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ARCHAEOLOGY AND THE ANTIQUITY OF ANCIENT CIVILIZATION: A CONFLICT WITH BIBLICAL CHRONOLOGY? — PART I

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Abstract

Near the end of the 19th century, A.D., White made the claim that historical and scientific evidence regarding the antiquity of ancient civilizations proved that the Biblical chronology was impossibly short and of no historical value. During the course of the 20th century, historians have been steadily decreasing their estimate of when ancient civilization began. In recent years, several scholars have been working on a radical revision of ancient history which reduces the antiquity of ancient civilization even further. These recent revisions of ancient history may very well prove to eliminate entirely any supposed conflict between Biblical chronology and the antiquity of human civilization.

Introduction

One of the issues in the Creation/evolution controversy is the antiquity of man, both primitive man and civilized man. In this article, we will be concerned primarily with the issue of the antiquity of the ancient civilizations.

The publication of Darwin's book, *Origin of Species,* in 1859 produced an upheaval in the history of human thinking, but not because evolution was a new idea. The concept of an evolutionary development of life forms had been around since the time of the ancient philosophers, more than 500 years B.C., and was in fact popular among many intellectuals for a century before the publication of Darwin's book. But the appearance of *Origin of Species,* whatever the reason, sparked a new interest in this ancient concept that swept over the entire globe like a tidal wave and caught the imagination of people of every station and walk.

One of the most enthusiastic supporters of evolution in the early days after the publication of Darwin's book was Andrew Dixon White. In 1896, after years of diligent research, White published a large two-volume

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work entitled, *A History of the Warfare of Science with Theology in Christendom.* The entire work was devoted to showing how the new "scientific" thinking (evolutionism) had triumphed over the oppressive superstitions of the Biblical religion.

Chapter 6 of Volume 1 is entitled, "The Antiquity of Man, Egyptology, and Assyriology." The chapter begins with these words:

> In the great ranges of investigation which bear most directly upon the origin of man, there are two in which Science within the last few years has gained final victories. . . . The first of these conquests relates to the antiquity of man upon the earth.[1]

The first half of the chapter is a historical survey of the conclusions of Christian and Jewish theologians regarding the antiquity of man and the age of the earth from their study of the Old Testament chronological data. White then, in the remainder of the chapter, proceeds to show how recent archaeological discoveries proved that the antiquity of man was much greater than any interpretation of the Biblical chronology could possibly accommodate.

The conclusions of several Egyptologists regarding the date for the beginning of ancient Egypt's dynastic history are cited by White: Marriette dates the beginning of the first dynasty at 5004 B.C., Brugsch at 4500 B.C., and Meyer at 3180 B.C. White also correctly points out that Egyptian civilization was already highly developed even during the first few dynasties which suggested to him a lengthy pre-dynastic period of development. White also points out (correctly) that there are no major discontinuities in the history of ancient Egypt that could possibly correspond to the worldwide Flood of the book of Genesis. The conclusion White arrives at is that the Biblical chronology is impossibly short and is of no historical value. The purpose of this study is to re-evaluate this conclusion in the light of more recent developments.

Biblical Chronology

Throughout this article, our discussion will be based upon three assumptions that are generally held by many Creationist scholars; no attempt will be made at this point to defend these. The first assumption is that the chronological data contained in the Old Testament is accurate. This issue is, of course, tightly bound with the larger issue of the inspiration and inerrancy of Scripture which is far beyond the scope of this article.

The second assumption is that there are no gaps in the genealogies of Genesis 11 which would mean that there is a total of 352 years from the time of the Flood to the birth of Abraham.[2,3] Some Creationists do feel that there may be gaps in the genealogies of Genesis 5 and/or Genesis 11 but for the purposes of this discussion we will be conservative and assume no gaps, at least in Genesis 11. These first two assumptions allow us to calculate the dates of the major events of Old Testament history, some of which are shown in Table I. The date that is of the greatest interest to us for our present discussion is that of the Flood; 2519 B.C.

If we further assume that the Flood of Genesis 9-11 was indeed a worldwide catastrophe that laid down

Table I. Dates of Major Events in Old Testament History According to Biblical Chronology.

Event	Date B.C.
The Great Flood	2519
Birth of Abraham	2167
Jacob Enters Egypt	1877
Exodus From Egypt	1447
Conquest of Canaan	1407
Death of Solomon	931
Babylonian Exile	587

the vast majority of the sedimentary rock strata, we can safely conclude that the archaeological remains from any pre-Flood civilization were obliterated and that the archaeological record we now possess is entirely post-Flood (except perhaps for isolated artifacts). This is why we are concerned only with post-Flood chronology.

If we accept these three assumptions, then the problem before us is whether the 2500 B.C. date for the Flood is compatible with the date of the most ancient civilizations that have been discovered by archaeologists. In White's day, over 85 years ago, the beginning of Egypt's dynastic history was variously dated between 3000 and 5000 years B.C. What is the current state of affairs?

Egypt

This history of ancient Egypt is of primary importance for two reasons. First because of the great continuity of Egypt's 31 dynasties spanning over 2700 years according to the conventional dating of these dynasties. Secondly, because the chronology of ancient Egypt is considered to be so well established that contacts with Egypt are used to determine absolute dates for many other kingdoms of ancient times that otherwise would have only a relative chronology. For example, an archaeologist digging in Palestine or Syria can assign an upper limit to an absolute date on the B.C. time scale to a certain level of a tell if he can find in that level some Egyptian artifacts that can be identified as belonging to the reign of a particular Pharaoh or from a particular dynasty. In this way, the absolute dates of other ancient civilizations are determined by where they fit into Egypt's history.

If it can be shown that Egyptian civilization is more ancient than 2500 B.C., then we will have good reason to question one or more of our three assumptions discussed above. We have already seen that at the turn of the century, there was a great divergence of opinion among Egyptologists regarding the date of the beginning of Egypt's dynastic history. Since that time the more ancient dates have been rejected and there has emerged a much more uniform consensus which places the beginning of the first dynasty at c. 3100 B.C. (although some favor a date as late as c. 2900 B.C.) In 1975, Johannes Lehmann noted that:

> In the course of a single century's research, the earliest date in Egyptian history— that of Egypt's unification under King Menes [first King of the first dynasty]— has plummeted from 5876 to 2900 B.C., and not even the latter year has been established beyond doubt. Do we, in fact, have any firm dates at all?[4]

Likewise, the date of the beginning of Egypt's pre-dynastic period has also been lowered and it is now generally dated somewhere during the interval between 5000 and 4500 B.C. (see Table II).

Even more recently this 20th century consensus has been challenged by Jewish, Christian, and secular writers who are calling for a complete revision of ancient history. An important aspect of this revision is a radically different view of Egyptian chronology which reduces the antiquity of Egypt's dynastic history even further.

Table II. The Periods of Egypt's Ancient History.

Period	Dynasties	Commonly Accepted B.C. Dates
Pre-dynastic	—	c. 5000 - c. 3000
Proto-dynastic	1-3	c. 3000 - 2613
Old Kingdom	4-6	2613 - 2181
First Intermediate	7-10	2181- 2133
Middle Kingdom	11,12	2133 - 1786
Second Intermediate	13-17	1786 - 1567
New Kingdom	18-20	1567 - 1085
Third Intermediate	21-24	1085 - 715
Late Dynastic	25-31	715 - 332

Oedipus and Akhnaton

Our story begins with a Jewish scholar, Immanuel Velikovsky, born in Russia in 1895. Velikovsky received a medical degree from the University of Moscow and studied psychoanalysis in Vienna under Wilhelm Stekel, one of Freud's disciples. From 1924 to 1939 Velikovsky lived in Palestine and practiced psychoanalysis.

In 1939, shortly before his death, Sigmund Freud published his last book entitled *Moses and Monotheism*. In this work, Freud developed the theory that the 18th dynasty Egyptian Pharaoh Akhnaton was the first monotheist and that Moses borrowed the concept from him. Velikovsky read Freud's book shortly after it was published and his interest in Pharaoh Akhnaton was immediately stimulated. During that same year. 1939, Velikovsky left Palestine to spend a sabbatical year doing research in New York. He never returned to his practice of psychoanalysis in Palestine.

Velikovsky's initial studies impressed him with a number of remarkable parallels between Pharaoh Akhnaton and the legendary figure of Greek tragedy, Oedipus, who curiously enough, was the subject of one of Freud's psychoanalytic theories earlier in his career. The puzzling thing about these parallels was that the various tragedies about Oedipus were written by playwrights separated by 700 miles from Egypt and by 700 years from the era of Akhnaton! The challenge of such a puzzle launched Velikovsky into an intense study of ancient times and resulted in a radical reconstruction.

Ages in Chaos

Basic to the reconstruction is the recognition that ancient Egyptian history, which for modern historians is the foundation and reference point for synchronizing the histories of many other ancient kingdoms, is in a state of chronological disarray. The history of ancient Egypt was first arranged into 31 dynasties by a third century A.D. Egyptian priest by the name of Manetho.

For many years scholars have recognized that Manetho's chronology left much to be desired. In 1927, the well known Egyptologist James Breasted wrote that the chronology of Manetho was:

> a late, careless, and uncritical compilation, the dynastic totals of which can be proven wrong from the contemporary monuments in the vast majority of cases, where such monuments have survived. Its dynastic totals are so absurdly high throughout, that they are not worthy of a moment's credence, being often nearly or quite double the maximum drawn from contemporary monuments, and they will not stand the slightest careful criticism. Their accuracy is now maintained only by a small and constantly decreasing number of modern scholars.[5]

Velikovsky has gone even further and has called Manetho's chronology "a most confused and deliberately extended and misleading list."[6] In another place Velikovsky writes:

> In composing his history of Egypt and putting together a register of its dynasties, Manetho was guided by the desire to prove to the Greeks, the masters of his land, that the Egyptian people and culture were much older than theirs and also older than the Babylonian nation and civilization.[7]

Rather than trying to sort out the chronology of Manetho and the various king lists recorded on monumental inscriptions, Velikovsky has taken an entirely different approach in his attempt to recover the history of ancient Egypt. Velikovsky noticed that despite the fact than the Old Testament historical narratives record many contacts between Egypt and Israel, the modern student of Egypt's ancient history was unable to identify any of these contacts in reading the books of modern historians (one exception to this will be noted later).

Not only were there no synchronisms between the histories of Israel and Egypt but there were countless discrepancies and enigmas encountered in the attempt of archaeologists to reconcile the history of the Ancient Near East with the results of their excavations. Velikovsky's approach was to ignore the chronology of Manetho and the monumental king lists and instead to search for direct historical links between Israel and Egypt using the Hebrew Scriptures and the available Egyptian inscriptions. Using this approach, Velikovsky began the task of rewriting ancient history.

After 12 years of research, the first installment of the reconstruction was published in 1952 under the title *Ages in Chaos*. This work covers a period of 600 years from the time of the Exodus to the era of Ahab and Jehoshaphat. In *Ages in Chaos*, Velikovsky synchronizes the end of the Middle Kingdom in Egypt with the Exodus and identifies the Hyksos, who ruled Egypt during the Second Intermediate Period, as being the Amalekites of Scripture (see Table II).

The beginning of the New Kingdom in Egypt is moved from the 16th century B.C. to the 11th century B.C. and numerous synchronisms between Egypt during the 18th dynasty and Israel during the Monarchial Period are established (see Table III). Tuthmosis I is identified as the Pharaoh who according to I Kings 9:16 captured the Canaanite city of Gezer and gave it as a dowry to his daughter who married Solomon.[8]

Table III. Egypt's Eighteenth Dynasty.

Ruler	Commonly Accepted Dates B.C.
Amosis	1570 - 1546
Amenhotep I	1546 - 1526
Tuthmosis I	1525 - 1512
Tuthmosis II	1512 - 1504
Hatshepsut	1503 - 1482
Tuthmosis III	1504 - 1450
Amenhotep II	1450 - 1425
Tuthmosis IV	1425 - 1417
Amenhotep III	1417 - 1379
Akhnaton	1379 - 1362
Smenkhkare	1364 - 1361
Tutankhamun	1361 - 1352
Ay	1352 - 1348
Horemheb	1348 - 1320

Queen Hatshepsut (conventionally dated 1503-1482 B.C.) is identified as the Queen of Sheba who visited King Solomon during the middle of the 10th century B.C. Thirty-eight pages of evidence are given in support of this identification.[9] Velikovsky points out that the Talmud indicates that " Sheba'in the title Queen of Sheba is not a geographical designation but a personal name."[10] A quick check of the NAS concordance shows that the word Sheba is used both ways in the Old Testament (three times as a personal name, once as a Canaanite city, and once as a nation or place). Velikovsky also points out that Josephus speaks of the Queen who visited Solomon as being the ruler of Egypt and Ethiopia. A series of reliefs on the walls of Queen Hatshepsut's splendid temple near Thebes tell of her journey to the land of Punt which Velikovsky identifies as Israel.

Tuthmosis III (sole reign: 1482-1450 B.C., according to conventional dating) is identified as the Pharaoh Shishak of Scripture who despoiled the temple of Solomon in the fifth year of Rehoboam, Solomon's son and successor. Hieroglyphic inscriptions cut in the walls of the great Amon temple in Karnak record the military campaigns of Tuthmosis III. Velikovsky reveals that one of these reliefs pictures a large quantity of temple furnishing and utensils that corresponds in a remarkable way to descriptions in the Old Testament of the furniture and equipment made for the tabernacle and temple.[11] This relief at the temple of Amon does not mention or picture any idols or images of gods or goddesses, a fact which is consistent with Velikovsky's contention that it depicts spoil taken from the Jerusalem temple.

Amenhotep II (conventionally dated 1450-1425 B.C.) is identified as the King Zerah who invaded Judah and was defeated by King Asa (910-869 B.C.), the great-grandson of Solomon. Curiously enough, the Scriptural account of this battle (II Chronicles 14) calls Zerah an Ethiopian; Velikovsky points out that there was Ethiopian blood in the 18th dynasty and that in one monument Amenhotep I is pictured with a black face.[12]

The Amarna period (conventionally dated 1379-1352 B.C.) is redated to the time of Ahab and Jehoshaphat (first half of the ninth century B.C.) and Ahab is actually identified as one of the Amarna correspondents. Pharaoh Akhnaton, who Freud considered to be the first monotheist, is redated to the ninth century B.C., approximately 600 years after the time of Moses.[13]

In 1960, twenty years after its conception, *Oedipus and Akhnaton* was published. This work deals at much greater length with the Amarna period and with the specific problem that first called Velikovsky's attention to the need for the reconstruction.[14]

The foreword to *Ages in Chaos* promised that an additional volume would soon appear that would bring the reconstruction down to the time of Alexander the Great. Publication of the sequel was delayed again and again, and in the intervening years, the remainder of the reconstruction grew to three additional volumes instead of one. Finally, after an additional 25 years of research, *Peoples of the Sea* appeared in 1977 covering the period from the Persian era to Alexander the Great. The next year, 1978, *Ramses II and His Time* was published, covering the period of the Neo-Babylonian Empire. A forthcoming volume promises to fill in the period of the Assyrian supremacy. Several articles in *Kronos* provide some of the material from this forthcoming volume[15-18] and defend Velikovsky's rearrangement of dynasties 19 and those following.

In his study of the Assyrian period, Velikovsky argues that the 22nd-24th (Lybian) dynasties and the 25th (Ethiopian) dynasty are the only ones correctly dated in the conventional chronology. One of the reasons for this is that Tirhakah, the third Pharaoh of the 25th dynasty, is mentioned both in eighth century Assyrian inscriptions and in the Scriptures (II Kings 19 and Isaiah 37).

During the reign of Hezekiah, Sennacherib King of Assyria invades Judah and lays siege to Jerusalem. It was earlier in this same campaign that Sennacherib lays siege to the city of Lachish possibly to cut off any aid that might come from Egypt. While at Lachish, Sennacherib sends part of his army to lay siege to Jerusalem and warns Hezekiah not to place his trust in Pharaoh King of Egypt. Isaiah the prophet reassures Hezekiah that the Assyrian siege will be lifted because the servants of Sennacherib blasphemed Yahweh. The plot thickens when an army led by Tirhakah of Cush (Ethiopia) approaches to challenge the Assyrian forces. Ultimately, deliverance comes not from man but from God when a mysterious catastrophe destroys the entire Assyrian army during the night. Just reading the Biblical account shows that the Pharaoh of Egypt and Tirhakah the Ethiopian are one and the same and it was not hard for historians to make the connection with the 25th dynasty Tirhakah.

Babylonian/Hittite Empire

In *Ramses II and His Time.* Velikovsky deals with the Neo-Babylonian period, the time of Jeremiah, Ezekiel, and Daniel. Ramses II (conventionally dated 1290-1224 B.C.) is the third ruler of Manetho's 19th dynasty. Velikovsky argues that the 19th dynasty does not directly follow the 18th and that the correct order is 18, 22-25 (Lybian & Ethiopian) and then 19. He also argues that the 19th and 26th dynasties are identical rather than being separated by over 600 years. Ramses I (of the 19th dynasty) is identified as Necho I (of the 26th dynasty); Seti I (19th) is Psammetichus I (26th);

Ramses II (19th) is Necho II (26th), etc. Necho II is the Pharaoh who killed King Josiah of Judah at Megiddo (609 B.C.) when Josiah attempted to block Necho's passage to Carchemish where Babylonian forces had the remnants of the Assyrian army cornered.

The Hittite Empire of the 13th century B.C. is brought forward over 600 years and is identified as part of the Neo-Babylonian Empire. When the ancient ruins at Boghazkoi first began to be excavated in 1905, art experts dated the stone orthostats to the seventh and sixth centuries B.C. But other scholars were sure that the ruins were that of the Hatti, the enemies of Ramses II during the 13th century B.C. When Hugo Winkler discovered at Boghazkoi in 1906 a copy of the treaty between Ramses II and Hattusulis III, King of the Hatti, the issue was settled. The treaty was a translation of one previously found in Egypt and there was no longer any doubt that the ruins were from the 13th century B.C. Velikovsky's reconstruction restores the so-called Hittite empire to the 7th/6th centuries B.C. and identifies Hattusilis III as being none other than the dreaded Nebuchadnezzar of Scripture who lived during the time of Daniel the prophet. The ruins excavated in central Anatolia have nothing to do with the Biblical Hittites; 250 pages of evidence are given in support of this portion of the reconstruction.[19]

Sea Peoples/Persians

In *Peoples of the Sea,* Ramses III (1198-1166 B.C.) of the 20th dynasty is moved closer to the present era by 800 years. The Sea Peoples that Ramses III repulsed from Egypt in a series of battles are shown to be not the Philistines of Scripture (which is the conventional identification) but rather the Persians using Greek mercenaries. Velikovsky points out that Greek letters appear on the back of glazed tiles used in a palace supposedly built by Ramses III hundreds of years before the Greek alphabet emerged.

Just a mile away from this palace, a cemetery was discovered and excavated in the 1880's by Griffith and Naville. Based on scarabs of Ramses III, Griffith dated the cemetery to the 12th century B.C. But Naville was equally certain that the cemetery should be dated very late, to the fourth century B.C. because of the style of the paintings and hieroglyphs. By uncovering old enigmas such as this that had been all but forgotten by modern scholars, Velikovsky shows that Ramses III and the 20th dynasty belong in the Persian and Greek era, 800 years closer to the present.[20]

Other scholars, who also see a need for a revision of ancient history, have taken issue with much of the latter part of Velikovsky's reconstruction as presented in *Ramses II and His Time* and *Peoples of the Sea.* Many have now rejected the way Velikovsky rearranges dynasties 19 and following, his identification of the Hatti of Anatolia as being part of the Neo-Babylonian Empire, and his identification of the Peleset (one of the Sea People) as being Persians of the 5th/4th century B.C.

The Exodus Problem

In 1956, a scholar in California, Dr. Donovan Courville, also began working on a revision of ancient history. Stimulated by reading *Ages in Chaos,* Courville began a similar study of his own taking a somewhat different approach. Fifteen years later, a two-volume work was published, *The Exodus Problem and Its Ramifications.*[21] Dr. Courville has also published a number of articles dealing with this revision, three of which have appeared in the *Creation Research Society Quarterly*.[22-29]

Courville agrees with Velikovsky that the Exodus occurred at the end of the Middle Kingdom in Egypt and that it was, in fact, the catastrophic nature of the 10 plagues that actually brought about the end of the Middle Kingdom and ushered in the Second Intermediate Period when Egypt was ruled by foreigners (the Amalekites in the Old Testament; the Hyksos in Egyptian records). Courville also agrees with Velikovsky in his redating of the 18th dynasty although there are significant differences for some of the later periods. Both Velikovsky and Courville follow the chronology of the Old Testament Scriptures and thus redate the end of the Middle Kingdom to about 1450 B.C. This would bring the Middle Kingdom (and all earlier periods of Egypt's history) closer to the present by about 340 years.

Overlapping Dynasties

Velikovsky's reconstruction begins at the close of the Middle Kingdom, but Courville extended his revision all the way back to the first dynasty. One of the fundamental assumptions of modern Egyptologists is that the 31 dynasties of Manetho (with one exception) are consecutive and non-overlapping. Courville has challenged this assumption and has presented a wealth of evidence to show that many of these dynasties are contemporary and overlapping, ruling over different segments of Egypt at the same time.

According to Courville's revision, dynasties one and two are consecutive and 3-5 are consecutive but they are roughly contemporary with one and two. Dynasties 7-10 are shown to be contemporary with 14-17 and dynasties 20-23 are shown to be contemporary with 24-26. According to this arrangement, the Old Kingdom period is contemporary with the Middle Kingdom period rather than preceding it by 400-500 years and simliarly, the First Intermediate Period is contemporary with the Second Intermediate Period (see Table II). The duration of Egypt's dynastic history is thus greatly reduced and the beginning of the first dynasty is dated around 2150 B.C., about 370 years after the date of the Flood.

The third scholar to do extensive research in this area is John J. Bimson. Earning his Ph.D. from the University of Sheffield, Bimson had a major portion of his dissertation published in 1978 under the title, *Redating the Exodus and Conquest* and has written a number of articles for the British journal *SIS Rewiew.*[30] A number of other scholars have been involved to a lesser extent writing primarily for journals devoted to the further investigation of theories of Velikovsky.[31] The revision of the history of ancient times is, of course, a massive and complex task and, as we might expect, there are a number of problems that have not yet been fully resolved, a fact which makes the ongoing discussion very stimulating.

The Conquest of Canaan

One of the most difficult and controversial problems in the field of Biblical archaeology is determining at what point in the sequence of the archaeological ages that the Conquest of Canaan by the Israelites occurred. According to Biblical chronology, the Conquest occurred at about 1400 B.C. The more conservative Biblical scholars who follow the Biblical chronology usually place the Conquest at the end of the Late Bronze I period (see Table IV). More liberal scholars who feel that the Biblical chronology is not correct usually place the entry of the Hebrews into Canaan at the end of the Late Bronze II period or early in the Iron Age.

Table IV. The Archaeological Ages.

Period	Conventional Dates B.C.	Revised Dates B.C.
Early Bronze I-III	3200 - 2300	2200 - 1400
EBIV/MBI Intermediate	2300 - 2000	1400 - 1200
Middle Bronze II	2000 - 1500	1200 - 925
Late Bronze I	1500 - 1400	925 - 850
Late Bronze II	1400 - 1200	850 - 700
Iron Age	1200 - 330	700 - 330

Although Velikovsky's reconstruction requires it, he has written very little about how the archaeological ages should be redated. He has suggested that the end of the Early Bronze Age be synchronized with the destruction of the cities of the plain (Genesis 19) and that the end of the Middle Bronze Age be synchronized with the Conquest of Canaan but has produced very little evidence to support these synchronisms.[32]

Courville has given a lot more attention to the problem of redating the archaeological ages and has proposed that the Conquest of Canaan be placed at the end of the Early Bronze Age. This placement of the Conquest involves a lowering of the absolute date of the end of the Early Bronze Age by an enormous 900 years (from 2300 B.C. to 1400 B.C.). A previous article by the present writer has defended at length this synchronism.[33]

Table IV shows the archaeological periods in Palestine, the conventional dating of these periods, and the revised dating that has been defended by the present writer in a recent article.[34] All of the periods have been shortened somewhat and have been brought forward on the B.C. time scale considerably. Courville, Luckerman, and Livingston favor the idea that the Late Bronze Age and the Iron Age are not consecutive but actually overlap considerably. Courville, for example, has argued that the Late Bronze Age corresponds to the same period of time as the Iron I and Iron II periods.[35] Bimson, on the other hand, contends that the Iron Age follows the Late Bronze Age and must be compressed considerably.[36] This is an issue that deserves further study.

The Tower of Babel

One of the issues that concerns modern Egyptologists is the origin of Egypt's dynastic civilization. Walter Emery, Professor of Egyptology at the University of London, makes the following three points:[37]

(1) The cultural connection between Egypt and Mesopotamia at the beginning of Egypt's dynastic history is beyond dispute and is generally accepted by scholars. One example is the Narmer Palette from Egypt's first dynasty which displays unmistakable Mesopotamian influence.

(2) Dynastic civilization appeared suddenly in Egypt. There is no development from the more primitive pre-dynastic culture to the highly developed dynastic culture.

(3) In contrast to Egypt, there is a period of cultural development in Mesopotamia from a pre-historic culture to a dynastic type of civilization.

These three points suggest that the beginning of Egypt's dynastic history is due to a population movement from Mesopotamia to the Nile valley which carried with it the more advanced culture.

Courville identifies this population movement as the result of the dispersion from the Tower of Babel recorded in Genesis 11 and places it at the transition between the Chalcolithic Age and the Early Bronze Age (see Tables IV & V).[38] The Tower of Babel incident is not precisely dated in the Biblical narrative, but clearly it is after the Flood and before the time of Abraham. Speaking of the transition between the pre-historic Chalcolithic Age and the Early Bronze Age, William Albright writes;

> There must have been an exceedingly intensive transfusion of culture going on in the Near and Middle East. Syria and Palestine naturally became the cultural intermediaries through which Mesopotamia influences streamed into Egypt in the period before the first dynasty.[39]

Table V. The Pre-Historic Ages in Palestine.

Period	Commonly Accepted Dates B.C.
Paleolithic	2 million - 16,000
Mesolithic	16,000 - 8,300
Neolithic	8,300 - 4,000
Chalcolithic	4,000 - 3,200

Conclusion

While there are some significant differences in the revisions of ancient times proposed by Velikovsky, Courville, and Bimson, the general thrust of all three is to greatly reduce the antiquity of Egypt and the other ancient near eastern civilizations. Courville's revision, in particular, extends all the way back to the beginning of Egypt's dynastic history and leaves over 350 years for post-Flood repopulation and cultural recovery, a period which would include Egypt's pre-dynastic era. If the revision proposed by Courville should prove to be more or less correct, there would be no real conflict between Biblical chronology and the history of ancient civilizations.

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A STATISTICAL ANALYSIS OF THE POST-FLOOD GAP POSSIBILITY

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Abstract

An extensive statistical analysis of the post-Flood lifespans with various calibration models shows that it is possible to find statistical models that predict hundreds and possibly even thousands of years between patriarchs. However, if the interpolation and extrapolation performance of the calibration model plus the model's insensitivity to statistical outliers is considered, there are statistical calibration models using the natural logarithm of lifespan that show no gaps in the Genesis 11 genealogy.

Introduction

Evolutionary anthropologists contend that man in his present form has been in existence from one to two million years. This evolutionary thinking, however, seems to be in direct contradiction with the Bible. Henry Morris has noted this conflict in *Biblical Cosmology and Modern Science:*

> To explain a discrepancy between one million and two thousand years, for the time from the first man to the time of Abraham (about 2000 B.C. by secular chronology) in terms of genealogical gaps means that the average such gap between each pair of names in Genesis 5 and 11 is more than fifty thousand years! Each "gap" is therefore more than eight times as long as the entire period of recorded history.[1]

Recently, Richard Niessen countered this evolutionary thinking on genealogical gaps in Genesis 5 and 11 by presenting nine logical and mainly Biblical evidences for a tight chronology." A follow-up to the Biblical evidence for no gaps was provided in statistical evidence by William Seaver.[3] His statistical analysis of these Genesis lifespans showed that the pre-Flood lifespans were stable, that the post-Flood life spans fitted an asymptotic exponential decay curve which converged to the 70-80 year lifespan of Psalm 90:12, and that if there were gaps in the genealogies of Genesis 11 the gaps would have to "systematic, specific, nonrandom, and of the asymptotic exponential decay model form."[4] In addition to the Biblical and statistical evidence for no gaps, scientific research from other disciplines is also supporting the point of a tight chronology in Genesis 5 and 11. For instance, Humphreys' excellent work on the creation of earth's magnetic fields revealed that it would take approximately 6000 years for the magnetic fields to decay to their present

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strength if the current rate of decline was extrapolated back to Creation.[5] The weight of Biblical, statistical, and scientific evidence for a tight chronology in Genesis 5 and 11 is great, and thus the likelihood of gaps of any significant size are very small. Henry Morris does not deny the possibility that minor gaps could occur in the Genesis 11 genealogical list; but if they exist, the gaps must be relatively small and not thousands of years as proposed by evolutionists.[6,7]

The intention of this author is not to examine the Genesis 5 genealogy since the Biblical evidence from Genesis 4:25, 26 and Jude 11 allows for no gaps. Niessen's study on tight chronology in Genesis 5 and 11 is an excellent source for the theological arguments. However, the clearest possibility for a gap, according to Morris and Whitcomb, is in the genealogy of Genesis 11 between Eber and Peleg before the Tower of Babel where the lifespans dropped from 464 to 239 years respectively.[8] Recent statistical model methods developed for the calibration problem shall be used to find point and interval estimates for the generations between patriarchs (particularly between Peleg and previous patriarchs) that provide evidence of the statistical feasibility of a tight chronology for Genesis 11. Not only does this imply that any gaps would have to be minor but also that the Flood date of 2518 B.C. is a stable, safe estimate.

The Apparent Post-Flood Gap

Assuming consecutive generations, that is, no gaps in the Genesis 5 and 11 genealogies, the dates for the year of birth and lifespan are given in Table I.[9,10] A semilogarithmetic graph of the post-Flood lifespans versus the generations in Figure 1 as done by Dillow reveals the gap possibility between Eber and Peleg.[11,12] However, a graph of these same lifespans versus the patriarchs year of birth after Creation in Figure 2 with semilogarithmetic scale accents the apparent gap between Eber and Peleg to such an extent that two different models seem to be necessary to fit the post-Flood data: one before Peleg and one after him. Since the four patriarchs, Shem, Arpachshad, Shelah, and Eber, are insufficient data points to derive a statistical model, attention is focused on all the lifespans inclusive of Peleg down to Moses' contemporaries. With these ten observations, it is possible to derive statistical models which fit this post-Flood era and provide predictions of how many generations away Eber's lifespans are from Peleg. While point estimation of the generations or the gap is the primary concern, a statistical interval estimation procedure (where appropriate) will be used so that there is a measure of confidence about any perceived gap. As noticed in Table I, Peleg's generation will be the base, and the generations from Peleg to Joseph are assumed to be consecutive in light of Seaver's statistical chronological work on the post-Flood data.[13]

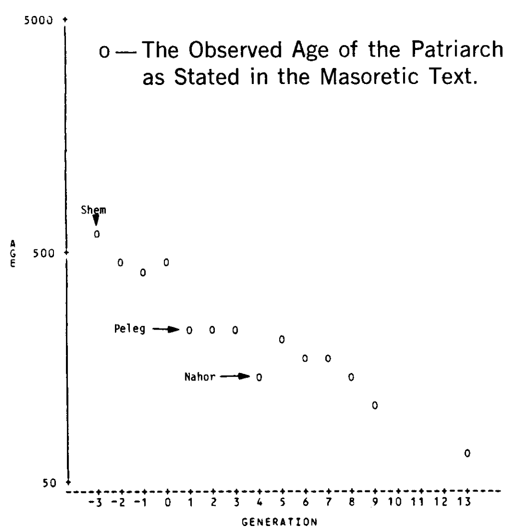


Figure 1. Semilogarithmetic Graph of Lifespans Versus Generation of Patriarch.

Statistical Calibration Models

Most statistical regression models involving the prediction of a point require determining the value of Y corresponding to a given X. For example, to calibrate a thermocouple, we assume that the temperature reading given by the thermocouple is a linear function of the actual temperature with an error term ϵ_i such that the observed temperature $= \beta_0 + \beta_1$ (actual temperature) $+ \epsilon_i$ or

$$Y_i = \beta_0 + \beta_1 X_i + \epsilon_i, \qquad (1)$$

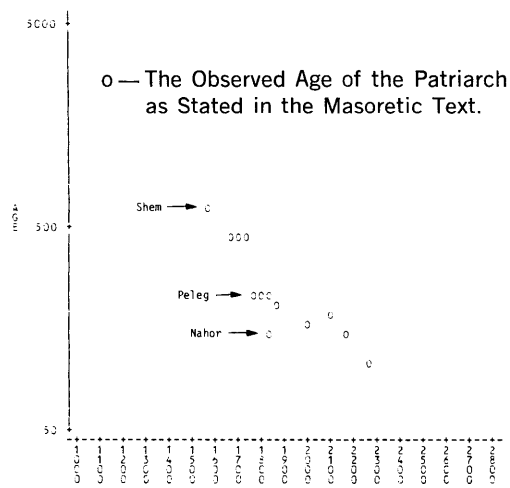


Figure 2. Semilogarithmetic Graph of Lifespans Versus Year of Birth after Creation.

where β_0 and β_1 are unknown parameters. The calibration problem is concerned with measuring the actual temperature X* from the observed temperature Y* given the data $(Y_1, X_1), (Y_2, X_2) \ldots, (Y_n, X_n)$ which is used to derive the estimating equation,

$$\hat{Y}_i = b_0 + b_1 X_i, \qquad (2)$$

where b_0 and b_1 are estimates of β_0 and β_1 respectively. For the post-Flood data, Y_i equals the lifespan which is completely known, and X_i equals the generation of the patriarch which is assumed partially known. Thus, the prime concern in calibration analysis is point estimation of the X values from the known Y values.

There are several competing point estimators of X, each with advantages and disadvantages. There is the classical estimator,

$$X_c^* = (Y^* - b_0)/b_1 \qquad (3)$$

Table I. Selected Post-Flood Lifespans

Patriarch	Year of Birth After Creation	Year of Birth Before Christ, B.C.	Life-Span†	Age at Birth of Son	Generations from Peleg
Noah	1056	3118	950	502	?††
Shem	1558	2616	600	100	?
Arpachshad	1658	2516	438	35	?
Shelah	1693	2481	433	30	?
Eber	1723	2451	464	34	?
Peleg	1757	2417	239	30	1
Reu	1787	2387	239	32	2
Serug	1819	2355	230	30	3
Nahor	1849	2325	148	29	4
Terah	1878	2296	205	130	5
Abraham	2008	2166	175	100	6
Isaac	2108	2066	180	60	7
Jacob	2168	2006	147	91	8
Joseph	2259	1915	110	?	9
Moses' Contemporaries	—	—	70	—	13

†Ages are taken from the Masoretic Text.
††If the generations are consecutive, then Noah through Eber's generations would be -4, -3, -2, -1, and 0 respectively.

where b_0 and b_1 are the least square solutions to β_0 and β_1 in (1) above based upon n observations. With this classical estimator, interval estimates for X* (the number of generations) can be constructed.[14,15] Lwin and Maritz have noted that the classical estimation model does best when estimation is confined to extrapolation (the extremities of the range and outside of the calibration range) which is the need for this gap analysis.[16] In addition, with the classical predictor model it is possible to compare the fitted values $\hat{Y}_i$ and the observed values Y_i (called residuals, $e_i = Y_i - \hat{Y}_i$) to flag any unusual observations (called outliers) that could hinder the model from accurate prediction. Figure 2 definitely seems to indicate that Nahor's lifespan was shorter than expected and thus a possible statistical outlier. As noted by Belsley, Kuh, and Welsch and other statisticians, there are numerous outlier diagnostics for the classical linear regression model.[17-19]

A second possible estimator where generation is regressed against lifespan is the inverse estimator

$$X_i = \beta_0' + \beta_1' Y_i + \epsilon_i' \tag{4}$$

where β'_0 and β'_1 are the parameter values of the population and ϵ'_i is again some measurement of error. The sample inverse estimation model is shown as follows:

$$X^*_{inv} = b_0' + b_1' Y^* . \tag{5}$$

Intuitively, this inverse estimator seems viable. However, the inverse point estimator is only superior to the classical estimator when X* lies in a small interval about X_0, i.e., estimation is restricted to the interior of the calibration range.[20,21] Thus, it should be expected that this estimator will do well for Peleg through Moses' contemporaries and not well outside of this range.

A third feasible estimator of generation X* is a nonparametric regression approach based on the median of pairwise slopes.[22] This basic regression model (equation (6) below), developed by Thiel,

$$Y^* = b_0'' - \text{Median}\,\{b_1''\}\, X^*_{np} \tag{6}$$

does not allow for interval estimates for an individual observation; but it is not affected by statistical outliers, such as Nahor. Equation (6) can be converted to a nonparametric calibration model as shown below:

$$X^*_{np} = (Y^* - b_0'')/\text{Median}\,\{b_1''\}. \tag{7}$$

Finally, there is the non-linear predictor of Schwenke and Milliken but confidence intervals for small samples are not exact, and this procedure is totally valid only when Y and X can both be taken as random variables, a requirement also necessary for the inverse estimator.[23] Thus, attention shall focus only on the classical, the inverse, and the nonparametric models.

If the post-Flood data from Peleg to Moses' contemporaries do support the hypothesis $|\beta_1| > 0$, then the calibration model in general is appropriate.[24] The more significant the relation between Y and X or ln Y and X, the better the calibration model will perform.

Point Estimation of the Generation Gap by the Lifespan Models

Using only the lifespans and not the natural logarithm of lifespan [ln(lifespan) or ln Y] from Peleg to Moses' contemporaries, Table II shows the equation results for the classical, the inverse, the nonparametric, and the jackknife model (which Duncan and others have noted as more insensitive to one outlier in the data).[25,26] The intercepts, 258.114, 271 and 258.3, and the slopes, -14.45, -15.00, and -14.51 respectively for the classical, the inverse, and the jackknife models are not that different, respectively. Assuming consecutive generations, all four lifespan models are 11 to 14 generations from Eber at X = 0, creating a possible gap of 12 to 15 generations between Eber and Peleg. With the median begetting age of Table I being 34 years and ignoring Noah and Shem who were born before the Flood, we could be dealing with a gap of at least 416 years ([l + 14.25] x 34) between Eber and Peleg. There are also large generation prediction gaps for the other three pre-Peleg Patriarchs as shown in Table II. For instance, Shem is off by at least 16 generations (-3-(-19.23)) to almost 21 generations

Table II. Comparative Analysis of Gap Possibilities by Four Lifespan Models.

Model	Classical	Inverse	Nonparametric	Jackknife
Equation	$X^*_i = \frac{(Y_i - 258.114)}{(-14.45)}$	$X^*_i = 16.049 - .0588Y_i$	$X^*_i = \frac{(Y_i - 271)}{(-15.00)}$	$X^*_i = \frac{(Y_i - 258.3)}{(-14.51)}$
Sum of Squares Interpolation (SS_{inter})	20.764	17.671	23.617	20.615
Sum of Squares Extrapolation (SS_{extra})	862.311	519.923	703.379	853.001
General Predictions† Prior to Peleg				
Shem (−3)	−23.66	−19.23	−21.93	−23.55
Arpachshad (−2)	−12.45	−9.71	−11.13	−12.38
Shelah (−1)	−12.10	−9.41	−10.80	−12.04
Eber (0)	−14.25	−11.23	−12.87	−14.18

†Assuming consecutive generations, the expected generations away from Peleg are indicated in parentheses. The SS_{extra} are computed from these expected values and the predicted values for each model.

(-3-(-23.77)). Furthermore, all four lifespan models have a very low sum of squares $\left(\sum_{i=1}^{n}(X_i - X^*)^2\right)$ for interpolation (with the inverse model the lowest at 17.671) but extremely large sum of squares for extrapolation. These findings are excellent fuel for the evolutionist's argument that there are gaps in the genealogies or to the idea that there is one statistical model for the pre-Peleg patriarchs and another for Peleg and those that follow.

In addition to examining the sum of squares for the X (the generation) to measure the fit of the calibration model, further insight into the adequacy of a statistical model is gained by comparing the observed values of the lifespan (Y_i) versus the predicted values for lifespan ($\hat{Y}_i$). These differences, $e_i = Y_i - \hat{Y}_i$, are called residuals. Extremely large residuals, large studentized residuals, large studentized residuals with the i^{th} observation deleted, large diagonal elements of the hat matrix, large changes in fit at some data point i standardized by the standard error of the fit with the i^{th} point omitted, plus other outlier diagnostics can be used to flag extreme observations that have diverse but drastic effects on linear models.[27] With a Pearson correlation of .9218 (significant at a probability less than .0001) between lifespan and generation for the classical and the inverse models, it is tempting to conclude that the model is appropriate. However, Nahor is flagged as a outlier by numerous statistical diagnostics but particularly by a studentized residual with the i^{th} observation deleted of -4.28, significant at a probability less than .005 . Removal of Nahor from the classical or inverse lifespan models does not change the generation predictability appreciably even though the Pearson correlation does increase to .9783. In fact, with the removal of Nahor, various outlier diagnostics suggested by Hoaglin and Welsch flag Peleg, Joseph, and Moses' contemporaries as suspect influential observations.[28]

While the evolutionist who desires to show gaps in the Genesis 11 genealogies to support his beliefs or the researcher who may even want to push back the Flood date further than 2518 B.C. with partial gaps to accommodate various archaeological suppositions may embrace any of these four lifespan models to validate his stance, the poor performance of these four calibration models in extrapolation, the outliers in the models, and the previous research of Dillow and Seaver all suggest that there must be a better statistical and Biblical model. This model, if it exists, should do well in interpolation and extrapolation for generation, should be minimally affected by outliers, and should not differ drastically from previous research on these patriarch ages. The natural logarithm model [ln(lifespan) or ln (Y)] is such a possibility.

Point Estimation of the Generation Gap by the Natural Logarithm Models

Dillow used the natural logarithm model

$$\ln Y = \ln b_0 + b_1 X \qquad (8)$$

to describe the non-linear or exponential decay relationship between generation and lifespan over the patriarchs from Noah to Moses' contemporaries.[29] Seaver's non-linear model, the asymptotic exponential decay, not only described the relationship between lifespan and generation better over the observations from Shem to Moses' contemporaries but also predicted well outside of the data's range.[30] There are non-linear calibration models as mentioned earlier, but such sophistication is statistical overkill. The easiest approach is to take the models in equations (2)-(7) and replace Y with ln(Y) producing the following three new calibration models.

$$X^*_c = (\ln Y^* - \ln b_0)/b_1 \qquad (9)$$

$$X^*_{inv} = b_0^1 + b_1^1 \ln Y^* \qquad (10)$$

$$X^*_{np} = (\ln Y^* - b_0'')/\mathrm{Median}\,\{b_1''\}. \qquad (11)$$

Of course, these calibration models based on natural logarithms could be converted to an exponential decay curve of the form,

$$\hat{Y}_i = b_0 e^{-b_1 X_i} \qquad (12)$$

This conversion is not necessary since the concern is the prediction of X, the generation.

Still assuming consecutive generations but using the ln(lifespan) or ln(Y) calibration models, the sum of squares interpolation in Table III are slightly less than those for the basic lifespan model (as shown in Table II) with greater improvements for the nonparametric

Table III. Comparative Analysis of Gap Possibilities by Four Natural Logarithm Models

Model	Classical	Inverse	Nonparametric	Jackknife
Equation	$X^*_i = \frac{(\ln Y_i - 5.6780)}{(-.0995)}$	$X^*_i = 49.4525 - 8.5579 \ln Y_i$	$X^*_i = \frac{(\ln Y_i - 5.9342)}{(-.1309)}$	$X^*_i = \frac{(\ln Y_i - 5.7018)}{(-.1064)}$
Sum of Squares Interpolation (SS_{inter})	20.473	17.443	21.844	18.628
Sum of Squares Extrapolation (SS_{extra})	52.284	17.402	3.504	38.033
General Predictions† Prior to Peleg				
Shem (−3)	−7.22	−5.29	−3.53	−6.53
Arpachshad (−2)	−4.06	−2.50	−1.13	−3.58
Shelah (−1)	−3.95	−2.50	−1.04	−3.47
Eber (0)	−4.64	−3.09	−1.57	−4.12

†Assuming consecutive generations, the expected generations away from Peleg are indicated in parentheses. The SS_{extra} are computed from these expected values and the predicted values from each model.

(23.617 to 21.844 SS_{inter}) and the jackknife models (20.615 to 18.28 SS_{inter}). This finding is extremely significant in that it points out that all of the Y and ln(Y) models have similar descriptive ability for the data of Peleg to Moses' contemporaries and that the natural logarithm transformation did not affect interpolation results. Further support of this point is provided by a similar Pearson correlation for the ln(Y) model [classical and inverse only] of .9229, significant also at $\alpha <$ .0001. However, for the four pre-Peleg patriarchs there is an astronomical decrease in the sum of squares extrapolation: from 862.311 to 52.284 for the classical model, from 519.923 to 17.402 for the inverse model, from 703.379 to 3.504 for the nonparametric model, and lastly from 853.001 to 38.003 for the jackknife model as shown in Tables II and III. In light of these extrapolation results and the specific generation difference in Table IV, the nonparametric calibration model based on ln(Y) is by far the best point estimator of patriarch generations. This particular nonparametric model misses Eber by only 1.57 generations and is easily within one generation of Shem, Arpachshad, and Shelah (see Table IV). None of the other three ln(Y) calibration models predict large gaps in the generation; but there are consistent gaps of 2-4 generations for Shem, Eber, Nahor and Isaac.

Table IV. Generation Differences for the Classical, Inverse, Nonparametric, and Jackknife Calibration Models

Patriarch	Classical	Inverse	Non-parametric	Jack-knife
Shem	4.22	2.29	.53	3.53
Arpachshad	2.06	.60	.87	1.58
Shelah	2.95	1.50	.04	2.47
Eber	4.64	3.09	1.57	4.12
Peleg	-1.03	-1.59	-2.50	-1.12
Reu	-.03	-.59	1.50	-.12
Serug	.59	.09	.79	.52
Nahor	-2.84	-2.69	-3.16	-2.62
Terah	1.43	1.10	.33	1.04
Abraham	.84	.75	.12	.95
Isaac	2.13	1.99	1.34	2.22
Jacob	1.09	1.25	.79	1.31
Joseph	-.82	-.23	-.42	-.41
Moses' Contemporaries	-1.36	-.09	-.12	-.66

These findings give extreme credence to the faith of the Creationist that there cannot be large gaps of thousands of years in the Genesis 11 genealogy but no more than around a hundred years. However, the ln(Y) nonparametric model is even more significant in that there is a statistical model that can be fitted to the untouched Genesis 11 lifespans without compromising the Biblical truth of consecutive generations noted by Niessen.[31]

Additional Evidence for the ln(Y) Nonparametric Calibration Model

In light of statistical theory mentioned earlier, a natural question is why does the ln(Y) inverse calibration model do better than the ln(Y) classical model in extrapolation? The reason for this discrepancy is the greater outlier tendencies in the variable ln(Y) than in the variable generation. This is more obvious when Nahor, a statistical outlier having the studentized residual with the i^{th} observation deleted of 2.4 which is significant at a level of significance of .025 (but not as significant as in the classical lifespan model), is deleted from the data. The equations for the classical and inverse calibration models with Nahor omitted are shown below:

$$X^{\dagger}_i = (\ln(Y^{\dagger}_i) - 5.7392)/(-.1045) \quad (13)$$

and

$$X^{\dagger}_i = 50.9177 - 8.7861 \ln(Y^{\dagger}_i). \quad (14)$$

While there are slight coefficient changes in these models compared to the full data equivalents in Table III, the biggest changes occur in the SS_{inter} and SS_{extra}. The SS_{extra} for the classical model reduces drastically from 52.284 to 31.840 but there is only a miniscule change from 17.402 to 16.712 for the inverse model. The inverse model shows marked improvement from 16.443 to 9.351 for SS_{Inter} while the classical changes slightly from 20.473 to 19.773. The improvements for the inverse model were thus over the interpolation range and conversely were for the classical model over the extrapolation range, which is to be expected in light of the outliers and statistical theory.

Additional insight into the impact of observations such as Nahor, Peleg, Isaac, and Moses' contemporaries on the ln(Y) classical model can be gained by examining the recursive residuals. Recursive residuals are independently and identically distributed and, unlike ordinary residuals, do not have the deficiencies of the data in one part being spread over all the residuals.[32] For instance, in studentized residuals with the i^{th} observation deleted (such as Nahor), there is an isolated look at whether one observation is a statistical outlier. It is not uncommon for one statistical outlier to mask others in the same data set, and recursive residuals flag this problem. Basically, for this Genesis data set of 10 points, discard the first patriarch, Peleg, and fit the model to the remaining nine points. The first recursive residual is then defined as the standardized residual of the first observation. Next Peleg and Reu are discarded, and the model is fitted to the remaining eight observations. The second recursive residual is then computed. The process is repeated down to the last two observations (Joseph and Moses' contemporaries) since at least two points are needed for the fitting of a two-parameter model. The recursive residuals are given in Table V and a normal probability plot of these residuals is in Figure 3. According to Galpin and Hawkins, Nahor would definitely be an indicative of other possible outliers such as Peleg (-.1216) and Isaac (-.0937).[33]

A significant by-product of the recursive residual analysis is a recursive calibration model with sum of squares extrapolation computed in Table V. Remembering that the SS_{extra} are only computed for the patriarchs Shem through Eber, it is interesting to note the continual improvement in the SS_{extra} as successive observations are deleted. In fact, the recursive calibration model after omission of Peleg, Reu, Serug, and Nahor

$$X^* = (\ln Y^* - 6.0464)/(-.1387) \qquad (15)$$

is almost identical to that for the nonparametric ln(Y) model in Table III (the best calibration model using all the data),

$$X^* = (\ln Y - 5.9342)/(-.1309). \qquad (16)$$

This recursive calibration model has SS_{cxtra} = 4.39 whereas the nonparametric ln(Y) model had SS_{extra} = 3.504. Also, the recursive calibration model for Jacob, Joseph, and Moses' contemporaries is almost identical to that of the nonparametric ln(Y) model.

While interval estimates for an individual observation are not possible for the nonparametric model nor for the inverse model since generation is not a random variable, it is possible to construct such an interval estimate for the classical calibration mode1.[34] Since the recursive classical ln(Y) model for Terah is practically identical to the nonparametric ln(Y) calibration model and is highly significant (a Pearson correlation of .9813, significant even at α = .005), an interval estimate for the generation of the patriarch can be computed for Shem through Eber according to the following formulas, where

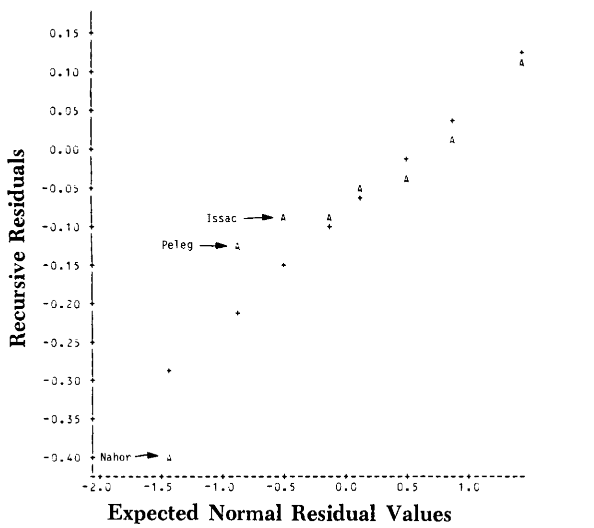
$$g = ts\left[(Y^* - \bar{Y})^2/\Sigma(X_i - \bar{X})^2 + b_1^2(1 + 1/n) - [t^2s^2/\Sigma(X_i - \bar{X})^2][1 + 1/n]\right]^{1/2} \qquad (17)$$

and

$$\begin{matrix} X_{upper} \\ X_{lower} \end{matrix} = \bar{X} \pm \left[b_1(Y_0 - \bar{Y}) + g\right] / \left[b_1^2 - t^2s^2/\Sigma(X_i - \bar{X})^2\right]. \qquad (18)$$

These 95 percent confidence interval estimates, which are not symmetric about the point estimate for generation, are shown in Table VI below,

The largest difference from the assumed consecutive generation and the upper interval estimate is no more than 4.57 generations for Eber and no less than 2.02 generations [-2-(4.02)] for Arpachshad. Assuming the median begetting age of 34 years as done earlier, there could be gaps of not more than 70-170 years at the maximum for the interval estimate analysis.



A — the actual recursive residual for the patriarchs (Table V) If +\$ are connected with a straight line, recursive residuals that deviate markedly from this line may be considered outliers.

Figure 3. Normal Probability Plot of Recursive Residuals.

Table V. Recursive Residual Analysis for the Classical ln(Lifespan) Model.

Observation	Patriarch	Lifespan	Recursive Calibration Equation with Prior Observations Deleted	Recursive Residuals	Sum of Squares Extrapolation
1	Peleg	239	(ln Y* − 5.6780)/(−.0995)	−.1216	52.31
2	Reu	239	(ln Y* − 5.7269)/(−.1054)	−.0478	33.59
3	Serug	230	(ln Y* − 5.7505)/(−.1082)	+.0148	26.81
4	Nahor	148	(ln Y* − 5.7414)/(−.1072)	−.3949	29.24
5	Terah	205	(ln Y* − 6.0464)/(−.1387)	−.0382	4.39
6	Abraham	175	(ln Y* − 6.0840)/(−.1424)	−.0860	6.04
7	Isaac	180	(ln Y* − 6.1942)/(−.1526)	−.0937	13.67
8	Jacob	197	(ln Y* − 6.0292)/(−.1383)	+.1092	3.86
9	Joseph	110	(ln Y* − 5.7174)/(−.1130)	————	29.09
10	Moses' Contemporaries	70	————	————	———

Table VI. Ninety-five Percent Confident Estimates for the Individual Pre-Peleg Patriarchs*

Patriarch	Consecutive Generation	Point Estimate of Generation	Lower Interval Estimate	Upper Interval Estimate
Shem	- 3	-2.53	.28	-7.01
Arpachshad	- 0	-.26	2.18	-4.02
Shelah	- 1	-.18	2.25	-3.91
Eber	0	-.67	1.83	-4.57

*These are not simultaneous confidence interval estimates but only individual interval estimates.[35]

Validation of the Model

To the non-statistician it would seem as if there has been model manipulation in locating a statistical model that fits the generation and ln(age) relationship. However, the discussion thus far has focused on checking the adequacy of the model and to a large extent on model validation. According to Montgomery and Peck, the essence of model validation is determining "if the model will function successfully in its intended operating environment."[36] This validation process involves testing the predictive performance of the model in the interpolation and extrapolation modes, examining signs and magnitudes of the model coefficients, comparing the model predictions and coefficients with physical theory, and studying the stability of the model coefficients as a result of outliers or diverse correlation structures.[37] Much of this has already been done. Considering the extrapolation mode and the stability of the coefficients, the nonparametric calibration In (age) model (equation 16) which is based on the actual data without any omissions and which is outlier resistant seems to be the better post-Flood model. In terms of interpolation, the inverse and classical calibration models using ln(age) (equations 13 and 14) fare slightly better.

To complete the model validation process, there are a few possible statistical approaches.[38] First, the collection of fresh data with which to investigate the model's predictive performance is a possibility, but with historical data as in Genesis this is not feasible. Seaver, in his study of the Genesis lifespans, did show how the asymptotic exponential decay curve provided excellent estimates for today's lifespan.[39] A second choice for validation is data splitting. For a time sequenced data set, the observations would be split into an estimation data set and a prediction data set; but for the Genesis data there are not enough observations for such an approach according to Snee.[40] However, another version of data splitting which essentially takes n observations and splits these into n subsamples of size one is a simplistic validation procedure. The regression model is then fitted to the remaining n - 1 observations and the resulting equation is used to predict the withheld observation, y_i. If the predicted value with the i^{th} observation deleted is noted $\hat{y}_{(i)}$, then the prediction error for the point i is

$$e_{(i)} = y_i - \hat{y}_{(i)} \qquad (19)$$

and the prediction error for all points is the sum of squares for the n deleted residuals over the interpolation range that is, $\Sigma e^2_{(i)}$.[41, 42] This sum of squares is called the PRESS statistic and can be found by either formula below:

$$\text{PRESS} = \sum_{i=1}^{n} \left(y_i - \hat{y}_{(i)}\right)^2 \qquad (20)$$

or

$$\text{PRESS} = \sum_{i=1}^{n} \left(\frac{e_i}{1-h_{ii}}\right)^2 \qquad (21)$$

The formula in equation (21) makes it easy to see that the PRESS statistic is just a weighted sum of squares of the residuals, where the weights are related to the outlier tendencies of the observation (h_{ii}).[43]

Performing this kind of analysis on the inverse and classical calibration models using ln(age) as shown in Table VII provides a way to validate the overall predictive performance and to flag observations that degrade the predictive performance of the model. While the original inverse and classical models explained 85 percent of the variability in the response variable (R^2 = .8517), an approximate coefficient of determination for prediction (called R^2_{pred}) can be calculated for each model from the PRESS statistic information as follows:

$$R^2_{pred} = 1\text{-PRESS/sum of squares for response variable} \qquad (22)$$

From Table VII the inverse model explains about 80 percent of the variability in predicting new observations. The drop in explainability from 85 to 80 percent is due to the high prediction error squared for Nahor primarily (9.072), followed slightly by Isaac and Peleg. For the classical ln(age) model, the explainability drops from 85 to 75 percent and is again primarily due to Nahor and Isaac (.10505 and .05678 respectively) but also to Moses'contemporaries at .08746.

The bottom line of this type of validation is that the ln(age) calibration models work well in interpolation. Again certain patriarchs are highlighted as influential observations for these models signifying even more that the outlier resistant nonparametric calibration model is a better choice for explaining the post-Flood data of Genesis.

Conclusions

This statistical analysis of gaps in the post-Flood genealogy of Genesis 11 with calibration models, which consider lifespan as a random variable and generation as fixed, has several important conclusions and implications. First, the Genesis 11 lifespan data is very complicated because of the statistical outliers: Nahor who died before his time, Peleg and Reu who lived to be of the same age in an era of declining lifespan, Isaac who lived longer than expected at 180 years, and Moses' contemporaries who lived to 70-80 years according to Psalm 90:12. With at least 40 percent (4 out of 10) of these data having outlier tendencies, only recent statistical outlier diagnostics have enabled the researcher to flag these unusual observations and to examine their diverse impact on the mathematical model for longevity and on the creationist view of consecutive generations in Genesis 11.

Secondly, it is possible to choose a statistical model based on lifespans which will predict large gaps of hundreds of years or more between the pre-Peleg patriarchs, which the evolutionists might extend to thousands of years or more to maintain his position on the age of the earth. However, when sound statistical reasoning considers the interpolation and extrapolation

Table VII. One by One Data Splitting Validation of the Inverse and Classical ln(Age) Calibration Models.

		Inverse Model			Classical Model		
Generation	ln(Age)	Residual e_i	h_{ii}	Square of Prediction Error $[e_i/(1-h_{ii})]^2$	Residual e_i	h_{ii}	Square of Prediction Error $[e_i/(1-h_{ii})]^2$
1	5.476	−1.585	.203	3.957	−.102	.296	.02100
2	5.476	−.585	.203	.539	−.003	.223	.00001
3	5.438	.086	.183	.011	.059	.167	.00494
4	4.997	−2.687	.108	9.072	−.283	.128	.10505
5	5.323	1.101	.136	1.624	.143	.105	.02539
6	5.165	.747	.103	.694	.084	.100	.00869
7	5.193	1.988	.106	4.947	.212	.112	.05678
8	4.990	1.255	.109	1.984	.109	.141	.01597
9	4.700	−.226	.217	.083	−.082	.187	.10115
13	4.248	−.094	.631	.065	−.136	.541	.08746
Press				22.976			.33543
$R^2_{prediction}$	$1 - 22.976/117.60 = .8046$				$1 - .33543/1.36756 = .7547$		

quality of the calibration model plus the impact of statistical outliers, the existence of gaps in the Genesis 11 genealogy is not a tenable position. It is an encouragement to the Creationist to know that there exists a statistical model which shows no gaps between Eber and Peleg or between any of the other patriarchs and which reveals that the differences in ages in Genesis 11 are statistically possible.

Thirdly, these findings of no gaps using only part of the post-Flood data from Peleg to Moses'contemporaries plus the earlier research of Dillow and then Seaver who used all the data of Genesis 11 gives even further confirmation that any gaps would have to be systematic, specific and nonrandom and of the exponential decay, more probably, of the asymptotic exponential decay form. The excellent performance of the nonparametric ln(lifespan) calibration model and the parametric ln(lifespan) recursive model in extrapolation and interpolation gives tremendous confidence in a Flood date of 2518 B.C. and a Creation date of 4174 B.C. and shows the scientific and statistical reliability of the Scriptures.

Finally, from a statistician's viewpoint, there is a simplistic beauty in a series of numbers that is easy to acknowledge as randomness and nonmeaningful and thus, miss the Creator behind them. However, close examination of the complexity of the lifespans in Genesis 11 in this research causes one to stand in awe of God's wisdom, God's character, and His revelation to man.

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PANORAMA OF SCIENCE

More on Growth of a Population

Creationists, at least those of the young-Earth variety, are very much interested in the growth of populations, in order to see how the population increased so quickly after the Flood. An example from Canadian history may be of some interest. In a book on Canadian history it is stated:

> In the conquered province of Quebec, the people multiplied with astonishing celerity. In 1760, their numbers were approximately 60,000, and in 1790, 160,000, an increase in one generation of about 166 percent, about five per cent annually. The birth rate after the conquest seems to have been higher than before it; in 1770 it had reached the astronomical figure of 65 per 1000. After all, there was land and food for all . . .[1]

The conquest was the British conquest of Canada in 1759 and 1760. Later the book states: ". . . there is some evidence (from the census) that the death rate was no higher in Upper Canada (now Ontario) in 1851 than it is in Ontario today . . ," and a little later:

> The statement made above, that the death rate in Upper Canada in 1851 may have been no higher than it is today may seem surprising, given our modern advantages, but the usual impression of the period as one of enormous infant mortality, epidemic disease, short lives and numerous deaths may need some revision. Certain causes of death carried off large numbers, but others fewer than today. Thus while 20 percent of all deaths were returned as from contagious diseases, there were only fifty deaths reported in the whole province from cancer.[2]

Editor's Note: One of the referees asked if the effects of immigration was included in the population growth. Harold's answer is as follows:

> The increase mentioned (More on the Growth of a Population) was wholly or mostly due to births. After 1759 there would have been very little immigration for quite a few years.

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Contributed by Harold L. Armstrong

On the Nature of the Grains of Wind-Blown Sand

It is often taken for granted that grains of wind-blown sand, such as that found in a desert, should be more rounded than those on a beach. But a study, a few years ago, in the Simpson Desert, Australia, showed that the grains there are quite angu1ar.[1]

This may be of interest to Creationists because, while such deposits as loess, or the sand which went to form sandstone, are often supposed to have been deposited by the wind, the Flood would seem to have been a very likely agent. The study cited here would seem to show that it is hard to decide one way or the other by the shape of the grains.

There is another possible clue, however, which seems to have been little noticed. One might expect wind-blown sand often to contain vegetable material, such as tumbleweed, bits of brushwood, etc. Such debris is common in many sand dunes. And if the sand remained or hardened, the debris would remain as fossils.

When the sand was deposited by water, on the other hand, such debris would be floated away. As far as I can learn, fossilized debris is not common in sandstone. So this may be evidence that the sand was deposited by water; and what better opportunity has there been for such deposition than during the Flood?

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Contributed by Harold L. Armstrong

LETTERS TO THE EDITOR

Genesis 1

Frequently a question returns to me, does Genesis 1 refer to the entire Universe, or only to our Solar System? I am hoping you will place the following discussion in your "Letters to the Editor," where others can constructively criticize it. There are several verses in the Bible that bear on this problem.

We may recall that the Hebrew word *shamayim*, heaven(s), appears in Genesis 1:1. It is an unusual plural form, serving like the English word "sheep," and how it is used in the sentence will determine whether it shall be considered singular or plural. In Genesis 18 it is translated "firmament." According to the KJV translators, the verse should read "In the beginning God created the heaven and the earth."

Actually the word "heaven(s)" is of little help in clarifying just how much was created "in the beginning." To Bible writers "heaven(s)" was everything above their heads, and "earth" was everything under their feet. The Bible recognizes three heavens: (1) 1st heaven, atmospheric, Genesis 1:6-8; (2) 2nd heaven, starry, Genesis 15:5; and (3) 3rd heaven, Paradise where God dwells, II Corinthians 12:2.

More helpful in our problem of what was included in the work recorded in Genesis 1:1 are the words of Christ (Matthew 19:4) "Have ye not read that he which made them at the beginning made them male and female . . . ?" Other versions read: RSV, NEB "Made them from the beginning"; NASB "he who created them from the beginning"; Mark 10:6, NEB "in the beginning, at creation, God made them male and female." It thus appears that in the same great event "in the beginning," the earth and the heaven(s) and