for hand calculations that indicated sheet deposition with current winnowing (Klevberg and Oard, 1998).An obstacle to further data analysis was the labor required to enter and statistically analyze the data. A Creation Research Society grant, breakeven hourly rates provided by TD&H Engineering, and the invaluable assistance of volunteers allowed us to complete the study. In

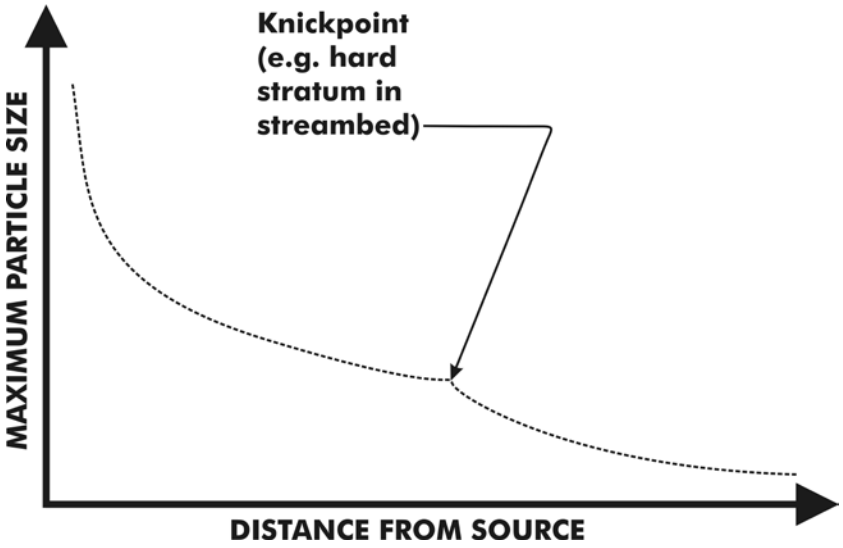


Figure 3. Schematic presentation of Sternberg's Law showing how size of particles (clasts) becomes smaller downstream. Abrupt changes in the mathematical description may occur at knickpoints (usually harder strata) or where tributaries enter the main stream.

the intervening years, technology has facilitated analysis of large datasets.

Sternberg's Law

This area of hydrologic research caught the attention of geologists long ago. Gravel is often observably smaller downstream, often of lithologies from the mountains and not the lowlands farther from the source. Sternberg (1875), in his famous study of the Rhine River, concluded abrasion was the cause of fining, while relative mobility has been shown in many more recent studies to be more important (Potter and Pettijohn, 1963; Pelletier, 1981; Hoey and Ferguson, 1997). However, the mathematical relationship is the same. Sternberg's Law expresses an obvious first-order relationship between potential energy and stream competence:

$$S = k \frac{dy}{dx}$$

where the term S is related to stream slope (hence velocity, power, and competence) via a constant k and the change in elevation above base level with distance downstream. Sternberg focused on diminution of a given particle (pebble) with distance downstream, expressed below in its original integral form:

$$W = W_0 e^{-aL}$$

where W is the weight of the largest observed pebble that has decreased from its initial weight exponentially over a distance L with a stream-specific constant *a*. The assumption is that a given pebble has lost this mass during transport.

Rates of transport and abrasion are both related to the stream power, in turn related to the height above base level. Sternberg's Law can be seen describing the conversion of potential energy to geologic work, by the first-order differential equation and resulting exponential stream profile, with concavity proportional to fining and decreasing over time. While abrasion can be a factor, the law applies even where fining is entirely due to sorting (Hoey and Ferguson, 1997; Brown, 2004). Sediment supply is an important variable. Fine sediment will produce a prograding wave that travels down the stream. Bed surface to subsurface sediment exchange takes place with finer sediment, but coarser sediments can become buried by advancing bedforms and removed from the transport process (Purkait, 2006). Fining is more rapid during higher discharges. Knickpoints (sudden changes in stream gradient, such as rapids or waterfalls) and other changes in stream geometry have obvious, complicating effects (Figure 3), as do stream networks. However, on the scale of a single reach, the relationship holds, and downstream-fining patterns are commonly discernable.

Development of Paleohydrology

Paleohydrology applies hydraulic principles to Earth history through physical data. While the results lack certainty, they are useful. For example, gravel on a particular topographic feature (paleoslope) can be used to calculate minimum current strength. Transport is inferred from lithology (different from substrate) and rounding of clasts. A transport hypothesis is disproven by field evidence showing an angular material identical to the substrate with only weathered joints between clasts. Transport in a shallow, meandering stream is likewise disproven by clasts that are too large to have been transported in such a stream.

Sternberg's Law was formulated for gravel, but also works for sand. Gravel and sand are large enough that electrostatic effects are negligible, and surface tension is also negligible for gravel. Silt and clay can have low

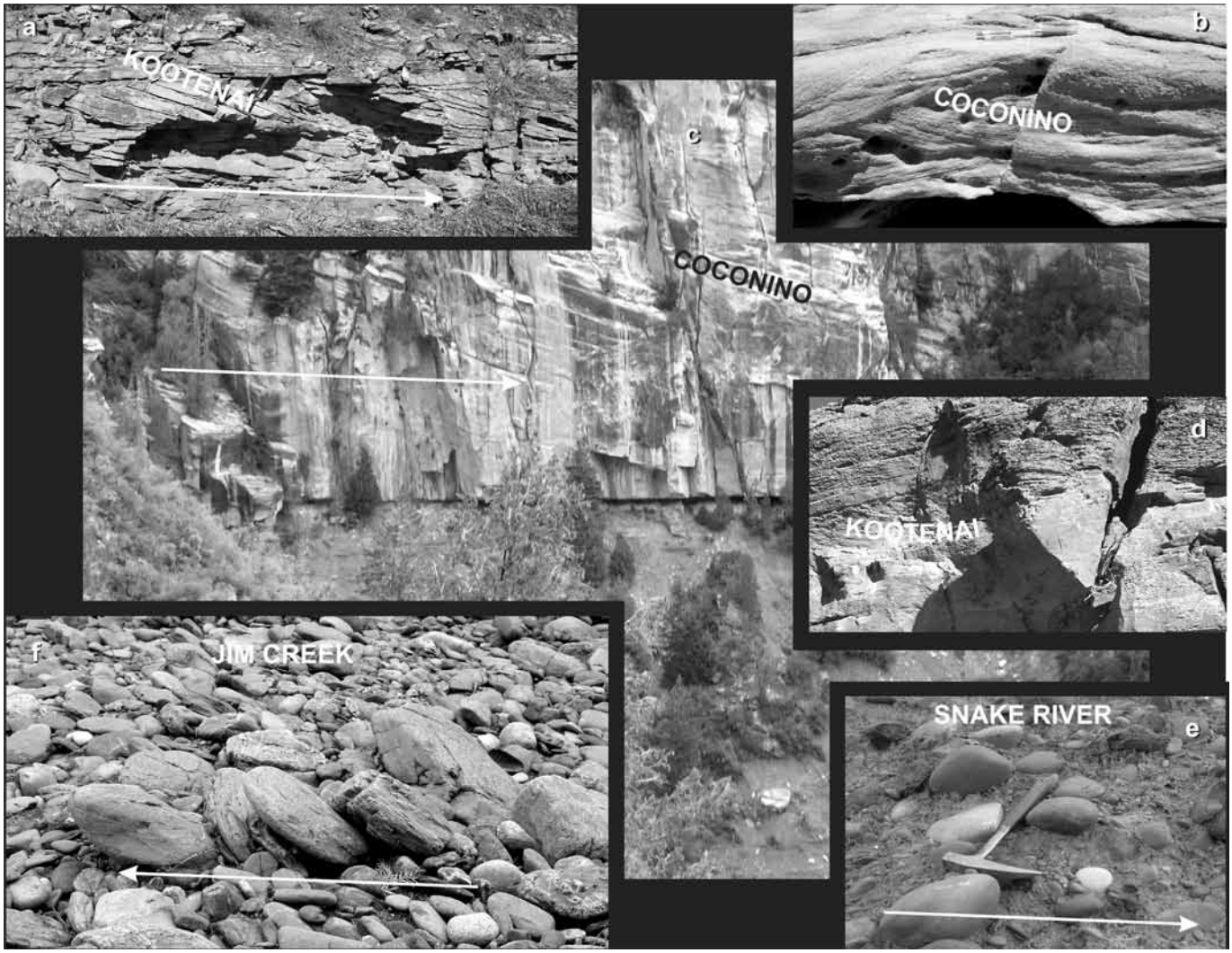


Figure 4. While there are many paleocurrent indicators–aligned fossils, sole markings, striations, asymmetric ripples, etc.–one of the main indicators for sandstones is cross-bedding. Upper four images show cross-bedded sandstones. Those at left are seen parallel to the paleocurrent direction as indicated by arrows. Those at right are oblique to the paleocurrent direction (no arrow). (a) lower Kootenai Formation, Sand Coulee, Montana. (b) close-up of Coconino Sandstone, Grand Canyon, Arizona. (c) Coconino outcrop in Grand Canyon. (d) Upper Kootenai Formation, Centerville, Montana. Lower two images are gravel, showing imbrication, which is the primary paleocurrent indicator for such coarse sediments. (e) deposit along Snake River in Idaho. (f) deposit in Jim Creek, Snohomish County, Washington. All photographs outside Montana, courtesy Michael J. Oard.

settling velocities, may flocculate, and boundary layer thickness may exceed particle diameter. Gravel typically rolls along the stream bottom as bed load, but sand may also move by saltation or even suspension. Fines (silt + clay) are usually transported as suspended load. Clay-size particles may require significantly higher current speeds to dislodge than to deposit, as they are cohesive. Thus, the finer the sediment, the more complex the transport typically becomes, and the mathematical description of the transport and depositional processes becomes less likely to conform to the simplified Sternberg expression. The finer sediments may be transported intermittently, sometimes settling between larger rocks that shelter them from currents. The smaller the particle, the more complex the depositional history may be. The flip side of this is that many more expressions that are of genetic sig-

nificance have been derived for finer sediments than a simple Sternberg's Law description, including flow regime inferences from bedforms and various paleocurrent indicators (Figure 4). Most studies focus on sands rather than gravels. Sandstone is common in the rock record, and lower-energy environments today serve as convenient analogues (especially for those disinclined to consider high energy or catastrophic, depositional environments). High-energy environments are not so easily studied. Thus, environmental interpretations of grain-size statistics have been developed for sands, but not as much for gravels. Statistical methods are often employed for rivers, shorelines, and rock units in many settings with efforts made to separate alluvial from littoral genetic processes, for example, and various transport sequences (Passega, 1964; Sahu, 1964; Skaberne, 1996; Martins et al., 1997; Taj, 2011; Ganjoo and Kumar, 2012; Srivastava et al., 2012; Parthasarathy et al., 2016; Baiyegunhi et al., 2017). Evaluation of scatter plots of sorting versus skewness have been used for decades to distinguish depositional environments of sands (Friedman, 1961) and even finer-grained sediments (Diemer and Forsythe, 1995; Pinem and Muslim, 2019). Discriminant functions have been developed for sands, but not gravels (Madukwe, 2016; Rashed and Siad, 2016). Means of inferring transport mechanisms from sand grain-size distributions were pioneered in the salient work of Passega (1964).

On the other hand, gravel permits estimates of minimum stream competence. At least one study with a suitable reach of an extant gravel-bedded river has been performed (Hoey and Ferguson, 1997), and many attempted, but gravel-bedded rivers offer challenges and complexities that preclude application of Sternberg's Law on a small scale (Buffington and Montgomery, 1999; Evans and Holm-Denoma, 2018). Interestingly, it was this heterogeneity in gravel-bedded rivers and the differing requirements for suitable gravel for fish to host their eggs that prompted Kondolf and Wolman (1993) to formulate their grain-size analysis functions. In studies of seabed sediments along the coast of New England, Schlee (1973) extended the work of Passega to gravels, though inferred processes (e.g., continental glaciation) rather than only observed processes were included. Many individual streams have been studied per Sternberg's Law. Quantitative paleohydrologic analyses by creationists have produced salient results, such as Lalomov (2003) in Crimea and Barnhart's (2011) analysis of unconsolidated deposits from Hurricane Katrina and the Tapeats Sandstone (Barnhart, 2012a, 2012b). However, few areas exhibit *sheets* of gravel like Montana east of the Continental Divide. The Cypress Hills Formation and Flaxville Formation ("cypflax") deposits that blanket part of the study area for this research project (Figure 5a) differ significantly from ordinary fluvial deposits (Klevberg and Oard, 1998; Oard and Klevberg, 1998). Surficial gravel deposits extend into Canada, and extensive research has been conducted in Alberta (Edwards and Scafe, 1996). This study addresses an apparent lack of such research in Montana and includes the sheet gravels.

Mystery of Bench Gravels

Montana east of the Continental Divide (Figure 2) presents a useful topographic contrast for paleohydrology. The rugged Rocky Mountains abruptly face the Great Plains. Other than a few isolated or "island" mountain ranges that pop out of the prairie away from other mountains (stippled gray in Figure 2) and a few prominent river valleys, the Great Plains is comprised of rather flat "benches" carved into soft sedimentary rocks that ramp into each other and are often mantled by gravel of very hard lithologies. These are commonly labeled "braid plain deposits" by uniformitarians (Vuke et al., 2002, 2007), but their architecture does not match the expected patchwork of lag gravels and sands of anastomosing streams (Evans and Holm-Denoma, 2018). Most economical gravel deposits are from these bench gravels, though some pits mine glacial gravels, and a few operate in valley bottom alluvium.

Gravel deposits capping the Cypress Hills and Flaxville Plain in Montana, Alberta, and Saskatchewan (Figure 5) defy uniformitarian explanation and are better explained by late diluvial deposition (Klevberg and Oard, 1998; Oard and Klevberg, 1998, 2005; Oard et al. 2005a, 2005b, 2006). Paleocurrent indicators include imbrication and cross-bedding (Figure 4). Clasts are well rounded and covered with percussion marks (Figure 5b). Deposits are in sheet form and cover the high planation surfaces *above* the level of glaciation. Work performed by Klevberg and Oard was almost entirely a *competence* study. While some analysis was included of grain-size statistics showing current winnowing indicative of regional rather than fluvial currents, no *capacity* analysis was included, and no additional statistical analysis was pursued.

Forensic Methods

Klevberg and Oard (1998) argued for sheet flow rather than channelized flow for the "cypflax" deposits, based on many observations of individual clasts, deposit architecture, and their mapped and observed lateral extent. Minimum current speed was derived from maximum clast size and open channel equations, and current depth was inferred from paleoslope and minimum current speed. Staff of the Montana Bureau of Mines and Geology believe that these deposits can

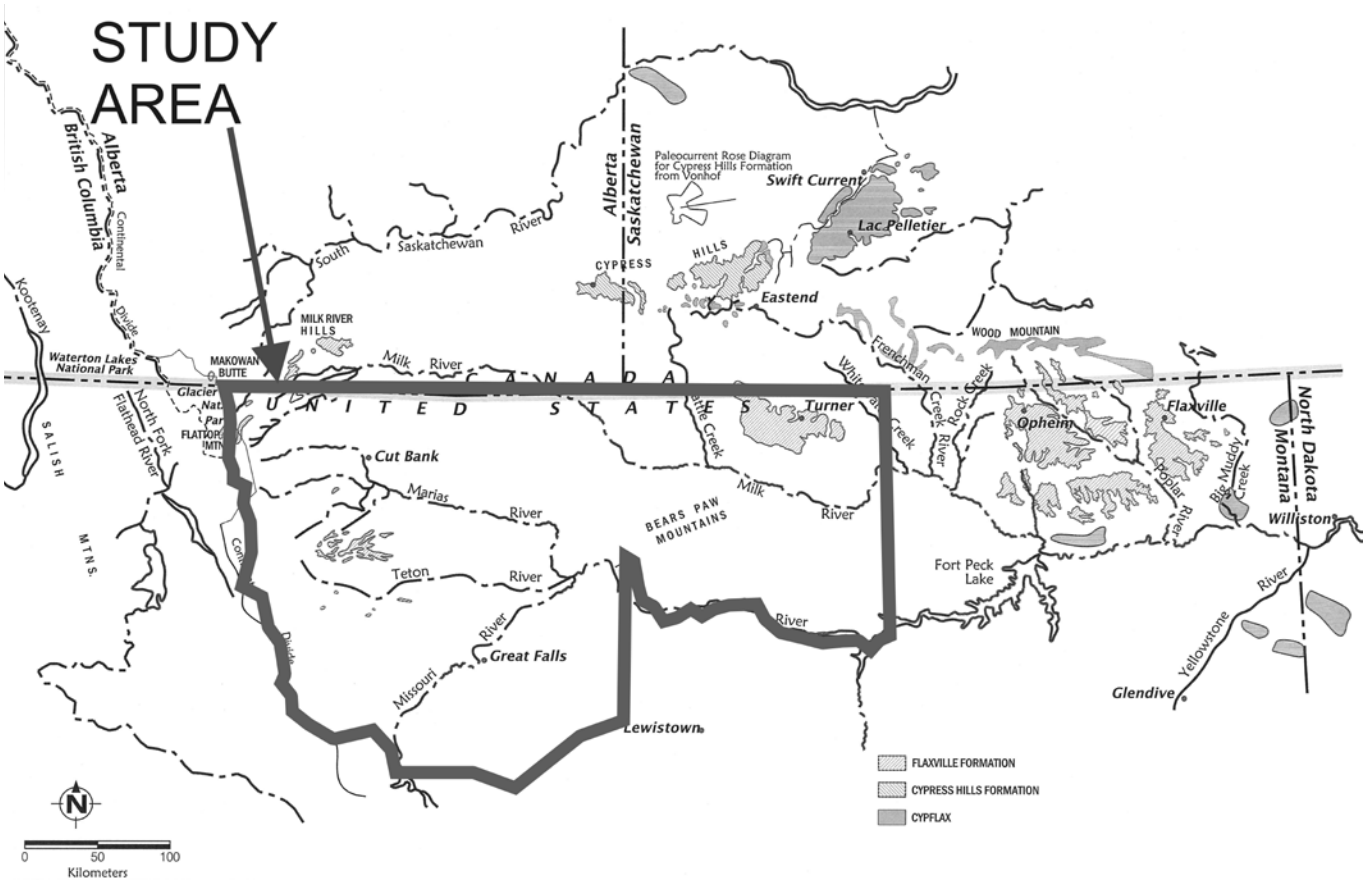
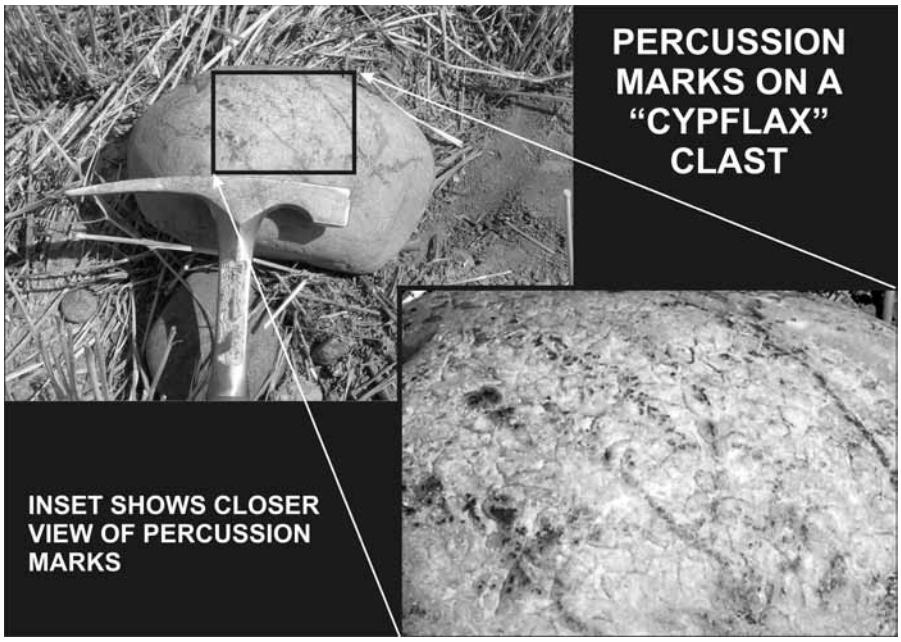


Figure 5. (a) ***(above)*** **Map showing Cypress Hills Formation and Flaxville Formation deposits on erosional remnants in Montana, Alberta, and Saskatchewan. These appear to grade into each other with equivocal deposits (labelled simply "cypflax"). Rose diagram on figure north of Cypress Hills is based primarily on crossbeds in sand interbeds. (b)** ***(below)*** **photograph of "cypflax" cobble with close-up of percussion marks. Stripes are rust streaks from farm implements scraping over cobble.**



be explained by lateral accretion with gradual downcutting to form a very low slope perpendicular to the flow direction. While this seems farfetched (Klevberg and Oard, 1998), more work could be done to further define depositional environments and discard hypotheses that are not feasible. This research is an initial step.

Natural history is *history*, not science (Reed and Klevberg, 2014a, 2014b), but science plays an essential forensic role. Predictions of hypotheses can be identified, and these predictions tested by present observations. This procedure was demonstrated in Klevberg and Oard (1998) and is used in this study.

Creationists acknowledge that non-diluvial geologic processes, such as continental glaciation, contribute to the present form of surficial deposits. There are various ways to distinguish these in the field, but many are subjective, influenced by natural-history paradigms. This project minimized subjectivity by statistically analyzing a large, semi-random sample population, and using those results to test predictions of possible genetic mechanisms. Sternberg's Law is a one-dimensional representation of fining along a stream channel (Figure 6). As shown in Figure 7, this research project extended analysis to two dimensions

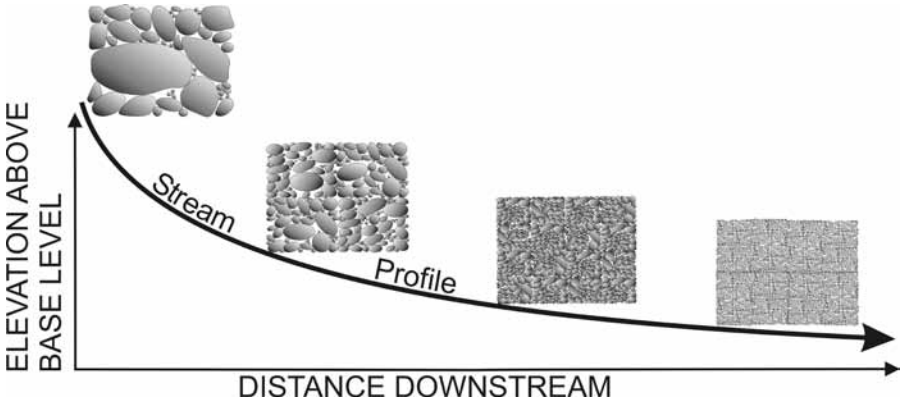


Figure 6. Schematic representation of Sternberg's Law in terms of elevation above base level showing how both fineness and rounding increases downstream.

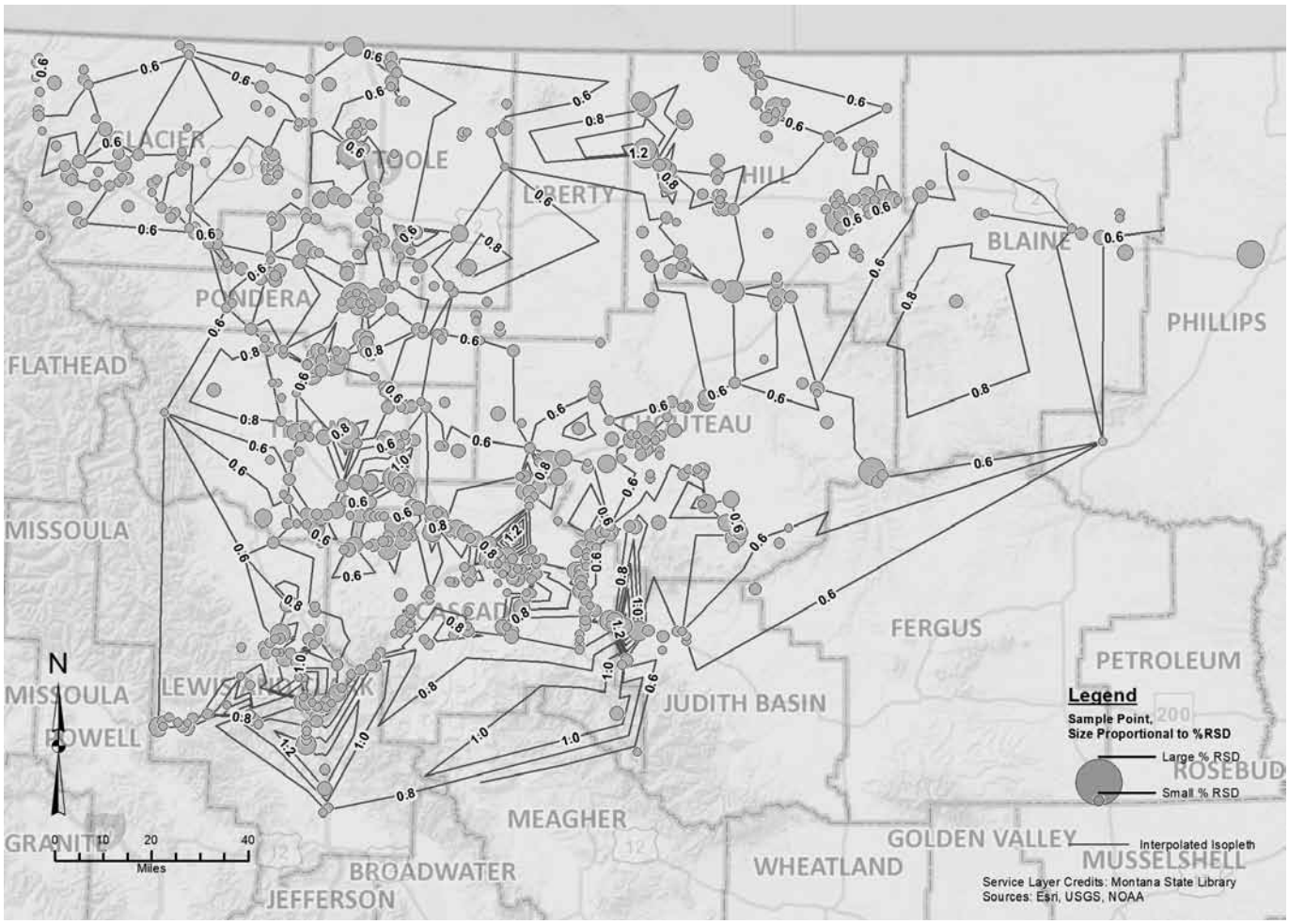


Figure 7. Map of study area generated from project data using global information system (GIS) with isopleths of kurtosis calculated using Inman (1952) functions.

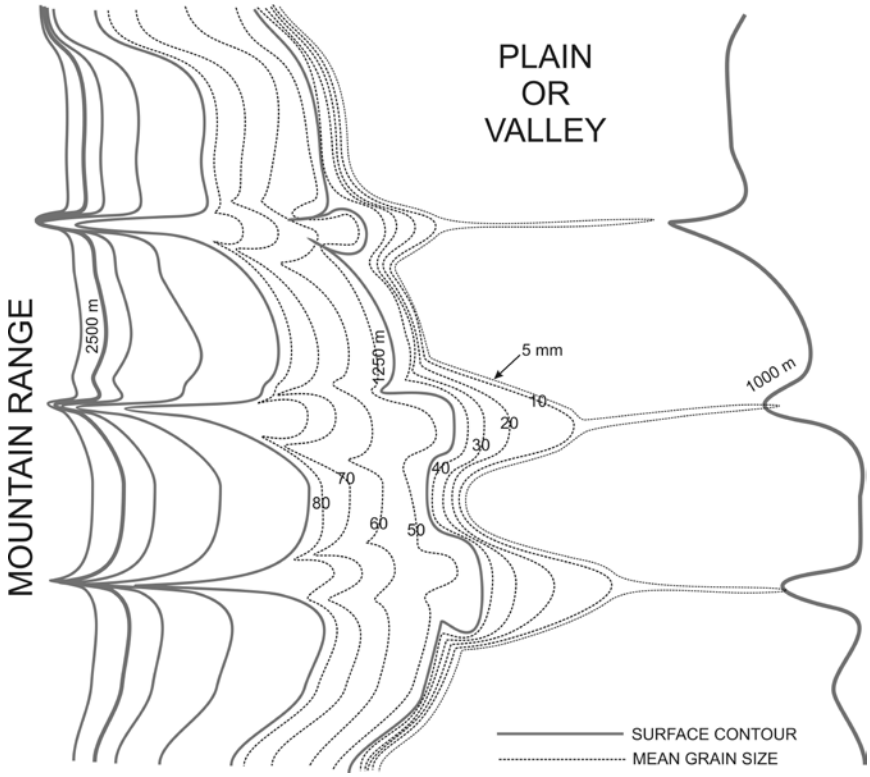


Figure 8. Idealized map showing ground surface contours (solid lines) and mean grain size isopleths (dashed lines) to illustrate how streams emanating from mountain front transport larger clasts greater distances than are transported onto interfluves.

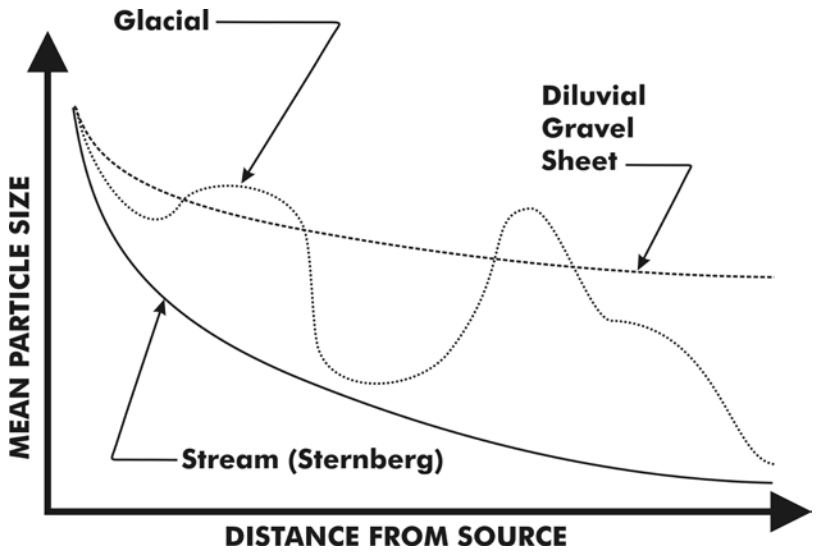


Figure 9. Predictions of depositional processes on Sternberg plot. Diluvial deposition would mimic fluvial deposition on a large scale and show more gradual downstream fining, thanks to large, powerful currents. Glacial transport would show a general trend to drop larger boulders from ice, with many irregularities in deposition (e.g., till).

(thickness is negligible at this scale) in order to indicate possible gravel sources and paleocurrent directions. The approach was:

1. List predictions of different depositional hypotheses.
2. Develop maps showing actual grain-size patterns using standard grain size distribution statistics.
3. Test predictions by data.

Stream channels flowing from the Rocky Mountains should show a strong Sternberg's Law behavior from west-southwest to east-northeast, with no correlation north and south, since eastward fining would occur at different rates in different streams (Figure 8). A simplified diagram of this prediction of downstream fining is shown in Figure 3. Sheet deposition should show greater uniformity and might not show the rapid downstream fining of modern streams. Glacial deposits should form isolated, short segments near the Continental Divide and farther out on the plains, trending northwest to southeast but otherwise patternless. Figure 9 compares these predictions relative to a Sternberg fining curve (Figure 3).

Statistical Methods

Statistical evaluation of coarse sediment transport focuses on the median or b-axis of each clast. Some geologists record only the long, a-axis, but the b-axis determines the bed shear stress to be overcome for the clast to begin rolling as bed load. This dimension also determines whether the clast will pass through the mesh of a given sieve. This is fortuitous, as the dimension measured by sieve analysis is that of interest for paleohydrology.

Previous studies have noted the need for: (1) large sets of data, and (2) individual samples large enough to be representative of larger clasts (ASTM D75; Koch and Link, 1980; Edwards and Scafe, 1996). Collecting and ana-

lyzing such samples is laborious, but the process has proceeded for many years as MDT has looked for aggregate sources for road projects. The author's initial estimate of a minimum population for a meaningful signal-to-noise ratio for this study was 1,500 samples. Data for a total of 5,839 samples representing 699 gravel pits or sampling locations were entered.

Potential Sources of Error

Several potential sources of error were identified and addressed, as possible: data entry errors, nonrandom selection of gravel pits, inclusion of results for processed material and binder, interpolation/extrapolation errors in producing grain size distribution curves, small sieve stacks and heavy tails, omission of oversize, and geographic rounding errors. Data entry errors could originate from mistakes on laboratory sheets, errors when the original reports were typed up, and errors when those reports were entered into the spreadsheet. Site sampling was not truly random. "High grading" was practiced; good gravel deposits were sought out, and areas barren of gravel were ignored. Where gravel was plentiful, sites near roads were commonly selected. In a few cases, the samples were not pit run gravel, but were stockpiled materials, sometimes crushed and screened. Oversized material was sometimes ignored since the objective of sampling was to locate suitable mine sites for obtaining construction material rather than simply doing geologic research. For the same reason, sieve stacks were often too short, i.e., sieves were based on required material properties, which resulted in some uncertainties in the actual particle distribution curve. Once the laboratory results were input into the spreadsheet, these "missing sieves" were interpolated and in a few cases extrapolated. The site locations were based on legal descriptions and only determined to the nearest section. The potential error in location is the width of a section, i.e., one mile (1.6 km).Some pits had many samples, others few. Those with more samples would result in a smaller relative standard deviation (RSD). The dots representing individual pits on maps were scaled to match the RSD values: large numbers of samples resulted in small RSD values and small dots on the maps. A problem arose with isolated samples where the standard deviation was undefined, so these were arbitrarily assigned larger RSD values (i.e., larger dots on the maps). This allows a visual assessment of data quality while not obscuring contouring. I have judged that variations in values represented by RSD are random and negligible in magnitude compared with distances between sampling locations.

Reducing Error

Original errors on laboratory data sheets are unknown but probably few, since construction materials testing laboratory supervisors usually proofread them before reports are generated. This study's spreadsheet was programmed to detect data entry errors from the original typing and those that occurred when the data were entered into the spreadsheet. Since it is impossible for the cumulative percent passing through a smaller sieve to exceed that of a larger sieve, any sample where numbers indicated this occurred was flagged. Each was then examined, and in most cases corrected; the error was usually an obvious transposition or misreading of low-fidelity copy. While site sampling was not truly geographically random, the number and distribution of samples was sufficiently so with a few exceptions. Few pits were sampled in mountainous areas, and Liberty County is poorly represented. The mountaintops are inconsequential to a Sternberg's Law analysis; however, the Liberty gap (i.e., lack of results for Liberty County) could influence results. It can later be filled in; it was only due to exhausting the budget to photocopy reports there. The Boundary Plateau (or Turner Plateau) was also omitted (Figure 2). "High grading" is deemed of little consequence since the gravel that attracted MDT samplers was the subject of this investigation. However, good gravel deposits may locally be mantled by fine-grained soils, one of the vagaries of geologic investigation in general, and perhaps best dealt with by large sample populations. A conditional statement was included in the spreadsheet to detect samples with curves not typical of gravel (typically far more uniform), and a few cases of processed material were identified and excluded. Omitted, oversized material in reports was more problematic, as maximum clast-size defines minimum paleocurrent competence.

A more conservative approach of using the D_{95} value was therefore followed instead of using largest clast or D_{99} (D_n refers to the diameter at which n percent of the mass of the sample is finer). Interpolated D_n values were tested in the same way as data entry errors were detected, and a few random samples were also checked using hand calculations and by entering the data into Geosystem software, the laboratory package used by TD&H Engineering to generate gradation reports. Samples with these detected errors were not analyzed. These numbered 204, leaving 5,635 samples for analysis. The maximum potential location error of one mile is 0.4% of the width of the study area and deemed inconsequential. More significant location errors were flagged, and hard copies examined. Common errors were in direction (e.g., labeling a range 13W instead of 13E, an error of 156 miles).

Table II. Equations for Gravel Statistics.

Authors→	Inman	Kondolf and Wolman	Trask	Folk and Ward
Type	Arithmetic	Geometric	Mixed	Geometric-Inclusive
Median	φ_{50}	D_{50}	D_{50}	φ_{50}
Mean	$(\varphi_{16}+\varphi_{84})/2$	$(D_{16}+D_{84})^{0.5}$	$(D_{25}+D_{75})/2$	$(\varphi_{16}+\varphi_{50}+\varphi_{84})/3$
Sorting	$(\varphi_{84}-\varphi_{16})/2$	$(D_{16}/D_{84})^{0.5}$	$(D_{25}/D_{75})^{0.5}$	$(\varphi_{84}-\varphi_{16})/4+(\varphi_{95}-\varphi_{5})/6.6$
Skewness	$(\varphi_{5}-\varphi_{95})/(\varphi_{84}-\varphi_{16})/2$	$((D_{16}*D_{84})/(D_{75}/D_{25}))^{-0.5}$	$(D_{25}*D_{75})/(D_{50}^{2})$	$(\varphi_{84}+\varphi_{16}-2\varphi_{50})/(2(\varphi_{84}-\varphi_{16}))+$ $(\varphi_{95+}\varphi_{5}-2\varphi_{50})/(2(\varphi_{5+}\varphi_{95}))$
Kurtosis	$(((\varphi95-\varphi5)/2)-((\varphi84-\varphi16))/2)/$ $((\varphi_{84}-\varphi_{16})/2)$	$((D_{16}/D_{84})/(D_{75}/D_{25}))^{0.5}$	$(D_{75}-D_{25})/$ $(2*(D_{90}-D_{10}))$	$(\varphi_{95}-\varphi_{5})/(2.44(\varphi_{75}-\varphi_{25}))$

Computations

Automated methods proved more troublesome and error prone than simply entering all the data by hand. Data were loaded into an Excel spreadsheet with routines written in Visual Basic. While a database program would have been more elegant, Excel was familiar and readily available. A sixth-order polynomial was fitted to the data in order to determine the following parameters: D_{100}, D_{95}, D_{87}, etc., measured on the b-axis. Extrapolation was required for material retained on the largest sieve and where a value of more than 10% fines (clay + silt) was present. The polynomial was constrained to prevent local maxima or minima (physically impossible). Interpolation was required for necessary intermediate values needed to calculate statistical parameters. Once all the D_n values had been obtained to fill out that part of the spreadsheet, statistical values were generated per Table II. Four common methods are shown in Table II (Trask, 1932; Inman, 1952; Folk and Ward, 1957; Kondolf and Wolman, 1993). These differences largely revolve around the assumptions of normal or log normal population distribution and how the actual population differs from these assumptions. The Trask definitions are the earliest, simplest, and widely used for petroleum geology in sandstone reservoirs. The Kondolf and Wolman definitions are heavily weighted to tails since they were developed to evaluate gravel river beds for salmonid spawning potential. Folk and Ward (1957) are probably the most widely used in sedimentation studies as they address both tails and central distribution. Legal descriptions of the sample locations were used to create a GIS base map and a series of isopleth ("equal quantity") maps showing contoured statistical values. The three different hypotheses for gravel deposition compared in this study predict distinct patterns that can be visually compared with the actual patterns. The uniformitarian fluvial hypothesis predicts patterns for each stream particular to it, that are closely spaced near the mountains and more widely spaced on the plains per Sternberg's Law (Figure 8). Sternberg's Law also applies to some modern braid plains (Browne, 2004). Mountain "islands" (or "island mountains") complicate the pattern, and extensive bench gravels attributed to braided streams are accommodated by Figure 10.

Working Hypotheses

Various transport mechanisms can be envisioned, from the mundane to the outlandish. These have been addressed in greater detail previously (Klevberg and Oard, 1998). Discounting various unobserved and imaginative mechanisms, and acknowledging there is always the possibility of something not yet thought of, there remain four broad mechanisms for sediment transport: mass wasting, ice, water, and wind. Mass wasting may occur subaerially or subaqueously. Ice may transport sediment beneath the ice, within the ice, or on the ice, often in association with water. Transport in water may be channelized, sheet flow, or cyclic, occurring in fluvial, diluvial, lacustrine, or marine environments. Wind applies only to subaerial transport of particles small enough to be moved by the low density fluid that is air.

Mass wasting is readily discounted at this scale, and wind does not transport gravel. Evidence for both cordilleran and continental glacial transport is found as widespread diamict (glacial till), angular rocks from distant sources, and erratic boulders. The area believed to have been glaciated (Fullerton et al., 2004) covers most of the study area,

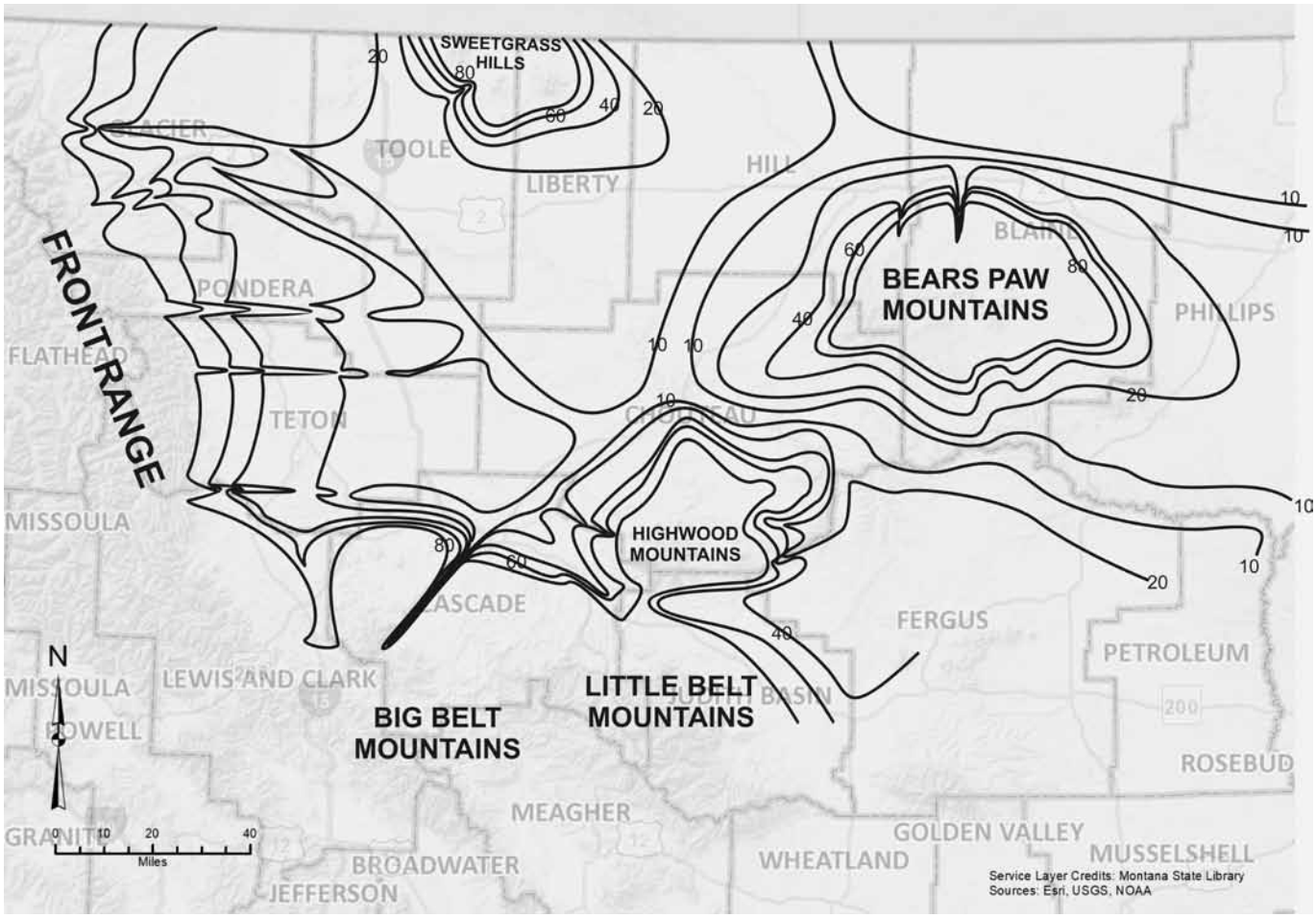


Figure 10. The influence of mountain ranges and the presence of gravel-capped benches traditionally interpreted as "braid plains" are incorporated into this figure of the study area, significantly modifying the idealized situation shown in Figure 8.

except that southeast of the Missouri River (Figure 2). There is evidence for water transport across the study area—rounded clasts, stratification, sorting, cross-bedding, and imbrication. These are predicted by both the fluvial and diluvial (sheet flow) hypotheses. Although grain-size variations have been used in marine settings (Diemer and Forsythe, 1995), neither the fluvial nor diluvial hypotheses predicts that setting. Marine processes such as turbidity currents are lumped under the general term "diluvial" here. Diluvial sheet deposition could create a simple pattern (Figure 11), but it would be complicated by topography, especially as flow became shallower and more channelized. Genesis 8 indicates assuaging of Floodwaters receded over a period of months. Eventually, decreasing flow in developing channels would approximate Sternberg's Law.

Findings

The significance of the computed statistics is shown in Table III. These statistics were mapped for the methods included in Table II, though most of the figures generated are not shown, due to space considerations.

Patterns

Maximum particle size (approximated by D_{95}) decreases from the mountain front toward the Great Plains (Figure 12). The pattern is not as clear for mean size, but the Trask mean (see Table II) generally diminishes from 10–20 mm at the mountain front to 5–15 mm at the east end of the study area (Figure 13). The mean values for the other three methods display a similar relationship.

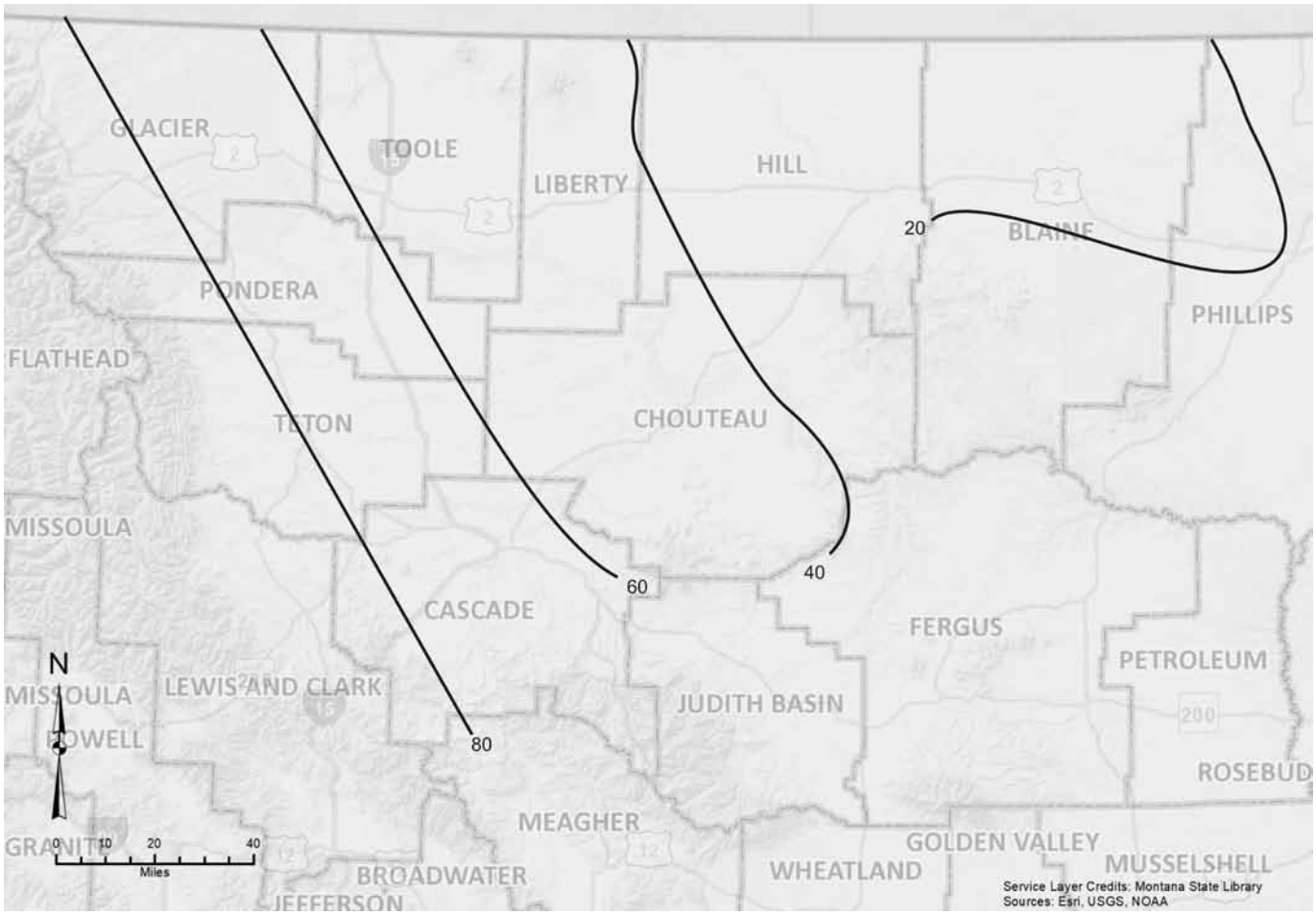


Figure 11. As shown in Figure 9, diluvial transport could be expected to "stretch out" the downstream fining and erase the interfluves that produce the pattern in Figure 8. The simple pattern shown here would be greatly affected by the obstructions created by mountain ranges.

Effects from the mountain ranges are imprinted on the general fining-eastward trend.

Sorting

Sorting is a fundamental statistic. It is the standard deviation of the population and the inverse of grading, e.g., a poorly-sorted sediment is a well-graded sediment, with a wide range of particle sizes. It often forms a clear Sternberg's relationship downstream (Figure 14) that points to origin. McLaren (1981) noted at least three cases (Table IV). Erosion, transport, and deposition may be repeated, with the sedimentary deposit of one event becoming the source for the next. Taking the limit of this function results in Case IV. As McLaren (1981) showed, sorting always improves with transport. Incorporation of bedload (Case IV) changes this situation, though as the current wanes, Cases I–III again apply. The importance of waning current effects was pointed out by Unde and Dhakal (2009) where mixed clay and gravel deposits were observed to form in backwater eddies.

Figures 14–16 show the relationship (or lack thereof) between mean size and sorting. Note the very low coefficient of determination (r^2) of the linear fit to the data in Figure 16. Various scenarios could explain this:

- Transport from a given source is not reflected in the data, i.e., they are unrelated deposits.
- Transport from a given source is reflected in the data but not the source itself, i.e., they are similarly deposited ("all at once").
- A significant portion of the data resulted from Case IV.
- Glacial transport was involved; ice was too viscous for sorting to occur.

Table III. Significance of Gravel Statistics.

Parameter	Definition	Significance
D_{100}	Minimum b-axis for which 100% of sample mass is finer.	Current strength minimum determined from D_{100} and paleoslope.
D_{95}	Minimum b-axis for which 95% of sample mass is finer.	More conservative for current strength estimation by eliminating outliers.
D_{50}	Minimum b-axis for which 50% of sample mass is finer.	Median. Primarily useful in computing other statistics.
Coefficent of Uniformity	Particle size distribution curve shape parameter: $D_{60}/D_{10.}$	Needed for classifying soil as well-graded (poorly sorted) or poorly-graded (well sorted).
Coefficient of Curvature	Particle size distribution curve shape parameter: $D_{30}^2/(D_{60} \bullet D_{10})$.	Needed for classifying soil as well-graded or poorly-graded per ASTM D2487.
Median	D_{50} or $\varphi_{50.}$	D_{50} value in millimeters; phi value (φ_{50}) is $-\log_2(D_{50})$
Mean	Lognormal, mass-based, variously defined (see Table II).	Average grain size based on sample mass. Useful in determining capacity but not competancy of stream.
Sorting	Lognormal, mass-based, variously defined (see Table II)—standard deviation.	Variation in grain size. High values mean poorly sorted. Sorting is typically effect of transport distance wherein smaller particles move faster downstream and reduce the range of particle sizes at a given location.
Skewness	Asymmetry of probability distribution, variously defined (see Table II)—third moment (geometric definitions).	Symmetry of distribution. Positive skewness means weighted toward fine grains, negative means coarse grains.
Kurtosis	«Tailedness» of probability distribution, variously defined (see Table II)—fourth moment (geometric definitions).	Degree of sorting of middle portion of distribution versus coarse and fine tails. Leptokurtic distributions are better sorted in middle than ends («peaky», $k>1$), while platykurtic distributions are better sorted in tails and «flat peaked» ($k<1$). Values near 1.0 are mesokurtic.

Skewness

Skewness is more equivocal (Figure 17; cp. Figure 18). As shown in Table IV, positive skewness coincides with Cases II–IV and is not diagnostic. The relationship between mean and skewness (Figure 19) shows the r^2 is an insignificant 0.0313. The aforementioned scenarios explaining sorting could explain skewness.

Kurtosis

High kurtosis values (i.e., those clustered at the tails and peak around the mean) indicate many outliers or tails relative to the middle sizes. An example of kurtosis results is Figure 7. While there are not marked differences between kurtosis plots using the four methods, there are some minor ones. Kurtosis is generally higher away from the mountains and in the canyons of the Missouri River. A material that would produce relatively high kurtosis (and positive skewness) is seen in Figure 20. Note the considerable sand matrix in well sorted gravel.

Scatter Plots

Figure 21 shows the project data with a linear regression. The r^2 value is 0.018, which is evidence of noisy data or dubious correlation. Figure 22 includes a portion of these data along with relationships for sand bodies in various modern environments. While skewed slightly to the negative (coarse) side, positive skewness is nearly as common. This could be explained by a mixture of Case I and the other cases per Table IV.

C-M Diagram

A C-M diagram displays the D_{99} value (C) versus the D_{50} value (M). M is the abscissa, while C is the ordinate. Figure 23 shows the project data compared to observed depositional processes. Note that D_{95} values were substituted for D_{99}

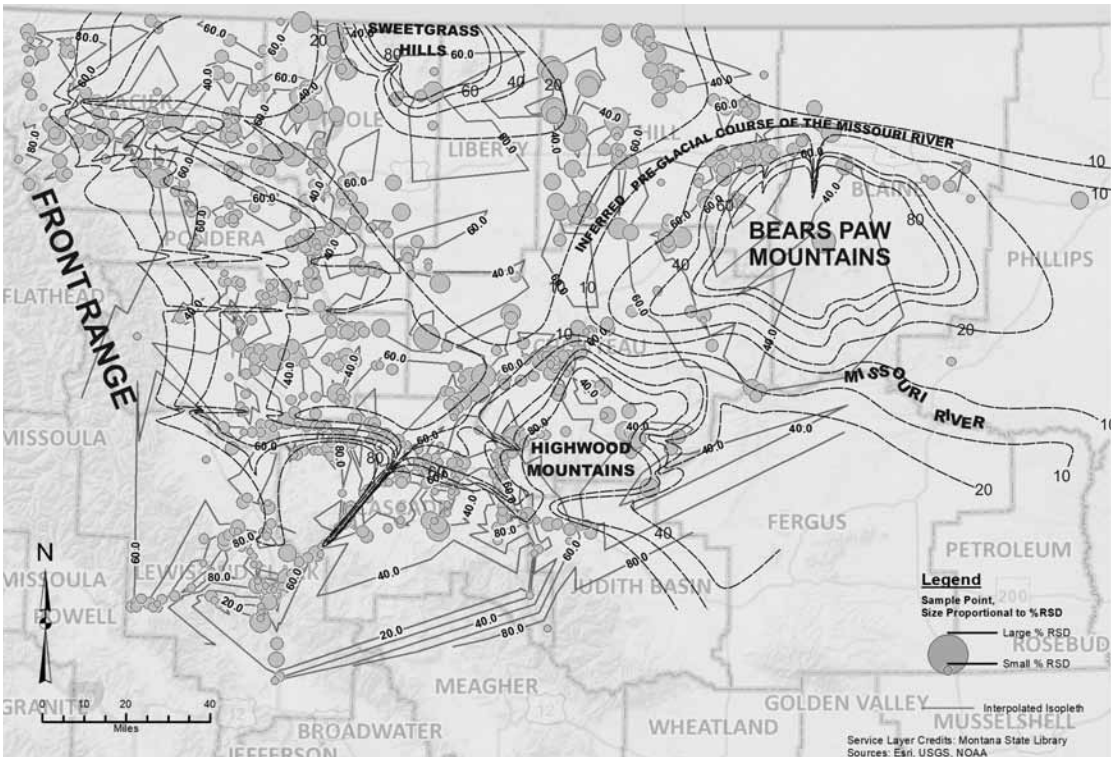
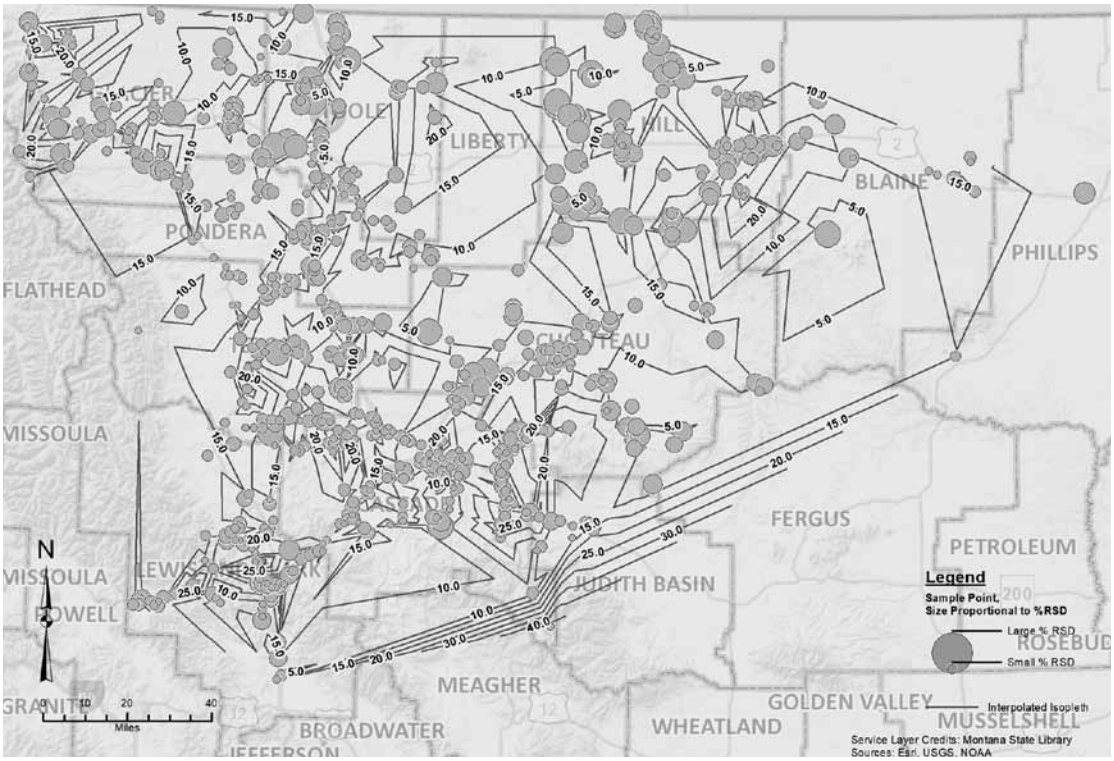


Figure 12 ***(above)*****. Isopleth map of 95th percentile of clast size superimposed on Figure 10. Dashed lines are isopleths from project data; solid lines are predicted isopleths based on Sternberg's Law. Note that while there is considerable discordance between the two, there is some localized similarity, and there is a definite fining from west-southwest to east-northeast across the study area.**

Figure 13 ***(below)*****. GIS-generated map of Trask (1932) mean. Fining from mountain front onto prairie is evident, but no clear pattern in the data corresponding to modern streams.**



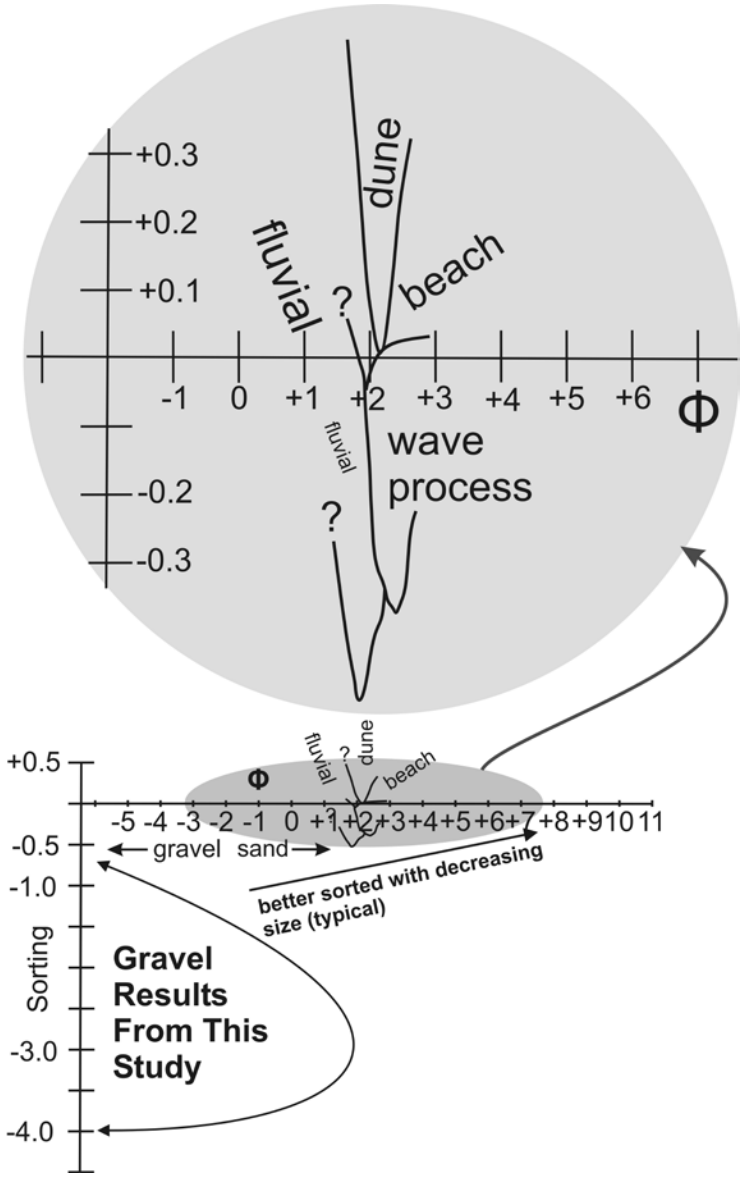


Figure 14. Particle size in phi units versus sorting coefficient showing transport process domains per Passega (1964) and others in the sand range (right side of figure) and a parabola tracing the edge of gravel data from this study (left side of figure). Arrow shows expected increase in sorting with decrease in size resulting from sorting action of current.

values as described above. The data would plot somewhat higher with reliable D_{99} values, though the difference might not be perceptible at this scale. Note the preponderance of data with C-M values coinciding with modern river terrace and beach deposits.

Conclusions

Methods:

1. Sternberg's Law is a first-order differential equation reflecting the relationship between geologic work and potential energy. It works for a variety of particle sizes and diminution mechanisms.
2. Unlike smaller particle sizes, gravel permits paleohydrologic calculations of minimum stream (i.e., current) competence.
3 The study area is highly appropriate for a Sternberg's Law analysis due to the large area of marked relief between the Rocky Mountains and the Great Plains.
4. Sheets of gravel composed of exotic lithologies cover most of the benches (Great Plains outside river valleys); this differs significantly from the typical fluvial environment that is the subject of nearly all Sternberg's Law studies. They all lack the expected architecture for braid plains. However, sheetflow deposition should also follow Sternberg's Law as the same relation of energy and work applies.
5. Predictions of hypotheses can be identified and compared with observations both statistically and graphically.
6. The final data set achieved the goals of the project for population size and precision. The minimum estimated population size to achieve desired accuracy and precision was 1,500. The final spreadsheet contained a total of 5,839 samples.

Conclusions:

7. Mapping revealed a general Sternberg's relationship, fining eastward though interrupted by "island mountains." However, the relationship is not strong as shown by many crossing lines of predicted and observed values.
8. There is very little correlation between sorting and mean grain size. This could result from transport from unrelated deposits, mixed deposition from a sudden drop in current strength, material eroded by a current with excess capacity, or glacial transport.

Table IV. Effects of Transport Sequence (after McLaren, 1981).

Case	Process	Mean	Sorting	Skewness
I	Erosion incapable of removing largest clasts from source, transport, total deposition	smaller	better	negative
	Erosion capable of removing all clasts, segregation in transport, total deposition following lag deposition (segregation)			
II	Erosion incapable of removing largest clasts from source, then lag deposition	coarser	better	positive
	Erosion capable of removing all clasts, then lag deposition			
IIIA	Erosion incapable of removing largest clasts from source, transport, selective deposition	finer	better	positive
IIIB	Erosion capable of removing all clasts, transport, then selective deposition	coarser		
IVA	Current with excess capacity erodes into bed, wanes, selective deposition	fining*	poorer	positive*
IVB	Current with excess capacity erodes into bed, wanes, total deposition			uncertain*

Cases I–III from McLaren (1981); Case IV added.

*Constant changes to mean and skewness with constant incorporation of material and deposition.

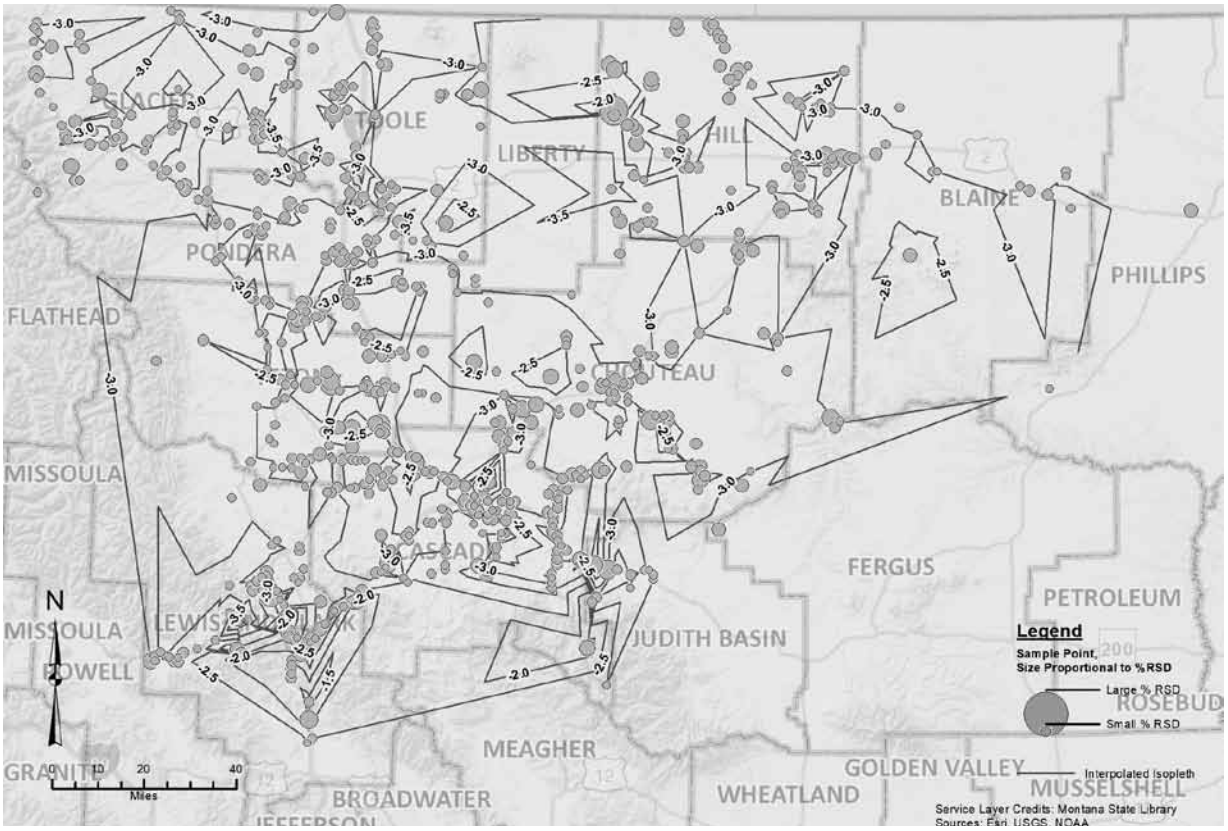
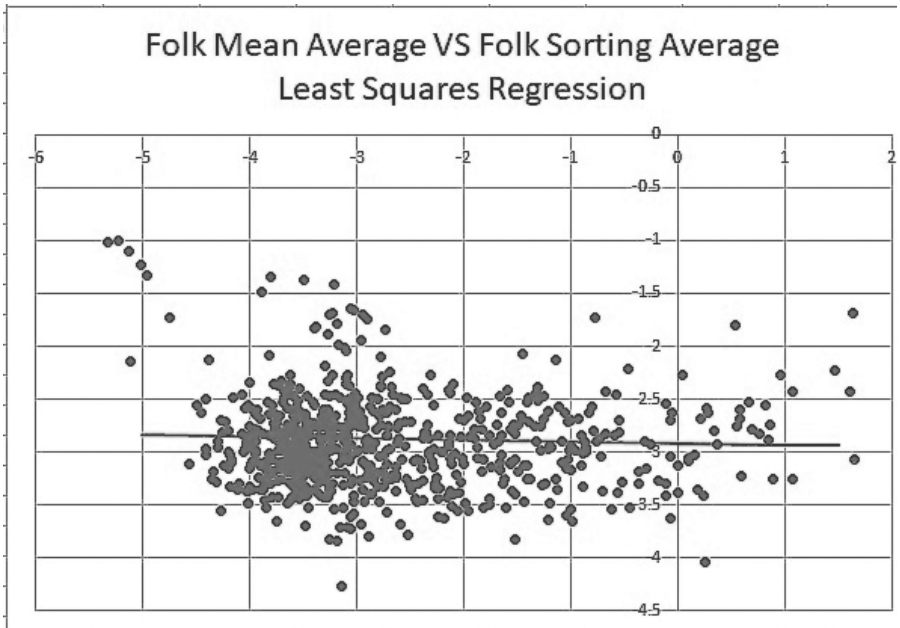


Figure 15. Map of study area showing sorting coefficient per Folk and Ward (1957). The strength of trends or patterns in these data is underwhelming.



N	699								
m =	-0.01643								
B=	-2.91621								
x	y = mx+b								
-5	-2.83407								
1	-2.93264								
0	-2.91621								
1	-2.93264								
1.5	-2.94085								
Byx =	0.886281								
R	-0.05		Correlatiom Coefficient						
R^2	0.0022		Coefficient of Determnation						

Figure 16. Mean versus sorting using Folk and Ward (1957). The term "average" in the title refers to the fact that each point represents an individual gravel deposit for which a single datum (mean, sorting) was obtained. Sorting is poorly developed and does not appear to vary with mean. A linear regression was applied as shown.

9. Skewness is poorly developed and is not diagnostic.
10. Kurtosis is generally higher away from the mountains and in canyons; however, source materials that could produce higher kurtosis are also present in the area.
11. Scatter plots indicate very noisy data or lack of correlation. More than one scenario for weathering, transport, and deposition could explain this; there is no unique solution.
12. The C-M diagram shows strong correlation with modern river terrace and beach deposits.

Inferences regarding depositional processes and comparison of working hypotheses will be presented in Part II.

Acknowledgements

This project was truly a team effort. Data collection 25 years ago was performed by Beverly Oard and Krista Koljonen with the cooperation of Montana Department of Transportation personnel. The completion of analysis was made possible by a research grant from the Creation Research Society, and TD&H Engineering provided bare-bones hourly rates. Cindy Wojciechowski went beyond requirements entering data with amazing accuracy. James Hiersche donated hours of his time programming the spreadsheet and processing the data. While my coworkers may not be convinced of my position on Earth history, they gladly contributed to the advancement of science through this project. Michael Oard provided an invaluable review of the first draft of this paper and encouragement and assistance over many years. *Deum laudo* (Proverbs 20:15,17).

Glossary

alluvial – deposition by flooding rivers or similar overbank processes

braid plain – a plain formed by anastamosing or braided channels

capacity – the amount of material a stream can transport without reference to size (e.g., large amount of clay or fine sand)

competence – the size of particles that can be moved by a current; adequate current strength (i.e., bed shear stress) to transport larger particles (e.g., gravel)

diluvial – in general (*sensu stricto*), the term refers to the Deluge of Genesis 7–8, though it is sometimes used (*sensu lato*) for processes or deposits associated with any megaflood

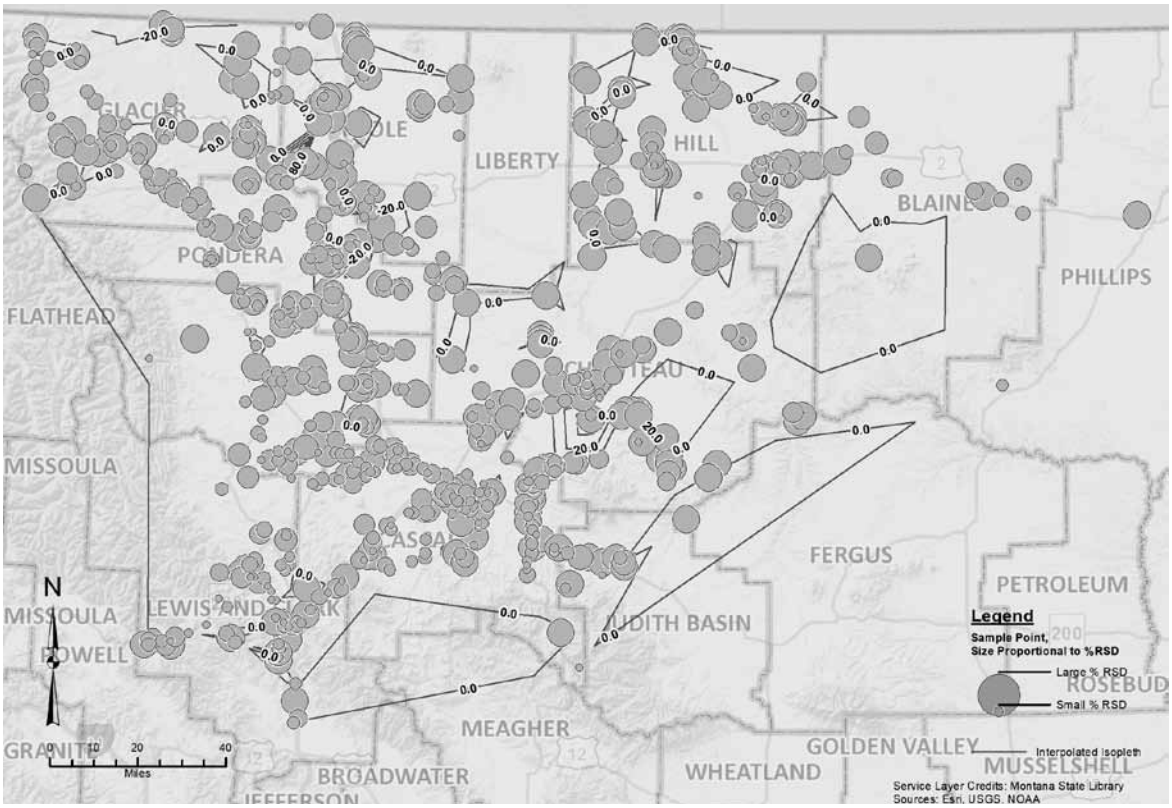
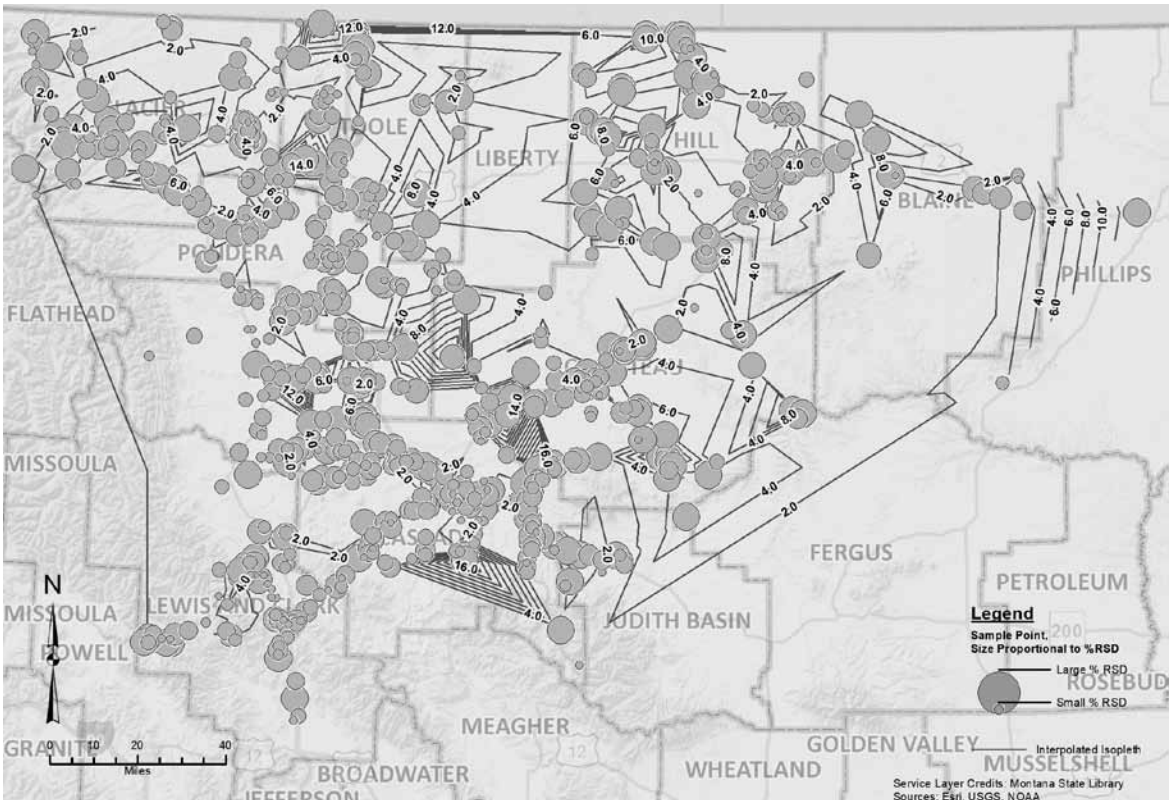
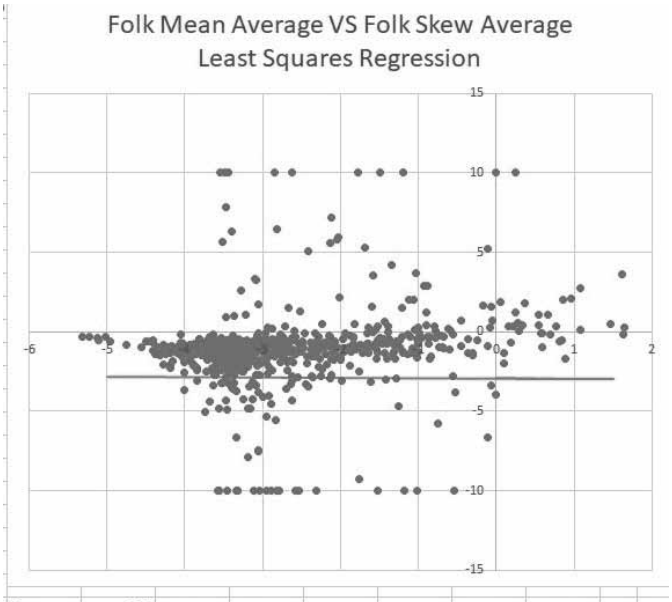


Figure 17 ***(above)*****. Map of study area generated for Folk and Ward skewness results.**

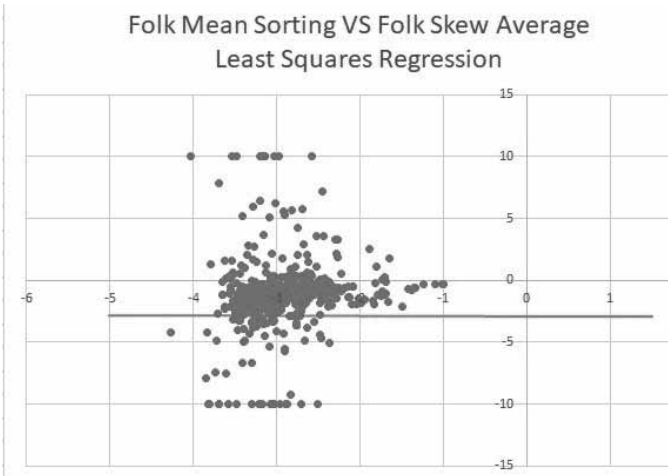
Figure 18 ***(below)*****. Kondolf and Wolman (1993) skewness results.**





N	699
m =	0.3655
B=	23.2243
x	y = mx+b
-5	21.3969
1	23.5898
0	23.2243
1	23.5898
1.5	23.7725
Byx =	0.4116
R	0.18 Correlation Coefficient
R^2	0.0313

Figure 19. Mean versus skewness using Folk and Ward (1957). Linear regression applied.



N	699
m =	0.7980
B=	-1.1408
x	y = mx+b
-5	-3.1922
1	1.5961
0	0.7980
1	1.5961
1.5	1.9951
Byx =	0.3999
R	0.13 Correlation Coefficient
R^2	0.0180

Figure 21. Spreadsheet output of sorting versus skewness. Typically, an important comparison, in this case it shows no strong trends with a flat linear curve fit. Distant outliers were truncated at ±10 to enhance legibility.

Figure 20 *(left)*. Camrose Colony gravel pit near Ledger, Montana. This area is dominated by glacial material, and a few of the rocks in this pit are exotics believed to have been glacially transported.

fluvial – deposited by streams within their channels

lacustrine – deposition or other processes in a lake

littoral – processes operating along a shoreline

paleohydrology – inferring limitations on past hydrologic processes from existing slopes, deposits, maximum particle sizes, etc.

planation surface – an erosion surface that is noticeably flat and planes rocks without regard to their geologic structure

relative mobility – observation that small particles move more quickly than larger ones in a given current (all else being equal)

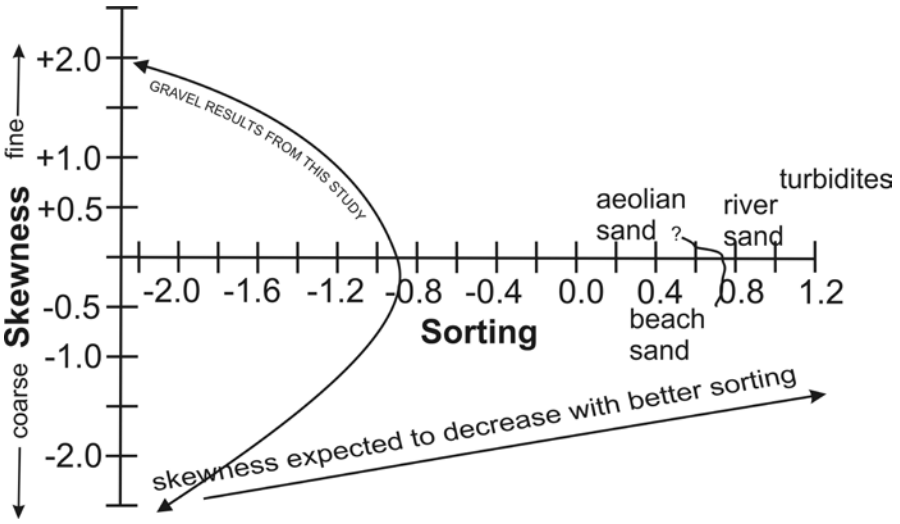


Figure 22. Sorting coefficient versus skewness showing domains of transport processes in sand range and parabola tracing the edge of gravel data from this study (left side of figure). Arrow shows expected decrease in skewness with increase in sorting resulting from action of current during transport.

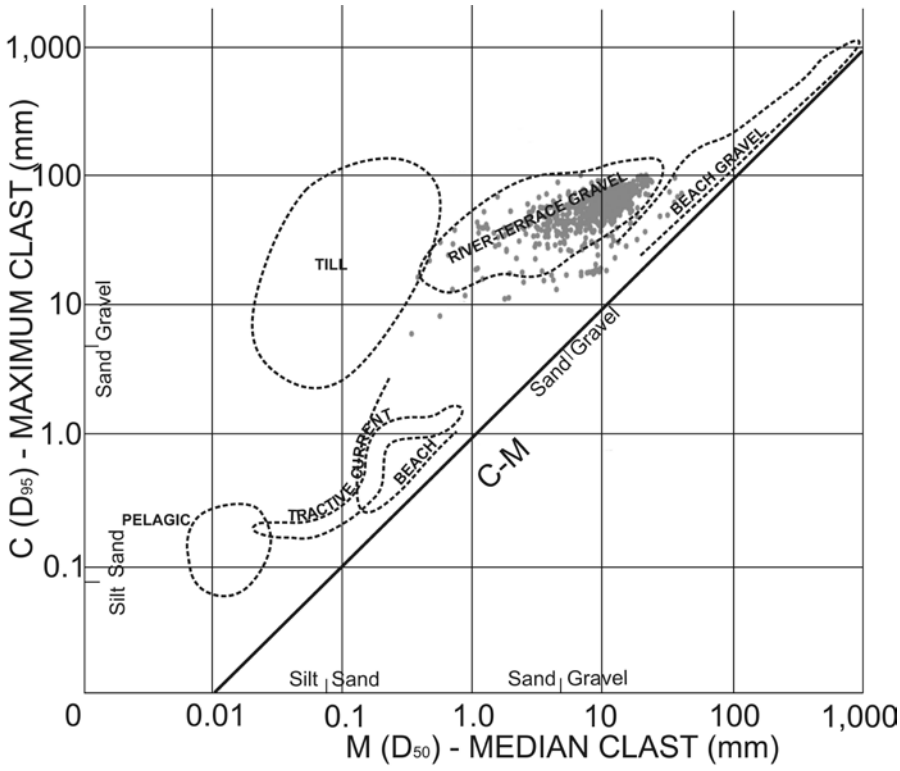


Figure 23. Plot of maximum (C) vs. mean (M) clast size. Maximum is normally defined as D_{99}, but D_{95} substituted here, shifting points very slightly down. Fields corresponding to transport mechanisms are shown by dashed lines as modified from Passega (1964) and Schlee (1973).

winnowing – a special case of relative mobility in which the current is not strong enough to move particles above a certain size or moves them only very slowly while readily removing smaller sizes, leaving a coarser (lag) deposit

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Author and Title INDEX for Volume 60, 2023–2024

David V. Bassett*

This title/author index covers articles, panorama notes, and other features. For items with two or more pages, the reference is to the first page only. After the page number, a letter indicates which type of entry is involved: article (A), panorama note (P), research note (N), letter to the editor (L), book or video review (R), conference abstract (CA), cover photo (CP), or other departments (such as editorials, editor's forum, laboratory director's comments, president's remarks, photo essays, etc.) (D).

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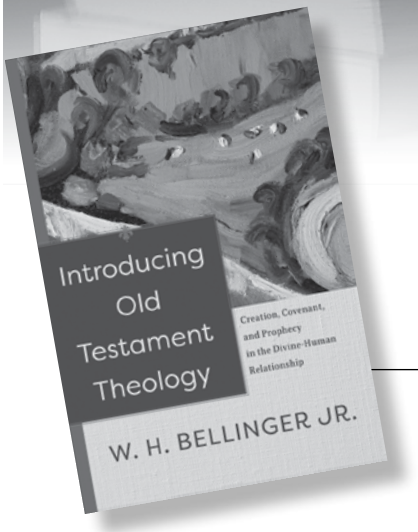
Media Reviews



Introducing Old Testament Theology

by W. H. Bellinger, Jr.

Baker Academic, 2022,
224 pages, $63.00 (hardcover)

Introduction

W. H. Bellinger, Jr. is professor emeritus of religion at Baylor University in Waco, Texas. He holds a PhD from the University of Cambridge, and has written several books, the latest titled "Introducing Old Testament Theology" (Bellinger, 2022). Bellinger's goal with this book is to promote a new way of interpreting the Old Testament, including major themes, such as creation, history, the Psalms, wisdom literature, and prophecy. This he does, since as he quotes the theologian Brent Shawn, the Old Testament is dying, and in need of 'invigoration' (p. 19). Since Bellinger has great stature as a theologian, and since his works influence many in the Christian community, it is well worth examining his views on the Old Testament, and especially Genesis and creation in his latest book.

The book is difficult to read. The author speaks in vague, general, and abstract terms. His writing appears to be affected by Marxism, reading feminist themes and social justice into various books of the Old Testament (pps. 138–140, 154, 162, 169), turning prophets like Amos and Zephaniah into social jus-

tice warriors. It is hard to discern what his opinion is on various theological questions, such as creation, which is of importance for a creation journal. Instead of plainly presenting his own views on creation, Genesis, and the Old Testament, he merely describes the views of several theologians on the Old Testament from the past 90 years. Nowhere does Bellinger mention the theory of evolution. Neither does he take any position as to the length of the days in Genesis or the age of the universe. As such, this is a rather large omission in a book that is purported to be comprehensive in nature. Despite this, there are several signs that seem to imply that Bellinger does not take creation literally.

Bellinger's view of Scriptures seems somewhat low. According to Bellinger's "narrative view" of history, the tools we have to construct the past and express our predecessors' faith in God consist merely of narratives, created by humans, who have limited knowledge and live by presuppositions (p. 37, 43). The human element seems to dominate in the narration of salvation history.

Bellinger's Model

Bellinger views the whole Old Testament not so much as a historical book, but rather a literary-theological document, tied to literary frameworks (p. 171), an expression of Jewish theology. But this theology has to rest on God's revelation and historical-redemptive acts, otherwise the theology is meaningless, a wax nose that may be turned into anything one wants it to say. Consider how the book of Revelation uses a symbolic/topical structure with colorful imagery of various beings and events repeating themselves (Beale, 2015, pps. 9–17). In contrast, Genesis is a historical book, describing important events tied to salvation history: creation, the Fall, and the Flood. These references to salvation history are conspicuously missing from Bellinger's book.

Nevertheless, Bellinger does give a broad outline of what he thinks is the structure of the Old Testament with an analogy of a three-legged stool.

The first leg includes creation, centered around Genesis, wherein God blesses mankind, and offers His wisdom to the world, through which He blesses it and allows the creation to respond. The second leg involves covenant theology, with a focus on the events in the book of Exodus. Therein is an account of God's deliverance of His people to whom He gives instructions on how to live and opportunity to respond. These laws are constituted in the Torah, the first five books of the Old Testament. The last leg involves prophetic theology in which God calls for fidelity to Himself as Creator and liberator (p. 2). His people must then respond to the prophets by turning away from injustice and idolatry and tending to the garden of Creation and keeping the covenant, as expounded in the laws of the Torah.

Bellinger then applies these three principles in the rest of the book to the different segments of the Old Testament: the Pentateuch, the historical books (i.e. Kings, Chronicles, Right, Nehemiah and Ezra), the Psalms (as an expression of Israel's worship of God), the Wisdom books and the prophets.

Bellinger's Old Testament model leaves several things to be desired. One wonders if Bellinger's God is truly the sovereign Creator who commands all things to come to pass (Lamentations 3:37; Ephesians 1:11). It seems that in Bellinger's estimation, God and His people are co-equal actors in the grand scheme of things where God says or does something and then waits for the people to respond (p. 38). Also, what are God's people liberated from? Sin? Slavery?

The Pentateuch

Since the book introduces a new approach to understanding the Old Testament, Bellinger's interpretation of the Pentateuch and in it the creation account is of prime importance, especially for a book review in the journal on creation theology. Therefore, the Pentateuch, and in it the book of Genesis will be the main focus of this section.

Most concerning of all is the fact that Bellinger denies physical death with the events in Genesis 2–3 (pps. 72–73). If this were so, it would mean physical death must have come before Adam and Eve. This leaves the door wide open for evolutionary views, which involve the death of millions of organisms.

When we speak of death in a biblical sense, we must talk about it *holistically*. We cannot separate physical death from spiritual or judicial death. Death occurs when the soul and the body are separated from one another (Murray, 1977, pps. 56–57). That is why in Genesis 2:17 God tells Adam that if he eats from the tree, 'dying you shall die' (מוֹת תָּמוּת).

Unusually, Bellinger starts the construction of his Old Testament theology in the middle point of the Bible, with the Psalms, which he describes as the "confession of a worshiping community" (pps. 46–47), rather than the historical account of creation in the book of Genesis.

In contrast with Bellinger's views, the book of Psalms recounts mighty acts of God. For example, Psalm 8 describes the glory of God's Creation, and Psalm 33:9 describes how the heavens were made by the word of the Lord: "For He spoke, and it was done; He commanded and it stood fast." This means that God's Word is efficacious and immediate, and that creation could not have lasted for very long periods of time (Young, p. 56–57). Psalm 104:6–9 describes how the waters of the Flood covered the highest mountains, and that afterwards God set a boundary that they may never cross to cover the earth again. Psalm 78 is like a condensed history of the Jewish people. Psalm 81:10 recounts how God brought His people out of the land of Egypt, and how they crossed the Red Sea in Psalm 106:7. It is incomprehensible why Bellinger would start in the middle, rather than at the beginning. He is putting the cart before the horse.

Sadly, Bellinger repeats the theologically liberal ideas that Genesis contains two different accounts of creation (p. 66), that Genesis reads like a worship litany (p. 67), that it resembles the Babylonian creation story described in Enuma Elish (p. 68), and that Genesis was formulated much later in human history in the priestly writings. This is something that the so-called 'JEDP' theory claims that Moses did not actually write the five books of Moses, but various subsequent groups of compilers, the Jahwist, the Elohist, the Deuteronomic, and the Priestly compilers (the first letters of the name of each group spelling out the acronym 'JEDP').

These ideas have been refuted in various creationist writings. For example, Adamthwaite's (2014a, 2014b) works on the Gilgamesh epic refutes the idea that Genesis was copied from a Babylonian legend. The lifespan of the ancient patriarchs in Genesis 1–11 largely overlapped. Thus, Noah could have conversed both with Enos (who preceded him by seven generations) and Abraham (who came ten generations after him). Thus, the transmission of information from Adam to Noah to Abraham to Moses would have passed through fewer hands, instead of being cobbled together by groups of vague, unnamed editors/redactors/compilers.

Since Bellinger does not take Genesis literally, he must understand it either allegorically or topically. Apparently, Bellinger holds to the Framework Hypothesis, which describes Genesis 1 as a topical description of creation events (pp. 67–69). During the first three days of creation God creates spaces (the skies, the sea, and the land) to contain the heavenly bodies and living organisms in days 4–6 (birds, fish, land animals), to form a nice symmetry.

Questionable are Day 3, where land plants are already created as occupants of the dry land, and Day 4 which are simultaneously part of God's formative and filling acts of creation. Rather, young-earth creationists typically see a progression of God's creative acts from Day 1 to Day 6, culminating in God's resting from His creative acts (Hebrews 4:3). As Osborne states, quoted by Gentry, "there is no theoretical reason why literary and historical interests coincide." The Framework Hypothesis commits a logical fallacy by saying that Genesis 1 must be exclusively either literary or literal in its genre (Gentry, 2016, pps. 170–171). Architects construct houses before inhabitants move in.

Genesis 1 does not follow the style of a worship litany. Rather, the structure of the Hebrew sentences follows what is known as the 'vav consecutive,' a sequential description of historical events. If we read Genesis 1, we read various actions of God pertaining to Creation: "Then God said," "And God saw," "And God called," etc. Twenty-two of the thirty-one verses in Genesis 1 begin with the Hebrew letter ו (vav). The book of Numbers, Chapter 7 describes a similar sequence of events divided among several days, yet no theologian thinks that these events are allegory or poetical, or some form of worship litany (Sarfati, 2015, p. 48). A worship litany has to be based on God's mighty and wonderful deeds. How can the very beginning of the Bible be a worship litany if the writers have no previous knowledge yet of what great things God has done?

Bellinger also claims that most Bible interpreters believe that there are two Creation accounts in Genesis Chapter 1 and Chapters 2–3 (p. 66). This also has been thoroughly refuted in the creationist literature. The structure of Genesis 2 merely resembles that of Genesis 5 and 10, which serve as a heading for the ten divisions in the book of Genesis (Pipa and Hall, 2005. p. 122). Genesis 1 simply serves as a prologue describing the creation of the universe.

Summary and Conclusion

The Old Testament is alive and well. It has always been that way. It is in no need of a modern, liberal reformulation and reinterpretation. Jesus says in John 6:63 that "The words that I speak to you are spirit, and they are life." All in all, Bellinger's book is very general and vague. It misses out almost completely on the interpretation of creation, yet it is his version of 'creation theology' that he is allegedly applying to the different parts of the Old Testament. By denying physical death at the Fall, Bellinger denies a literal Genesis, and opens the door for various theistic evolutionary viewpoints. As such, his book compromises the Old Testament. "Introducing Old Testament Theology" is an underwhelming read. Despite the accolades of several theologians on the back of the book, it does not add much value to the interpretation of the Old Testament, rather it even retracts from it.

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Instructions to Authors

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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 abbreviated 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.

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

Book Reviews:

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

Author Copies:

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

Creation Research Society Membership/Subscription Application and Renewal Form

The membership/subscription categories are defined below:

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

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

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

This is a ❑ new ❑ renewal application for the subscription year beginning Summer 20_____. *(Please type or print legibly.)*

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❑ Senior [per year]	❑ $48	❑ $68	❑ $85	❑ $30
❑ Life member	❑ $600	❑ $600	❑ $600	❑ $600
❑ Student* [per year]	❑ $48	❑ $68	❑ $85	❑ $30
❑ Subscriber [per year]	❑ $56	❑ $76	❑ $96	❑ $38

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

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

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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.

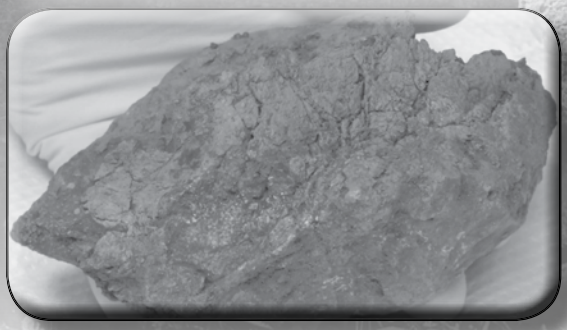
Membership—Voting membership is limited to scientists who have at least an earned graduate degree in a natural or applied science and subscribe to the Statement of Belief. Sustaining membership is available for those who do not meet the academic criterion for voting membership, but do subscribe to the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

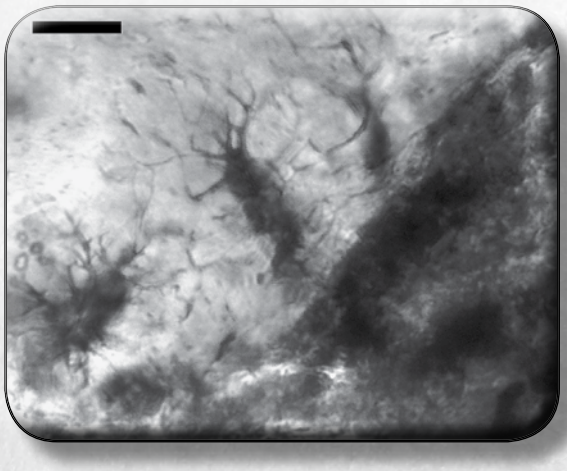
1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.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

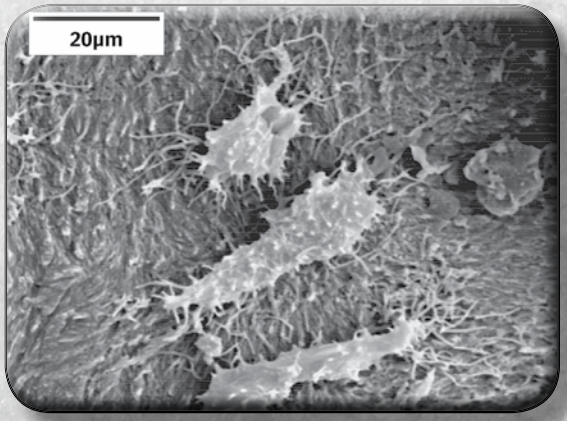
Investigation of Dinosaur Intact Natural Osteo-tissue



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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