Treatise on the Biblical Calendar, second edition (abbreviated TBC2)
by Herb Solinsky January 11, 2008

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[1] Preface

This is the second edition of this general treatise on the biblical calendar. It does not presuppose that the reader is already familiar with various aspects of the biblical calendar. It begins with the most basic matters and gradually fills in the details in an orderly fashion, never requiring the reader to know something that will be explained later. The main companion to this is a literal Bible translation and a concordance with Strong's numbers.

It is anticipated that eventually other related topics will be added in subsequent editions.

During the twilight that ended March 20, 2007 the new crescent was seen in Israel. Several hours later at about 2:07 local time in Israel on March 21, the vernal equinox was accurately predicted by BRESIM software for modern astronomy. This study includes a discussion of the question of whether March 21, beginning on the preceding evening, is the first day of the first month or the first day of the 13th month. This already gives the reader advance notice of some of its later conclusions, namely that the new crescent and the vernal equinox are significant for the biblical calendar. Evidence will be presented for this.

For those readers who already have significant knowledge of the biblical calendar and desire a summary of how the conclusion is attained, I will now refer to the chapter numbers. Chapters [10] through [14] are important for some conclusions that have a bearing on the whole matter. Here the key is the lack of mathematical astronomy by ancient Israel. Chapters [22], [27], and [29] through [32] relates to the observational process and the communication process that pertains to the day of the new moon and its practical dissemination in ancient Israel. Next see chapters [37] and [38] for the biblical understanding of the vernal equinox. Chapters [40] and appendix B go together, and these are very critical in the whole effort to understand the relationship between the day of the vernal equinox and the first day of the first month in the Babylonian calendar. Chapter [44] is very important to see the corroboration of chapter [40] from a first century witness. Finally, chapter [45] ties together all the parts and gives separate evidence independent of the detailed computer calculations in the appendix. People who distrust computers should easily see the simple logic here. If the very

knowledgeable reader desires to see the final summary in a nutshell, just go to chapter [45] and also to appendix B.

I grew up in New York City and was the son of Jewish parents, who sent me to a Hebrew school after public school hours for six years. The highlight of this training was learning elementary biblical Hebrew. In adulthood I earned an M.S. degree in Mathematics from the University of Arizona. My profession is software engineering. This background served me well in later biblical, astronomical, and calendaric studies.

The order of presenting the subject is critical to aide in logical reasoning and especially to avoid circular reasoning. I avoid writing anything that uses a result that is claimed to be proved later, because that approach can lead to circular reasoning. An appendix that is focused on a single self-contained technical topic may be read at the time it is first mentioned in the body of the text, and is therefore not considered to violate the concept of proceeding in a logical order without resorting to conclusions based upon what is written later.

When studying controversial aspects of history, one must first grasp proper methods of study. The most elementary and important matter in studying history is distinguishing between primary and secondary sources. A primary source is a record of the events that is dated close to the time of the events. A secondary source is a rewriting of the available primary sources with personal reasoning, suppositions, interpretations, correlations, deletions, additions, modifications, conclusions, etc. A good secondary source will include documentation of the primary sources used so that the reader may go to those primary sources and check on the author's possible assumptions, additions, and biases. The primary sources must also be weighed for degrees of bias in them.

The meanings of certain Hebrew words in the Bible are especially significant for an understanding of the biblical calendar. Archaeological discoveries concerning ancient Semitic languages were achieved in the 19th and 20th centuries, which are important toward recovering the meanings of certain Hebrew words. One chapter is devoted to this in order to explain the reason for the importance of ancient Semitic languages.

Acknowledgements

This study began in the summer of 1967 while examining some volumes of *Scripta Mathematica*, a journal of Yeshiva University. This journal of mathematics had some articles as well as reviews of books concerning the mathematics and the history of the Jewish calendar. I was amazed that such material would appear in a serious mathematics journal. My interest and curiosity in the subject was kindled at that moment, and I gradually acquired a growing collection of books and articles on the biblical calendar and the Jewish calendar. This igniting moment happened at the library at the University of Arizona in Tucson while I was pursuing graduate work in mathematics. At that moment I never expected that this study would eventually consume thousands of hours of my time and naturally branch out into long-term studies into Josephus, Philo, the history of astronomy and ancient calendars, the Dead Sea Scrolls, the agriculture and climate of Israel, Rabbinic writings, etc. Major research libraries made this possible, and thus a significant acknowledgement must go to the multitudes of libraries that I visited, often until closing time. On several occasions I visited the library at Hebrew Union College in Cincinnati and later utilized their photocopy services for out-of-town requests. Institutions of higher learning in greater Dallas and Fort Worth, Texas, in Louisville, Kentucky, and in greater Los Angeles were indispensable over the years. I also made several visits to the libraries at the University of Texas at Austin and the University of Chicago.

During the years 1980 through 1982 my friend Rob Anderson caught the biblical calendar interest as well, and he volunteered to write a computer program that ran on a Hewlett-Packard HP-3000 minicomputer that would approximate the visibility of the new crescent based upon Karl Schoch's curve. The software that he wrote was partly based upon the bibliographic reference Van Flandern and Pulkkinen. His many and varied computer studies were a significant help to understand how the astronomical circumstances for the calendar changed for the first month and the seventh month, the minimum and maximum time from the astronomical new moon to the sighting of the new crescent, the time from sunset to moonset on days that the new crescent would be seen, the date that the biblical festivals would fall based upon a calendar of simulated visibility, the relationship between the time of the new crescent and the full moon, etc. He and I discussed many aspects of the calendar in those years, and also the astronomy of the moon. Rob also made some visits to various libraries for specialized related subjects. In September 1982, using some of the tabulated results of the studies that Rob Anderson produced with his creative software, the book titled *The Calendar God Gave to Moses* became a reality. Although I wrote

nearly all the words and determined the arrangement of the chapters, all of the statistical data concerning the calendar came from Rob Anderson's efforts; thus its authorship was listed as "Herb Solinsky and Rob Anderson". The present treatise will occasionally make reference to Rob Anderson, and though his work stopped in 1982, that effort still lives on for acknowledgement in this treatise. Initially 400 copies were dispersed, but over the years several times that number were sent out. Jack Hines from Colorado Springs, Colorado and John Trescott from Anadarko, Oklahoma also sent out significant numbers of that 84-page book from 1982 over the years. Rob Anderson's use of the HP-3000 computer was no longer available, and astronomy software needed to be pursued.

My studies on the calendar never ceased after 1982 with that 84-page book. There was never any reason to change the overall conclusion of that study, but I certainly began to grasp many aspects of this in much greater detail and with better explanations. As the scholarly community began to fill in the gaps in the history of Babylonian and Greek astronomy, I soaked this up and saw how to use some of this material to narrow down the reasonable choices related to the history of ancient Israel and the biblical calendar. The present study represents a major leap forward into some areas that I could not foresee in 1982. While this first edition does not include extensive study into the meaning of "abib" and the agriculture of barley in Israel, I have already written extensively on this in a separate monograph during 2001-2004, and the next edition of this treatise will include a rearrangement of that material along with some newer related material on the wave sheaf offering. I anticipate that this treatise will grow to at least three times the size of the 1982 study, and its contents will include so much that is new, that it should have a new title. This is not merely a revision of the 1982 study, but a leap forward, addressing certain areas whose surface was only scratched at that time.

In early 1995 I began to explore astronomy software for use with the personal computer. I want to thank John Mosley, the Program Supervisor at Griffith Observatory in Los Angeles. He was very kind and patient with me as he answered my questions over several telephone calls about various astronomy software packages. He had tested and reviewed many software packages for *Sky and Telescope* magazine. He advised me that LoadStar Professional was the most accurate software available for the moon with an IBM PC compatible computer, including ease of use. It does use the JPL (Jet Propulsion Laboratory) results for accuracy in the distant past. This is DOS

based rather than Windows based, and it has never been upgraded, so that its graphics is primitive compared to what is currently available. Nevertheless, its accuracy still serves my needs very adequately.

On May 4, 1995 I was very thankful that I was able to spend 30 minutes over the phone speaking with Professor Bradley E. Schaefer, who, in my opinion is the most knowledgeable person alive on technical matters relating to the visibility of the new crescent. I learned much from that phone call, and some of his publications that were helpful are listed in the bibliography. He was the first one to alert me about the need to consider humidity as a significant factor for the ability to see the new crescent.

In mid-September 1982 I had a desire to speak with Professor Otto Neugebauer about the history of the Jewish calendar from before the destruction of the Temple in 70. I telephoned the History of Mathematics department at Brown University, and he himself answered the phone!!! My desire was satisfied and I acknowledge his assistance and willingness to speak with me.

In the summer of 1992 I noticed that there was an agricultural experimental station that was labeled as an extension of Texas A & M University, located in Plano, Texas. After contacting this facility by telephone, I was transferred to Professor David Marshall, who is a grain geneticist, specializing in wheat and barley. He invited me to visit him at his office, and I happily accepted for the purpose of learning more about barley, including how and when it ripens. I was mentally sky high as he loaned me a tall pile of his personal books about barley and grains. He told me that I should look into the genetics of barley because different varieties ripen at different times. I followed his advice, and two months later I spent nearly three days at the library of Texas A & M University in College Station. I am grateful to David Marshall.

In November 1997 I received a telephone call from Jack Hines explaining the need to make computer projections of the dates of the biblical festivals through the year 2010. At his suggestion he and I agreed to independently use different software to apply Karl Schoch's curve and then compare dates and reconcile differences in order to reach agreement. We did this, but in the process of reconciling differences and discussing the options in the software that he was using, I learned more about the meanings of certain astronomical

coordinate systems. I thank Jack Hines for his useful suggestions, his participation, and his encouragement.

Useful discussions transpired with Wayne Atchison, Phil Frankford, Ralph Lyman, Steve Rathkopf, and Jim Sorenson.

[2] Goals of this Study and the applied Philosophy to attain these Goals

There are two broad and primary goals of this study. The first is to discover the nature of the calendar that was used by ancient Israel, i.e., the biblical calendar. The second is to expound a procedure that may be applied in today's society by which this calendar *(or one especially "close" to it)* may be used.

The modern calculated Jewish calendar will be abbreviated MCJC. If one considers it worthwhile to replace the MCJC with another calendar, that would only make sense if the proposed replacement was based upon the same principles as the calendar used by ancient Israel, i.e., the biblical calendar. The second requirement for replacing the MCJC is to expound a procedure that may be applied in today's society by which this calendar may be used.

It is important to have a clear stated philosophy with the guiding principles that are to be used to develop a procedure to apply the calendar that was used by ancient Israel. The philosophy used in this study is now presented in the order of the priority of the philosophical principles.

(A) **The Biblical Model**. If the same illustrative astronomical positions and other conditions that occur today were also to have prevailed in ancient times, the decision or conclusion to be determined today should agree as much as possible with the ancient decision in Israel relating to the calendar. The MCJC is weak in this respect, especially because the principles in its calculation do not closely approximate the consistent reality of astronomy. If this biblical model is not given the highest priority in the calendaric procedure, then the procedure will be open to the same criticism as the MCJC and will have no advantage over the MCJC.

(B) **Avoiding Arbitrary Rules**. The proposed procedure should embody a minimum number of subjective rules with an arbitrary decision. The MCJC is weak in this respect because there are many arbitrary rules related to the

calculation as well as to the final decision. If this point is violated, then the proposed procedure is justly open to the criticism that it is a relatively fictitious calendar, i.e., it has modern invented rules, and is therefore inherently no better than the MCJC. The criticism of adopting a fictional calendar having subjective and arbitrary rules is a serious one.

(C) **Spiritual Unity**. The proposed procedure should resolve disputes over the date for the festivals in any area of the world, so that if people desire to attend a festival together, then they should arrive at the same date for the holy convocations. This does not require or imply organizational unity of those in attendance; instead, it implies spiritual unity that crosses organizational boundaries. Spiritual unity does not imply doctrinal unity on nearly all subjects, but it does imply a spirit of peace with the ability to accept people whose viewpoints do not always agree with yours. While it is possible for people to meet together for a festival of tabernacles for which all of their dates only agree upon six of the eight days, that is far from ideal because there is a loss of 25 percent of the feast in full togetherness. Even if some people plan to stay extra days beyond those that they personally consider to be holy convocations, they are likely to avoid certain group activities that conflict with their dates of holy convocation.

There is much in Scripture to support spiritual unity, and at the appropriate place this will be discussed in some detail.

[3] Cognate Words in Ancient Semitic Languages to aide Hebrew

The Bible is the ancient texts of Scripture in its original languages. But unless we can know the ancient meanings of all the words and expressions found in these ancient texts of Scripture, our understanding of the Bible will have limitations. Let us consider how the Hebrew language came to be the language of the Hebrew Scriptures.

About 1900 BCE Abraham left Ur of the Chaldeans to go to the land of Canaan (Gen 11:31; 15:7). This area was about 450 miles northeast of Jerusalem. Gary Rendsburg wrote on page 116 "… Abraham's Ur should be identified with modern Urfa in southern Turkey (near Harran), which not only accords with local Jewish and Muslim tradition, but truly is 'beyond the River,' to use the biblical expression [Josh 24:2]." Maps in most Bibles do not show Ur near Harran where is ought to be. Ur is in a region for which Akkadian was the ancient Semitic language. Abraham, Lot, and their

servants with their families brought this primary language of the Middle East with them, but Isaac, Jacob, and his sons' families lived in Canaan where they were a tiny minority in the midst of the Canaanites who did not speak Akkadian. In order to converse with their more numerous neighbors, these descendants of the original group with Abraham had to learn the local language of the Canaanites, and over time it should be expected that their use of Akkadian gradually died out because it was impractical in that environment. Roughly 500 years after Abraham's time, Joshua led the Israelites back into the land of Canaan after their captivity in Egypt. It is not known how much of the language of Canaan they retained during their generations in Egypt, but once they entered the Promised Land, their continuing contact with the native peoples led to further merging of the language of the Israelites with that of the Canaanites. In the review by Galia Hatav, on page 131 we read, "Saenz-Badillos provides a full survey of the history of the Hebrew language, tracing its origins in the Canaanite period, through a span of 3,000 years, including its modern use in Israel." Saenz-Badillos wrote, on page 53, "From the moment of its appearance in a documented written form, Hebrew offers, as we saw in the previous chapter, clear evidence that it belongs to the Canaanite group of languages, with certain peculiarities of its own."

On page 12 of the book by Cyrus Gordon there is a discussion about the ancient city of Ugarit on the eastern coast of the Mediterranean Sea to the north of ancient Israel. This was the capital of the small Ugaritic Kingdom, which flourished from about 1400 to 1200 BCE during the time period of the Judges in Israel. This page states, "Ugarit itself was located near the northwest corner of what we may call Canaan, the land that nurtured a number of linguistically related groups including the Phoenicians and the Hebrews."

The discovery of the first texts in the Ugaritic language in 1929 is described on page 14 of the book by Mark Smith. On page 15 he mentions that in 1930 a few scholars had assigned certain shaped letters in these texts to equivalent letters in ancient Hebrew. These letter assignments were made based upon the initial assumption that the Ugaritic language was very similar to ancient Hebrew. Once this decipherment was made, the Ugaritic language was easily understood by scholars who knew Hebrew.

While there are some differences in grammar between Ugaritic and ancient Hebrew, these Semitic languages are very closely related. In 1930 a

significant library of Ugaritic texts was discovered in the Ugaritic Kingdom. The northern boundary of the ancient Canaanites is unknown, so that leading scholars of Ugaritic studies at the end of the twentieth century are no longer willing to state that the Canaanites spoke the language that is called Ugaritic, but it was surely very close to it, as was biblical Hebrew. On page 1 of the Ugaritic grammar book by Daniel Sivan, he mentions that over 1300 texts have been unearthed from this greater region. He wrote, "At the present time, these clay tablets represent the only substantial second millennium B. C. E. source wholly written in the language of the inhabitants of the greater Syria-Israel region." On pages 2-3 he wrote that a few scholars hold the view that Ugaritic is a Canaanite dialect, but others maintain that it is an independent language quite distinct from Canaanite. On page 4 Sivan wrote, "Ever since the discovery of the Ugaritic writings many studies have been written concerning the expressions of style and of form that are common to Ugaritic and Biblical Hebrew literature both in larger literary units and isolated refrains." Later, on the same page we note, "The profound connection between the two literatures serves to elucidate many difficult passages in the Bible on [the] one hand and points to a common stylistic stock on the other."

On pages 224-225 of the book by Mark Smith, he wrote, "In retrospect, the Ugaritic texts have fulfilled their promise for biblical studies. No other corpus from Syria to Mesopotamia, no roughly contemporary corpus such as the Mari texts, the El-Amarna letters, or the Emar texts (though these still hold considerable promise!), or even later texts such as the Dead Sea Scrolls, have made the same impact on the understanding of Israel's languages and culture."

Certain words found in biblical Hebrew have a meaning that is not clearly determined from the biblical contexts. Some of these words have a cognate in the Ugaritic language or in another Semitic language. By a cognate, I mean a word that sounds almost the same in the other language, is spelled almost the same using equivalent letters, is used in similar contexts, and which seems to have a common linguistic ancestry. Additional contexts of the cognate in the other Semitic language often provide clarifications or more precise meanings of some Hebrew words.

In his discussion of Hebrew lexicons, on page 201, Michael O'Conner wrote, "The most important change between them [both the first edition of the Koehler-Baumgartner Hebrew lexicon in 1953 and Zorell's Hebrew lexicon

of 1954] and Buhl [his revision of Gesenius' Hebrew lexicon in 1915] was the discovery of Ugaritic [in 1929]: this is well represented in Koehler-Baumgartner 1 and almost not at all in Zorell." If grammatical care and most especially contextual matching is not followed, then the use of allegedly cognate words to transfer meanings can lead to wild speculations, and some irresponsible scholars have thereby given a foul taste to the use of Ugaritic in biblical studies; see pages 159-166 of the book by Mark Smith who especially points to the abuses of Mitchell Dahood in damaging the reputation of the use of Semitic cognates. Michael O'Conner comments on this negativity as follows on page 203, "It may be that the [irresponsible] excesses of G. R. Driver and Mitchell Dahood are to be blamed for the negative view often taken nowadays of comparative [Semitic] argumentation, but the neglect of such argumentation has had a deleterious effect." In other words, abuses of the use of Semitic cognates has led some scholars to want to abandon its use altogether, and this abandonment has been harmful, especially if grammatical care and good contextual matching is achieved.

Another ancient nation on the eastern coast of the Mediterranean Sea and north of Israel is Phoenicia whose language is called Phoenician. As mentioned above in the quotation from the book by Cyrus Gordon, Phoenician was also similar to ancient Hebrew. On pages 58 and 60 of the book by Edward Lipinski, he wrote, "Phoenician is the Canaanite form of speech used in the first millennium B.C. in the coastal cities of Byblos, Sidon, Tyre, in the neighboring towns, and in the various settlements and colonies established in Anatolia, along the Mediterranean shores, and on the Atlantic coast of Spain and of Morocco."

The language of the Phoenician colonies is called the Punic language, which is also very similar to Hebrew. Later, Aramaic became the language of the Mesopotamian region, but Aramaic was originally an eastern Mesopotamian Semitic language that also has many affinities to Hebrew. Syriac is a later offshoot of Aramaic. The common ancient Semitic languages that are closest to biblical Hebrew in order of closeness are the group of Ugaritic, Phoenician, and Punic, followed by Aramaic, Syraic, and Akkadian. Arabic is another Semitic language that is less close to biblical Hebrew.

The Israelites began their use of Hebrew in the land of Canaan where they derived their language. It was directly north of this area that Ugaritic and Phoenician were spoken. The deities of the Canaanites as mentioned in the

Bible, namely Baal and Dagon, are also discussed in Ugaritic along with pagan practices associated with those deities, so the religion of the Ugaritic Kingdom and the religion of the Canaanites must have been very similar. Cognate words in these languages that are embedded in similar contexts and are not used in an idiomatic expression should have virtually the same meanings. The ancient Israelites adopted the vocabulary of this region in their language.

Comments concerning whether etymology is useful are now addressed because I have seen some individuals come to unwarranted conclusions from the application of etymology. The supposed first or early use of a word is its etymology. On page 148 of his linguistic discussion, Peter Cotterell wrote, "The myth of point meaning. The first is *the myth of point meaning* - the supposition that even if a word has a range of possible meanings attested in the dictionary, there lies behind them all a single 'basic' meaning." Then on page 149 he wrote, "The etymological fallacy. The myth of point meaning is closely related to *the etymological fallacy*. Words represent dynamic phenomena, their possible range of associated referents constantly changing, and changing unpredictably." On page 150 he wrote, "Thus, the meaning of a word will not be revealed by consideration of its etymology but by a consideration of all possible meanings of that word known to have been available at the time the word was used (thus avoiding the diachronic fallacy [the meaning may change over time]), and of the text, cotext, and context within which it appears. Even then it is necessary to be aware that an individual source may make use of any available symbol in any arbitrary manner provided only that the meaning would be reasonably transparent *to the intended receivers*." Later on this page the author continues, "The fact is that the etymology of a word *may* help to suggest a possible meaning in a particular text. But it is the context that is determinative and not the etymology." Even comparative Semitic cognates are useless if the contexts of the cognates are not the same.

The KJV was published in England in 1611 at a time after that nation had rejected the authority of the Roman Catholic Church and replaced it with its national church, the Anglican Church. However, there was some religious tolerance in England, especially for the Jews. Gesenius wrote his famous Hebrew lexicon before the middle of the nineteenth century, and he often used the meanings of ancient Arabic, Aramaic, and Syriac words to explain some Hebrew words. Thus Gesenius employed Semitic cognates to help understand biblical Hebrew, yet he did so in a responsible manner of

matching the context. But after his death newer archaeological discoveries written in ancient Akkadian, Ugaritic, Phoenician, and Punic have been made, and thus many useful papers, lexicons, and commentaries have been written since the middle of the twentieth century that help explain certain Hebrew words and phrases. This is called the use of comparative Semitic languages applied to biblical Hebrew.

The Hebrew Scriptures were written over a period of hundreds of years in an ancient culture. The reader who wishes to study the Scriptures in solitary confinement with nothing but an English translation of the Bible will be disappointed because some of the Hebrew words are only now being capable of comprehension in its original context through archaeology, history, comparative Semitic languages, etc. There is no single source to acquire that will provide all data that one needs to fully understand the latest attainable knowledge about ancient Hebrew. Strong's concordance is outdated in the scholarship of its lexicons, which were prepared by volunteer students. Many of its etymologies are conjectural and misleading. Etymology itself, even if correct, is often not a reasonable guide to discover the meaning of a Hebrew word. In general, etymology, especially when it is often a guess, is not a good method to use to arrive at the meaning of a Hebrew word that is not easily attained from its biblical contexts.

When journal articles discuss the meaning of a Hebrew word, they never refer to the Hebrew lexicon at the back of Strong's concordance because its lack of authority and care is well recognized in scholarly circles. The claims in Strong's concordance that word *xxxx* was etymologically derived from word *yyyy* are generally mere conjecture and should not be repeated. The only time I ever look at the lexicons at the back of Strong's concordance is to check that another writer has correctly quoted from it. But the word numbers in Strong's concordance are a very useful method for identifying the words for English speaking people for whom this is being written. Most Hebrew words do have stems, which are from two to four letters within the word.

I will provide literal translations of many Scriptures. For some significant words I will supply the Strong's number and often provide a transliteration of the Hebrew word in its standard singular form (for non-verbs) or its infinitive form (for verbs). Sometimes I will put the Strong's number and the transliteration in square brackets immediately after the English word. Authors, editors, and other sources that are used are cited in full in the bibliography at the end. The English letter spellings that are used within

Strong's concordance to transliterate the Hebrew words are most often contrary to all of the three Jewish schools of pronunciation (Ashkenazic, Sephardic, and Yemenite). Hence I will not use the spellings in Strong's concordance.

[4] Disguised Confusing Footnote in the Brown-Driver-Briggs Lexicon

The original BDB Hebrew lexicon was first published in 1907 by Oxford University Press. In 1979 this was reprinted by Hendrickson Publishers, who added Strong's numbers to the Hebrew words, but kept the text and the page numbers the same. The 1979 edition also added a useful appendix with Strong's numbers at the end. Long after this lexicon was completed in 1907, some important discoveries about some biblical Hebrew words have been made utilizing comparative Semitic languages, especially derived from excavations of Ugaritic writings north of Israel and the Dead Sea Scrolls south of Jerusalem. These discoveries affect the meanings of some Hebrew words. Nevertheless, for most words BDB remains an especially complete and useful reference work.

Sometime after the original 1907 edition was printed, the original publisher added a final chapter on pages 1119-1127 titled, "Addenda et Corrigenda", which is a list of further notes and corrections. When Hendrickson Publishers decided to reprint BDB in 1979, instead of leaving this final chapter at the end, they took each entry and ***attempted*** to place it as a footnote on the same page as the word to which it adds or corrects. Unfortunately, in some rare instances, the added note from the final chapter was too long to fully fit as a footnote on the same page as the original word, so that it was continued onto the next page without a clear warning near the bottom of the continuation page. This has deceived some sincere people on the continuation page for a critical Hebrew word concerning the calendar.

The Hebrew word *chodesh*, having Strong's number 2320, is discussed on pages 294-295 of BDB, and is given the translation "new moon" or "month". At the bottom of page 294 there is a difference between all printings from Oxford University Press compared to the 1979 edition. The 1979 edition has four extra lines at the bottom of the page, and some people have been led astray by not realizing that these four lines are the continuation of a footnote from the bottom of page 293 for the Hebrew verb *chadar*, having Strong's number 2314. Therefore, these four lines have nothing to do with *chodesh*, and they appear as a disguised confusing

footnote. Part of this footnote says, “conceal behind curtain, conceal, confine”, and this gives the false impression that *chodesh* refers to the condition of the moon when it cannot be seen. In the chapter of “Addenda et Corrigenda” in the later reprints by Oxford University Press, this long note for *chadar* appears in the middle of column 1 on page 1123 where it specifies that it refers to the Hebrew word *chadar* from page 293. BDB makes no implication at all concerning the appearance of the moon at the “new moon”. The new moon will be discussed below where it seems most appropriate.

[5] Introduction to Ancient Calendars and Ancient Astronomy

In modern times much has been discovered about ancient calendars generally, especially with the help of applying the computer and astronomy software to ancient records in order to sift out conjecture from fact. During the 20th century many volumes of ancient astronomical records were translated and published. These have been studied in detail, and an improved history of ancient mathematical astronomy has been erected, especially since the Akkadian language of Assyria and of the priests of Babylonia was first deciphered in the late 1800's and archaeological discoveries were translated. It is unfortunate that such information is not readily available in every small-town library or on the Internet without cost. Recent research is copyrighted and may not be legally reproduced on the Internet for free or without permission. Thus the person who desires to study such matters today is very greatly handicapped by either living far away from research libraries, or even when only 50 miles away, a major effort must be made to fight one's way through congested traffic many times over a period of years to become familiar with the available literature. Sometimes an innocent unsuspecting person may come to a premature conclusion about the biblical calendar and then writes with conviction, thus leading other innocent ones into conclusions that would not stand up among learned people. Other people are not so innocent because they have a bias against all ideas contrary to the modern calculated Jewish calendar. Such bias often leads those to throw dust and smoke into the air and attempt to cause confusion among others who really seek genuine biblical understanding.

Since the calendar is linked to the astronomy of the sun, earth, and moon, it is important to discuss this early to define certain technical terms and to ensure that irrational and erroneous thoughts about astronomy are avoided.

[6] Ellipses and Orbits of Heavenly Bodies

The path that one heavenly body takes as it goes around another heavenly body is called its orbit. Ancient peoples did not know that the planets orbited the sun. Instead they thought that all the heavenly bodies circled around the earth. There was only one ancient Greek astronomer who went against his contemporaries by espousing his theory that the "wandering stars and the earth" (the planets) circled the sun, namely Aristarchus of Samos c. 280 BCE (see pages 74-75 of Toomer 1996). The only other ancient astronomer who is known to have accepted this sun-centered viewpoint is Seleucus of Babylon c. 150 BCE (see page 391 of Pedersen 1993 and page 247 of Stahl).

When discussing history, it is always best to quote from the original historical sources or translations of them (these are called primary sources), and then arrive at conclusions. Unfortunately, when the history of ancient astronomy is the topic, problems are encountered that prohibit quoting from original sources before Ptolemy (c. 150 CE). One insurmountable problem is that the important ancient astronomical texts are not written for the purpose of teaching others their methods; there are no ancient textbooks. Instead we find columns or tables of numbers with some occasional notes, and there are records of observations with some notes. The ingenuity of modern historians of mathematics and astronomy has enabled them to determine the meanings of the various columns and the meanings of the scientific terms used. Modern science has reverse engineered the ancient texts to learn what must have been their ancient methods in order for the columns of numbers and the occasional notes to make sense. While English translations of ancient astronomical texts certainly exist, there would be no benefit to quote from any one text for an understanding of the underlying methods unless one were writing a detailed textbook which required some significant knowledge of mathematics and astronomy. This difficulty in not being able to quote from the primary sources pertaining to ancient astronomy for the layman makes it necessary to quote and cite modern secondary sources.

For the history of astronomy the original ancient sources are so obscure that a correct interpretation requires great care by specialists in this field, so that scholars who are only historians or only modern astronomers may easily go astray in their conclusions. A generic example of the obscurity is a writing tablet with orderly columns of numbers having some symbol at the top of each column and some miscellaneous remarks. First, one translates the numbers into today's numbers, and also translates the miscellaneous

remarks. Second, one determines patterns to the numbers and relates these patterns to known values relating to astronomical time periods of heavenly bodies. Some columns become reasonably easy to interpret or explain, while other columns may remain a matter of modern scholarly debate for 100 years or more because the tablets themselves do not define the meaning of the columns. Simply publishing a literal translation of the tablet does not do the layman any good at all.

Because of this, when some scholar publishes a paper about the history of ancient astronomy, it may require some years of scholarly debate in order that a clear mutual understanding of the correctness of that paper will emerge. During the twentieth century some papers were published in this subject that were subsequently proven false by the best scholars in this field. But less knowledgeable writers on the history of science thought that some of these papers were correct before they were proven false, and thus popular published articles, Internet website articles, and books on the history of ancient astronomy are available with information that modern specialists in this field know to be false. Unless a person devotes some years of study to the literature on this subject and keeps up with the latest journals and advanced books related to the history of ancient astronomy, it is easy to be led astray. I have performed Internet searches and have been greatly dismayed at the widespread misinformation available. I have taken great care to learn who the best authorities are in this field, and I have only used internationally respected specialists for my quotations and sources. I have kept up with the latest literature for the specific details that are especially significant for this study.

Educated people of today know that the earth rotates on its axis once each 24-hour day, but we still speak of the sun rising up in the morning rather than the earth rotating to enable us to see the sun. Thus the sun does not really move fast around the earth so as to truly rise in the morning, but the expressions in our language, which have been handed down to us since ancient times have remained. The NKJV states in Eccl 1:5, “The sun also rises, and the sun goes down, And hastens to the place where it arose”. Nothing is improper here by saying what appears to happen from the perspective of an observer on earth. Gen 1:14 mentions the dividing of the daytime from the night, and it says that the lights in the heavens have this purpose. We must not be critical of the Bible here on the grounds that the rotation of the earth on its axis would be explained as the cause today.

Regardless of the physics, the Bible was written in terms of human perception from the surface of the earth and must be accepted this way.

The Bible gives no hint of advanced mathematical or astronomical knowledge from the days of Moses. Ancient people thought that the sun went around the earth in an orbit having the shape of a circle, and that the moon went around the earth in an orbit having the shape of a circle. Ancient Greek astronomers used the mathematics of circles to approximate the predictions of eclipses and other astronomical events, but they had to add some complexity to their mathematical schemes because they eventually discovered that the speed of the moon around the earth was not constant. They modified their mathematics in an attempt to make their predictions agree with what they observed later, yet they continued to accept circular motion of the heavenly bodies.

The German astronomer Johannes Kepler (1571-1630) discovered that the orbit of Mars around the sun had the shape of an ellipse. Sir Isaac Newton (1642-1727) proved that all planets of our solar system had an orbit around the sun shaped as an ellipse. Ancient predictions could never become extremely accurate compared to what was achieved by Newton because ancient astronomers did not truly understand the laws of motion, the shape of orbits, the physical reality of what was primarily moving, and the higher mathematics needed to prove the more precise physical relationships through time. Kepler was innovative and brilliant in using geometry to derive his results about Mars, but without having the calculus that Newton was the first to apply to astronomy, Kepler was greatly handicapped to go beyond his great achievements. But Kepler had at his disposal the very carefully documented results of many years of fine observations by Tycho Brahe, who used accurate carefully constructed mechanical astronomical instruments, and Brahe was funded by willing donors who were not concerned that the effort was not useful to people at that time. Kepler stood upon the shoulders of Brahe. Newton said that his achievements were only possible because he stood upon the shoulders of giants. The inventions of the telescope and the pendulum clock were a great help to astronomers who gave accurate data to Newton. The invention of the printing press helped to spread scientific achievements far and wide so that brilliant minds in diverse places could rapidly feed upon each other's results. The funding of European universities and the exchange of knowledge among people in a variety of scientific disciplines that was characteristic of the renaissance helped to make this achievement possible. The ancient world lacked such a critical mass of

diverse inventions and published scientific papers that teamed together to enable such magnificent results. A key word of this paragraph is ***ellipse***. A few remarks about the nature of an ellipse may be useful in order for the reader to appreciate certain later comments concerning the moon's orbit around the earth. If the reader does not understand some of the discussion in the next few paragraphs, it is of no great consequence.

Picture a circular white pancake resting on a dark tabletop and consider looking at it from directly above. Its boundary looks like a circle. Then picture yourself standing upright on the floor a short distance from the table while looking at the pancake. If the height of the table is only the size of your big toe, the boundary of the pancake will look very much like a circle, but if the height of the table is only a little below the height of your eyes, the boundary will look like a very squashed circle. At some in between height, the boundary will look somewhat like an egg. Each boundary shape of the circular pancake viewed from a very low height to one near the height of your eyes is technically called an ellipse in mathematical terminology.

The orbit of the earth around the sun is nearly a perfect ellipse that is somewhat close to being a circle. The orbit of the moon around the earth is nearly a perfect ellipse that is a little less circular. If the moon and the planets did not have gravitational relationship with the earth, then the earth's orbit would be as perfect an ellipse as one could expect for a physical object. If the sun and the planets away from the earth did not attract the moon, then the moon's orbit around the earth would be a nearly perfect ellipse. However, in a technical sense the last sentence is not quite true because if the sun continues to pull at the earth and would no longer pull on the moon, the moon would fly off away from the earth because the annual orbit of the moon around the sun is based on the sun's pull on the moon, not the earth's pull on the moon.

The position of the sun within the earth's orbital ellipse and the position of the earth within the moon's orbital ellipse are not at the center where one might expect. The following will explain where they are. Picture a straight stick nailed to the center of an ellipse, and picture the length of the stick to only extend from one edge of the ellipse to the other. Now imagine hitting the stick so that it spins around the ellipse, but imagine the length of the stick stretching and shrinking as it turns, so that it always only extends from one edge of the ellipse to the other. The major axis of the ellipse is the stick's line segment when it is longest in its spin, and the minor axis of the ellipse is

the stick's line segment when it is shortest in its spin. These axes are perpendicular to one another and cross at the center of the ellipse.

Picture a stick in the position of the major axis, but imagine it to be broken at the center of the ellipse with its two halves loosely glued together so that it may change angle where the glue holds them. Now imagine putting the palm of each of your hands at the ends of the stick and slowly pushing them together as when beginning to clap hands. The clapping movement should be toward the center of the ellipse so that as both hands move at the same speed, the stick rests in the plane of the ellipse, and the glued spot moves up the minor axis. Stop the movement when the glue touches one end of the minor axis. The two ends of the stick at your palms lie along the major axis, and the two halves of the stick are joined at one end of the minor axis. Now each end at a palm is at a point called a focus of the ellipse. Each ellipse has two foci, both of which are on the major axis and off the minor axis. The procedure described shows that the distance from each focus to an end of the minor axis equals half the length of the major axis. There is only one point on an ellipse closest to a focus; that is the nearer of the two points at the ends of the major axis. Similarly, there is only one point on an ellipse furthest from a focus; that is the further of the two points at the ends of the major axis.

The sun is at a focus of the earth's orbital ellipse. The earth is at a focus of the moon's orbital ellipse. Thus the sun is never at the center of the earth's orbit and the earth is never at the center of the moon's orbit.

[7] Astronomical New Moon (Conjunction) and Full Moon

From the viewpoint of an observer on the earth far away from the north and south poles, the moon has periodically changing appearances. Typical appearances of the moon's cycle may be described as (1) the widening crescent, (2) the moon increasing toward full circle, (3) the full circle, (4) the moon decreasing away from full circle, (5) the narrowing crescent, and (6) invisibility. The ***astronomical new moon*** (as recognized by modern astronomers) is the moment in time (or the moon's position) in each cycle of the moon around the earth at which the center of the moon is closest to the straight line between the sun and the earth. The astronomical new moon is also called the ***conjunction*** of the sun and the moon as observed from a person on the surface of the earth.

A ***solar eclipse*** is the covering of the sun by the moon as seen by an observer on the earth when the moon comes between the sun and the earth. Such an eclipse is called ***total eclipse*** when the circle of the moon lies inside the circle of the sun. A solar eclipse can only occur during the time of the conjunction. How dark is it during a solar eclipse, and how long does a solar eclipse last? On pages 198-199 of Zirker we read, "During a total eclipse, however, the corona [the sun's disk] is only as bright as the full moon." On page 30 we read, "The maximum diameter difference is 2'38" and the maximum duration of totality is 7 minutes and 40 seconds for an observer near the equator. The 1973 eclipse in West Africa came very close to this maximum theoretical totality. On the average, a total eclipse only lasts for two or three minutes and seems much shorter."

Chapter 12 of Zirker's book is titled "The Great Hawaiian Eclipse" where Zirker describes the famous total eclipse over the Hawaiian Islands on July 11, 1991, which is significant because of the world famous observatory on Mauna Kea at 13,700 feet above sea level, which provided superb scientific facilities for observation. This total eclipse lasted 4 minutes 11 seconds (page 197). Page 197 states, "Schoolchildren [on Hawaii] were equipped with dark slides to view the eclipse and preparations were made to bus them to favorable locations." The reason that they look through special dark slides is so that their eyes are not damaged due to the harmful rays of the sun. During the 4 minutes 11 seconds of totality of the solar eclipse, one's eyes should not be damaged because the brightness is near that of the full moon, but outside that narrow window of time, one's eyes surely will be damaged when the moon only partially blocks the sun.

The following definitions are relative to a place on the earth significantly away from the north and south poles. The ***crescent period*** of the moon's cycle is the time after the three-quarter-size moon and before the following one-quarter-size moon excluding the time during which the moon is invisible and the time at which there may be a solar eclipse. The moon is called a crescent during the crescent period. The ***old crescent*** is the moon during the time that it is visible, assuming the atmosphere is clear, on the last day that it is visible prior to the astronomical new moon. The old crescent is seen looking east in the morning. The ***new crescent*** is the moon during the time that it is visible, assuming the atmosphere is clear, on the first day that it is visible after the astronomical new moon. The new crescent is seen looking west in the evening. The new crescent is sometimes called a young crescent.

Bartel Leendert van der Waerden (1903-1996) was an internationally prominent scholar in the fields of mathematics and the history of ancient astronomy. On page 169 of van der Waerden, he wrote: “The difference between the first days of an exact month [month starting with and ending with the conjunction] and an observed lunar month [month starting with and ending with the new crescent] is one or two days, or in exceptional cases three days.”

On page 66 of Beaulieu we find, “In ancient Babylonia the day was reckoned from one sunset to the next. The monthly count was based on lunar phases, with the month beginning after sunset when the new crescent of the moon was seen again in the western horizon. This happened at the earliest one day, and at the latest three days after conjunction.”

At the end of the above sentence is “2” (footnote) which states the following (same page, square bracket comments are in the journal, not from me), “That the moon never disappeared for more than three days following conjunction was evidently known to Assyrian and Babylonian astronomers, as shown in H. Hunger, *Astrological Reports to Assyrian Kings* (SAA 8, 1992), text 346, a report sent by the scholar Asaredu the younger: ‘On this 30th day [the moon became visible]. The lord of kings will say: “Is [the sign?] not affected?” The moon disappeared on the 27th; the 28th and the 29th it stayed inside the sky, and was seen on the 30th; when else should it have been seen? It should stay in the sky less than 4 days, it never stayed 4 days.’”

On page 87 Beaulieu wrote: “Even after the 6th century B.C., when Babylonian astronomers developed the mathematical schemes which enabled them to calculate month-lengths in advance, it is probable that observation remained the sole authoritative way of fixing the beginning of the month.” Page 244 of Britton 1999 indicates that the Babylonian method for predicting the sighting of the new crescent is likely to have originated within the years 457-419 BCE. The Babylonian calculation for the sighting of the new crescent is based upon approximate repeating sequences of data over long periods of time. Existing records of some of the data that are used in these patterns go back to 568 BCE, which is 18 years after Solomon's temple was destroyed in 586 BCE, and the earliest archaeological source that has all astronomical parameters that are needed for the prediction of the sighting of the new crescent is dated 373 BCE (see page 197 of Hunger and Pingree). Thus the time at which the Babylonians developed methods to

approximately determine the day of the new crescent is about 450 BCE. Perhaps about 400 BCE their method was actively being used. I have not seen any published papers that attempt to quantify how accurately the Babylonian methods predicted the new crescent.

Based upon data showing that one factor of considerable significance to the Babylonians is predicting the time from when the sun sets below the western horizon to the time when the moon sets below the western horizon during the crescent phase (although other time based factors were also sought by the Babylonians), and knowing that this method has some degree of reliability toward predicting the visibility of the new crescent (but is far from a perfect method), my estimated guess is that their predictions for the new crescent were correct between 80 and 85 percent of the time when the weather was clear.

Today we speak of the conjunction and we define it in terms of the three dimensional geometry of the sun-earth-moon system and the language of orbits. But ancient people did not have our modern concept of a sun centered solar system (except for two known ancient astronomers who were ridiculed), and to the best of our knowledge today, ancient people did not have our three dimensional model of the sun-earth-moon system. We must realize that the ancient concept of the conjunction and our modern concept are different. They could see a solar eclipse, and whenever there was a solar eclipse, there was necessarily a conjunction also. But that was the only kind of conjunction they could see. What concept could they have for the conjunction generally if they could not see it? Page 110 of Koch-Westenholz states, “The Babylonians seem never to have given an astronomical explanation of eclipses.” Page 101 of Koch-Westenholz states, “I know of no Babylonian astronomical explanation of the phases of the moon, ...” The Babylonians did notice the obvious fact that when the full moon occurs the moon and sun are at opposite ends of the sky, and during the symmetrically opposite time of the lunar cycle the moon and sun are traveling along side by side. A translation of an ancient Babylonian text that discusses the moon's cycle of disappearance is on page 101 of Koch-Westenholz, where “you” refers to the moon: “On the day of disappearance, approach the path of the sun so that [on the thirtieth day (?)], you shall be in conjunction, you shall be the sun's companion.” Here the author's translation “conjunction” does not require that it refer to an instant in time. It is merely the time that the sun and moon are companions, traveling together.

With clear weather the Babylonians knew there could be one, two, or three nights of invisibility of the moon (as mentioned above from van der Waerden and from Beaulieu). At the moment of true conjunction the moon and sun can be at most 5.2 degrees apart from a point on the earth's surface. At this narrow an angle if the sun is in view or very near the horizon, the light from the sun will be too brilliant for the moon to be seen directly or even indirectly (the latter is called earthshine). ***Earthshine*** is the light from the sun to the earth, which then reflects back to the moon and then reflects to the observer on earth. Thus earthshine is the light seen from a double reflection. It is usually easy to see earthshine as the completion of the moon's circle as a faint grayish blue with the crescent at one edge on the second day old crescent. Often earthshine may be seen on the day of the new crescent if it is not a very narrow crescent. Neither modern nor ancient people could see earthshine at the time of conjunction because the sun's brilliance is too close to the moon, and this has nothing to do with air pollution.

When the conjunction occurs, the moon is invisible except during a rare solar eclipse when the moon covers the sun from view from observers in a certain region on the earth for at most 7 minutes and 40 seconds (see the quote from Zirker above). Without knowledgeable calculations, it is not possible to accurately determine the time of the conjunction. Because the conjunction is not visible except during a rare solar eclipse, ancient people who did manage to arrive at some mental concept of the conjunction (such as the time period when the sun and moon are traveling together) and who also desired to achieve a mathematical computation to predict the time of the conjunction, would only be able to check the accuracy of their mathematical prediction during the rare occasion of a solar eclipse where they were located. The strong desire of certain ancient peoples, specifically the Chinese, the Babylonians, and the Greeks, to be able to predict solar eclipses, along with a knowledge of the mathematics that enabled then to make this approximation led to their interest in the conjunction as the approximate time when the sun and moon were traveling together.

Historical records of eclipses over a long period of time will suggest cycles of repetition of eclipses, and this may be simply described as a "bookkeeping" method to predict eclipses. In the book on ancient eclipse predictions by John Steele 2000, he discusses Chinese eclipse predictions on pages 175-215. On page 177 in the context of China, Steele wrote, "Although there are many steps in this process – and many potential places

for mistakes – it has the advantage that eclipse prediction is reduced merely to bookkeeping, and yet the method still predicts most visible eclipses over the course of a hundred years or so. Furthermore, the calendar tends to predict too many, rather than too few, eclipses." Later on this page we find, "The first mathematical treatment of eclipse calculation [in China] without reference to an eclipse cycle is found in the *Ch'ing-ch'u-li* from the third century AD." Steele's description of these methods reveals a computation to repeat an eclipse rather than a mathematical geometrical model of where the heavenly bodies will be in the future. The purpose of including this piece of history is to remove some of the exotic imagined ideas that some laymen possess concerning the abilities of ancient peoples.

The ***full moon*** is the moment in time (or the moon's position) in each cycle of the moon around the earth in which the center of the earth is closest to the straight line between the sun and moon. The full moon is also called the ***opposition***. When the full moon occurs, it looks like a full circle. However, the time of the moon's appearance as a full circle lasts at least two nights and it looks quite circular for several nights, so without knowledgeable calculations, it is not possible to accurately determine the time of the full moon by observing the circularity of the moon. On the other hand, it is possible to use a different observational method to make a judgment of the day after the moment of full moon as follows. During the several days near the time of the full moon the following two statements are true. Before the moment of the full moon, the moon rises in the east before the sun sets in the west. After the moment of the full moon, the moon rises in the east after the sun sets in the west. Using these principles one can use the rule that the first evening in which the moon rises in the east after the sun sets in the west begins the day after the moment of the full moon. One drawback of using this observational method is that it requires a straight horizontal unobstructed view of both the eastern horizon and the western horizon, and both of these horizons must be at the same altitude above sea level. Hills and trees will hinder accuracy. Besides this, if two observers perform this activity from different locations that have opposing horizons, which differ in their altitude above sea level, it is possible that their conclusions will differ in a near borderline case.

[8] Variation from Astronomical New Moon to Full Moon; Variation from New Crescent to Full Moon

Someone may imagine that since the day immediately following the moment of the full moon could be known by the method described above, perhaps the day of the conjunction could be known from the day of the full moon. This conjecture is now discussed.

On the bottom of page 6 of Parker 1950, he wrote, “The necessary time for full moon varies from 13.73 to 15.80 days after conjunction.” This is a swing of 2.07 days, which is about 49 hours 41 minutes. This shows that the conjunction (i.e., astronomical new moon) does not have to be exactly opposite the full moon.

By examining a few cases near these extremes in the 20th century we may compare the day of the lunar month based upon whether one considers the first day of the lunar month to be the day on which the conjunction occurs or the day on which the new crescent is seen. Let us consider three cases in which the computation for visibility of the new crescent is made from Jerusalem, and the boundary for a new day is computed as sunset. For those who wish to check with other software, I am considering the latitude of Jerusalem to be 31.80 N and the longitude of Jerusalem to be 35.22 E, which are the coordinates I have seen for an official weather station of Jerusalem. The abbreviation ***UT*** stands for “universal time”, and is intended to refer to the time zone based upon Greenwich, England.

Case 1: Conjunction on July 7, 1967 at 17:01 UT and sunset 16:48 UT

The full moon occurred on July 21, 1967 at 14:39 UT. The time from conjunction to full moon is 13.90 days (a little over the minimum of 13.73).

Note that the conjunction occurred shortly after sunset, close to the beginning of a new day. For a month that is considered to begin on the day of the conjunction, the full moon occurs on the 14th day of the month in this example.

On the evening that ends July 9, 1967 the new crescent will be theoretically visible. For a month that is considered to begin on the day beginning with the new crescent, the full moon occurs on the 12th day of the month.

Case 2: Conjunction on December 12, 1966 at 3:15 UT and sunset 14:35 UT

The full moon occurred on December 27, 1966 at 17:45 UT. The time from conjunction to full moon is 15.60 days (a little under the maximum of 15.80 days). For a month that is considered to begin on the day of the conjunction, the full moon occurs on the 15th day of the month in this example.

On the evening that ends December 13, 1966 the new crescent will be theoretically visible. For a month that is considered to begin on the day beginning with the new crescent, the full moon occurs on the 13th day of the month.

Case 3: Conjunction on September 26, 1973 at 13:54 UT and sunset 15:32 UT

The full moon occurred on October 12, 1973 at 3:11 UT. Note that the conjunction occurred shortly before sunset, close to the end of a new day. The time from conjunction to full moon is 15.55 days (a little under the maximum of 15.80 days). For a month that is considered to begin on the day of the conjunction, the full moon occurs on the 17th day of the month in this example!!

On the evening that ends September 28, 1973 the new crescent will be theoretically visible. For a month that is considered to begin on the day beginning with the new crescent, the full moon occurs on the 14th day of the month.

Conclusion from these Examples

In these examples, for a conjunction month, the full moon occurs from the 14th to the 17th day of the month. The 17th is very rare.

In these examples, for a new crescent month, the full moon occurs from the 12th to the 14th day of the month. In the most extreme case for a new crescent month, the full moon can occur on the 16th day of the month, but this is very rare. Typically the full moon occurs on the 13th, 14th, and 15th for the new crescent month.

[9] Ancient Meaning of the Full Moon

What did the full moon mean to the ordinary person in ancient times? We have one example of what it meant to the Jewish philosopher Philo who

lived in Alexandria, Egypt and who wrote in the early first century. On page 17 of Philo_QE (section 9), in a context concerning Passover, Philo wrote, "For when it [the moon] has become full on the fourteenth (day), it becomes full of light in the perception of the people." On page 401 of Philo_7 (Special Laws 2:155), in a context concerning the seventh month, Philo wrote, "The feast begins at the middle of the month, on the fifteenth day, when the moon is full, a day purposely chosen because then there is no darkness, but everything is continuously lighted up as the sun shines from morning to evening and the moon from evening to morning and while the stars give place to each other no shadow is cast upon their brightness." We see here that Philo considers both the 14th and the 15th days of the month to be days of the full moon. Hence he does not consider the full moon to be an instant in time or only one day of the month, but a general period when the moon is quite circular. As an ordinary person he did not adopt the meaning for the full moon of advanced Greek astronomers as a mathematically predicted moment when a lunar eclipse would sometimes occur. Due to the elliptical orbit of the moon, this mathematical moment will vary by a few days in relation to the conjunction, and it will also vary by a few days in relation to the new crescent. The precision of mathematics was not Philo's approach to the meaning of the full moon.

Although Philo, a Jew who lived in Alexandria, Egypt, is a historical first century witness that the moon is full on the 14th and 15th days of the Jewish months, this is not a biblical argument that a biblical month is full on the 14th and 15th days of the month.

In the first century BCE Vitruvius wrote the views of the Greek astronomer and mathematician Aristarchus of Samos (c. 280 BCE) concerning the full moon. On page 264 Vitruvius (translated by Morgan) wrote, "On the fourteenth day, being diametrically across the whole extent of the firmament from the sun, she is at her full and rises when the sun is setting." This is approximately the rule given above, namely the first evening in which the moon rises in the east after the sun sets in the west begins the day after the moment of the full moon. However, Philo of Alexandria took a looser concept of the full moon allowing both the 14th and 15th days of the month to be days of the full moon.

[10] When in History did Prediction of the Astronomical New Moon Begin?

The history of ancient astronomy shows that it was not until near the time of the birth of Alexander the Great that ancient astronomers were first able to estimate the time of the conjunction of the moon by a calculation.

On page 169 of van der Waerden, he wrote:

"In Babylonia, the month began on the evening on which the crescent was visible for the first time after [the astronomical] New Moon. More precisely: If on the [ending] evening of the 29th day of any month the crescent was visible, the month has 29 days; if not, the month has 30 days. The same rule still holds in Muslim countries."

"I shall call these months 'observed lunar months'. The words of Geminos indicate that the Greek months originally were just observed lunar months."

"The months beginning with the conjunction will be called 'exact lunar months' or 'conjunction months'. These months are a theoretical construction; they could not be used in practice in classical times, because before Kallippos [Callippos] (330 B.C.) astronomers were not able to predict the true conjunction."

Thus van der Waerden points to 330 BCE as the time before which ancient mathematical astronomical knowledge was not able to predict the time of the astronomical new moon.

The orbit of the moon around the earth is an ellipse. The earth is not at the center of this ellipse, but at one of the two foci of the ellipse. The moon moves faster around the earth when it is closer to the earth than when it is farther from the earth. Due to the sun's gravitational attraction to the earth and moon, the distance from the earth to the sun affects the distance from the moon to the earth, which in turn affects the time from conjunction to conjunction! The exact time from conjunction to conjunction does vary through the year! Knowing the average time from conjunction to conjunction does not help to know any current lunar month's time from conjunction to conjunction.

The minimum time from one conjunction to the next conjunction is 13 hours 40 minutes less than the maximum time from one conjunction to the next conjunction (see pages 21-22 in Stephenson and Baolin). A mathematical mastery of this variation is needed in order to accurately predict the time of an astronomical new moon.

A high level of confidence of the accurate prediction of solar eclipses by ancient peoples was certainly impossible because this requires a knowledge of where the moon's shadow will reach the earth, and that requires a knowledge of the distance from the moon to the earth (which requires a knowledge of the elliptical orbit of the moon), the size of the earth, and the shape of the earth (which is somewhat pear-shaped rather than perfectly spherical). Since they could not predict the shadow path of the moon upon the earth, the best they could achieve is a statement that a solar eclipse was a reasonable possibility. But in order to do that, they would need to have a good ability to predict the astronomical new moon as well as how to rule out most astronomical new moons as being capable of providing a solar eclipse. This simply shows that we can judge the ability of ancient astronomers to approximately predict the astronomical new moon by their attempts to predict a possible solar eclipse.

Of specific interest is the paper by John M. Steele 1997 where, on page 134 he lists the oldest Babylonian solar eclipse prediction for which we have full data in 358 BCE, exactly 100 years after Ezra first brought a group from the House of Judah back to Jerusalem after the Babylonian captivity. This solar eclipse prediction was 181 years after King Cyrus the Great of Persia conquered Babylon on October 12, 539 BCE (see page 14 of Parker and Dubberstein). Since the empire was now the Persian Empire rather than the Babylonian Empire, the learned astronomers who continued their work should be called Persians, but the general practice is to continue referring to them as Babylonian or “late Babylonian”. The same pagan priests continued to improve their work in mathematical astronomy. John Steele 1997 analyzes the 61 preserved solar eclipse predictions of the Babylonians for which full data is available including the time at which the eclipse is hoped to be seen, and these fall within the years 358 BCE - 37 CE. The terminology used by the Babylonians shows that a solar eclipse was to be “watched for”, showing an uncertainty that it would be seen. Less than half (28 of 61) were either seen or would have been seen if the precise time of the eclipse would have occurred during daytime in the region of Babylon. In other words, in these 28 cases the latitude of the moon's shadow did fall within some part of greater Babylon, but in the other 33 cases the moon's shadow was outside this region. These ancient astronomers used water clocks, which divided the day into 360 equal parts, each being four minutes. The average error of these water clocks is eight minutes from true time. The predictions included the calculated time for the eclipse to occur. The worst two predictions among these 28 cases were 8.08 hours in error and 4.76

hours in error (page 135). The average error was 1.96 hours (page 136). For the other 33 cases of predictions the average error in the time of conjunction (here the word “conjunction” relates to a hoped for solar eclipse) is 3.67 hours, nearly twice as great (page 137)! Their predictions of solar eclipses did not get more accurate in the later period of their recordings (pages 138-139).

The mathematical methods that were used by the Babylonians were very different from the methods used by the Greeks. The former used nearly repeating sequences based on prior historical records (not a formula based on a general physical mathematical model), while the latter developed a geometrical mathematical model based on circles after 400 BCE. The Greeks were aware of the methods used by the Babylonians (see page 118 of Jones, the chapter by Toomer 1988, and page 61 of Fatoohi and others), but the most advanced Greek astronomers preferred their own methods. The methods of the Greeks were more advanced in the sense that they were based on mathematical methods for approximate geometrical models, and the geometry itself led to the concept of the conjunction. In contrast to this, the Babylonians were interested in predicting solar eclipses, which by definition only occur at the time of a conjunction; they did not show a general interest in predicting the time of all conjunctions, and this was likely the cause for van der Waerden's limiting of the year for calculating the approximate astronomical new moon (conjunction) to 330 BCE. On page 41 of Aaboe we read, “Babylonian mathematical astronomy has two features that seem strange to modern eyes, and it may thus be in order to mention them here. First, it is entirely arithmetical in character or, in negative terms, there is no trace of geometrical models like the ones we have become accustomed to since the time of Eudoxos [Greek astronomer of Cnidos, c. 408 to 355 BCE (see pages 63-66, 335 of Pedersen 1993)]. Second, the cuneiform literature [clay tablets bearing the Akkadian language of the Assyrians and a remnant of the Babylonians] nowhere attempts to justify the precepts of the procedure texts; thus it has rested with modern scholars to uncover the underlying theoretical structures.” In other words, the Babylonians have left us their many tablets showing columns of numbers, and it remained for modern scholars to decode the meaning of these columns and how they were computed. In some cases there are narratives that accompany these numbers that mention certain sighted phenomena in the heavens or some indications of the meanings of one or more columns, but there are no geometrical diagrams showing a mathematical model of anything in the heavens among the Babylonians.

The conclusion is that there are unusual aspects of the variation of the moon's cycle around the earth that prevented ancient people from predicting the approximate conjunction until about 330 BCE by the advanced methods of the Greeks, or instead, until about 360 BCE for the non-geometrical methods of the Babylonians whose average error was about three hours. Moreover, the Babylonians were focused on solar eclipses rather than conjunctions in general, while the Greeks showed an interest in conjunctions. Another very significant factor that contributed to the difficulty of predicting the conjunction is the lack of visual confirmation of a conjunction unless there was a rare solar eclipse to confirm it. The water clocks used by the ancient Babylonian astronomers had an average error of eight minutes and their smallest unit of measuring time was four minutes. Their predictions were long term, i.e., there is nothing to indicate that they attempted a revised prediction within days of a solar eclipse. When conditions were not right for a solar eclipse they never predicted a "conjunction" because it would have been foolish to predict a phenomenon that was not potentially verifiable with an observation.

A ***lunar eclipse*** is the covering of the sun's light to the moon by the earth as seen by an observer on the earth when the earth comes between the sun and the moon. In sharp contrast to the special difficulties of predicting solar eclipses, there are no comparable problems in predicting lunar eclipses. Lunar eclipses must occur during the full moon, may be seen by nearly half of the people on the earth where the weather is not nasty (the side of the earth where it is night), are visible more frequently than solar eclipses from any one location, have calculations that may be tested from monthly approximate sightings of the full moon, and do not require predicting the path of a shadow (in this case, the shadow of the earth upon the moon). Hence there is a vast difference between the difficulty in predicting solar eclipses (some conjunctions) and the ease in predicting lunar eclipses (some full moons) by ancient astronomers. Page 3 of Britton 1989 states, "For a given location, therefore, lunar eclipses are seen nearly 4 times as frequently as solar eclipses." But even when there is no lunar eclipse, the full moon is still visible. When there is no solar eclipse, the moon is not visible.

Ancient Babylonian astronomers were significantly more successful in their accuracy at predicting lunar eclipses than they were at predicting solar eclipses. Of specific interest is the paper by John M. Steele and F. Richard Stephenson. The oldest Babylonian lunar eclipse prediction for which we

have full data is in 731 BCE (see page 125), which is 373 years before the first known reasonably accurate solar eclipse "hoped for" prediction by the Babylonians for which we have complete data! They were successful in their prediction for 731 BCE. Page 125 lists 35 Babylonian predictions of lunar eclipses for which we have complete data including the time of prediction to be observed. Also listed is the duration of time for which the eclipse was observed by the Babylonians, when it was successfully seen. These are dated from 731 to 77 BCE. Their average error for predicting the time of lunar eclipses was about one hour (page 130). In 90 percent of the predictions they were either successful or there was a near miss as defined by the authors (pages 123, 130). Their average error for lunar eclipse predictions was about one hour compared to about three hours for solar eclipses. It took about 400 years more for the Babylonian astronomers to be able to predict reasonably accurate possible solar eclipses (associated with the conjunction) than for them to be able to predict lunar eclipses (associated with the full moon).

There are numerous other dates of predictions of both lunar and possible solar eclipses by the Babylonians, but the time of day of their expected or hoped for sighting is not provided in the ancient sources. Without having the time of day of a predicted lunar eclipse or a possible solar eclipse it is impossible to judge the accuracy of the method of prediction, so it is not reliable to include such records in a discussion of known results. On the other hand, where columns of data are provided in a Babylonian text, it is possible for a modern specialist in this area of ancient science to judge whether the method is quite different from the more accurate later methods. In Britton 1989, John Britton evaluates the method used by the Babylonians for their earliest known attempt to predict possible solar eclipses. This text, which he called Text S, describes 38 solar eclipse possibilities from 475 to 457 BCE (see page 1 of Britton 1989). On page 44 Britton states, "We find in Text S an unusual mixture of disparate elements not known from other texts." After discussing the method used by these Babylonians, he wrote on page 46, "Indeed, with one exception the entire theory [for predicting possible solar eclipses] can be derived from counts of phenomena (lunar eclipses, eclipse possibilities, and months), and there is no evidence that measurements of times, angles or magnitudes played any role in its creation." From the data in Text S, Britton discusses its primary computation, which he calls "psi-star-of-S". His conclusion on page 46 is, "We see this best in the fact that psi-star-of-S, a function clearly derived from lunar eclipses and measuring the proximity to the node of the earth's shadow at conjunction (or the moon at mid-eclipse), is correctly applied to

solar eclipse possibilities by simply moving the entire function forward half a month." A simplified way of saying this is that these Babylonians estimated the time of the conjunction to be the midpoint between two successive computed full moons, and then judged the confidence for a solar eclipse based on the history of repeating eclipses. But we have seen above that it is very crude to estimate the conjunction to be the midpoint between two successive computed full moons, so this method for predicting solar eclipses by the Babylonians is indeed very crude compared to their later method which has an average error of about three hours. Hence we must dismiss this first Babylonian attempt at predicting solar eclipses (special conjunctions) as inferior and not to be included in the chronology with their later methods.

The conclusions are that the Babylonians were able to predict lunar eclipses by about 750 BCE with a time error of about one hour, and the Babylonians were able to predict possible solar eclipses about 360 BCE with a time error of about three hours. The Babylonians started the practice of predicting the sighting of the new crescent about 450 BCE.

[11] Transmission of Babylonian Astrology-Astronomy to other Peoples

For some decades of the 20th century Erica Reiner was the primary editor of the multi-volume Akkadian dictionary project during its development at the University of Chicago. One of her students in the study of Akkadian is Francesca Rochberg, who is one of the world's leading scholars of this ancient language. On page 11 of Rochberg's book in 2004 about the ancient Akkadian authors and their writings that span the period from ancient Assyria to the first century, she wrote, "In the ancient Near East, our sources do indeed indicate an indisputable progressiveness in astronomy. Nonetheless, the realms of 'astronomy' and 'astrology' were not separate in Mesopotamian intellectual culture, and so a self-conscious distinction between them such as we make in using these terms does not emerge in the cuneiform corpus." On page 10 we find, "In the horoscopes in particular, an interdependent relationship between astrology and predictive astronomy is demonstrable by the identification of connections among a variety of astronomical text genres and the content of horoscopes. Celestial divination, which carries through from the middle of the second practically to the end of the first millennium B.C., and the Babylonian astronomy of the post-500 B.C. period provide the intellectual context for the Babylonian horoscopes, which bear relation to both of these distinct traditions. Because of these

relationships, the horoscopes afford a unique view into Late Babylonian astronomical science." On page 41 we find, "… from a social point of view, Late Babylonian astronomy was supported by the institution of the temple." Also on page 41 we find, "It is clear that the individuals who computed astronomical phenomena were the same as those who copied omen texts and constructed horoscopes." On page 165 we find, "The following discussion is limited to those ideas that can be extracted from and supported by the literature of the Babylonian scholar-scribe who specialized in divination and took part in its related activities, such as prayer, incantation, or, indeed, the mathematical prediction of lunar eclipses."

David Brown wrote on page 7 of his book, "The term 'astrology-astronomy' will be used to refer to the particular branch of Mesopotamian scholarship herein considered. It is to be differentiated from cosmological or cosmogonical speculation – theories concerning the universe as a whole, or concerning the creation of the universe as a whole. Astrology and astronomy mean different things today, but the two words were used interchangeably at least until the 6th century AD. That is not to imply that before this time no difference was ever appreciated between what we would term astrology and what we would term astronomy."

At the time of the captivity and exile of the House of Judah to Babylon from 604 to 586 BCE, the common language of Babylon was Aramaic, but the written language of the Babylonian priests, who produced mathematical astronomy with its base 60 positional numbering system, continued to be the Akkadian language of the previous Assyrian Empire, through there were various dialects. David Brown wrote on page 31, "When reconstructing the background to the emergence of the accurate predicting of celestial astronomy, it is important to recall that the cuneiform languages, dialects and scripts were used only by an elite. The scientific developments that form the locus of this study appear only in these scholarly languages [not Aramaic]."

Because of their positional numbering system and their motivation to use predictive astronomy for astrological purposes that gave them prestige and income, these Babylonian priests developed generalized methods for multiplication and long division of fractional numbers. Thus the scientific language of the Babylonian priests who were the mathematical astronomers was hidden from the general population that had ceased using the Akkadian

language. Except for the private use by these priests, the Akkadian language ceased being a living language.

The prophet Daniel was given great authority in the secular government during the period c. 600 to c. 540 BCE, and based upon the biblical account in Daniel 2, he and his three friends were highest in the government. The Babylonian pagan temple priests were simultaneously reduced in authority. On page 209 Francesca Rochberg wrote, "One determinable change in the environment of later Babylonian scholarship was the shift of the locus of astronomical activity from the palace [i.e., support by secular government] to the temple [pagan support]. When exactly this occurred, however, is not well documented." On this same page we find, "By the fourth century B.C., however, evidence for the intense involvement of the king with the [pagan priestly] scholars appears to diminish." Rochberg neglected to see the excellent documentation in the Bible! When Daniel gained authority under King Nebuchadnezzar, he reduced the influence of the pagan priests who practiced their mixture of astrology with astronomy. Eventually they were ousted from the palace and took refuge in the pagan temple where they continued their practices. Both Ezra and Nehemiah, c. 450, were given favor by King Artaxerxes, and undoubtedly the pagan priests remained in disfavor with the king. On page 235 Rochberg wrote, "Regardless of the way astronomy functioned within the temple institution, association with the temple was without doubt the key to the survival of Babylonian astronomy for so many centuries after it had become seemingly defunct in the political sphere."

There is no historical evidence to indicate any cooperative sharing between the Levitical priesthood and the pagan Babylonian astrologers-astronomers who continued writing their documents in the Akkadian language, which the general population did not understand. The Akkadian cuneiform script was vastly different from the 22-letter alphabet of both Hebrew and Aramaic. Akkadian script consisted of hundreds of wedge-shaped signs (see page 1 of Dalley). Since Scripture is opposed to the use of horoscopes (see Isa 47:13 for the general tone, although it does not directly refer to horoscopes), and these were intimately associated with activities of the pagan temples where astronomy was pursued and preserved, zealous Levitical priests should have been motivated to stay away from such places and activities.

Pages 237-244 of Rochberg 2004 discuss the transmission of Babylonian astrology with astronomy to the Greeks after Alexander the Great conquered

the Persian Empire in 331 BCE, and afterward to India. Astrology and astronomy were sent together as a package.

[12] Egyptian Astronomical Science before Alexander the Great

Today a child learns to distinguish between 25, 205, and 2005 through the base ten position of the zeros. When performing the operations of addition, subtraction, multiplication, and division without a calculator, the vertical alignment of the digits into neat columns of units' digits, tens' digits, hundreds' digits, etc., makes the general procedure for these basic operations seem exceptionally simple. In today's society we take this simplicity for granted. But archaeological remains of calculations by different ancient civilizations reveals that very few ancient cultures had a concept of a base value (such as 10) in which the same symbol (such as 2) in a different position would have a different value (such as 2, 20, 200, et cetera). The written biblical examples of numbers in the Hebrew language show no knowledge of a base ten positional number system with a symbol for zero to define the position and hence the value. Without this positional base concept using a zero, general long division becomes very cumbersome and time-consuming. For example, if the reader attempts to use the symbolism of the Roman number system (with "L" for 50, "XL" for 40, "C" for 100, "M" for 500, etc.), and then attempts to do general long division in this system, it will be a significant chore. Although ancient societies had a concept of a fraction and they knew how to divide by 10 (obtaining a tithe) because the language used words that were multiples of 10, this certainly does not imply that they had a simple general method for long division that could be done quickly. Dividing by 5 was twice a tithe, so that was easy. Dividing by 20 was half a tithe, so that was easy. But these are special examples rather than a general method for long division that would work for all numbers. Try dividing the Roman equivalent of 237892.21 by the Roman equivalent of 542.37 using only the Roman number system and see how far you get without our modern symbolism for numbers with a zero. Without a positional base number system using a zero, the method for general long division that elementary school children are taught today would not even exist because that very method depends on position.

The reference RMP (= Rhind mathematical papyrus) is an explanatory book concerning ancient Egyptian mathematics published by the British Museum. It provides a detailed analysis of a papyrus from ancient Egypt that gives examples of how to solve a wide variety of mathematical problems. Page 16

of van der Waerden 1961 dates this papyrus after 1800 BCE, which is after the time of the building of the great pyramids at Giza. Page 12 of RMP states, “The hieroglyphic script had distinct signs for units, tens, hundreds, etc., the numbers of each being indicated by repetition of the sign. There was no sign for zero and no positional notation, so that the representation of large numbers became extremely cumbersome.” Page 5 of Gillings states that the ancient Egyptian method for writing the number 1967 required 23 characters while the method for writing 20,000 required only two characters. This ancient Egyptian method for the representation of numbers does not enable the simple methods of general long division used by modern elementary school children or the equivalent simple methods used by the ancient Babylonians. Pages 16-18 of RMP give examples of how long division was performed by the Egyptians, and page 19 of van der Waerden explains the Egyptian methods for long division in a slightly different way. The methods are laborious and cumbersome by today's standards, and if there were a need for many general long division computations, it would be discouraging to have to use the methods of the ancient Egyptians. Mathematical astronomy would require extensive use of general methods of long division where the divisor may be a whole number plus a fraction.

Page 36 of van der Waerden raises the question of whether the ancient Egyptians had more advanced mathematical methods than those that have survived until today. By the word “ancient”, he means before the time of Alexander the Great, after which the city of Alexandria was founded and the Greek astronomers emigrated to Alexandria where they used the mathematical methods of the Babylonians, but dressed in the Greek language rather than the Akkadian language of the Babylonian pagan priests. He gives two reasons against this. One reason is that there are both elementary mathematical Egyptian texts and advanced texts, and the general character of the mathematics remains the same in both kinds of texts. The second reason is that the Greeks had access to ancient Egyptian mathematical and geometrical methods. The Egyptians successfully used the geometrical methods in a practical way for building purposes, and the Greeks did use selected geometrical methods of the ancient Egyptians. If the Egyptians had developed good methods for doing arithmetic, we would also find some trace of this among the many Greek writings in mathematics. But the Greeks only show use of the Babylonian methods in arithmetic. The ancient Egyptians did *not* use the positional base 60 number system of the Babylonians or the Babylonian multiplication tables up to 60 times 60.

Pages 353-356 of Ruggles discusses the pyramids of Giza, which are the most impressive pyramids of Egypt. Ruggles makes it clear that we do not know the methods by which the Egyptians constructed these massive monuments. In modern times several writers have made guesses concerning how this may have been done. The largest pyramid required over two million blocks, each weighing about 15 tons, and it is not known how the blocks were transported to such a height. They must have had an excellent knowledge of applied levers and pulleys, but even this supposition does not explain how they could have done it. Our lack of knowing how this marvelous feat of construction occurred is not evidence that it required advanced methods of mathematics that differs significantly from the examples we already possess. The mathematics needed for building construction is different from the mathematics that is needed for mathematical astronomy.

On pages 128-129 of Clagett, he wrote the following:

"It should be clear from my summary account that the ancient Egyptian documents do not employ any kinematic models, whether treated geometrically or arithmetically. However they did use tabulated lists of star risings and transits (as is revealed clearly in Documents III.11, III.12, and III.14), all tied to their efforts to measure time by means of the apparent motions of celestial bodies."

"On more than one occasion in this chapter, I have remarked on the absence in early Egyptian astronomy of the use of degrees, minutes, and seconds to quantify angles or arcs, though slopes were copiously used in the construction of buildings, water clocks and shadow clocks, such slopes were measured by linear ratios."

Otto Neugebauer (1899-1990) is unquestionably considered to be the greatest historian of ancient mathematical astronomy in the 20th century. He studied the ancient Egyptian language as well as the ancient Assyrian language known as Akkadian (see pp. 289-290 of Swerdlow 1993), and his pioneering studies were based on his own readings of the original texts. Neugebauer first studied how to read Egyptian hieroglyphics so that he could study ancient Egyptian mathematics from the original documents. Before he began his studies on ancient Egyptian and Babylonian astronomy, he made a detailed study of their mathematics. His doctoral dissertation was

on ancient Egyptian mathematics, primarily based on the Rhind Papyrus from ancient Egypt.

After repeated efforts Neugebauer convinced Richard Anthony Parker, the most acclaimed expert on ancient Egyptian science and calendation, to leave the University of Chicago and join him as a professor at Brown University in 1949. Neugebauer and Parker published three volumes of ancient Egyptian astronomical texts from before the time of Alexander the Great (see Neugebauer and Parker). These many texts from ancient Egypt show that we have an understanding of their ancient knowledge of astronomy. These texts show no indication of the abilities later achieved by the Babylonians and Greeks in predictive astronomy, as Clagett pointed out.

On page 559 of HAMA, Neugebauer wrote, “Egypt has no place in a work on the history of mathematical astronomy. Nevertheless I devote a separate ‘Book’ on this subject [10 pages] in order to draw the reader's attention to its insignificance which cannot be too strongly emphasized in comparison with the Babylonian and the Greek contribution to the development of scientific astronomy.”

Concerning the extremely high accuracy of aligning the largest ancient Egyptian pyramids with the east-west direction, and hence a precise knowledge of the time of the equinoxes by the ancient Egyptians, Neugebauer 1980 wrote on pages 1-2, “It is therefore perhaps permissible to suggest as a possible method a procedure which combines greatest simplicity with high accuracy, without astronomical theory whatsoever beyond the primitive experience of symmetry of shadows in the course of one day.” A diagram and further discussion by Neugebauer explain how the Egyptians could have achieved the accurate alignments without any mathematically sophisticated theory. The reason he sought and proposed this method is simply that his studies into ancient Egyptian mathematics and astronomy did not hint at any Egyptian ability to accurately predict the time of the equinoxes.

Ronald Wells wrote a chapter titled “Astronomy in Egypt”, which concerns the time before Alexander the Great and his command to build the most modern city of ancient civilization, Alexandria. On page 40 of this chapter, Wells provides the following summary: “Historians of science concede only two items of [astronomical] scientific significance bequeathed to us by the ancient Egyptians: the civil calendar of 365 days used by astronomers even

as late as Copernicus in the Middle Ages, and the division of the day and night into 12 hours each. These fundamental contributions may seem meager to many; engineering of the pyramids and surviving temples notwithstanding." Page 7 of this book edited by Walker states, "Ronald A. Wells was a Fulbright scholar in Egypt at the University of Cairo and at Helwan Observatory in 1983-4, and again at the Institute of Archaeology, Egyptology Division, University of Hamburg, in 1987-8."

Otto Neugebauer wrote (1945) on page 11, "It will be clear from this discussion that the level reached by Babylonian mathematics was decisive for the development of such methods [for the numerical study of astronomy]. The determination of characteristic constants (e.g., period, amplitude, and phase in periodic motions) not only requires highly developed methods of computation but inevitably leads to the problem of solving systems of equations corresponding to the outside conditions imposed upon the problem by the observational data. In other words, without a good stock of mathematical tools, devices of the type which we find everywhere in the Babylonian lunar and planetary theory could not be designed. Egyptian mathematics would have rendered hopeless any attempt to solve problems of the type needed constantly in Babylonian astronomy." On page 8 he wrote, "It is a serious mistake to try to invest Egyptian mathematical or astronomical documents with the false glory of scientific achievements or to assume a still unknown science, secret or lost, not found in the extant texts."

Neugebauer wrote (1969) on page 78, "The handling of fractions always remained a special art in Egyptian arithmetic. Though experience teaches one very soon to operate quite rapidly within this framework, one will readily agree that the methods exclude any extensive astronomical computations comparable to the enormous numerical work which one finds incorporated in Greek and late Babylonian astronomy. No wonder that Egyptian astronomy played no role whatsoever in the development of this field."

From the many ancient texts of the Egyptians we conclude that they did not apply mathematics to astronomy before the time of Alexander the Great. After that time, the city of Alexandria was founded and the leading Greek mathematicians and astronomers settled in that city of Egypt, so that it became the world's leading center of Greek astronomy. But this was not part of ancient Egyptian culture; instead, it was the transplanting of Greek

science into Egypt by foreigners due to the newly constructed city of Alexandria with its modern marble streets and its grand marble museum and library. This combination museum and library with its many lecture halls became the best ancient equivalent to a modern university, and its library became the greatest one in ancient times.

The attention devoted to ancient Egypt serves the purpose of showing that ancient Israel could not have obtained knowledge of mathematical astronomy from Egypt because Egypt did not possess knowledge of mathematical astronomy.

[13] Did Abraham teach Mathematical Astronomy to the Egyptians?

The Jewish historian Josephus (37 – c. 100) wrote a history of the Jews that has many details that are not found in Scripture, and the question arises concerning whether these details are all true. One of these details concerns the abilities of Abraham and the Babylonian knowledge of mathematical astronomy at the time of Abraham.

On page 83 of Josephus_4 we find at Antiquities 1:166-168, "For, seeing that the Egyptians were addicted to a variety of different customs and disparaged one another's practices and were consequently at enmity with one another, Abraham conferred with each party and, exposing the arguments which they adduced in favour of their particular views, demonstrated that they were idle and contained nothing true. Thus gaining their admiration at these meetings as a man of extreme sagacity, gifted not only with high intelligence but with power to convince his hearers on any subject which he undertook to teach, he introduced them to arithmetic and transmitted to them the laws of astronomy. For before the coming of Abraham the Egyptians were ignorant of these sciences, which thus traveled from the Chaldaeans into Egypt, whence they passed to the Greeks."

The previous conclusions that were attained from archaeology with the help of computers and the modern knowledge of mathematical astronomy are now restated. The Babylonians were able to predict lunar eclipses by about 750 BCE with a time error of about one hour, and the Babylonians were able to predict possible solar eclipses about 360 BCE with a time error of about three hours. The Babylonians started the practice of predicting the sighting of the new crescent about 450 BCE. But Abraham lived c. 2000 BCE, over 1000 years before the great achievements of Babylonian mathematical

astronomy occurred. Furthermore, ancient Egypt did not possess mathematical astronomy until the Greeks emigrated there and brought it with them after the death of Alexander the Great in 323 BCE. We therefore conclude that Josephus did not know the history of the acquisition of mathematical astronomy by the Egyptians, and it does not make sense to believe that Abraham knew any significant mathematical astronomy himself. Furthermore, the Egyptians did not use the Babylonian positional base 60 number system, which they would have used it if Abraham had convinced them of its superiority.

About a century before Josephus, other Jews bragged about Abraham's achievements, even in astrology! The interested reader may consult pages 146-151 of Gruen.

[14] Did Ancient Israel Excel in Advanced Mathematical Astronomy?

Scripture defines the wisdom of ancient Israel in an unconventional way in the following passage.

Deut 4:5, "Behold I have taught you statutes and ordinances as YHWH my Almighty commanded me, that you should do so in the midst of the land where you are going to possess it."
Deut 4:6, "So keep and do [them], for that [is] your wisdom and your understanding in the sight of the peoples who shall hear all these statutes. Then they shall say, surely this great people [is] a wise and understanding nation."
Deut 4:7, "For what great nation [is there] that has an Almighty [so] near to it as YHWH our Almighty in everything we call upon Him."
Deut 4:8, "And what great nation [is there] that has statutes and ordinances [as] righteous as all this law that I set before you today?"

The nations of the world think of wisdom in terms of scientific achievement and the acquiring of great knowledge, but that is not the way Moses was told to proclaim wisdom to Israel. Mathematical astronomy was not to be wisdom for them. I do not doubt that the ancient Israelites had the mental capacity to be able to develop advanced mathematics, but without the collective need for this effort by Israelite society, what would motivate such an effort? Ancient Israel could determine the calendar from observation, so they had no need for any advanced tedious calculations.

Did ancient Israel use a positional digit system with a zero, which would enable rapid multiplication and division? On page 26 of GKC2 (the latest English edition of the Hebrew grammar book by Gesenius), the numerical value of the 22 Hebrew letters is presented. This shows one letter for the value 2, another letter for the value 20, and another letter for the value 200. This illustrates the nature of the symbolic number system in ancient Hebrew, and shows that it was not a positional digit system with a zero. Page 30 has further comments on this system, which was used on coins in Judea from the Maccabean period (c. 150 BCE). The time of the origin of this system is unknown. This system would be a hindrance for general long division and is not useful for mathematical astronomy.

A good deal of effort has been put into the history of ancient astronomy in previous chapters in order to evaluate what could have been known by ancient Israel at the time of Moses and afterward. The ancient Israelites from the time of Moses in Egypt could not have borrowed mathematical astronomy from Egypt because Egypt did not possess mathematical astronomical knowledge until it was brought there by Greek astronomers more than 1000 years after Moses died. From biblical chronology I estimate that the Israelite exodus from Egypt occurred c.1480 BCE.

Although the Jews were in captivity in Babylon where the pagan priests had an advanced knowledge of both mathematics and mathematical astronomy written in the complex Akkadian language with its hundreds of symbols for words (not for numbers), there is no evidence that these Jews acquired this knowledge. Ancient Jewish writings from the Dead Sea Scrolls, from Philo, from Josephus, from archeological artifacts, and from the *Mishnah* (c. 200 CE), give no hint that the Jews became familiar with the Babylonian mathematical methods of computation before the time of the Greek astronomer Ptolemy (c. 150 CE) who lived in Alexandria, Egypt. The *Talmud* does claim that Mar Samuel was able to compute a calendar for many years in advance, c. 250 CE, although none of the details are known.

Jewish scholars do not claim that the ancient Israelites had abilities in mathematical astronomy that surpassed that of their ancient neighbors. There is no historical evidence for it. On pages 555-556 of Langermann we find, "Although the sun, moon, and stars are mentioned in the Hebrew Bible, that ancient and sacred text does not display any sustained exposition which can be called an astronomical text. The earliest sources for a Hebrew tradition are found in a few passages in the *Talmud* and Midrash [c. 200-600 CE]."

The *Babylonian Talmud*, specifically the section designated Rosh Hashanah 25a (RH 25a), which is on page 110 of BT-RH, quotes Rabban Gamaliel II of Yavneh as having said, "I have it on the authority of the house of my father's father [Gamaliel the Elder from the early first century] that the renewal of the moon takes place after not less than twenty-nine days and a half [day] and two-thirds of an hour and seventy-three halakin." Since there are 1080 halakin in one hour, this is 29.5 days 44 minutes 3 1/3 seconds. Thus RH 25a claims that from one new moon to the next new moon is at least this length of time. On page 308 of Swerdlow this is shown to exactly equal the value used by the Greek astronomer Hipparchus (c. 190 - c. 120 BCE) for the average length of the month, which he wrote in the base 60 as 29;31,50,8,20 days, which equals 29 + 31/60 + 50/(60x60) + 8/ (60x60x60) + 20/ (60x60x60x60) days. But did Hipparchus derive this value himself? No! The paper by Toomer 1980 discusses this value for the average lunar synodic month in more detail. On page 108 footnotes 6 and 11 he clearly points out (as he implied on pages 98-99) that the Babylonians had already derived this value at an earlier time, and thus he shows that this value was not first computed by Hipparchus, but accepted as true by Hipparchus and taken by him from the Babylonians. Toomer also gives credit to Asger Aaboe for a paper he wrote in 1955 indicating that Aaboe realized that this number came from the Babylonians rather than Hipparchus. On page 98 Toomer credits F. X. Kugler as apparently recognizing this in a book he wrote dated 1900. On pages 168, 240-241 of Hunger and Pingree it is stated that this length of an average synodic month comes exactly and directly from column G in the Babylonian lunar System B, and on page 236 this book states that the earliest tablet containing System B material from Babylon is dated 258 BCE. Hence this number was derived by the Babylonians some time before 258 BCE. On page 54 of Britton 2002, John Britton estimates the origin of the mean synodic month to c. 300 BCE.

How might ancient people determine the length of a lunar month? By taking two widely separated eclipses of the same kind and when the moon is traveling at about the same point in its cycle of varying velocity, and then dividing the time length between them by the number of lunar months, one may estimate the average length of a synodic month. Hipparchus was trying to compute eclipse periods, and for this purpose he used two old records of eclipse observations from Babylon that he possessed as well as two eclipse observations from his own lifetime. From these two pairs of eclipses

Toomer's paper explains that a computation of the average lunar synodic month would in fact disagree with the number that he received from Babylon, but Hipparchus accepted their number anyway. The last of the base 60 numbers above is 20, but the computation from Hipparachus' eclipse records would instead round off this last number to a 9. While the long division computation gives a different number, the difference between these values is less than a tenth of a second! How accurate are these numbers (20 and 9 for the last place) compared to the true value of the average lunar synodic month near the time of Hipparchus and the earlier Babylonians?

On page 87 of Depuydt 2002, Leo Depuydt provides the following estimated modern computations for the mean synodic month in the years 2000 BCE, 1000 BCE, and 1 CE, and I have converted these to the Babylonian base 60 system. The computed estimated time is based upon eclipse records going back to 747 BCE and the assumption that the trend continued in a similar way prior to that date.

2000 BCE 29d 12h 44m 2.08s = 29; 31, 50, 5, 12
1000 BCE 29d 12h 44m 2.29s = 29; 31, 50, 5, 43.5
1 CE 29d 12h 44m 2.49s = 29; 31, 50, 6, 13.5

Compare the above modern computed lengths of the mean synodic month through time with that of the Babylonians and the Greek astronomer Hipparchus below.

Babylonians c. 300 BCE = 29; 31, 50, 8, 20 (also the *Talmud*)
Hipparchus' data c. 150 BCE = 29; 31, 50, 8, 9

We have seen that the *Babylonian Talmud*, which was released by Jewish scholars c. 600 CE, uses the exact time length of a mean synodic month that originates from ancient Babylonian astronomers at roughly 300 BCE, yet the *Talmud* refers back to the house of Gamaliel in the first century for this figure. Is it reasonable to think that some Israelites derived this time for the average length of a lunar month independently on their own? No it is not, because this number is slightly under one second too large based upon the above data. The use of different eclipse records for a computation ought to give a different result. The paper by Toomer points out that the Greek astronomer Ptolemy of Alexandria c. 150 CE wrote about the achievements of Hipparchus 300 years earlier, and both of them realized that picking a different pair of eclipses from which to compute the average length of a

lunar month would provide a different result. Ptolemy discussed the specific nature of which eclipse records would likely produce a more reliable result, and he based this on the earlier work of Hipparchus. The reason for the use of different eclipses producing a different result is that the apparent speed of the moon as observed from the earth varies at different times of the month, at different times of the year, and at different times of the eclipse cycle known as the Saros, which is 223 mean synodic months (18.03 years). Thus any computation based upon a specific pair of eclipse observations will result in a unique value for the average length of a lunar month, although properly chosen records will provide close results.

The Babylonians began predicting the visibility of the new crescent at roughly the year 400 BCE, and this prediction is based upon an accurate understanding of the moon's cycle for repeating its speed variation, or lunar anomaly, within the Babylonian System A (see the paper by Britton 1999, especially page 244). The cycle of lunar anomaly is the Saros cycle. From roughly this time onward they would be in a good position to be able to judge which pair of eclipse records should produce an accurate figure for the average lunar synodic month. As stated above, the oldest existing Babylonian System B material is dated 258 BCE, and this system includes the fundamental parameter that Hipparchus used for the mean synodic month, which was championed by Ptolemy c. 150, and was later incorporated into the *Babylonian Talmud* c. 600. We have no explicit knowledge of exactly when or exactly how this length of the mean synodic month was determined within System B by the Babylonians, although it is a very reasonable conjecture that some pair of eclipse records from the same part of a Saros cycle was a key. On page 45 of Britton 2002, John Britton estimates the origin of System B to be as early as c. 330 BCE, but on page 54 his estimate for the origin of the mean synodic month is c. 300.

Pages 13 and 22 of Spier show that the modern calculated Jewish calendar uses the approximation for the average length of a month from RH 25a in the *Babylonian Talmud*, yet we now know that this came from ancient Babylonian astronomers c. 300 BCE. The *Babylonian Talmud* is called "Babylonian" because its Jewish authors lived in Babylonia at the time of its publication c. 600 CE, not about 900 years earlier when the Babylonian astronomers derived this figure. But other factors are also used for the modern calculated Jewish calendar, which are not due to either ancient Babylon or Hipparchus, and are not found in the *Talmud*. Num 10:10 shows a responsibility of the Levitical priesthood in declaring the "beginning of the

months", and thus control of the calendar and its knowledge could be expected to have been passed down from generation to generation via the hereditary priesthood. However, after the Temple was destroyed in 70 CE the Levitical priesthood vanished from Jewish history along with its influence over the calendar. No writings from this priesthood have survived from before the destruction of the Temple, except for the fact that Josephus was a priest who was born in 37 CE and died c. 100. While his writings exist, none of them were written before the destruction of the Temple, and he does not discuss when a month begins in any direct way. He never mentions any astronomical calculations being done by the ancient Jews, and neither does Philo of Alexandria (c. 20 BCE - c. 50 CE).

In order to perform the mathematical computations for general long division of fractional numbers that would be necessary for predictive astronomy, it would be necessary to utilize a number system with a base, which would therefore enable a positional notation and the use of a symbol for zero. For computational uses without a computer, modern society uses the base 10 for ordinary purposes, although modern computers use the base 2, and for the sake of human ease of readability, the base 2 is typically converted to base 16 (hexadecimal) for computer professionals. The Babylonians and Greeks used the base 60 number system for their capable calculations. After the achievements of the Babylonians and Greeks in the Eastern Hemisphere, the Mayan Indians in the Western Hemisphere used the base 20 number system. The way that the Hebrew text of the Bible expresses numerical values indicates that the ancient Israelites did not use a positional number system with a base and a symbol for zero.

Hence, from a mathematical viewpoint along with the lack of any archaeological evidence to the contrary (although there are archaeological discoveries in the site of ancient Israel), it is safe to conclude that ancient Israel, before the destruction of Solomon's Temple by Nebuchadnezzar in 586 BCE and the three waves of Israelite exile to Babylon from 604–586 BCE, did not possess the type of mathematical abilities that would have enabled them to perform the mathematical computations needed for success at predictive astronomy.

The ancient pagan Babylonian priests were interested in astrology. They predicted the future of kings and kingdoms. They gained wealth and political prestige through this practice until Daniel told both the dream and its interpretation to the king (Daniel 2). They then lost political prestige, but

their pagan practices continued as they developed horoscopy. Some of these pagan priests were the predictive astronomers. Their desire for wealth and prestige led to their efforts at computational and predictive astronomy. The Greeks had a greater interest in science for the sake of knowledge, although they too were interested in astrology and its use to gain wealth. The leisure time to devote to astronomy came from the wealth gained by astrology.

The historical evidence indicates that neither the ancient Israelites before the destruction of Solomon's Temple in 586 BCE nor the Jews after this until the destruction of the Second Temple in 70 CE sought to develop their own mathematical astronomy. Ancient Egypt before Alexander the Great did not possess any predictive mathematical astronomical knowledge, so ancient Israel could not have inherited such knowledge from them. Neither the Bible, nor archaeology, nor Jewish history give any indication that Israelites before the destruction of the Second Temple in 70 CE had advanced abilities in mathematical astronomical knowledge. It was not until the time of Alexander the Great, that ancient astronomers were able to approximately predict the time of the true conjunction.

The difference in time between the computed average time of the conjunction (based on repeated additions of the average synodic lunar month, which is employed in the modern calculated Jewish calendar) and the true conjunction is about 14 hours according to page 45 of Wiesenberg. Thus the modern calculated Jewish calendar (MCJC) is not based upon predicting the true conjunction. The Jews at the time of Moses were not using the MCJC with its adoption of the Babylonian length of the average month, and they were not able to calculate the time of the conjunction.

[15] Control of the Temple, and thus the Calendar, in the Early First Century

When studying the history of the calendar whose roots are embedded in the Bible, one encounters writings from Josephus and from Rabbinc literature. Then the reader is faced with the problem of determining whether all the statements one finds in these sources are historically true.

(A) Primary Sources of History in the early First Century

In analyzing who controlled the Temple before the war between the Romans and the Jews broke out in 66, the major primary sources are the New Testament and Josephus, and the question of whether the Rabbinic texts that

begin with the *Mishnah* (c. 200 CE) are to be properly accepted as primary sources deserves some initial brief comment. From the destruction of the Temple in Jerusalem in 70 CE to the publication of the *Mishnah* c. 200 CE is 130 years. While the authors of the New Testament were personal witnesses of what they wrote (though Mark and Luke received their information from others who were personal witnesses) and Josephus was a personal witness beginning about the middle of the first century (he was born in 37 CE, but utilized other historians before him, especially Nicolaus of Damascus for events in the second century BCE), the *Mishnah* was not set into its written form by anyone who was a personal witnesses of events before 70 or who personally knew anyone who was such a personal witness. Except for some relatively few apparent borrowings from the *Megillat Taanit* (published c. 120), it is not known how the infrequent historical statements in the *Mishnah* and later Rabbinic texts from before the destruction of the Temple have found their way into those texts.

However, by comparing certain statements in these three sources with one another that relate to authority in Judea during the time sought, and by supplementing this with a few remarks from the Roman historians Tacitus and Trogus, we can make a reasoned evaluation on whether the use of the *Mishnah* and later Rabbinic texts are reliable as a historical source of events from before 70. In any case, the *Mishnah* falls short of being a primary source because it was not put into published form close to the time of the events we now seek (before 70 CE), and we have no record of any primary sources that it utilizes except for the *Megillat Taanit*, which is only a very condensed skeleton of some events, and which was completed c. 120. Rabbinic texts may have used some primary sources for its historical statements, but this is evaluated in appendix A.

In the present discussion our interest lies in which groups of Jews controlled the Temple services, especially during the first century before the war began in 66. The New Testament mentions the high priest, chief priests, Sadducees, Pharisees, and scribes. Josephus mentions these groups also, but adds the Essenes and the zealots. Since the latter two groups are never mentioned in the New Testament, they should be dismissed as candidates for having control of the Temple in the 70 years before its destruction.

(B) Branches of Modern Judaism relate to Solving this Issue

Jewish scholars are biased in their writings and opinions, and it is important to address this in order to warn the reader concerning the literature on this subject. Scholars may be grouped based on their personal religious affinity, and this is sometimes reflected in their writing even though they may carefully avoid telling the audience their religious outlook.

Modern Judaism is divided into many groups, but these may be roughly categorized into four divisions based upon their attitude toward the Pentateuch and the *Talmud*. My summary is somewhat oversimplified and it pertains to the culture within the United States rather than modern Israel, but growing up as a Conservative Jew in New York City and having a grass-roots feel from personal contacts, in my opinion it is not very far off base. Certainly not all individuals within these groups conform to the characteristics to be described next, but these characterizations do approximately reflect the historical development of these divisions and the views of some major scholars from these groups. Jewish laymen sometimes tend to be more idealistic and less studied in the details of their religion, so that many of them are less likely to fit the broad description than the knowledgeable students and scholarly representatives. In discussing these divisions, the major emphasis will be on their attitude toward the law of Moses, and that is the reason for limiting the discussion to the Pentateuch within the Tanak. All of the divisions of Judaism consider the entire Tanak to be a sacred document of their religion.

The first division is Orthodox Judaism, which treats both the Pentateuch and the *Talmud* as inspired, and accepts the laws of the Pentateuch as they are interpreted in the Talmud. The second division, Conservative Judaism, treats both the Pentateuch and the *Talmud* as sacred documents of their faith, but regards common views of archaeological interpretation as well as secular history and biblical textual criticism as valid sources for occasionally modifying their reliance on the Pentateuch and the *Talmud* as representing correct history. Adherents of Conservative Judaism tend to be less strict in their observance of the laws than Orthodox Jews, and their knowledge of the *Talmud* (excluding Conservative scholars) is typically significantly less than that of Orthodox Jews. The third division, Reformed Judaism, treats the Pentateuch as a sacred document, but not the *Talmud*. Reformed Jews regard the laws of the Pentateuch to be interpreted figuratively or allegorically, and to be applied in a changeable way according to the times. From a literal standpoint Reformed Jews are the least observant of the laws of the Pentateuch. Reformed Jews do not regard the Pentateuch as depicting correct

history. The fourth division, Karaite Judaism, treats the Pentateuch as inspired, but the *Talmud* is not considered to be a sacred document. Karaites interpret the laws of the Pentateuch in a literal way, and they are strict in observing them. Karaism is the smallest of the four divisions in numbers of adherents, and their interpretation of the laws is not uniform amongst themselves. Orthodox Judaism and Karaite Judaism both represent Jewish fundamentalism, but the latter discards *Talmud*ic interpretation.

It is to be expected that a scholar who was reared in Judaism will be biased toward the *Talmud* according to that rearing. Only Orthodox scholars will be heavily motivated to treat the *Talmud* as representing true history, although a minority of Conservative scholars will write in such as fashion that they will often appear to masquerade as Orthodox Jews. If one examines a book, a paper, or an article in an encyclopedia that was written by an Orthodox Jew, one can expect that author to use the *Talmud* heavily as accurate history. All Jewish scholars will downplay the New Testament. Within their writings, Jewish scholars very rarely label themselves according to their specific Jewish upbringing, but the reader who examines their works can usually decide whether or not each one appears to favor the Orthodox position. It is important to make some judgment about an author's position because bias plays a role when the reader is trying to determine which position represents correct history. It is possible to use certain criteria in order to judge whether it makes sense to treat the *Talmud* as if it was inspired, which is the accepted position of Orthodox Jews.

If two laymen are debating an issue and one of them uses an opinion by an implicit Orthodox Jewish scholar while the other uses a differing opinion by a Conservative Jewish scholar, the two laymen will not be able to agree because the sources that they each favor are in disagreement. That is the reason why it is so important to go back to the primary sources and discuss the place of the *Talmud* for historical purposes before the Temple was destroyed. After this is done and after the bias of a scholar is identified, one will know how to weigh that author's writings.

(C) The New Testament as a Primary Source

The writers of the New Testament were convicted to motivate its readers to seek eternal life according to the faith they had come to accept, but except for Paul who declared himself to be a Pharisee (Acts 23:6; 26:5; Phil 3:5), there is no clear evidence that they were personally biased for or against the

Pharisees compared to the Sadducees in the subject of who controlled the Temple. Josephus devoted more personal attention to the politics of the groups and was involved in politics, so he should be expected to be far more biased than the writers of the New Testament. We will consider the matter of the bias of Josephus to some degree. From these considerations it should be clear that the most important primary source of historical information from before the Temple was destroyed in 70 CE is the New Testament, so this will be discussed first.

Obviously, favoring one primary source will produce conclusions that are biased toward that source. Any author who arrives at conclusions has no choice but to favor some source after giving reasons. Both Sadducees and Pharisees are condemned in the New Testament in the sense of having incorrect teachings (Mat 16:6, 11-12). Thus, according to the writers of the New Testament, one cannot look to either of these groups as having the original biblically correct understanding of some particular teaching of the Tanak merely because of the label *Sadducee* or *Pharisee* attached to the doctrinal opinion.

(D) Many of the Scribes were Sadducees. Mat 23:2 and Moses' Seat

Luke 20:27 [NKJV], "Then some of the Sadducees, who deny that there is a resurrection, came to [Him] and asked Him,
Luke 20:28, saying: 'Teacher, Moses wrote to us [that] if a man's brother dies, having a wife, and he dies without children, his brother should take his wife and raise up offspring for his brother.'" [Speech continues through verse 33]
Luke 20:34 [Response to the Sadducees], "The sons of this age marry and are given in marriage." [Speech continues through verse 38]
Luke 20:39, "Then some of the scribes answered and said, 'Teacher, You have answered well.'
Luke 20:40, But after that they dared not question Him anymore."

From verse 39 it is clear that scribes had been there all along, and from verses 27 and 40 it is clear that these scribes were Sadducees. In fact the Sadducees would not have asked Him this sensitive question if Pharisees had been present because that would have immediately sparked a heated debate between the two groups over their difference on this issue.

Acts 23:9 makes it clear that some scribes were Pharisees. Hence scribes included some Sadducees and some Pharisees.

On page 22 of Bar-Ilan we find the following paragraph: "Most of the scribes of the end of the Second Temple period whose genealogy is known were priests: Yosef (T. Shabbat 13:11), Yohanan (P. T. Maaser Sheni 5:4, 56c), Beit Kadros (T. Menahot 13:19), Josephus and others. It is clear that during the time of the Temple, priests, some of whom were scribes, used to manage the Temple property, contributions and gifts in addition to annual tithes (Neh 13:13; T. Shekalim 2:14-15; Josephus, War 6:387-91). The Temple as the official cultural-religious center was also the center of the knowledge of reading and writing, and because of that the priests in charge of the Temple were evidently responsible for the preservation of the Tora, its copying in general and the scribal profession in particular." Thus in the view of Bar-Ilan, a historical expert in the realm of scribes and priests in the first century, we see the priests in charge of the Temple and the scribes heavily represented by priests. Some writers have been unaware of the representation of priests among the scribes and have given a distorted picture of Mat 23:2.

Acts 5:17 [NKJV], "Then the high priest rose up, and all those who [were] with him (which is the sect of the Sadducees), and they were filled with indignation." This shows the chief priests to be included within the Sadducees at that time, although it is unclear how many Sadducees might be from outside the priesthood.

Thus, when we see Mat 23:2 [NASB], "The scribes and the Pharisees have seated themselves in the chair of Moses", the scribes are mentioned first, and they have a major representation from among priests, which were seen to be closely equated with or within the Sadducees. Hence Matthew is not excluding the Sadducees from Moses' seat, and the mention of Scribes (which includes Sadducees) comes first. There are three primary biblical functions of the Levitical priesthood. The first concerns the performance of the sacrificial system including personal counseling with those who bring sacrifices for personal reasons (such as to atone for their sins) and rituals at the sacred alter for the holy days, the Sabbaths, the new moons, and the daily sacrifices. The second concerns teaching the law to the people, which is shown in Mal 2:7 and Heb 7:11. The third concerns the prominent role of the priests and Levites throughout the court system of Israel according to the

law of Moses (Deut 17:9; 19:17; 21:5). Thus the priests were to officiate at the holy alter, teach the people, and judge legal cases.

Let us consider the meaning of "Moses' chair or seat" from Mat 23:2. Moses did have the supreme role in the first primitive court of one judge in Israel. In Ex 18:13-26 we see the role of Moses as the civil judge rather than in the role of communicating the law from YHWH to the people. Ex 18:13 has the expression "Moses sat to judge the people". This sitting implies a chair or seat of office for judging. The Hebrew word *shaar*, Strong's number 8179, is normally translated gate, but it sometimes means "court". Deut 16:18 [NKJV], "You shall appoint judges and officers in all your gates [courts]..." Amos 5:15 [NKJV], "Hate evil, love good; establish justice in the gate [court]". On page 1045 of BDB the second meaning of this word is "space inside gate, as public meeting-place, market", and within this category, BDB later adds "where elders, judges, king, sat officially". Examples of sitting in the gate (meaning court) include Gen 19:1; Ruth 4:1-2; II Sam 19:8; I Ki 22:10; II Chr 18:9; Est 2:19, 21; Job 29:7; Prov 31:23; Jer 38:7. The advice of Moses' father-in-law in Ex 18:13-26 was a pyramid structure of judges, but in Num 11:16-17, 24-25 this pyramid structure was replaced by a flat structure (equal authority) of 70 men of the elders of the people, and this flat structure is not called a single body; the implication is that they were spread all through the people of Israel as a system of equal local courts (perhaps a few men per court), and that cases too difficult for them went to Moses. At the end of the 40 years in the wilderness, more details about the future court system were revealed in Deuteronomy, where Deut 17:9; 19:17; 21:5 show the prominent role of the priests and Levites throughout the court system of Israel according to the law of Moses. Yet before this was revealed, nothing was said in Num 11:16-17, 24-25 about tribal representation of these 70 men.

From biblical examples, Moses' chair or seat sensibly means the official seat from which civil case judgment comes, a judicial function, not a legislative function. This is neither the changing of existing laws, nor the legislation of new laws, but the application of existing laws to specific cases in dispute between relevant parties who seek to bring their case to a civil court. Priests would not consider their procedures to be under the jurisdiction of a civil court. Civil justice of disputes does not include the methods and rules whereby the priests carried out their functions, which were not civil disputes in nature. This reasoning only considers the context of the Tanak applied to Mat 23:2, so the question remains as to whether, in the first century, an

expanded jurisdiction existed for the main Sanhedrin in Jerusalem, in which it is assumed that Moses' seat was exercised. In a religious society certain aspects of civil laws must be derived from the law of Moses as it was understood in their day, but the question remains concerning whether the central Sanhedrin had a legislative function at all. The Sanhedrin will have to be discussed in more detail.

(E) Sanhedrin in the New Testament

The Greek word *sunedrion* for sanhedrin, Strong's number 4892, occurs 22 times in the New Testament. These are Mat 5:22; 10:17; 26:59; Mark 13:9; 14:55; 15:1; Lk 22:66; John 11:47; Acts 4:15; 5:21, 27, 34, 41; 6:12, 15; 22:30; 23:1, 6, 15, 20, 28; 24:20. In three of these places (Mat 5:22; 10:17; Mark 13:9) a local court is the meaning, but in all other 19 cases this is the Sanhedrin in Jerusalem associated with the Temple. In 17 of these 19 cases the Greek definite article is used, which implies that there is only one Sanhedrin associated with the Temple. The two exceptions without the definite article are Mark 15:1 and John 11:47. The context of all 22 places is consistent in showing a civil court where accusation against a party is made, witnesses for or against that party are questioned, the accused party is questioned, and a judgment for or against that party is rendered. Except for Acts 23 where the outsider Paul introduced the doctrinal issue of the resurrection from the dead in order to cause strife and detract attention from his own case, in none of the meetings of the Sanhedrin associated with the Temple do we encounter a debate over the application of the law of Moses or the meaning of the Scripture. In the only examples available, the Sanhedrin appears to be a civil court in which civil cases are relevant, not an environment for the debate over biblical doctrine. The Sadducees and Pharisees appear to try to get along with one another peaceably within the Sanhedrin, except for the case in which Paul caused a stir over doctrine. The conclusion from the New Testament is that the Sanhedrin in Jerusalem associated with the Temple acted as the supreme court to hear cases, but did not engage in legislating new additions to the law of Moses.

(F) The Parable of the Wicked Vinedressers

Luke spent considerable time with Paul (a former Pharisee) - see Col 4:14; II Tim 4:11 and the “we” portions of Acts that includes the presence of Luke as the author - Acts 16:10-17; 20:5 - 21:13; 27:1 - 28:16. Luke partially relied on Paul for some of the relations between the leaders of the Jews

when he wrote. Paul, having been a Pharisee and having lived in Jerusalem, would have been an excellent first hand source of extra background information for Luke's writings.

Luke 20:9 [NKJV], “Then He began to tell the people this parable: A certain man planted a vineyard, leased it to vinedressers, and went into a far country for a long time.”
Luke 20:10, “... the vinedressers beat him ...”
Luke 20:11, “... they [the vinedressers] beat him also ...”
Luke 20:12, “... they [the vinedressers] wounded him also ...”
Luke 20:13, “... I will send My beloved son ...”
Luke 20:14, “... vinedressers ... reasoned among themselves ... let us kill him.”
Luke 20:15, “... they [the vinedressers] ... killed [him]. Therefore what will the owner of the vineyard do to them?”
Luke 20:16, “He will come and destroy those vinedressers and give the vineyard to others. And when they heard [it] they said. Certainly not!”
Luke 20:17, “Then He looked at them and said, What then is this that is written: The stone which the builders rejected Has become the chief cornerstone!”
Luke 20:18, “Whoever falls on that stone will be broken; but on whomever it falls, it will grind to powder.”
Luke 20:19, “And the chief priests and the scribes that very hour sought to lay hands on Him, but they feared the people - for they knew He had spoken this parable against them.”

The parallel passage in Mark starts in Mark 11:27 where it mentions, “the chief priests, the scribes, and the elders came to Him”. The continuous flow of the narrative goes down to Mark 12:12, “And they [chief priests, scribes, and elders] sought to lay hands on Him, but they feared the multitude, for they knew He had spoken the parable against them.”

The parallel passage in Matthew begins in Mat 21:33 and ends in Mat 21:45-46, “Now when the chief priests and Pharisees heard His parables, they perceived that He was speaking of them, but when they sought to lay hands on Him, they feared the multitudes, because they took Him for a prophet.”

In this parable the phrase, “the stone which the builders rejected” is mentioned in Mat 21:42; Mark 12:10; Luke 20:17 directly before the

conclusion which shows that the leaders of Israel correctly perceived He was talking about them as the builders who rejected Him (the stone), and also about them as the vinedressers who killed Him (the son). Israel is the vineyard.

In the midst of the conclusion to this parable, when He says, in Mat 21:43, "the kingdom will be taken from you", it is clear that He is agreeing with their interpretation that they are the leaders and that the kingdom refers to Israel and especially its government.

Luke says, "chief priests and scribes". Mark says, "chief priests, scribes, and elders". Matthew says, "chief priests and Pharisees". Despite these differences, all three mention chief priests first. These leaders understood that they themselves were the vinedressers in the parable, and the vineyard was Israel. Thus the parable teaches that at the time near the death of Christ the leading position was in the hands of the chief priests, which were Sadducees, but the Pharisees also had some leadership. This is the clearest statement of which group held the leading position from the standpoint of the seat of semi-autonomous government permitted by the Jews under the Roman Empire.

(G) How the High Priest Spoke to the Audience that included the Pharisees

John 11:47 [NKJV], "Then the chief priests and the Pharisees gathered a council and said, What shall we do? For this Man works many signs."
John 11:48, "If we let Him alone like this, everyone will believe in Him, and the Romans will come and take away both our place and nation."
John 11:49, "And one of them, Caiaphas, being high priest that year, said to them, You know nothing at all, ..."

For the high priest to say to his audience that included the Pharisees, "you know nothing at all", it seems obvious that he had no fear of the Pharisees and there could hardly be any substance to the idea that the Pharisees had so much authority over the Temple that they could push him around as they might choose.

(H) Pilate's Understanding of the Chief Priests' Authority

Mark 15:10 [NKJV], "For he [Pilate] knew that the chief priests had handed Him over because of envy."

If the chief priests did not have primary authority, but instead the Pharisees controlled the Temple area, the chief priests would have had less reason to be envious of Christ's authority through His miracles. Instead the Pharisees would have played a more prominent role during the trial due to their authority, and the Pharisees would have shown envy. Note that Mark 15:10 does not say, "The Pharisees had handed Him over", but instead, "the chief priests had handed Him over". The last two times in Matthew that the Pharisees are mentioned are Mat 23:39; 27:62, but the trial occurred between these places. The last time that the Pharisees are mentioned in the other three Gospels are Mk 12:13; Lk 19:39; John 18:3, but these are all before the trial began. Thus the Pharisees by name seem totally absent from the trial.

(I) The Role of Gamaliel

Acts 5:34 [NKJV], "Then one in the council [= Sanhedrin] stood up, a Pharisee named Gamaliel ..."

If Gamaliel was the head of the Sanhedrin this would not merely say "one in the Sanhedrin". The language shows that Gamaliel was not the head of the Sanhedrin.

(J) Legal Authority of the Chief Priests

Paul lets his audience know of his background as a Pharisee in Acts 23:6; 26:5; Phil 3:5, and as a former student of the Pharisee Gamaliel in Acts 22:3. If Paul had a choice in seeking credentials for authority, he would naturally seek it from among the Pharisees rather than the high priest or the chief priests who were of the Sadducees. Here is what we find when we see where Paul went for authority. Acts 9:1-2 [NKJV], "Then Saul … went to the high priest and asked letters from him to the synagogues of Damascus so that if he found any who were of the Way, whether men or women, he might bring them bound to Jerusalem." Acts 9:14, "Ananias said, And here he [Paul] has authority from the chief priests to bind all who call upon Your name." Acts 26:10, "This I [Paul] also did in Jerusalem, and many of the saints I shut up in prison, having received authority from the chief priests; and when they were put to death, I cast my vote against them." In Acts 26:12, "While thus occupied, as I journeyed to Damascus with authority and commission from the chief priests..." We see that Paul does not go to any supposed Pharisaic leader for legal authority, but rather to the chief priests. Paul's

personal identification with the Pharisees would have caused him to go to the Pharisees for authority if they could give it.

Acts 22:30 [NKJV], "The next day, because he [the Roman commander] wanted to know for certain why he [Paul] was accused by the Jews, he released him from his bonds, and commanded the chief priests and all their council [= Sanhedrin] to appear, and brought Paul down and set him before them." Here the Roman commander shows that he understands "their Sanhedrin" to be that of the chief priests despite the fact that in Acts 23:6 Paul perceives that both Sadducees and Pharisees were present. Thus the chief priests were dominant.

The Pharisees did have sufficient clout in the local synagogues that they could excommunicate Jews from the life of the synagogue provided there was reasonable cause (John 9:13, 21-22, 34; 12:42). However, the synagogue environment is not the Temple where the chief priests (Sadducees) were dominant.

(K) Conclusion from the New Testament

The evidence from the New Testament has been given, and the Sadducees including the high priest and chief priests are clearly dominant concerning the overall political control of civil government from the semi-autonomous viewpoint that the Romans permitted. Qualification to the Levitical priesthood was a matter of heredity, not learning, and not popular support. Since only the priesthood was permitted to carry out the Temple services commanded in Scripture, and the priesthood was associated with the Sadducees, we would conclude that the Sadducees dominated the control of the Temple services. But there is still a need to discuss Josephus and the Rabbinic texts.

(L) The Roman Historian Tacitus

Scholars estimate that Tacitus was perhaps 15 to 20 years younger than Josephus. He wrote most of his history while Josephus was still alive. He wrote in Latin, the common language of the city of Rome, and had records from the library at Rome as references. In Tacitus' History 5:8 (page 662), he wrote, "A great part of Judaea consists of scattered villages. They also have towns. Jerusalem is the capital. There stood a temple of immense wealth." Later in the same section and page he continues, "The Macedonian

power [Alexander the Great and the Greek generals that succeeded him] was now weak, while the Parthian had not yet reached its full strength, and, as the Romans were still far off [in time and distance], the Jews chose kings [the Maccabeean dynasty] for themselves. [Foreigners were] Expelled by the fickle populace, and regaining their throne by force of arms, these [Maccabeean] princes, while they ventured on the wholesale banishment of [some of] their subjects, on the destruction of cities, on the murder of brothers, wives, and parents, and other usual atrocities of despots, fostered the national superstition [Judaism] by appropriating the dignity of the priesthood as the support of their political power."

This negative account of the Jews by Tacitus after their four-year war with the Romans ending in 70 CE (ending in 73 in Masada) does attribute political power of the Jews to the priesthood as Rome saw the situation while the Temple stood. Since the successive governors of Judea were appointed by the Roman government from 6 CE until the war broke out in 66, this view by Tacitus must represent the viewpoint of the Roman governors who were there. Notice the attitude of the Roman governor Pilate in Mat 27:24 [NKJV], "When Pilate saw that he could not prevail at all [in front of the large crowd of Jews], but rather that a tumult was rising, he took water and washed his hands before the multitude, saying, 'I am innocent of the blood of this just Person.'" Mark 15:15 declares that Pilate wanted to gratify the crowd. The Roman governors recognized the priesthood as having legal status over the Jews, and they backed up the priesthood with their authority in order to keep the Jews stable and the taxes to Rome flowing steadily. According to Josephus these governors sometimes changed high priests as they saw fit. Even John 11:49 states, "Caiaphas, being high priest that year", thus implying frequent changes in the priesthood. At the very top Rome was in charge, but Rome used its governor to control matters through the high priest. Rome backed the priesthood to keep the country stable. When the Temple was destroyed and Rome was angry with the Jews for starting the fighting that began the war, Rome no longer backed the priesthood. We see that Tacitus agrees with the conclusion of the New Testament.

(M) The Roman Historian Pompeius Trogus

The third generation Roman citizen Pompeius Trogus wrote a history in Latin c. 20. (see pages 2-3 of Yardley and Develin). At some time within the next 200 years a person named Justin wrote excerpts from Trogus' history,

and these excerpts survive in Latin (pages 2-6). The well known early church father Augustine (c. 400) wrote that Justin wrote a brief history following Trogus (page 6). On page 230 we find this translation of 2:16, "After Moses his son, Arruas, was made priest in charge of the Egyptian objects of worship, and soon afterwards king. And ever after that it was the practice amongst the Jews for their kings to be their priests as well. This integration of their judicial and religious systems made the Jews unbelievably powerful." The following comment on this statement appears on page 241 of Stern, "Pompeius Trogus anachronistically depicts all Jewish history according to the conditions that prevailed during the Hasmonaean [Maccabeean] monarchy, when the king and the high priest were the same person; …" This excerpt from Trogus, who wrote in the early first century, shows that he understood the Levitical priests to exercise the judicial function. This independent primary witness agrees with Tacitus and the New Testament in attributing primacy of Jewish authority to the priests.

[16] Appointed-times and Years are known from Lights in the Sky

I will examine Gen 1:14-15 to show that appointed-times and years are determined from lights in the sky.

Gen 1:14, "And the Almighty said: Let there be lights [3974 *mahohr*] in the expanse of the heavens to separate between the daytime and between the night, and let them be for signs, and for appointed-times [4150 *moed*], and for days and years."
Gen 1:15, "And let them be for lights [3974 *mahohr*] in the expanse of the heavens to give light on the earth, and it was so."

In verse 15 the word "them" refers back to the subject in verse 14, namely the lights. Thus verse 15 is saying in essence, "let the lights be for lights ... to give light on the earth". Even the names of the heavenly bodies are absent to put emphasis on the "light bringing" purpose and mission of these heavenly bodies to fulfill the need to determine "signs, appointed-times, days, and years". The triply emphasized mission of light from the heavenly bodies to supply light to determine appointed-times and years must be given its appropriate place in thought and use.

The word "signs" [226 *oht*] in Gen 1:14 is used for the rainbow in Gen 9:12-13, for the ten plagues in Egypt, for the Sabbath in Ex 31:13, 17, for a miracle in Judg 6:17, for the prediction of two deaths in I Sam 2:34, and in

other ways. Gen 1:14 is saying that the lights in the heavens are examples of signs. Carefully reread Gen 1:14 to note that it is not saying that signs [226 *oht*] are to determine the appointed-times and years. The subject of the sentence is the lights in the sky, not the signs. The lights in the sky determine signs. The lights in the sky determine appointed-times. The lights in the sky determine days. The lights in the sky determine years. Verse 15 shows that it is some aspect of the light from these lights in the sky that cause the determination.

For the sake of completeness and to continue to show the use of the light from these heavenly lights, I now literally translate Gen 1:16-18.
Gen 1:16, "And the Almighty made the two great lights [3974 *mahohr*], the greater light [3974 *mahohr*] to rule the daytime and the lesser light [3974 *mahohr*] to rule the night, and [He made] the stars [to rule the night]."
Gen 1:17, "And the Almighty set them in the expanse of the heavens to give light upon the earth"
Gen 1:18 "and to rule by daytime and by night, and to separate between the light and between the darkness."

The nature of the rulership of the heavenly lights mentioned in verses 16-18 is the dominance of their light, which again puts emphasis on the light from these lights. At the end of verse 16, concerning the stars, I added in brackets "to rule the night" because that is exactly what is mentioned about the heavenly lights, including the stars, in verse 18.

There are people who teach that the biblical month begins at the sundown of a day when the moon cannot be seen at all. Some people will use the time of the conjunction (astronomical new moon). I will call this theory the invisible moon theory or the conjunction theory. This is contrary to the biblical emphasis and stress on the use of ***light*** to determine the appointed times.

On various occasions I have heard advocates of the conjunction theory claim that before the Babylonian captivity under Nebuchadnezzar, ancient Israel (specifically the House of Judah) determined the start of a month with the sundown that began a day, but the moon was invisible near that sundown. These people go on to claim that after the return from captivity under Ezra and Nehemiah, Israel, under the influence of the Babylonian calendar and Persian political dominance, no longer continued the alleged original practice since the time of Moses. To judge the rationality of this view, let us read a couple of verses from Neh 8.

Neh 8:2, “And Ezra the priest brought the law before the assembly of men and women and all who could hear with understanding on the first day of the seventh month.”
Neh 8:9, “And Nehemiah who [was] the governor, and Ezra the priest the scribe, and the Levites who taught the people, said to all the people: Today is holy to YHWH your Almighty.”

Since the day that is stated to be the first day of the seventh month is definitely declared to be holy, it must have been determined correctly, and this was after the return from the captivity under Ezra and Nehemiah. Hence they could not have adopted a pagan practice contrary to what was correct under the law as taught by Moses. The Levitical priesthood had the proper pattern to determine the start of a month set in motion from this day onward down through the later centuries until the Temple was destroyed in 70 CE, and there is no known time during which the priesthood is thought to have had any significant doctrinal upheaval in its own ranks during this period.

[17] A Month is a Cycle of the Moon

No discussion has yet been given concerning the meaning of appointed-times in Gen 1:14.

Ps 104:19, "He made the moon [3394 *yahrayach*] for appointed-times [4150 *moed*], the sun knows its going-away."

This use of appointed-times establishes that the moon is one of the heavenly bodies specifically indicated in Gen 1:14.

I Ki 6:38, "And in the eleventh year in the month [3391 *yerach*] Bul, it [is] the eighth month [2320 *chodesh*], the house was finished for all its parts and for all its plans, thus he built it seven years."

I Ki 8:2, "And all the men of Israel were assembled toward King Solomon at the feast in the month [3391 *yerach*] Ethanim, which [is] the seventh month [2320 *chodesh*]."

Strong's number 3394 for moon (*yahrayach*) and Strong's number 3391 for month (*yerach*) have the same three Hebrew consonants and look the same when the vowels points are removed. (In the Hebrew language the 22 letters

shown in the sections of Ps 119 are called consonants even though some of them act as vowels. The original Hebrew text of the Scriptures only had these 22 consonants. The vowels points (and some such marks are more than points, but that is the term by which they are called in Hebrew school) were added to aid pronunciation by the Masoretes about the year 650. This identical original appearance in the Hebrew word for moon (3394) and the Hebrew word for month (3391) shows that a biblical month is a cycle of the moon. These verses, I Ki 6:38; 8:2, also have another word for month [2320 *chodesh*], and it shows that the two different words, *yerach* and *chodesh*, indicate the same thing, a month.

[18] Full Moon occurs about the 14th and 15th Days of the Biblical Month

Ancient Semitic writings in Ugaritic that are discovered through archaeological excavations do not show the vowel signs that have been common to biblical Hebrew since c. 650 when the Masoretes added these marks to help the reader to pronounce the words. Scholars who transliterate the Ugaritic words into English letters do not add the vowels because they are not in the original writings. Scholars often write the Hebrew letter *chet* as *h* instead of *ch* as I have done. If the vowels are omitted and only one English letter is written for one Hebrew letter, the two Hebrew words for month could be written *yrh* and *hds*, instead of *yerach* and *chodesh.* In words that are cognate between Ugaritic and Hebrew, the sound for t in Ugaritic often replaces the sound for the letter *shin* (written *sh* or merely *s*) in Hebrew. The Ugaritic language has the cognate words for both of the Hebrew words for month, and scholars write them *yrh* and *hdt*!!!

The Hebrew word for "day" is *yom*, and without the vowel marks, it is *ym*, The Ugaritic cognate word for "day" is also written *ym*!!!

On page 270 of the book by Pardee where he discusses the pagan context in the Ugaritic Kingdom, we find the following about the Ugaritic word *yrh*, "*yrh*, cognate with Hebrew *yareh*; 'new moon' is expressed by the word *hdt* alone, literally 'newness,' in the phrase *ym hdt*, 'day of the new moon'; the plural *hdtm* in text 58 (RS 19.015.13) designates a series of 'royal sacrificial feasts' extending over an unknown number of months; 'full moon' is expressed by *mlat*, literally 'fullness,' also with the word for 'day' (*ym mlat*, 'day of the full moon'); in terms of sacrifices offered, the new moon festival was less important than that of the full moon."

On pages 271-272 of the book by Gregorio del Olmo Lete, we find the following, "According to its heading, the Ugaritic text KTU 1.109 can be defined as 'a sacrificial new-moon ritual,' either on a particular month or, more probably, during each month of the year. In any case, this is the only indication of *time* for the ritual act: the 14th-15th day of the month, *ym mlat* (lit.: 'day of fullness'). The translation of the Ugaritic text is given as follows on page 273, "On the fourteenth day the king washes (remaining) purified. On the day of the full moon two month-old head of cattle are felled as a banquet offering to Balu of Sapanu, (plus) two ewes and one 'domestic' dove; …"

As was discussed near the beginning of this study, the Hebrew language of ancient Israel developed using the basic vocabulary of the language of Canaan and the nearby peoples, so that the cognate words of the same context should have the same meaning. From the Hebrew words in the Scriptures relating to the cognate words in Ugaritic, this shows that the full moon occurs near the 14th or 15th day of the biblical month.

[19] A Biblical Month is a Whole Number of Days

A cycle of the moon around the earth is about 44 minutes more than 29.5 days, but in this chapter we shall see from some verses using both of the Hebrew words for month, namely *chodesh* and *yerach*, that biblically speaking, a month is a whole number of days, with no fraction remaining. In Judea in the first century the Jewish culture did use a common term for hour, but earlier in ancient Israel's history, there is no small subdivision of time such as hours or minutes. However, by some unknown means, the night was apparently split into three "watches" (Ex 13:34; Judg 7:19; Ps 63:6; 90:4; 119:148; Lam 2:19).

If there is always clear weather for good visibility, and the sighting of the new crescent is made from Israel, then every month should have 29 or 30, days. This is not true for all places on the earth. For example, with good visibility from southern Australia, on rare occasions there can be a 31-day month.

The literal expression ***a month of days*** as seen in several verses below, is idiomatically translated ***a full month*** in almost all translations. These examples show that a biblical month is a whole number of days.

Gen 29:14, “And he dwelt with him a month [2320 *chodesh*] of days.”
Num 11:19, “You shall not eat one day, or two days, or five days, or 10 days, or 20 days,”
Num 11:20, “[but] until a month [2320 *chodesh*] of days, until it comes out from your nostrils, and it will be loathsome to you because you have rejected YHWH who is among you, and you have wept before Him saying, Why did we go out of Egypt?”
Num 11:21, “And Moses said, the people [are] 600,000 on foot among whom I am, and You said, I will give them flesh that they may eat a month [2320 *chodesh*] of days.”
Deut 21:13, “and she shall put off her captive's clothing and remain in your house, and grieve for her father and mother a month [3391 *yerach*] of days. And after that you may go in to her and be her husband and she will be your wife.”
II Ki 15:13, “Shallum the son of Jabesh reigned in the 39th year of Uzziah, king of Judah, and he reigned a month [3391 *yerach*] of days in Samaria.”

[20] A Biblical Month has a Maximum of 30 Days

We have seen that a biblical month is a cycle of the moon around the earth, and it is a whole number of days. A cycle of the moon averages a little more than 29.5 days. Suppose the moon cannot be seen at all for some number of days when the month would normally be expected to end? How many days can a biblical month continue if the moon is not seen at all? There is a prophetic time when the moon will not give its light.

Isa 13:9-10, “Behold the day of YHWH comes, cruel with both wrath and fierce anger, to lay the land desolate. And He will destroy its sinners from it. For the stars of heaven and their constellations will not give their light. The sun will be darkened in its going forth, and the moon will not cause its light to shine.”

Note the similarity to Joel 2:1-2; Ezek 32:7-8. The time length of the lack of light from the moon is not clear from this. All of the “day of YHWH” may be included, and the use of the word “day” here may refer to a lengthy time.

To students of biblical prophecy the context of Dan 7:21-27 fits that of the day of YHWH. The following begins to explain an important prophetic time period called a “time and times and half a time”.

Dan 7:25, “He shall speak pompous words against the Most High, shall persecute the saints of the Most High, and shall intend to change times and law. Then *the saints* shall be given into his hand for a time and times and half a time.”

This identical expression is also mentioned in Dan 12:7 and Rev 12:14. The context of Rev 12:14 fits perfectly with Rev 12:6, and the latter is explicitly stated to be 1260 days.

The beast of Rev 13:6 fits perfectly with the beast of Dan 7:25, which is the fourth beast in Dan 7:7-8, 19-27. The “time and times and half a time” in Dan 7:25 was already shown to refer to 1260 days. Therefore, the 42 months that are mentioned in Rev 13:4-6 is the same time period of 1260 days, which is a “time and times and half a time”.

Now “42 x 30 = 1260” and here “42 months is 1260 days. In this circumstance a month divides out to be 30 days. This may be explained by recognizing that the moon will not give its light, as shown above in Isa 13:9-10 and Ezek 32:7-8.

The result of this examination is the conclusion that a month is not permitted to have more than 30 days if the moon does not give its light or is not visible.

While some people may conjecture that astronomy will be altered to miraculously force a month to have 30 days at this future time, it seems more rational that the miracle of the lack of light from the moon will prevent a month from exceeding 30 days.

There is another miracle associated with “the shadow of the sun dial of Ahaz going back 10 degrees” in II Ki 20:11 and Isa 38:8. But the context associates this with the time of Sennacherib, king of Assyria, in II Ki 19:35-37; 20:6; Isa 38:6. The 14th year of Sennacherib is mentioned in both II Ki 18:13 and Isa 36:1, and secular history along with biblical reference works date this to 701 BCE. However, archaeological evidence from Babylonian cuneiform inscriptions of astronomical eclipses and other events perfectly agree with computer calculations going backwards to 747 BCE, which verify the unchanging continuation of the orbits of the heavenly bodies back to that time. This proves that the miraculous event associated with “the shadow of the sun dial of Ahaz going back 10 degrees” was a

miracle as perceived by people concerning the miraculous placement of light and shadow. Although a literal translation of Isa 38:8 appears to say that the sun itself moved back 10 degrees, the context is discussing the shadow of the sun moving 10 degrees rather than the sun itself. Hence "the shadow of" should be added in italics in order to read, "So *the shadow of* the sun returned 10 degrees" in verse 8.

People have conjectured that astronomy became altered during "Joshua's long day" (see Josh 10:12-13). The earth rotates on its axis to produce the visual effect of the sun moving around the earth. But the sun does not actually move around the earth. When Joshua requested that the sun stand still, this was according to Joshua's perception that the sun actually moved rather than the earth rotating. In this miracle, according to the literal Hebrew wording, both the sun and the moon appeared to stop moving according to human perception, so that light would be provided for the battle. The Bible is not clear how this miracle came to pass. This may have been a miracle of light perception or light movement rather than a temporary cessation of the rotation of the earth and a temporary cessation of the movement of the moon around the earth, or some other alteration of orbits involving the sun, earth, and moon. An astronomical alteration would have required a combination of many miracles including the prevention of massive ocean floods upon many shores as well as the falling of buildings and the imbalance in standing living creatures during the massive change in bodily momentum as the earth's rotation would have been affected. It is far more plausible that the miracle involved human perception of light rather than an alteration in the relative position of the heavenly bodies. In any case, a literal reading of Joshua's request does not take into account the reality of what happens astronomically, namely, that the earth rotates instead of the sun moving around the earth. There are great historical monuments, namely the pyramids, that bear witness to the unchanging orbit of the earth around the sun.

Pages 333, 336-337 of Lockyer show that most of the Egyptian pyramids are oriented east-west, and the two largest pyramids at Giza built by Cheops and Chephren are oriented east-west, having one wall aligned exactly east-west. Pages 63-64 of Lockyer explain that the sun's shadow on a vertical object from sunrise to sunset falls exactly east-west only on the days of the vernal equinox and the autumnal equinox. This witness of the great pyramids at Giza indicates that at the time of their construction, the orbit and axis of the earth with respect to the sun was the same as today because at the equinoxes

the east-west shadow of one wall of these pyramids is perfectly aligned in the east-west direction. One would imagine that if the earth's orbit had changed due to the miracle associated with "Joshua's long day", then the alignment of these pyramids would have changed, so that one wall would no longer be aligned exactly in the east-west direction. Although Egyptian chronology remains a matter of controversy, so that it is not possible to date these pyramids with certainty, all estimates are that they were built long before the time of Moses. I would conclude that the earth's orbit did not change during the miracle of "Joshua's long day".

During the time of the flood there is another unusual association with the length of a month. Gen 7:11 mentions that the flood began on the 17th day of the second month. In Gen 8:3-4 the wording seems to imply that 150 days passed until the 17th day of the seventh month. Here five months seem to total 150 days, which divides out to 30 days per month. This may be explained by realizing that with so much water covering the earth, there would be thick clouds (with much rain at the beginning), so that when the month would normally begin, no moon could be seen to mark its beginning. Therefore, the maximum length of the month, namely 30 days, would be permitted.

The extent of a month is from one sundown to some later sundown, with a total of 29 or 30 days, at least in theory. In practice, if there is a succession of months for which the sky is cloudy or rainy over all of Israel where people reside on days near the start of each of those months, then each of those months will have the maximum number of days per month, namely 30 days. Then, when the weather first becomes clear at the start of a month, that month may have less than 29 days to make up for the artificial prolongation of some months to 30 days.

[21] The Sun and Moon are the Primary Lights in Gen 1:14

To explain the significance of the translation "appointed-times" in Gen 1:14, let us now consider the following.

Lev 23:2, "The appointed-times [4150 *moed*] of YHWH which you shall proclaim [to be] holy convocations, My appointed-times [4150 *moed*] are these:"

Lev 23:3, “Six days work may be done, but on the seventh day is a Sabbath of rest, a holy convocation, you shall not do any work, it is a Sabbath to YHWH in all your dwellings.”
Lev 23:4, “These [are the] appointed-times [4150 *moed*] of YHWH, holy convocations which you shall proclaim in their appointed-times [4150 *moed*]:”.

These verses show that the appointed-times discussed in this chapter are days upon which there is to be a holy convocation. In Lev 23:3 note that the appointed-times include the Sabbath that repeats every seventh day. But this Sabbath example of an appointed-time [4150 *moed*] is not determined by the moon; instead it is determined by counting days, and days are determined by the alternation of darkness during the night followed by light during the day. This alternation of darkness and light is a result of the alternation of the absence and presence of the light from the sun, so that the sun is involved in determining this appointed-time, the Sabbath, but the moon is not involved for the following reason. Each month (or specific cycle of the moon) there are from one to three nights during which the moon cannot be seen at all, even with clear weather. During this period of invisibility of the moon, the days that are counted to arrive at the Sabbath have no contribution in counting light by the moon because the moon cannot be seen at that time. Notice the following description of rulership or dominance by the light of the heavenly bodies.

Ps 136:7, “To Him who made the great lights ...”
Ps 136:8, “The sun to rule in [the] daytime ...”
Ps 136:9, “The moon and the stars to rule in [the] night ...”

These verses show that the sun and moon are called the great lights, but the stars are also said to rule in the night. If it is not cloudy or rainy all night (and sometimes it is), it is possible to count the days by counting the nights during which one sees the stars as well as the daytimes during which one sees light given by the sun. However it is not possible to count days by counting the light from the moon due to its varying period of invisibility each month.

The use of the sun rather than the moon to determine the count to the Sabbath as an appointed-time, as well as calling the sun and the moon “the great lights” in Ps 136:7-9 and declaring the moon to be for appointed-times

in Ps 104:19, show that the sun and moon are the major contributors as lights to determine the appointed-times.

When one considers all the lights in the sky (sun, moon, stars, planets, and comets), the stars, planets, and comets do not have a cyclical period that matches the cycle of the year on the earth. Due to precession of the equinoxes, every 1000 years the stars shift 14.1 days further away from the vernal equinox. Therefore, by eliminating the other choices from consideration, the last word in Gen 1:14, "years" must involve the sun in some way.

[22] Blowing two Silver Trumpets on the Day that Begins each Month

Num 10:1-2, "And YHWH spoke to Moses saying, Make yourself two trumpets of silver. You shall make them of a hammered piece. And they shall be for summoning the assembly and for the breaking of the camps [to prepare to travel]."

The Hebrew noun (used as a gerund) that I translated "summoning" is *meekra* and has Strong's number 4744 (see BDB page 896, column 2). The Hebrew noun that I translated "assembly" is *adah* and has Strong's number 5712 (see BDB page 417, column 1).
Num 10:8, "And Aaron's sons, the priests, shall blow with [the two silver] trumpets."

Num 10:10, "And on [the] day of your gladness, and on your appointed-times [4150 *moed*], and on the beginnings of your months [2320 *chodesh*], you shall blow with [the two silver] trumpets over your burnt offerings and over [the] sacrifices of your peace offerings, and they shall be to you for a memorial before your Almighty; I am YHWH your Almighty."

Two general purposes are mentioned for these two silver trumpets in verse 2: (1) summoning the assembly, and (2) for the breaking of the camps. The latter purpose is relevant during the 40 years of wandering in the wilderness when they journeyed from place to place, and they also journeyed when going to war. Whenever the relevant people were called together for the purposes mentioned in this section, the trumpets were blown in specific ways to signal the nature of the event.

This shows that the Levitical priests were to blow two silver trumpets on all the important occasions, which included the first day of each month as well as on the appointed-times, and the latter include each seventh day recurring Sabbath as shown in Lev 23:2-3.

[23] Hebrew *chodesh* refers to the Day that Begins each Month

Now compare Num 10:10 with I Chr 23:30-31.

I Chr 23:30, "and [the sons of Aaron are] to stand every morning to thank and to praise YHWH, and likewise at evening," I Chr 23:31, "and for all the burnt offerings to YHWH for the Sabbaths, for the new-moons [2320 *chodesh*], and for the appointed-times [4150 *moed*] in the count [of animals], [according to the] ordinance concerning them continually before YHWH."

In I Chr 23:31 above we notice that the burnt offerings on the new moons [2320 *chodesh*] are mentioned, and in Num 10:10 above we notice that the burnt offerings on the beginnings of your months [2320 *chodesh*] are mentioned. The whole phrase "beginnings of your months" appears in verse 10 compared to "new-moons" in verse 31, showing that a month begins with a new moon. Verse 31 translated this word *chodesh* as "new-moons", while verse 10 translated the same word as "months". Other examples also show a double meaning for this word. Some examples where *chodesh* means "month" are Gen 29:14; Num 10:11; I Ki 5:14. Some examples where *chodesh* means "new-moon" are II Ki 4:23; Ezek 46:3; Hos 2:11; Amos 8:5. The last verse indicates that in ancient Israel the new moon day was treated as a public holiday where businesses were closed, although refraining from work on a new moon is not stated as a commandment in the law of Moses.

It has already been shown that a cycle of the heavenly body called the moon determines a month. The translation "new-moon", but without the hyphen, is the common translation for *chodesh* when it refers to the beginning of a month. Nevertheless, one may question whether "new-moon" is the best way to translate *chodesh*. Based upon Num 10:10 one may translate this single Hebrew word as "month-start" or "new-month" since it is definitely the beginning of a month. As already seen above, the word for moon is *yahrayach* [3394], which has no resemblance to *chodesh*. No Hebrew word for the physical body called the moon has a resemblance to the Hebrew word *chodesh*.

It is only through the other Hebrew word for month, *yerach* [3391], that we have the connection to the physical body known as the moon. On this basis it would be more literal to translate the Hebrew word *chodesh* as "month-start" or "new-month". The Hebrew noun *chodesh* [2320] has the same consonants as the Hebrew adjective *chadash* [2319] (almost always translated "new") and the Hebrew verb *chadash* [2318] (about half the time translated "renew" and half the time "repair"). The month following any month is not a renewal of the previous month or a repair of the previous month; instead it is indeed a new month. While the translation of *chodesh* as "new-month" seems more literal and precise than "new-moon", the latter is so firmly accepted that this will be used in the present study.

What about the suggestion to translate *chodesh* as "renewed-moon"? The moon itself is older than it was the previous month and the physical body itself is not renewed. If one wishes to make a case for translating the word *chodesh* as "renewed-moon" based upon the light from the moon, this is quite subjective because *chodesh* has the primary affinity with month, and the month is "new", not "renewed".

If we apply Num 10:1-2, 8, 10 to the beginnings of the months as specified in verse 10 along with "summoning the assembly" in verse 2, the following conclusion is drawn. Two priests were to blow two silver trumpets to summon the assembly and thereby announce that a new month had begun.

Deut 16:16 shows that only three times during the year all men are commanded to appear at one central place, not at the start of all the months. Therefore, the summoning of the assembly at the beginning of their months pertained to those people that were near the one place where the two silver trumpets were blown and the sacrifices were performed, not all people throughout the nation.

Num 10:10 shows the authority of the priesthood in declaring the start of each month through the blowing of the two silver trumpets. Num 28:11 also has the same phrase "and on the beginnings of your months". The passage in Num 28:11-15 describes the burnt offerings, the grain offering, and the drink offering that is specific for the priests to perform on the beginnings of their months. At this time when the people heard the specific sound of the two silver trumpets blown by the two priests, they then knew that the ceremony of the offerings for the beginning of the month were to begin soon. This sound would summon the people who were within a reasonable distance to

come and witness the priestly ceremonies associated with the beginning of the month. This would be an occasion for prayers, singing, and playing musical instruments when the priesthood fully developed the service for the beginning of the month.

[24] Isaiah 47:13, Astrologers, the Zodiac, and the meaning of *chodesh*

Isa 47:13 is a most interesting verse of Scripture because it teaches much about the Hebrew word *chodesh* and it condemns the Babylonian astrologers, as will be shown in this chapter. I will soon provide a literal translation of Isa 47:13, and one goal of this chapter is to explain why this translation is appropriate and accurate. Several of the Hebrew words with their Strong's number are included after the corresponding English word(s) in the literal translation because they are discussed in this chapter.

First, some remarks should be made concerning the context. Isa 1:1 mentions that Isaiah's recorded visions were during the reigns of the Judean kings Uzziah, Jotham, Ahaz, and Hezekiah. This approximates the period of Isaiah's visions as from c. 760 to c. 700 BCE. The Neo-Assyrian period is from c. 1000 to 612 BCE, at the end of which Babylon captured the Assyrian capital of Nineveh (see page xxiv of Rochberg 2004). Hence Isaiah lived during the time of dominance by the Assyrian Empire. Isa 8:4; 10:5-6 is a prophecy that Assyria will soon conquer some of its neighbors. Isa 30:31-33 is a prophecy that Assyria will be defeated. Babylon was south of Assyria, and the Babylonian Empire eventually occupied more than the extent of the Assyrian Empire. Isa 39:5-7 is a prophecy that the House of Judah will be defeated by Babylon. This implies that Babylon would first defeat Assyria, which fully transpired in 612 BCE. During Isaiah's lifetime, although the Assyrian Empire was politically dominant, the Babylonian Empire also existed to its south. Isa 47:1, 11 is a prophecy that eventually Babylon would be defeated, and Isa 47:13 is a taunt directed at Babylon. The "you" at the start of verse 13 is Babylon.

On page 8 of Rochberg 2004, she wrote, "The nightly watch of the sky seems to have been standard Babylonian practice since the reign of King Nabonassar (747-734 B.C.)." Recall the above remark that Isaiah's visions were from c. 760 to c. 700 BCE. On page 2 of Swerdlow 1998, he wrote, "Prognosticate by the new moon they [the Babylonian astrologers] did, and by the full moon, and by the appearance of the moon, and by eclipses of the sun and moon, and by the risings and settings and conjunctions of stars and

planets, and by halos and clouds and rain and winds, in short, by anything in the heavens, astronomical or meteorological, that could be taken as ominous, a prophetic sign given by the gods." When Swerdlow began with the words "prognosticate by", he meant that based upon the conditions that prevail during the time of the events mentioned, they would make predictions about the future with the intent that they would come to pass. With this historical context in mind, here is my literal translation of Isa 47:13.

Isa 47:13, "You [Babylon] are wearied with your many consultations. Now let [the] astrologers [*havar*, 1895] of [the] heavens [*shamayim*, 8064] stand up and save you, those who look-intensely [*chozeh*, 2372] at [the] stars, those-who-make-known [*yada*, 3045] at [the] new-moons [*chodesh*, 2320], what will happen to you."

The Jewish biblical scholar Ibn Ezra (1089 – 1164) wrote a commentary on the book of Isaiah, in which he wrote that the two Hebrew words together, *hovrev shamayim* [1895, 8064], mean "astrologers" (see page 216 of Ibn Ezra). This viewpoint made its way into the KJV, so that the KJV does not show the word "heavens", which is the literal meaning of *shamayim*.

The Hebrew word *havar* [1895] only occurs in this one place in the Hebrew Bible. From this Hebrew context alone, without any outside knowledge, there is insufficient information to determine the meaning of *havar* [1895]. Jerome was taught Hebrew by Jewish scholars, and he translated this from Hebrew into Latin c. 390. After his death the Roman Catholic Church accepted Jerome's translation from Hebrew to Latin (except for the Psalms) as the Vulgate, its official text of the Old Testament, which the Jews call the Tanak in Hebrew. In the bibliography, on page 180 of the Vulgate Isaiah at Isa 47:13, we see the Latin words *augures caeli*, which means "seers of the heaven". In Brenton for the Septuagint at Isa 47:13, the text shows the Greek *astrologoi tou ouranou*, which is translated "astrologers of the heaven". Generally, it is recognized that Jerome's knowledge of Hebrew was significantly better than the Septuagint translation into Greek from the Hebrew, although the Septuagint presents its own special problems because the Hebrew text from which the Septuagint was translated (this text is labeled the *Vorlage*) no longer exists. If we assume that the *Vorlage* was very close to the Septuagint that has survived, then there are many deletions and additions between the *Vorlage* and the Masoretic Text of the Hebrew Bible. The conclusions are that the *Vorlage* does not exist, and the Septuagint is not really reliable for the purpose of determining the proper

translation of the Hebrew Masoretic Text into English. Nevertheless, Jerome and the Septuagint agree in this instance, and these are the earliest known sources that provide a meaning of the Hebrew *havar* [1895].

Page 211 of BDB discusses *havar* [1895], and the word "astrologers" never appears in this entry, although a partially related idea is presented. BDB gives the meaning of *havar* to "divide" as a verb, but concerning this meaning BDB comments "so most [commentators], but dub. [= dubious, doubtful]". BDB quotes one source that proposes the translation "they that divide the heavens", but BDB gives no alternative. The fuller explanation given by BDB is "the distinguishing of signs of the zodiac, or other astrological division of the sky". The RSV gives the translation "those who divide the heavens", thus agreeing with this approach to the translation. BDB explains that the origin of the conjectural meaning "divide" is the similar sounding word in the Arabic language, *habara*, which means to "cut into large pieces, cut up".

My translation from German to English from page 184 of the short article by Josua Blau has this to say about the use of the Arabic word *habara* as the explanation of the Hebrew *havar* [1895]: "However, the Arabic *habara* is based upon the explanation 'cut'; indeed the subject of *habra* appears to be a 'piece of meat' and its meaning is 'meat in (large) cut pieces'; thus one can surely not accept this explanation of [the Hebrew] *havar*." Here Blau is emphasizing the need to have a similar context in order to reliably claim that a word from one Semitic language is a cognate to a word from another Semitic language. The context is different, so he fully rejects the explanation "to cut". Thus Blau rejects the basis behind the RSV translation "those who divide the heavens".

The theory of using this Arabic word as a suggested cognate to the Hebrew word *havar* [1895] does, at least momentarily, appear to be supported by the idea of the zodiac in the explanation of BDB. In order to determine whether the zodiac lends support to using this Arabic cognate theory (to divide the heavens), it is necessary to understand the origin of the zodiac and its meaning. This needs to be compared to the time at which Isaiah prophesied (c. 760 – c. 700 BCE).

On page 31 of the book by Koch-Westenholz the term *zodiac* is defined. Her definition uses the word ***ecliptic***, which is the apparent path of the sun in the sky during a complete year as observed from the earth. Constellations

(recognized star groups) appear in the sky at or close to the ecliptic. Her definition of the ***zodiac*** is: "The ecliptic is divided into twelve equal parts, [called] the signs of the zodiac. The zodiacal *signs* are a mathematical construction and do no longer correspond to the portion of the sky occupied by the zodiacal *constellations* whose name they bear. The zodiacal signs are: Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricorn, Aquarius, and Pisces." These signs are used in horoscopes.

Concerning the origin of the zodiac, which refers to the division of the year into 12 equal parts, each originally containing one designated constellation, but no longer tied to the current location of that constellation, here is a comment by John Britton, a specialist in ancient mathematical astronomy, especially Babylonian astronomy. On page 244 Britton 1999 wrote, "Obviously the [Babylonian System A] theory [of lunar anomaly] was invented earlier, but it [this mathematical theory of astronomy] seems unlikely to have materially predated the zodiac, which seems to have appeared between -463 and -453. On balance, if we assign its [this theory of lunar anomaly's] invention to -440 +/- 15 years, we should not be too far off."

Here Britton estimates the origin of the zodiac as 12 equally divided signs of the year between 464 and 454 BCE. On page x of Rochberg 1998, we note the following concerning the origin of horoscopes: "The appearance of horoscopes in Babylonia at the end of the fifth century B.C. [= c. 400 BCE] marks the point when the situation of the heavens at the time of a [person's] birth came to be regarded as significant for the future of an individual." On pages 20 and 25 Rochberg gives the year 410 BCE as the earliest known text of a horoscope. Horoscopes are based on the zodiac. Hence we see that the zodiac or horoscopes cannot be associated with any statement of Isaiah, showing a difference of 250 years. Thus the comment by BDB is out of place in its alleged association of dividing the heavens with the Hebrew word *havar* [1895]. Of course BDB was written before the date of the origin of the zodiac became known by historians of ancient astronomy. Thus BDB is out of date in this area. The origin of both the zodiac and horoscopes is ancient Babylon.

In an email sent by professor Lester Ness to the group HASTRO-L on June 17, 2004 he translated from the French on page 53 of the book by Auguste Bouche-Leclercq as follows, "However, it has been proven beyond doubt that the Egyptian zodiacs are all from the Roman period and freely imitate

the Greek zodiac. At one blow, all the extravagant suppositions based upon their [the Egyptian's] supposed antiquity are destroyed." This was written to combat the erroneous claims that the zodiac originated in ancient Egypt. The Greeks copied the zodiac from the Babylonians and added some of their own ideas.

Edward Ullendorff suggested another meaning of the Hebrew word *havar* [1895] on pages 339-340 of his paper. He favored the two Hebrew words together, *hovrev shamayim* [1895, 8064], to mean "worshippers of the heavens". He claimed that the Ugaritic word *thbr* (to worship) is cognate to the Hebrew word *havar.* However, the Ugaritic context has nothing to do with signs or bodies in the heavens, so that there is no contextual link between the Ugaritic word and the Hebrew word. Besides, the writers who discuss ancient Babylonian astrology do not suggest that these astrologers worshipped the heavenly bodies. They made prognostications based upon what might be seen that was associated with the phenomena in the heavens. Deut 4:19, which emphasizes worship, is not specifically associated with ancient Babylon.

The evidence of the greater historical context of Isaiah as well as the context within Isa 47:13 along with the translation of word *havar* [1895] in the Greek Septuagint, in the Latin Vulgate from the Hebrew by Jerome, and by Abraham Ibn Ezra all agree that its meaning should be the plural noun *astrologers*, yet the literal grammatical form of *havar* is that of a verb in the plural form. There is no good case for a different meaning based upon the context. Without the contextual evidence from historical astronomy and astrology that became available c. 2000, this might still be debatable.

On page 302 of BDB Isa 47:13 is specifically written under meaning 1c for the Hebrew word *chozeh* [2372], and this verse has this verb in its plural form immediately preceding "at [the] stars". BDB states of this context "as stargazers, in astrology".

Below the middle of column 1 on page 395 of BDB, Isa 47:13 is specifically written under the Hebrew word *yada* [3045], and it occurs in a plural verb form. Here BDB translates from *yada* to the end of the verse as follows, "who declare, at the new moons, of (the things) which are to come". Here BDB translates *yada* "who declare", but the context indicates that their declarations are predictions or prognostications.

In painstakingly crawling through Isa 47:13, at last we arrive at the primary Hebrew word that provides the reason for exploring this verse in its context in detail. That is the Hebrew word *chodesh* [2320]. Here it occurs in the plural, and it is preceded by the single letter lamed, which is a preposition that is pronounced "l". Pronounced together it is *leh-chadasheem*.

The question arises concerning whether *leh-chadasheem* means "every month (i.e., monthly)" or "at the new moons" in Isa 47:13. Consider the following factors.

(1) This plural form of *chodesh* with this preposition lamed occurs in five other places in the Hebrew Bible. These are I Chr 23:31; II Chr 2:4; 8:13; 31:3; Ezra 3:5. This preposition is flexible and its meaning depends on the context. It often means *at*, *for*, or *on*". In all six cases (Isa 47:13 being the sixth case) it may be consistently translated "at [the] new-moons". In the five examples outside Isaiah the context prevents it from meaning "every month".

(2) The translation "every month" is usually given in Num 28:14; I Chr 27:1; Est 3:7 where *chodesh* in the singular occurs twice in all three verses, and the preposition lamed is absent before these three double cases. The end of Num 28:14 literally means "month on month for [the] months of the year". In the Hebrew it is "*chodesh* [singular] *b-chadshoh* [preposition bet and singular] *l-chadshay* [preposition lamed and plural] *ha-shanah*". Here the plural form of *chodesh* is different from the plural form in Isa 47:13, though both have the preposition lamed. These three consistent examples show that the expression that is literally "month on month" (no lamed and no plural) means "every month"; thus there is no need for another expression to mean every month.

(3) In theoretical Hebrew grammar it would be a possibility for *leh-chadasheem* in Isa 47:13 to mean "every month", but there is no biblical context in which this is an example that is implied by the context. As already stated above, on page 395 of BDB, Isa 47:13 is quoted to end as follows: "who declare, at the new moons, of (the things) which are to come". Yet BDB contradicts itself on this, because on page 516, column 1, 9 lines from the bottom of the page, BDB states "*every* month" for *leh-chadasheem* in Isa 47:13. The Hebrew preposition lamed is very flexible, having a wide variety of meanings, so this is given as a grammatical possibility. Nevertheless, no

known context implies that this was a method that was in fact used in the ancient Hebrew language to mean “every month”.

(4) Near the beginning of this chapter quotations from Rochberg and from Swerdlow were given to show that during the era of Isaiah, on each night the Babylonian astrologers examined the sky for anything unusual, and then such unusual events were used as the basis for prognostications. It would be needlessly redundant for the end of Isa 47:13 to mean “monthly” when in fact the examination of the heavens was a nightly matter. However, prognostications were made for every new moon even if it was a very typical new moon. More emphasis was placed on the new moons because that was of central importance to the Babylonian calendar since it began each month. Translations of reports to the Assyrian kings by those who supervised the nightly watchers of the skies that includes the time of the later life of Isaiah may be found in the book by Hermann Hunger 1992. The prior quotation by Swerdlow is almost a summary of Hunger’s book.

The above considerations provide good reasons to reject the proposal found in some translations that *leh-chadasheem* in Isa 47:13 means “every month”. Thus the following is an accurate literal translation.

Isa 47:13, “You [Babylon] are wearied with your many consultations. Now let [the] astrologers [*havar*, 1895] of [the] heavens [*shamayim*, 8064] stand up and save you, those who look-intensely [*chozeh*, 2372] at [the] stars, those-who-make-known [*yada*, 3045] at [the] new-moons [*chodesh*, 2320], what will happen to you.”

The NRSV reaches an accurate literal sense of the whole verse. Isa 47:13 [NRSV], “You are wearied with your many consultations; let those who study the heavens stand up and save you, those who gaze at the stars and at each new moon predict what shall befall you.”

This shows that the Babylonian practice of predicting the future of nations and the future of kings by what is seen in the heavens is sinful. But it also shows that the Hebrew word *chodesh*, new-moon, is also applicable to Babylonian society!!! It shows that the fundamental concept that underlies the Israelite new-moon and the Babylonian new-moon are the same.

An example of the type of prognostication that was made by Babylonian priests is found on page 140 of Hunger 1992, catalogued as RMA 30, “If at

the moon's appearance its right horn becomes long, its left horn short: the king will conquer a land not his own." On the same page RMA 37 has, "If at the moon's appearance in intercalary Adar ([13th month] XII/2) its horns are pointed and (the moon) is red: the ruler will become strong and subdue the land."

Babylon had a pagan priesthood, which did not use two silver trumpets to announce the start of a month. The Babylonian priesthood spread into Assyria so that the border between Babylon and Assyria was somewhat artificial to their priesthood. Before Babylon conquered Assyria's capital city, Nineveh, in 612 BCE, this priesthood performed their nightly observations of the heavens and made their first forays at mathematical astronomy. The kings of Assyria recognized the supposed powers of this priesthood and received letters from this priesthood. One letter that is labeled number 303 (also labeled Harper 894) on page 208 in the book by Pfeiffer, was sent from an authoritative priest to the king of Assyria that contains the following: "On the 30th I saw the moon, it was in a high position for the 30th day; presently it will be as high as it stands on the 2nd day. If agreeable to the king my lord, let the king wait (for a report) from the city of Ashshur. The king my lord may then determine (for us) the (first) day (of the month)." The context of this letter mentions the phrase "saw the moon" as a contrast to not seeing the moon, so that this must refer to the first sighting of the crescent by the observer. Since this mentions that the moon was seen about as high in the sky as for a second day old moon, the author suggests that the king wait for a report from another location where perhaps the moon might have been seen one day earlier. The sighting was near the end of the 30th day of the month.

Here is a similar example from page 75 of Hunger 1992, where the completion of a damaged word in square brackets is by Hunger. It is catalogued as RMA 76: "We watched on the 29th day; the clouds were den[se], we did not see the moon. We watched on the 30th day; we saw the moon, but it was (already) very high. The (weather) of the 29th day has to do with it. What is it that the king my lord says?" Here the author suggests that if the weather had been clear one day earlier, it would likely have been seen. He wants the king to decide which of the two days should start the month.

In both examples the Assyrian king was to officially declare the first day of the month on the basis of the information provided. These examples and others like them make it clear that the sighting of the new crescent began the

first day of the month in Assyria and Babylon. Isa 47:13 applies the Hebrew word *chodesh* to the Babylonian context, which puts emphasis on the day that begins with the first sighting the moon, i.e., the new crescent.

[25] The Biblical New Moon relates to the Sighting of the New Crescent

We have seen that a month is a cycle of the moon, and the full moon typically occurs on the 14th or 15th day of the biblical month. We have also seen from Gen 1:14-18 that a month begins using the light from the moon as a visual indicator. The only visual discernable candidates for the biblical new moon that are available from this information are the old crescent and the new crescent. Isa 47:13 points to the new crescent. Gen 1:14 puts emphasis on the "lights", that is, what can be seen.

Ancient Egypt had a civil calendar that ignored the cycle of the moon. But according to page 140 of Depuydt 1997, ancient Egypt also had a religious calendar that began its month with the morning one day after the old crescent was seen in the morning. The reason they waited until the morning after the morning on which the old crescent was seen, is that they could not know that the old crescent was actually the old crescent until one morning later when nothing was seen. When a narrowing crescent is not especially thin, maybe it will not be the old crescent or maybe it will. This can only be known one morning later because the old crescent is, by its definition, the last of the narrowing crescents during the moon's cycle. This requirement to wait until one morning after the old crescent is one significant difference between the determination of the old crescent and the determination of the new crescent. When the new crescent is seen, it is immediately known because it had not been seen the night before.

In a previous chapter it was mentioned that the Hebrew noun *chodesh* [2320] (meaning *month* as well as *new-month* or *new-moon*) has the same consonants as the Hebrew adjective *chadash* [2319] (almost always translated "new", and having the meaning "new") and the Hebrew verb *chadash* [2318] (about half the time translated "renew" and half the time "repair"). Hence the collective association of ***new***, ***renew***, and ***repair*** is associated with the Hebrew word ***chodesh***, rather than the concept of old, dwindling, or thinning, which is associated with the old crescent. Therefore, from the choice of the Hebrew word *chodesh* for the new-moon, it must refer to the new crescent rather than the old crescent.

An astronomical reason for a biblical month consisting of a whole number of days is that each new crescent first becomes visible close to sundown, which is the time that the Sabbath begins and a numbered day of the month begins. We thus see that from the biblical viewpoint, the average synodic month as a precise fraction of days, hours, and minutes is never hinted at in Scripture and is foreign to biblical thought.

Ezra 6:15 mentions the month Adar and Neh 6:15 mentions the month Elul. These are Hebrew transliterations of month names in the Babylonian calendar, but these verses are in the context of Jerusalem. Scripture is a witness here that ancient Israel adopted the month names of the Babylonian calendar at the time of Ezra and Nehemiah. This would cause severe confusion unless a biblical month began by the same concept as the Babylonian calendar. This is also in harmony with the conclusion from Isa 47:13. Indeed, a month in the Babylonian calendar began with the day whose beginning evening was close to the time that the new crescent was seen in the western sky. But no month was permitted to have more than 30 days in the Babylonian calendar. This corroborates what was already determined from other biblical and archaeological evidence.

[26] Philo of Alexandria and the Jewish New Moon in the First Century

As a Jew living in Alexandria, Egypt in the early first century, Philo discusses the new moon from his Jewish perspective. On page 333 of Philo_7 (Special Laws 2:41) Philo wrote, “The third [feast recorded in the law] is the new moon which follows the conjunction of the moon with the sun.” Since this follows the conjunction, it must refer to the (visible) new crescent. On pages 391 and 393 of Philo_7 (Special Laws 2:141-142) Philo wrote, “Following the order stated above, we record the third type of feast which we proceed to explain. This is the New Moon, or the beginning of the lunar month, namely the period between one conjunction and the next, the length of which has been accurately calculated in the astronomical schools. The new moon holds its place among the feasts for many reasons. First, because it is the beginning of the month, and the beginning, both in number and in time, deserves honour. Secondly, because when it [the new moon] arrives, nothing in heaven is left without light, for while at the conjunction, when the moon is lost to sight under the sun, the side which faces earth is darkened, when the new month begins it resumes its natural brightness. The third reason is, that the stronger or more powerful element [the sun] at that time [the new moon] supplies the help [light] which is needed to the smaller

and weaker [the moon]. For it is just then [at the new moon] that the sun begins to illumine the moon with the light which we perceive and the moon reveals its own beauty to the eye."

In Alexandria, the leading center of Greek mathematical astronomy at that time, the conjunction is a well known concept to Philo, and he mentions the conjunction as a contrasting time to the new moon. It is clear that to Philo the Jew in the early first century in Alexandria, the new moon is the new crescent, and this begins the first day of the Jewish month. Evidently the Greek geometrical abstract concept of the conjunction had filtered down to the educated non-astronomer, Philo. He used this concept in writing to his audience without defining it, so he understood that his audience would also understand this term.

[27] Did the Jews use Calculation for their Calendar in the First Century?

On page 302 of *The Mishnah* the section Rosh Hashannah 2:8 appears, which Neusner subdivided into parts "A" through "I" as follows, and Neusner wrote what is in square brackets below. This is quoted word for word.

A. A picture of the shapes of the moon did Rabban Gamaliel have on a tablet and on the wall of his upper room, which he would show ordinary folk, saying, "Did you see it like this or like that?"

B. M'SH S: Two witnesses came and said, "We saw it at dawn [on the morning of the twenty-ninth] in the east and at eve in the west."

C. Said R. Yohanan Nuri, "They are false witnesses."

D. Now when they came to Yabneh, Rabban Gamaliel accepted their testimony [assuming they erred at dawn].

E. And furthermore two came along and said, "We saw it at its proper time, but on the night of the added day it did not appear [to the court]."

F. Then Rabban Gamaliel accepted their testimony.

G. Said R. Dosa b. Harkinas, "They are false witnesses."

H. “How can they testify that a woman has given birth, when, on the very next day, her stomach is still up there between her teeth [for there was no new moon!]”

I. Said to him R. Joshua, “I can see your position.”

Now I have some comments on the above.

(A) Due to the other names, this is considered to be the grandson of the Gamaliel in the NT, and this is considered by Orthodox Jews to be in the second century, perhaps about 110.

(B) The story may be invented to illustrate the stature and greatness of Gamaliel II. One cannot accept the historical truthfulness of everything in the *Mishnah*.

(C) Part A above is taken by Orthodox Jewish commentators including Maimonides to imply that Gamaliel II was able to calculate what the new moon should look like and whether it could be seen, and through his questioning of the witnesses and his calculations he could judge whether the witnesses were lying. But this is reading far too much into what is said. Assuming that this is historically true, Gamaliel may simply be trying to rattle the witnesses, so that they would not try to falsely testify. In other words, he wanted to see how confident they would be in their claim. Each year at about the same season, the angle of the new crescent would be generally the same, but not exactly the same. Thus an ignorant person would not know approximately what it ought to look like, but a knowledgeable person would know its approximate angle, although a knowledgeable person at that time in history would not know in advance whether it would be seen. On the other hand, in the majority of cases months did alternate with 29 and 30 days.

(D) This is the entire evidence that exists of the claim that in ancient times learned Jews could calculate whether the new crescent could be seen.

(E) The claim in B is false because it is not possible to see the old crescent and the new crescent so close together in time.

(F) The statement at the end of E indicates that on the next night the court was not able to see the new crescent, and this is the reason for the analogy given in part H.

(G) Parts G and I indicate that some people doubted that the alleged witnesses saw the new crescent, despite the fact that Gamaliel II accepted their testimony.

(H) The whole procedure and interest in obtaining witnesses for having seen the new moon should make it obvious that if its visibility was declared to have occurred at the end of the 29th day, then the ending month had only 29 days. Hence they were not using a calculation to determine the start of a month.

From the above, does it seem rational to accept the opinion and interpretation that in the early second century Jewish leaders could calculate whether the new crescent could be seen? Certainly not.

[28] The Biblical Year is a Whole number of Biblical Months

A ***tropical year*** is the average time from one vernal equinox to the next vernal equinox, or equivalently, from one autumnal equinox to the next autumnal equinox. In ordinary speech this is also called the solar year, and it approximates the agricultural year without drifting away.

Since a biblical month averages about 29.5 days, a 12-month period will contain about 354 days and a 13-month period will contain about 384 days. But a tropical year contains about 365.2422 days, which is about 11 days more than 12 biblical months.

Leviticus 23 is the most concentrated single area of the Hebrew Bible dealing with calendaric aspects of the festival days. Upon reading through Lev 23 it should be noted that months are never mentioned by name in this chapter, but always by numbered occurrence through the year. Thus once the first month is determined, all the other months are determined because they follow sequentially by number. The first month maintains a fixed relationship to the festivals. But now it will be shown that the festivals maintain a fixed relationship to the agricultural year in Palestine. Ex 34:22 shows that the Feast of Weeks approximates the wheat harvest. Ex 23:16 shows that the Feast of Ingathering approximates a harvest time of the year.

Deut 16:13 shows that the Feast of Booths approximates a harvest time of the year, but a comparison of Ex 23:14-17 and Deut 16:16 shows that the Feast of Ingathering is the same as the Feast of Booths. Since there is no harvest in Palestine during late autumn and winter, the festivals must maintain an approximately fixed relationship to the agricultural year. Therefore, the first month must maintain an approximately fixed relationship to the agricultural year and hence the tropical year. Technically this is expressed by saying that the biblical calendar is lunar-solar in nature.

The Bible has an example of a year with 13 months, showing that the biblical year was not an exact tropical year. Here is the example. The time difference between Ezek 1:1-2 and Ezek 8:1 is the difference between month 4 day 5 in the 5th year of King Jehoiachin's exile and month 6 day 5 in the 6th year of his exile. This is 14 or 15 months depending on whether the 5th year of his exile had 12 or 13 months. If the difference is 14 months, this is about 29.5 times 14 (= 413) days with an overestimate of 30 times 14 (= 420) days. The overestimate of 420 days is 17 days short of the known events because Ezek 3:15 accounts for 7 days and Ezek 4:4-6 accounts for 390 plus 40 days, the total being 437 days. Thus the difference must have been 15 months, which is about 29.5 times 15 (= 442.5) days, just five or six days more than the known events of that time period.

If one should claim that the 5th year of the king's exile was a tropical year, and an overestimate of 366 days ("leap" year) plus 60 days (two extra months) is allowed, the total is 426 days, which is still far short of the 437 days for the known events.

Thus, although the biblical year maintains an approximately fixed relationship to the agricultural year, the example with 13 months shows that the biblical year is not an exact tropical year.

It will now be shown that a biblical year consists of a whole number of biblical months rather than a smaller subdivision such as days. A biblical reason for this is that Num 28:14 has the Hebrew expression *chodesh bh chadshoh lh chadshay ha shanah*, meaning "month by month for months of the year", but idiomatically "each month throughout the year". Also, I Chr 27:1 has the Hebrew expression *chodesh bh chodesh lh col chadshay ha shanah*, meaning "month by month for all months of the year", but idiomatically "each month throughout the whole year". The above example

of a year with 13 months is further biblical evidence that a year consists of a whole number of months.

A biblical year cannot contain fewer than 12 months because Est 9:20-23, 26 maintains that each year on the 14th and 15th days of the month Adar the Jews are to celebrate the festival called Purim. Est 8:12 states that Adar is the 12th month. If a year could only have 11 months, then the Jews would be unable to celebrate Purim that year. Further evidence of a requirement of at least 12 months in the year comes from I Ki 4:7 and I Chr 27:1-15.

Hence a biblical year contains 12 months or 13 months, or approximately 354 days or 384 days. This is an illustration of the fact that the modern cultural concept of a year always having 365 or 366 days need not necessarily be practiced in some ancient societies.

In ancient Egypt, from some time onward, their civil calendar always had 365 days, which was divided up into 12 months of 30 days each plus five extra days (see page 28 of the reference by Ronald Wells). The time of the establishment of the 365-day Egyptian civil calendar has not been convincingly proved. However, from writings that have survived from Elephantine, Egypt during Persian rulership over Egypt, the double dating scheme that equates certain dates in the Egyptian calendar with dates in the Babylonian calendar unquestionably demonstrates that from 471 BCE onward into the Middle Ages this Egyptian calendar was used (see Horn and Wood 1954, Parker 1955, and Porten 1996). Since this calendar loses about 1/4 of a day each tropical year, in 120 years it would lose about 30 days. The Egyptians certainly realized that this calendar would continuously lose time in comparison to the agricultural year, but it did not stop them from using it anyway. Furthermore, this Egyptian calendar became the preferred calendar by which the best Greek astronomers in Alexandria recorded their astronomical observations, although they knew it fell short of the tropical year, which they measured quite accurately.

The main point in all this is to emphasize that any practical ancient calendar may have a concept of a *year* associated with that calendar, so that such a calendar *year* need not equal the tropical year. As long as a society considers a calendar *year* sufficiently practical for its use, it may use such a *year* for centuries regardless of its lack of accuracy compared to the tropical year. For ease of computation in whole numbers and payment for months worked, it is convenient to use 12 months of 30 days each and thus use a civil calendar of

360 days. The existence of such a calendar *year* does not provide evidence that a tropical year ever actually contained 360 days. The only way that such a claim could be proved is if there was historical evidence that the agricultural year actually averaged 360 days over many years, or if surviving archaeological statements associated with astronomical cycles claimed or directly implied that a tropical year equaled 360 days. This question of whether there is any known evidence in man's history for a 360 day tropical year has come up twice on the web site for discussions on the history of astronomy, HASTRO-L, since I became a member in 2000, and thereby received all its emails since then. HASTRO-L is the only on-line discussion group exclusively devoted to the history of astronomy on the Internet. HASTRO-L has many active contributors who are professors of history and professors of astronomy. There is no historical evidence that a tropical year ever equaled 360 days, although there is evidence for an ancient calendar having 360 days in certain areas of the ancient Middle East.

Some people have conjectured that during the time of the biblical flood in the days of Noah, a tropical year or a biblical year had 360 days. This remains unproved speculation. Chapters 7 and 8 of Genesis do not claim that each of the periods of time mentioned are non-overlapping, and do not claim that the sum of these time periods fully cover one exact year. The belief that a tropical year at the time of Noah had exactly 360 days is mere speculation.

[29] The Beginning of the Month and I Samuel 20

I Samuel 20 is very instructive to show how the biblical month began during the time of Samuel the prophet when King Saul reigned. It will be shown from the wording of this chapter that no calculated calendar could have been used at this time in Israel's history.

At this time of David's young adulthood, he has already experienced attempts by King Saul to kill him (I Sam 18:10-11; 19:9-10), but his very close friend Jonathan, the king's son, has great difficulty believing that his father wants to kill David. In order to convince Jonathan that Saul wants to kill David, David devises a plan to cause Saul to reveal his attitude toward David in the presence of Jonathan. Notice that this plan involves a day count of three from the following literal parts of verses.

I Sam 20:5, "until the third evening".
I Sam 20:12, "about [this] time the third morrow".

I Sam 20:19, “and [on the] third [day]”.

This shows their advance confidence that it would probably take two successive days for Saul’s actions to bring to light his attitude toward David. They expected that Jonathan would witness two consecutive days of Saul's behavior. The context assumes that the reader will automatically understand this without any explanation. We need to carefully examine the context to note what the writer of the text expected the reader to know.

I Sam 20:5, “And David said to Jonathan, Behold, tomorrow [is a] new-moon, and I should sit with the king to eat ...”.

I Sam 20:18, “And Jonathan said to him, Tomorrow [is a] new-moon, and you will be missed because your seat will be empty”.

In these verses the word “tomorrow” is translated from the Hebrew word *machar*, Strong's number 4279. This word refers to the next daytime, which begins in the morning rather than sundown. According to the choice of Hebrew words in these verses, the beginning of the festivity relating to the new moon is in the morning rather than at sundown. In these verses there is no reference to the standard Hebrew word for day, which is *yohm*, Strong’s number 3117. The use of the Hebrew word for new moon in these verses is not referring to a 24-hour day, but instead it refers to the time of festivity.

These two verses show that it was considered important for David to be present at a banquet hosted by the king due to a “new moon”, and there was a seat reserved for David. There is nothing in the context to suggest that this was the beginning of the seventh month and that a holy convocation was to take place. Indeed, if this had been the beginning of the seventh month, verses 5 and 18 would have more to say about why David would be missed! The reason given is the new moon, nothing more.

The Hebrew syntax in verses 27 and 34 is the same for one phrase that is not like any place in the Hebrew Scriptures where a numbered day of the month is mentioned. The Hebrew word order is “the *chodesh* the second”, which occurs that way four times in the Hebrew Bible: I Sam 20:27, 34; I Ki 6:1; I Chr 27:4. In the latter two places it means “the second month”. This expression “the *chodesh* the second” does not have the Hebrew word *yom* for “day”, does not have a preposition attached to the beginning of the number, and has the number after the word *chodesh*. These three factors do

not occur in any place where a numbered day of the month is mentioned in the Hebrew Bible. A Hebrew expression for a numbered day of the month occurs 98 times in the Bible. In 92 of these cases the Hebrew preposition *bh* (meaning "in" or "on") precedes the number. In two of these cases the Hebrew preposition *ad* (meaning "until") precedes the number. In 39 of these cases the Hebrew word *yom* (meaning "day") occurs at the number. While there are a total of four cases (Ezra 3:6; 10:17; Est 9:19, 21) in the Hebrew Bible where a numbered day of the month is mentioned and no preposition is prefixed to the number, all of these cases do have the Hebrew word *yom*, and none of these four cases have the number after the word *chodesh*. There is no example in Scripture with the syntax as in I Sam 20:27, 34 to indicate that is could mean a numbered day of the month.

The Hebrew word *chodesh* sometimes means "new-moon" and sometimes means "month", but because the syntax of this phrase in these two verses is never used for a day of the month, and because its meaning as "new moon" here gives a satisfying explanation to the context including the planned meeting of Jonathan and David on the third day from their initial meeting, *chodesh* will be translated "new-moon" below.

I Sam 20:27 literally states, "And it happened on the morrow of the new-moon the second, [the] place of David was empty. Then Saul said to Jonathan his son, Why didn't the son of Jesse come either yesterday or today to the meal?"

When the NASB is used, items in square brackets will show where the NASB has italics, indicating that no Hebrew word occurs for the italics. It may sometimes be useful to consider omitting the words in square brackets in the NASB because they are not based on words in the Hebrew text.

I Sam 20:27 [NASB], "And it came about the next day, the second [day of] the new moon that David's place was empty ..."

Thus there was something special about that meal on two successive days that made David's presence expected at both meals.

In verses 28 through 33 Saul and Jonathan dialogue with one another so that Jonathan becomes convinced that Saul wants to kill David.

I Sam 20:34 literally states, “And Jonathan arose from the table in fierce anger, and did not eat food on [the] day of the new-moon the second because he was grieved for David, for his father had dishonored him.”

I Sam 20:34 [NASB], “Then Jonathan arose from the table in fierce anger, and did not eat food on the second day of the new moon, for he was grieved over David because his father had dishonored him.”

I Sam 20:35 literally states, “And it happened in [the] morning that Jonathan went out [into] the field at [the] time appointed [with] David, and a little boy [was] with him.”

The morning in verse 35 is within the third day that David and Jonathan had planned to meet.

The special meal at the king's table on two successive days during which the presence of David, a national hero, was expected, shows that both meals were to commemorate the start of the month. The need existed to have two days of commemorative meals because they did not know in advance which of the two days would in fact begin the new month. From I Sam 20:27 we can say that David and Jonathan did not know in advance which of two successive days would officially be declared the new moon day, because otherwise there would not have been a need for two successive days of a festive meal during which David was expected to appear. The phrase in I Sam 20:5, 18 that “tomorrow is a new-moon” is literally misleading because it can be expected to cause the reader to think that they knew in advance that tomorrow would in fact actually be the first day of the new month. It should be translated “tomorrow is the new moon [festivity]”.

I Sam 20:5, 18 was applied to the first day to come, and the designation of “new-moon the second” was given to the second day to come. The need to have a second day of commemoration indicates that on the first of the two days, the new moon was not officially declared by the Levitical priesthood to be the start of a new month by the blowing of two silver trumpets in accordance with Num 10:10.

The average length of a month is close to 29.5 days, and most of the time there is an alternation of 29 and 30-day months, although there certainly are exceptions. At the time that David and Jonathan first met, one would surmise that the previous month had 29 days, so that it was most likely that

the current month that was nearly over would have 30 days. Thus, when David and Jonathan first met, they planned for the current month to be a 30-day month so that their next meeting would be on the third day rather than on the second day. They believed it was most likely that a second festive meal day would be needed due to an expected 30-day month. Therefore, when I Sam 20:5 and 18 speak of "tomorrow [is the] new-moon", that refers to the festive national holiday (not holy day) on the first of two successive days during which the new month might begin. The author of I Samuel 20 expected the reader to understand that there was to be at least one, and possibly two, successive days of festive meals at the king's table at the start of each month.

The start of a month is used to determine festivals, so by Gen 1:14, the light of a heavenly body must determine the start of a month. The first light of the moon would not anciently be known until it was seen. I Sam 20 is evidence that the day of the new moon was not pre-calculated, because otherwise there would not have been a need to plan for two successive days of festive meals. A pre-calculation would have been calculated to precisely one day rather than a choice of two days.

I Sam 20:5 and 18 should be understood to mean "tomorrow [is the] new-moon [festivity]" rather than the officially declared new moon. In other words, David and Jonathan did not really know that "tomorrow" would actually be the first day of the new month. In fact they expected that "tomorrow" would not be the first day of the new month!

When reading Josephus, one must be on guard for any reason that Josephus might have for distortion in his account of an event. In his description of I Sam 20 it is difficult to see any reason why he might deliberately distort any technicalities of the story. This chapter should not have been a controversy among Jews in the time of Josephus. He was certainly living at a time when Hebrew was still spoken among the upper class in Jerusalem where he was reared in the first century. Josephus was born in the year 37, so he was 32 or 33 years old when the Temple was destroyed in 70.

Josephus corroborates the translation of ***second new-moon*** in his paraphrase of I Sam 20:27. On pages 283 and 285 of Josephus_5, Ant 6:236, we read, "But when, on the second day of the feast of the new moon, David again did not appear, he asked his son Jonathan why, both on the past day and on this, the son of Jesse had been absent from the festive meal."

The Greek word that Josephus uses for “new moon” in the above translation is *noumeenia* (Strong's number 3561), not the Greek word *meen* (Strong’s number 3376), which means “month”. Thus the NASB, taking the Hebrew syntax as it is, translates it so as to agree with Josephus who chose the Greek word for “new moon” rather than the Greek word for “month”. The William Whiston translation is very poor here because he translates it as though Josephus used the other Greek word (*meen*).

Page 861 of the chapter by Moshe David Herr translates I Sam 20:27 “But on the morrow of the second new moon ...”, and translates I Sam 20:34 “... and he ate no food the second new moon day”. According to pages 84-85 of the book by Cahn, the Karaite Benjamin Nahawendi c. 825 CE understood I Sam 20:27, 34 similarly. The German interlinear translation by Rita Steurer also translated these verses using the German translation equivalent to “second new moon” rather than “second day of the month”. The German word for new moon is different from the German word for month.

On page 36 of the book by Solomon Gandz he wrote, “There can be no doubt that ‘on the morrow of the second new moon’ [in verse 27] has the same meaning as ‘on day of the second new moon’ [in verse 34] and that both phrases refer to the second day of the new moon festival, on which a festive meal was given at the King’s table and in which David was supposed to take part.” The very title of the chapter by Gandz is “The Origin of the Two New Moon Days”, and his analysis is consistent with the analysis given here, although his arrangement of the explanation is different and he does not use all of the logic presented here.

Within the above quote from Gandz, I have added the items in square brackets, and the two expressions enclosed within apostrophes have, in Gandz' work, the Hebrew words rather than the literal translation that I have substituted. Gandz discusses this chapter and Jewish commentaries upon it during the past 1700 years.

Horace was a Roman poet and satirist who wrote in Latin and lived from 65 BCE to 8 BCE. On page 20 of the book by Horace, Satire 1.9.67-70 states: “’Surely you wanted to tell me something, something confidential?’ ‘Oh, yes, but I'll choose a better time. Today is the thirtieth Sabbath. Why offend the circumcised Jews?’ ‘I don't care about religion’, I moan”.

Here the expression “thirtieth Sabbath” is a literal translation of Horace's Latin expression *tricesima Sabbata*. On page 375 of the book by Louis Feldman we find the following comment on this expression as found in the satire, “In summary, Horace's allusion in *tricesima Sabbata* is more effective if it refers not to some meaningless nonsense but rather to the thirtieth, a Sabbath, that is, the New Moon, so prominently celebrated in Horace's time.” Here it must be understood that the Jews desired to have a holiday (not holy day) on the new moon days. The Romans understood that the word Sabbath to a Jew meant a day on which he did not work at his ordinary job. It was easier for the Jews to tell the Romans that the new moon day that was the thirtieth of each month was always a Sabbath (called the thirtieth Sabbath) than to use other more accurate words from the biblical viewpoint. Biblically the new moon was not a Sabbath, but the Jews called it a Sabbath to simplify the implications of not working to the Romans.

The first of the two possible days of sighting the new crescent would place the first day of the month on the 30th day of the old month. Hence in Jewish practice of that time the 30th would be a holiday or a vacation day, and by loose extension (not technically correct), called a Sabbath. Since Horace expected his readers to understand him, this new moon holiday, called the “thirtieth Sabbath” was well known in Rome in the late second century BCE.

It was common knowledge in the Roman Empire during Horace's adulthood that Jews refrained from work on the first of the two possible days on which the new month might begin. This harmonizes perfectly with the implications from the Hebrew in I Sam 20:27, 34 and the whole chapter. The paraphrase by Josephus also agrees with this.

If Israelite society at the time of King Saul, when the prophet Samuel was still alive, was using a calculation to determine the start of the next month, there would have been no point in having two successive days of festive meals associated with the new moon, which shows an uncertainty of which day among two successive days that would start the month. Thus no calculated calendar could have been used at this time of Israel's history. Ancient Israel did not employ predictive astronomy for their calendar.

[30] Applying I Sam 20 to II Kings 4:23 and Amos 8:5

In II Ki 4:8-11 we see that a woman in Shunem made a room available for Elisha to lodge at whenever he was in that neighborhood. According to maps that are commonly available in some Bibles, and according to Josh 19:18, which shows Shunem within the boundary for the tribe of Issachar, Shunem was about 10 miles to the southwest of the Sea of Galilee (named differently in Elisha's day). This is in the southern part of Galilee, about 60 miles north of Jerusalem, certainly not local to Jerusalem to be able to hear two silver trumpets blowing, and then soon going to witness a priestly ceremony for the beginning of the month. In II Ki 4:22 she asked her husband to prepare a donkey for her to ride upon to visit Elisha. In verse 23 her husband responded, “Why are you going to him today? It is neither the new-moon nor the Sabbath.” This shows that under normal circumstances this wealthy woman rode a donkey to visit Elisha on the new moon and on the Sabbath. However, in I Sam 20, the day for a new moon festivity was simply called the new moon, and it occurred immediately after the 29th day of the month. The same is true in the days of the Roman poet Horace before the first century. Based upon this, we should understand the question in I Ki 4:23 to mean, “It is neither the new-moon [festivity] nor the Sabbath.” This new moon festivity may be the first of two successive days of festivity.

Recognizing now, that the context with the Hebrew word *chodesh* for “new-moon” may mean "new moon [festival]", the reader should not be surprised if this translation is proposed for appropriate contexts. The prophet Amos criticizes many people in the land who complain as follows in Amos 8:5, “When will the new-moon [festival] be past that we may sell grain and the Sabbath [be over] that we may trade wheat?” This indicates that there were restrictions by the national government against some activities on the new moon festival, but it does not indicate that there was some law within the law of Moses that prevented certain work on such days; there is no such law. There is no sin where there is no law. Nevertheless, Amos 8:5 along with II Ki 4:23 does indicate that the population beyond Jerusalem did involve themselves to some degree with the new moon festivity.

Since the new moon festivity had significance throughout Israel, it would especially have significance where the High Priest, the ark, the Temple, and the ceremonial sacrifices took place. Although ceremonial details are not specified in Scripture, this implies that people near the Temple would witness the priestly ceremonies associated with the beginning of the month. However, there is no commandment in the law of Moses that ordinary work

was forbidden or that attendance at this priestly ceremony was required for the beginning of the months.

[31] Rapid Communication to inform the Nation about the New Moon

Lev 23:24-25, "Speak to the children of Israel saying, 'In the seventh month, on [the] first [day] of the month, you shall have a rest, a memorial of soundings, a holy convocation. You shall not do any servile work and you shall offer a fire offering to YHWH.'"

This first day of the seventh month was a festival day in which no ordinary work was done, and there was a commanded meeting with a festival service for this day. Deut 16:16 specifies the three times of the year when the adult male population was commanded to gather in one location within Israel, and the first day of the seventh month was not one of those three times. Therefore, this festival at the beginning of the seventh month was kept at various local places throughout the nation. About half the months had 29 days and half the months had 30 days. These did not always alternate. The weather might be cloudy. Thus there would often be uncertainty whether the first of the two possible days for the new moon festivity would be the actual beginning of the seventh new month. With such uncertainty, the people would have no choice but to avoid normal work and have a holy convocation on the 30th day. If that first day would not be declared the actual beginning of the seventh month, they would then celebrate two consecutive days for the first day of the seventh month. A method of rapid communication would be needed to inform the local gatherings around the country that the first day of the new moon festivity was declared to be the actual start of the seventh month, if this had happened. Once the priesthood declared the first day to be holy, the next day was not holy. Rapid communication would make it unnecessary to celebrate a second day as a holy day in the local areas after the priesthood declared the first day to be holy.

How would rapid communication throughout all Israel be possible in ancient times?

When the new crescent is seen, shortly afterward the moon falls below the horizon and then there is no moonlight at all and it is very dark all night. This makes it dangerous to travel at night, whether to go to the top of some local hills or to return after arriving. A lantern could make travel possible, but it would be slow and still dangerous in total darkness. Consequently,

regardless of the method of primitive communication (certainly no telephones, Morse code, or radio), it would have to wait until daylight. During some circumstances of difficulty in sighting the new crescent near Jerusalem, the priesthood might even have to wait until some time during the middle of the following daytime to know whether to declare that first day as the true start of the new month.

Any big task is performed more quickly if multiple people are able to divide the task into smaller pieces, each one doing a small piece. For this to be effective in reducing the total time from start to finish, the time of their activity must overlap. Light travels much faster than people, horses, camels, or birds. Consider the following proposal. On the morning of the 30th day of the month certain people are appointed to travel to the top of designated hills throughout the country with materials that are able to start a controlled fire. The separated hills throughout the country would have to be close enough that they could see the fire from hills in the various directions. When the two silver trumpets were blown to announce the declaration of the start of the new month, the designated people who heard the trumpets would light their fires, and then this would rapidly spread throughout the country. The biggest time lag factor would be the time required to light the fire. It is even possible that a very small fire that could not be seen from far away was started first, and then this fire that was already kindled could speedily be used to start a larger fire that could be seen from other hills. Such a system could enable all of Israel to know about the declaration of the new month within a few hours during the afternoon of the 30th day. While it is perhaps possible to imagine this happening at night, it does not seem very likely because of the possible danger when visibility is impossible without a fire. Another problem with suggestions that the procedure occur at night is the likelihood that some of the watchers might fall asleep at night while waiting to see a fire at another hill. During the daytime it would be more interesting to be looking because there would at least be visible scenery.

There is documentation of such a fire system for rapid communication in the *Mishnah*, which was published c. 200 by Judah the Nasi (Prince). Although appendix A shows reasons for rejecting the *Mishnah* as infallible for both doctrine and history, such a fire system for rapid communication does make common sense and it is difficult to imagine why there ought to be doctrinal bias associated with the general concept even if some of the details are embellished and not trustworthy.

On page 301 of the *Mishnah* at RH 2:3 we find (square brackets are by Jacob Neusner),
"A. How did they kindle flares?
B. They bring long cedar wood sticks, reeds, oleaster wood and flax tow.
C. One binds them together with a rope.
D. And he goes up to the top of a hill and lights them.
E. Then he waves them to and fro and up and down, until he sees his fellow, doing the same on the next hilltop, and so on the third [and beyond]."

On the same page at RH 2:5 we find,
"A. There is a large courtyard in Jerusalem, called Bet Yazeq, to which all the witnesses gather.
B. And there the court examines them.
C. Now they prepare big meals for them, so that they should make it a habit of coming."

On page 302 at RH 2:6 we find,
"A. How do they examine the witnesses?
B. The pair which makes its appearance first do they examine first.
C. They bring the elder of them and say to him, 'Tell us, How did you see the moon? Was it facing the sun or turned away from it? Was it to the north or to the south? How high was it, and in which direction was it leaning? And how broad was it?'
D. If he said, 'It was facing the sun,' he has said nothing at all.
E. Then they would bring in the second party and examine him.
F. If their testimony coincided, their testimony was confirmed.
G. And in the case of all the other pairs of witnesses, they ask the main points,
H. not because they need their [evidence], but so that they should not go out disappointed,
I. so that they would make it a habit of coming along in the future."

[32] Summary about the New Moon Celebration and the Role of the Daytime

In summary, the 30th day of each month was a national holiday, not a commanded holy day, except for the seventh month. Two successive days may be celebrated for the beginning of the seventh month, and indeed for the beginning of every month. The priesthood had certain commanded duties to perform at the beginning of each month, but this was only commanded in

one location where two priests blew two silver trumpets to summon the assembly, thus announcing the beginning of the new month and alerting the local people that the time had arrived for them to come and celebrate the proceedings associated with the new moon ceremonies. Some of the population in various parts of Israel was involved in feasting on the 30th day of each month. Based on the example of I Sam 20, such feasting would also occur on the next day if the new moon was not declared on the 30th day.

The following are some practical factors that are associated with the 30th day:
(1) There was a need to enable the whole of Israel to know whether the 30th day began the new month.
(2) There was a need to wait for possible witnesses to arrive at the site where the two silver trumpets were waiting with the priests, and this might not happen until sometime during the following daytime.
(3) Rapid communication would require the daytime to enable the whole nation to be informed of the day that began the month.

The daytime of the 30th day was an important part of the celebration, and not merely for a festive meal. While it is certainly possible that witnesses could arrive during the night, only during the daytime was it possible for significant numbers of local people to witness the ceremonies associated with the new moon, provided that the declaration was made. For that reason, even if witnesses arrived during the early part of the night, common sense would dictate that the priesthood would always want to begin the ceremonies at a time of the daytime when a maximum number of people could be present. Therefore, the daytime of the first day of each month was significant for the ceremonies and the people. The daytime was also significant for communication on the 30th day to the rest of Israel.

The sundown that began the 30th day was primarily significant in watching for the new crescent, not for the celebrations of that day if the new moon was declared.

[33] Today's Ambiguity in the Phrase *New Moon*

One source of possible confusion is the failure to realize that present day astronomers and almanacs define a new moon in a way that usually precedes the biblical new moon by one or two days. In order to avoid confusion, I will call the modern astronomer's new moon the ***astronomical new moon***, not

the *new moon*. Another modern equivalent expression for the astronomical new moon is the ***conjunction of the moon with the sun***, or more briefly and simply, the ***conjunction***. At the time of the conjunction no one can see the new moon.

[34] Biblical View of the Sun's Yearly Motion is South - North

Ecclesiastes mentions the sun (*shemesh* in Hebrew) more than any other book of the Bible - 35 times! One pair of verses gets specific about its motion, but this is only noticed if care is taken to preserve the Hebrew word order and if courage is exercised to allow the Hebrew to make sense! A literal translation of Eccl 1:5-6 with special attention to keeping the word order the same as it is in the Hebrew text is:
Eccl 1:5, "And rises the sun and goes [away] the sun and to its place it pants, rising it there [again].
Eccl 1:6A, It [the sun] goes toward south and turns around toward north.
Eccl 1:6B, Turns around [and] turns around goes the wind, and on its circuits returns the wind."

Page 55 of Zlotowitz translates Eccl 1:5-6, “And the sun rises and the sun sets - then to its place it rushes; there is rises again. It goes toward the south and veers toward the north; the wind goes round and round, and on its rounds the wind returns.” On the next page appears the comment, “*Midrash Leckach Tov* [by Toviah ben Eliezer, 11th century] interprets this verse [verse 6A] as referring to the course of the sun as manifested by the winter and summer seasons, but it adds that on a deeper level the verses [5-6] refer to the Jews [they have moved from place to place due to persecution].”

About the year 400 CE Jerome translated the Tanak from Hebrew to Latin, which, except for the Psalms, became the Latin Vulgate. Page 307 of Japhet gives the following careful translation from Jerome's Vulgate for Eccl 1:5-6, (additions in square brackets are made by Japhet), “The sun rises and [the sun] sets and returns to its place. It rises there, goes to the south and turns about to the north. As it circles the world around goes the spirit, and upon its circuit returns [the spirit].” Jerome made this rhyme in the Latin.

In general I never use the Septuagint translation (abbreviated LXX) as a means of understanding some seldom used Hebrew words or difficult passages of the Tanak because it often shows mere guesses for the Greek translation, so it is not reliable as an ancient indicator of the meaning of the

Hebrew Bible. Among all of the books of the LXX, Ecclesiastes stands apart in a special way. Page 7 of Seow reveals, "The translation technique of LXX Ecclesiastes is unique among the books in the Bible, so that one may say with a reasonable amount of certainty that the translator is not the same as for any other books. The translation shows a number of features that are typical of the works of Aquila of Pontus, a second-century (C.E.) gentile convert to Judaism. Aquila, a pupil of the famous Rabbi Aqiba is best known for his translation of the Hebrew Bible into literalistic Greek [about 135 CE], among other reasons, to provide Jews who spoke Greek but did not read Hebrew or Aramaic with a translation that would reflect the Hebrew as much as possible. Thus, the Hebrew word order is rigidly adhered to and all details in Hebrew are represented, even when they seem awkward or even nonsensical in Greek." While scholars debate whether Aquila was the translator, we do know that the LXX for Ecclesiastes is literal and sticks very closely to the Hebrew. The commonly available translation of the LXX by Brenton translates Eccl 1:5-6, "And the sun arises, and the sun goes down and draws toward its place; arising there it proceeds southward, and goes round toward the north. The wind goes round and round, and the wind returns to its circuits." This translation reflects the fact that the word for "wind" does not occur in the Greek until after the word for "north". In fact, the Greek word order after "north" is "round round courses the wind", so Brenton's translation does put "wind" earlier in the verse than the Greek indicates. The Greek word *pneuma*, Strong's number 4151, is used for wind, which is the translation of the Hebrew word *ruach*, Strong's number 7307. Page 300 of Japhet translates the LXX more literally, "And the sun rises and the sun sets and draws to its place. It rises there, goes to the south and turns about to the north. Turns about, turning goes the *ruach* (*pneuma*), and upon its circuit returns the *ruach* (*pneuma*)." In footnote 31 on page 301 Japhet remarks, "This faithfulness to the MT [Massoretic Text of the Hebrew] is particularly striking when it creates forms which are awkward in the Greek."

Pages 298-299 of Japhet point out that Rashi, the well known Jewish commentator of the late middle ages, also treats the sun as the subject in Eccl 1:6.

The Syriac language is an offshoot of first century Aramaic and is thus a Semitic language that has affinities to Hebrew. The Syriac Peshitta is a translation from the Hebrew Bible that was made about 200 CE. The Peshitta in its literal word order, is in agreement with the Hebrew text of Eccl 1:5-6 in continuing with the sun as the subject of Eccl 1:6A; however,

George M. Lamsa's translation from the Syriac Peshitta departs from the literal view and translates it as if the wind were the subject at the beginning of verse 6. Lamsa often departs from the Syriac to agree with the KJV.

Page xi of Sternberg translates Eccl 1:5-6A, “The sun rises and the sun sets and hastens to its place and rises there. It walks to the south and returns to the north.”

In Sternberg's above translation the word “walks” comes from the Hebrew word *halach*, Strong's number 1980, which is typically used in reference to people walking, yet it is used in other ways for the movement of inanimate objects. However, from the viewpoint of an observer on earth, the position of the sun at sunset from day to day does change in distinct increments as a “walk”, and the position of the shadow cast by a narrow object at noontime from day to day also changes in distinct increments as a “walk”. These changes do form a south-north yearly cycle as will now be explained.

[35] The South - North Yearly Cycle indicated in Eccl 1:6A

A person who views sunsets daily from a place at which there is a clear view of the horizon might notice that the sun does not set at the same part of the horizon each day. He might think of performing the following experiment to determine the daily change in the position of the sun at sunset.

Permanently place a straight board and an object with a sighting point so that the middle of the board is about the length of a person west of the sighting point, and when looking approximately west with one's eye at the sighting point, the long top edge of the board is even with the horizon. Each day near sunset make a mark on the board where the board crosses the line of sight from the sighting point to the middle of the sun. For accuracy this should be done when the center of the sun is at the horizon.

If this is done from anywhere in the north temperate zone, for example Jerusalem (latitude 31.8 degrees north), during the coldest part of the year, the daily marks on the board keep going north (to the right). During the hottest part of the year the daily marks on the board keep going south. For several days while the temperature is getting quite hot, the marks will be at about the spot that is the furthest north of the marks; the middle day of this group is the day of the summer solstice. For several days while the temperature is getting quite cold, the marks will be at about the spot that is

the furthest south of the marks; the middle day of this group is the day of the winter solstice. The word "solstice" means "stopping of the sun" which describes the state of the marks at the solstices. At all other times of the year the marks are separated from one another while heading north, or separated from one another while heading south.

The marks on the board are furthest from one another at the midpoint between the solstice marks because the south-north motion of the sun is fastest at these points. The mark closest to the midpoint while the marks are heading north is the mark at the vernal equinox. The mark closest to the midpoint while the marks are heading south is the mark at the autumnal equinox. Although this method determines the equinoxes quite precisely by first knowing the solstices, it is not necessary to know the day of the solstices precisely because the marks barely change for several days about a solstice. Page xii of Sternberg is one of several sources that discusses this.

[36] Equinox and Solstice is in the Bible

The Hebrew word *tkufah*, Strong's number 8622, occurs four times in the Bible, Ex 34:22; I Sam 1:20; II Chr 24:23; Ps 19:7. In 1907 when the BDB lexicon was published (see page 880 for *tkufah*), the Dead Sea Scrolls were not yet discovered and clarifying insightful meanings into some ancient Hebrew words were not yet available. The Dead Sea Scrolls use the Hebrew word *tkufah* in contexts before the first century, and this is now discussed.

The paper by Hoenig discusses a scroll labeled I QH among the Dead Sea Scrolls. On pages 312-313 he explains two expressions found there: one is "*tkufah* of the day" and the other is "at the appointed time of the night at *tkufah*". Hoenig explains that the former means "zenith of the day" meaning "noon" and the latter means "at the appointed time of the night at zenith" meaning "midnight". It is particularly interesting that in the expression "at the appointed time of the night at *tkufah*" the Hebrew word for "appointed time" is *moed*, the same word used for the holy days in Lev 23 and for seasons in Gen 1:14. Thus it is not foreign to ancient Hebrew to use or associate *tkufah* with *moed*. This use of *tkufah* shows two heavenly bodies, the earth and sun, interacting on a daily basis so that at astronomically distinctive points in time *tkufah* refers to those points in time.

In the book chapter by Johann Maier one of the Dead Sea Scrolls is discussed that contains the Hebrew word *tkufah*. On page 146 Maier writes,

“The Songs themselves are attached to the thirteen Sabbaths of one quarter or season (*tqufah*) of a year, according to the editor the first quarter (the Nisan season) only.” Here we see the Hebrew word *tkufah* used for the season of spring, which begins with the vernal equinox and ends with the summer solstice. Here also astronomically distinctive points in time involving the earth and sun define a time period called *tkufah*.

The intertestamental apocryphal Book of Sirach (also known as Ecclesiaticus) contains the Hebrew word *tkufah*. This book was written in Hebrew about 190 BCE, but today only incomplete sections of it have survived, having been discovered with thousands of other Hebrew texts in the attic of a synagogue in Cairo, Egypt toward the end of the nineteenth century. The treasure of texts in that attic, which survived for many hundreds of years, is known as the Cairo Geniza. There are many copies of Sirach in Greek translation, and most of the Hebrew words in Sirach 43:7 are preserved, one of them being *tkufah*. The Greek translation for *tkufah* is *suntelia* (Strong's Greek number 4930), which means completion, fulfillment, or destruction. These words indicate a point in time at which some event occurred. In harmony with this idea, the Jerusalem Bible translates Sirach 43:7, “the moon it is that signals the feasts, a luminary that wanes after her full”. Here “her full” refers to the full moon and is translated from *tkufah* or *suntelia*. Here *tkufah* refers to a natural distinctive time of the moon in its movement about the earth.

These contexts from the Dead Sea Scrolls and from Sirach from before 70 CE show that the Hebrew word *tkufah* is used to refer to natural distinctive points or time intervals associated with the heavenly bodies of the earth, sun, and moon.

On page 394 of the lexicon by Holladay the word *tkufah* is defined. The parentheses and square brackets are part of the text of that book by Holladay where he writes about *tkufah* “turning (of sun at solstice) Ps 19:7; (of the year, i.e. end of year, at autumnal equinox) Ex 34:22; (of the days [i.e. of the year] = end of year I Sam 1:20”.

In Ex 34:22 Moses was told, in literal translation, “And you shall celebrate ... the Feast of Ingathering *tkufah* the year”. There is no Hebrew preposition attached to *tkufah* here so that the relationship between this feast and *tkufah* is very indefinite although translations attempt to make it definite by adding some preposition that is not in the Hebrew. This verse does not

define an explicit relationship between these events, but merely indicates that there is some vague closeness in terms of the general year. In harmony with the astronomical uses shown above, this refers to the autumnal equinox. Certainly Moses was aware of the equinoxes from the knowledge he gained in his upbringing in Egypt (Acts 7:22), and the fact that the greatest pyramids had one wall aligned exactly east-west. Only on the days of the equinoxes does the shadow of a vertical object fall exactly east-west all day long. The ancients were easily able to determine an east-west line. Therefore the equinoxes are visible signs of the sun in relation to the earth and do fall within the purview of signs in Gen 1:14 “lights in the expanse of the heavens ... for signs and for festivals and for days and years”.

The main points are:
(1) The Hebrew word *tkufah* found in Scripture does have use outside the Bible before Herod's Temple in Jerusalem was destroyed in 70 CE.
(2) Contexts with *tkufah* show it to mean distinctive points in time in relation to movements of the heavenly bodies as observed from people on earth. Also, it is used for the time period between the distinctive points, e.g., the Nisan *tkufah* or spring season. The word *tkufah* has multiple uses, as the examples showed.
(3) Moses used this word. While he did not specifically use it to refer to the vernal equinox, Ex 34:22 refers to the autumnal equinox, at least showing that Moses had a word in Hebrew that refers to an equinox.

Does Ex 34:22 refer to the end of the harvest when it uses the word *tkufah*? There is no ancient context that forces *tkufah* to mean a “point” of time defined by a harvest in contrast to ancient contexts that show it to relate to heavenly bodies. This is simply a matter of finding contexts that bring out meaning that is clear. Incidentally, the three main crops harvested at that general time of the year are figs, olives, and grapes. Figs are a summer fruit, whose harvest hardly ever extends into fall. The olive harvest occurs in September and October, and is over in most parts of Israel by about the third quarter of October. The grape harvest begins with sour grapes in July but with ripe grapes in some areas of Israel from the beginning of August. The grape harvest continues through about the first third of November in the area of Jerusalem. The uses of *tkufah* in the Dead Sea Scrolls show the meaning of a point in time.

[37] Equal Daytime and Nighttime is Not the Biblical Equinox

The word “equinox” comes from the Latin language and means “equal night” in that language, which implies that daytime and nighttime are equal at the time of an equinox. But did the ancient people that used this Latin name equinox use the meaning of this word in practice, or was it a mere guess that daytime and nighttime are equal on the days of the equinox? It will be shown that this was a mere guess.

Near the dates of the equinoxes the difference in time from sunrise to sunset from one day to the next is about two minutes. In order to determine the date upon which daytime and nighttime are equal at a certain latitude, it is required that a clock exist that can measure time during a 12 hour period to an accuracy that is better than two minutes per day. When ancient Babylonian astronomers recorded an eclipse or the disappearance of a planet behind the moon, they wrote down the time it occurred as well as the month, day of the month, and year of a king's reign. The paper of Stephenson explains that the smallest Babylonian unit of time was called an *us* and equaled 1/360 of a day, which is four minutes. Moreover, the Babylonians never expressed time as a fraction of an *us*. This shows that they made no attempt to express time more accurately than to the nearest four minutes with their water clocks. The paper of Steele showed a summary of a computer study of Babylonian astronomical phenomena from 562 BCE to 41 BCE, all recorded with a time of day. The conclusion was that the average accuracy of the recorded time was two *us*'s which represents eight minutes from the true time. Moreover, accuracy remained the same during this 500-year period; their water clocks used for this purpose did not improve. One reason that water clocks were not accurate is that as temperature changed, the dripping rate changed. Another reason is that the construction of the mechanism and the recording method were not accurate. Page 609 of Ward shows a graph of how the accuracy of time mechanisms improved through history, based on historical improvements. This chart shows a sudden leap to about two minutes per day in the year 1656 when Christiaan Huygens perfected the pendulum clock. Ancient peoples did not have the ability to determine the day at which daytime and nighttime were equal because their clocks were not accurate enough. The day upon which daytime and nighttime are equal depends on the latitude of the observation because refraction of light increases as one gets closer to the north and south poles.

As already explained from Eccl 1:5-6, the Bible indicates that the sun's annual position was noted on the basis of its south-north movement which was not a matter of measuring the time of day.

The Hebrew noun *tkufah* has an inner stem in common with the Hebrew verb *nahkahf,* which occurs 19 times in the Hebrew Bible. The latter means "to surround" 11 times - I Ki 7:24; II Ki 6:14; 11:8; II Chr 4:3; 23:7; Job 19:6; Ps 17:9; 22:16; 88:17; Isa 15:8; Lam 3:5. It means "to go around" four times - Josh 6:3, 11; Ps 48:12; Isa 29:1 ("add year to year, let feasts 'go around'"). It means "to destroy" twice - Job 19:26; Isa 10:34. It means "to curve" once - Lev 19:27. It means "to finish" once - Job 1:5. The overall flavor of this word indicates the idea of encirclement, which does not have any implication about accurate clock time measurement. The relationship between *tkufah* and *nahkahf* indicates that encirclement of heavenly bodies provides the basis of the meaning rather than the Latin meaning of equinox (equal night with day). When the word equinox is used, its original Latin meaning is discarded, and instead, the time of its practical determination anciently is meant. This time agrees with the modern astronomer's time for the equinox although the modern astronomer uses a technical definition that ancient peoples could not have used.

Page 124 of Pannekoek states, "Another instrument they [the Greek astronomers living in Egypt after the time of Alexander the Great] used was an equatorial ring, placed before the temples in Alexandria, in Rhodes, and perhaps in other towns, for calendar purposes. It consisted of a cylindrical belt, with its upper and lower borders exactly in the direction of the equatorial plane; the shadow of the southern half upon the inner side of the northern half left a narrow line of light at the upper or at the lower side of the equator. Thus the exact moment of the equinoxes could be fixed." This modern description of this ancient instrument uses the term "equatorial plane" which the ancient Greeks did not use; they bisected shadow angles at the solstices in order to construct this instrument, which is today called the equatorial ring. A discussion of the equatorial ring in use by the Greek astronomers and its inaccuracy due to refraction of the light from the sun is discussed on pages 15-17, 24-37 of the book by John Britton 1992. This problem of refraction could cause an error of one day if an equatorial ring were used.

Pages 73-74 of Pannekoek state, "The Babylonians, according to Greek testimony, used a vertical pole for measuring shadow length; thus they could determine the moments of solstice and, as medium points between the solstices, the moments of vernal and autumnal equinoxes."

The paper by Neugebauer 1980 proposes a simple geometric method by which the Great Pyramid could have been constructed so that it could have achieved its great accuracy in cardinal directions (precise east-west and north-south). Only on the days of the true equinoxes (not when daytime and nighttime are equal) does the shadow of a vertical object fall exactly east-west all of the daytime. This will be discussed further in the next chapter.

Pliny the Elder, writing about the middle of the first century, defines the equinox in two ways that are somewhat contradictory on page 309 of Pliny_1. He writes that “at the season of the equinox sunrise and sunset are seen on the same line”, and this is the east-west line; this definition is practical and accurate, and while stated in a way that is very different from a modern astronomy book, it is nevertheless the same in the time. Pliny also writes “the equal hours of day and night at the equinox”. When rounding off to hours this is correct, but not when rounding off to minutes in the latitude of the Mediterranean Sea where Pliny lived.

On page 81 of Pasachoff we find, “These points are called equinoxes because the daytime and the nighttime are supposedly equal 12-hour lengths on these days. Actually, because the refraction by the earth's atmosphere makes the sun appear to rise ahead of the middle of the sun, at U.S. latitudes the daytime exceeds the nighttime by about 10 minutes on the days of the equinoxes. The days of equal daytime and nighttime precede the vernal equinox and follow the autumnal equinox by a few days.” This is about four or five days for the U.S.

[38] The Vernal Equinox and Ex 12:2

Gen 1:14 mentions the lights in the heavens, and these are the sun, the moon, the stars, the planets, and comets. The cycles of the planets and comets are much too irregular in comparison to repeatable phenomena on the earth to consider in relation to a biblical calendar when considering the lights in the heavens. The stars must be excluded because during every 1000 tropical years the time of the appearance of the stars slowly shifts about 14.1 days further into the tropical year thus losing touch with the earth's seasons; this is called precession of the equinoxes in books on astronomy. Only the sun and moon remain to be considered. The moon determines the months but not which month is the first. Only the sun remains to be considered. The only repeatable time points involving the sun are the two equinoxes and the two solstices. Considering that the barley and wheat in Israel are harvested

in the spring, the vernal equinox is the only logical candidate to consider that involves the lights in the heavens on the direct basis on Gen 1:14.

We must seek to know what Moses knew. Acts 7:22 reads [NKJV], “And Moses was learned in all the wisdom of the Egyptians, and was mighty in words and deeds.” Pages 333, 336-337 of Lockyer show that most of the Egyptian pyramids are oriented east-west, and the two largest pyramids at Giza built by Cheops and Chephren are oriented east-west, having one wall aligned exactly east-west. Pages 63-64 of Lockyer explain that the sun's shadow on a vertical object from sunrise to sunset falls exactly east-west only on the days of the equinoxes. So it is clear that Moses knew how to determine the days of the equinoxes. When one considers that Gen 1:14 points to the lights in the heavens to determine the festivals and knowing that only the vernal equinox is related to the time of the year under consideration, Moses would naturally think of the vernal equinox in relation to Ex 12:2. That would be Egyptian training, Egyptian thinking, Egyptian context, and in harmony with Gen 1:14, the only explicit Scripture that directly addresses the determination of the festivals. Would Moses think of the vernal equinox if it had not yet occurred by that day? No, it would be premature for him to think of it. The natural thinking from Ex 12:2 in the context of Egypt and what Moses knew would point to the vernal equinox as having occurred.

Would Moses think it was necessary for him to explicitly mention the vernal equinox in the context of Gen 1:14? If this is the only choice there was, he need not think it was necessary. But the real biblical evidence will come when we get to Ezra and Nehemiah..

[39] Karl Schoch’s Curve for Predicting Visibility of the New Crescent

During the years 1907-1927 the German astronomer Karl Schoch (1873-1929) developed astronomical tables to predict the visibility of the new crescent. This was first published in German in 1927 and then in English in 1928. Before his death in 1929, he revised his tables downward into one simpler table. When the points are connected in this simpler table, it becomes a curve, which I call Schoch’s curve. The revised table is found on page 162 of the paper by Fotheringham, and it is reproduced in appendix C. This is the table that I personally use. It is only useful in the approximate latitudes of Israel and Babylon and below 4000 feet above sea level. (Schoch’s revised table is very close to the table that was independently

created by Paul Victor Neugebauer.) Although the original theoretical basis of Schoch's curve was eventually rightly criticized because it was partially based upon Babylonian records that were predictions rather than observations, further study based upon his table has verified its usefulness despite the fact that there is a borderline region during which it cannot accurately predict the visibility of the new crescent.

The paper by Fatoohi 1999 examines 209 examples of records of actual sightings of the new crescent by the ancient Babylonians. This involves the correct latitude for applying Schoch's curve, and the altitude is below 4000 feet. On page 66 of this study all 209 examples are plotted on a graph. This graph shows the original first curve of Schoch in 1927 compared with the curve of Paul Victor Neugebauer (this is close to Schoch's revised curve, which I use). It should be noted that the ancient Babylonians did not have the air pollution that prevails in modern society and even c. 1900 in Europe with its factories and smokestacks. The effect of today's general air pollution on visibility of the new crescent is not known. In the graph of the 209 cases, 8 of them fall below both the original Schoch curve and the curve of P. V. Neugebauer, the lowest two cases by about 0.9 degrees. I presume that today's air pollution would prevent those two cases. The fraction 8/209 is 3.8 percent of error below the curve. In this test there was no opportunity to know the number of cases in which people looked for the crescent above these curves and no one saw it. This graph also shows 8 examples above the lower curve, but not more than half a degree above the lower curve. Thus there are 16 examples out of 209 (which is 7.7 percent) that were borderline cases based upon plus or minus half a degree yet counting the two very low exceptions. If we exclude those two very low cases thinking that they would not be seen with today's air pollution, we have 14/209, which is 6.7 percent. We may tentatively conclude that about 7 percent of the cases are in the borderline region of plus or minus half a degree. This implies that Schoch's curve should be reliable about 93 percent of the time.

Schoch's curve is based upon certain angles of the sun, earth, and moon with respect to one another at the time of sunset, assuming clear weather, no air pollution, a reasonably low altitude above sea level (from today's knowledge we can say, under 4000 feet, which is higher than Mt. Zion), and the observation region is approximately in the latitudes of Israel and Babylon. Schoch observed both with and without binoculars, and correlated data with the results of others. His curve assumes naked eye observations (no binoculars, except perhaps for initial location to examine without

binoculars). Above that curve one can expect visibility of the crescent; below that curve, no visibility. In live practice, there is a narrow band near Karl Schoch's curve where it is near borderline and uncertain, so that some people with sharp vision looking at the right spot do see it, and others do not. Before Internet reports of crescent visibility were available, I used a computer program that utilized Karl Schoch's curve. I still use it and can tell whether it is near borderline, which generally should not exceed plus or minus 1/2 of a degree on Schoch's curve. If the humidity is very low or during the autumn when a low crescent looks like a flattened backwards C in the northern hemisphere, it may be seen as much as 1/2 of a degree below Schoch's curve, or possibly slightly lower. At the moment of the sighting of the crescent, if it is above 4 degrees in altitude above the horizon, then the distortion due to refraction is perhaps tolerable enough to consider that it might truly be recognized as the crescent. Below 4 degrees it is very doubtful that it could be recognized.

The principles of Karl Schoch's curve are explained next, without involving ourselves with mathematics. It is simply that the ***contrast*** between reflected light of the moon and the background sky must be ***different*** enough to perceive the arc of light.

For example, why don't people see the stars during the day? The stars are most certainly there during the day, but we do not see them because the contrast between the light of the stars (not their size which is much smaller than the center width of arc of the moon!) and the background sky is not enough. In other words, the sun's light is too brilliant to see the stars' light.

The most important word here is *contrast* or *difference*. That is why a nighttime bicycle rider is told to wear reflective or brilliant colored clothes. It does ***not*** matter whether the rider is fat or thin, but what matters is the ***contrast*** between his clothing and the blackness of night.

The same is true in seeing the light of the moon. Some computer programs (like Yallop's criterion) are based upon the apparent width across the center of the moon (or the percent reflection of the light of the moon, for example full moon 100 percent reflection).

When the sun sets, and you look at the background sky to the west, the brilliance of the sky is *not* the same everywhere. The further you look from where the sun sets, the ***less*** brilliant the background sky at that point. Also,

it is more brilliant directly above where the sun sets, than the same distance above, but also some distance to the right or left. It is these angles away from where the sun set that is an accurate measure of the ***brilliance*** of the background sky. If the moon is at a place where the background sky is not very brilliant, then and only then, can you see it. Thus the key is knowing the angles (the curve based on the graph coordinates of two angles) of where the sun is compared to where the moon is. This gives a measure of the contrast between the background sky and light from the moon.

Summary: Use the appropriate angles to determine the contrast, which was used to determine Schoch's curve.

If you take some width of the crescent and put it where the contrast is great, you see it. But if you take the same width of the crescent and put it where the contrast is small, you do not see it. Hence the ***width*** is ***not*** the main factor, but instead the ***contrast***. This concept is very simple, but the mathematics and astronomy are complex.

I do not use a program that predicts visibility of the crescent! Instead I use a program that gives me the accurate angles I want. Then I use the printed table that Karl Schoch determined (which really makes a curve by connecting the dots) to see if the moon is above the curve or below the curve. *Above* means visible. *Below* means not visible. But borderline is about 1/2 a degree above or below the curve (under 4000 feet) based upon extremes of humidity. As was mentioned above concerning the paper by Fatoohi and others, in ancient Babylon there were two cases among 209 in which people had reported seeing the new crescent at 0.9 degrees below Schoch's curve, but the air is more polluted today.

The key for borderline cases is humidity. The further you go below Schoch's curve, the lower the humidity must be to see it. For the areas with extremely low humidity one can go 1/2 a degree below Schoch's curve and still just barely see it.

Before modern high-speed communication and astronomical theory, one would have been reduced to local visibility, although I do not know how to define this and have never seen a definition of this that may be applied in a uniform manner considering the case of overlapping geographical areas for individual congregations. The first goal for a proponent of "local visibility" should be to define it so that the definition covers the issues of distance,

height above sea level, bad weather, the use of modern communications, et cetera. Perhaps one may give a definition of local visibility in terms of technology that was available about 1800 before the telephone and telegraph, but even the issue of using race horses for separated groups of people to communicate would begin to complicate matters. Can one apply a definition that might have made sense in 1800 to today's society, thus forbidding telephone calls and driving automobiles to learn what others have seen? While some people might say "yes" and want to pretend that we are locally primitive, even that is an arbitrary rule, and many people would want to communicate with others to determine what they individually should do.

[40] Ezra and Nehemiah in Relation to the Vernal Equinox and the Babylonian Calendar

Ezra 6:15 mentions the month Adar and Neh 6:15 mentions the month Elul. These are Hebrew transliterations of month names in the Babylonian calendar, but these verses are in the context of Jerusalem with the stamp of approval from Scripture. This chapter provides historical evidence that the Jews adopted the month names of the Babylonian calendar into their own calendar, apparently from the time of Ezra and Nehemiah onward. This would cause an obvious confusion unless it was true that nearly all of the time the months in Jerusalem would agree with the months in Babylon during the century of Ezra and Nehemiah. The goal is to learn when the first month of the biblical calendar begins by determining when the first month of the Babylonian calendar began during the century of Ezra and Nehemiah. Later, other corroborating evidence will be presented.

Appendix B provides the details that show the first month of the Babylonian calendar in the years from 499 BCE to 400 BCE, and it includes a discussion of the 19-year cycle. This appendix shows that near the middle of this century Ezra and Nehemiah journeyed from Babylon to Jerusalem.

The results from appendix B yield the following rule to determine the day of the vernal equinox in the Babylonian calendar during this century. Find the date containing the noontime that is closest to the time of the vernal equinox. That date is counted as the date of the vernal equinox. This appendix also provides the details showing that the first day of the first month of the Babylonian calendar during this century followed the pattern that the new crescent of Nisan was the new crescent that fell on or soonest after the day

of the vernal equinox. This implies that first the new crescent was sighted, and later that same day the vernal equinox was determined to have occurred.

The Jews were apparently willing to replace the use of the name Abib with the name Nisan in the context of Jerusalem because they accepted the Babylonian month names. Neh 8:2, 9 show that Ezra kept the holy day of the first day of the seventh month at the correct time. From this time onward Israel used the Babylonian month names for their calendar, which would have led to confusion unless the Israelite calendar and the Babylonian calendar began Nisan at the same time, almost always, during the century in which Ezra and Nehemiah lived.

The claim has been made that the Persian Empire forced the Jewish leadership in Israel to accept the Babylonian month names into their religious calendar and discontinue all of the original month names. Ezra 7 gives the text of a letter from the Persian King Artaxerxes to Ezra the priest, and in verse 16 the king writes that the religious laws are in the hand (power) of Ezra, showing that the king is respecting the independence of the priest in carrying out the laws of the Bible. Neh 5:14 shows that Nehemiah was appointed governor by the king, and in Neh 13:30 Nehemiah writes, "Thus I cleansed them [the Israelites] of everything pagan." Israel had religious autonomy and self-determination. If the Babylonian Nisan was oftentimes not the Jewish first month, then the Jews would have kept both sets of names to avoid confusion with their numbering of religious months. Or instead, the Jews could have merely used numbers of the months without names for the religious calendar. Another response to this is that the Persian Empire had no control over Scripture, and through inspiration of the Holy Spirit, Ezra 6:15 and Neh 6:15 could have used the month number rather than the month name in the context of Jerusalem. These verses give approval to the use of Babylonian month names and provide a calendaric witness to us.

The book of I Maccabees covers the history of Israel from about 175 BCE to 130 BCE and was originally written in Hebrew. It shows the military struggle of the Jews to gain independence from Seleucid domination. The Jews had some degree of success, but it was a continual struggle. In this context of greater Jerusalem the Jews use Babylonian month names for their calendar in I Macc 4:52, 59; 7:43, 49; 14:27; 16:14 when the Babylonian Empire and the subsequent Persian Empire no longer existed. Josephus also uses these month names and calls them Jewish, and these names have been

kept by the Jews until today. The existing biblical and historical evidence is that the Babylonian month names were not merely a secondary secular alternate method to designate dates apart from the biblical month numbers (as we today use January to December apart from the biblical month numbers), but that the Babylonian month names and the biblical month numbers were synonymous in designating months. For example, I Macc 4:52 reads, “Early in the morning on the 25th day of the ninth month, which is the month of Chislev, ...” This does not say that in this particular year the ninth month happened to be Chislev, but that the ninth month is Chislev. To emphasize this point even more vigorously, verse 59 states, “Then Judas and his brothers and all the assembly of Israel determined that every year at that season the days of dedication of the alter should be observed with joy and gladness for eight days, beginning with the 25th day of the month of Chislev”. Thus this festival of Hanukkah (Feast of Dedication in John 10:22) was always to begin on Chislev 25, thus requiring Chislev to always be the ninth month.

The book of Esther discusses the origin of the Feast of Purim, which has been kept by Jews from that time in 473 BCE in Babylon until today. For the year 473 BCE see the note to Est 8:12 in NIV. The date of the writing of the book of Esther is less certain. On page 718 of NIV we find, “Several scholars have dated the book in the Hellenistic period; the absence of Greek words and the style of the author's Hebrew dialect, however, suggest that the book must have been written before the Persian Empire fell to Greece [Alexander the Great] in 331”. In Est 9:19-23 it is clear that the Jews had decided that every year on the 14th and 15th days of the 12th month Adar they would celebrate Purim. Note the specific wording in Est 9:20-21, “And Mordecai wrote these things and sent letters to all the Jews, near and far, who were in all the provinces of king Ahasuerus, to establish among them that they should celebrate yearly the 14th and 15th days of the month of Adar,” and verse 23 concludes, “So the Jews accepted the custom which they had begun, as Mordecai had written to them”.

Thus Scripture teaches that the Jews accepted that the month named Adar would always be the month in which the Feast of Purim would fall. Adar is the name of the 12th month in the Jewish calendar as well as in the Babylonian calendar. The month names and month numbers were locked together; they did not slide around with respect to one another.

[41] Nisan and the Jews at Elephantine, Egypt

About 600 BCE a group of Jewish mercenaries were first employed on the island of Elephantine along the Nile River in southern Egypt about 500 miles south of the Mediterranean Sea close to the border of Ethiopia (see pages 7 and 34 of Bickerman 1962). The purpose of this military base was to protect the southern border of Egypt from invasion from the south. When Persia defeated Egypt in 525 BCE under the leadership of Cambyses, this military base became funded by the Persian Empire instead of Egypt because its need still existed.

A number of letters written in Aramaic have been discovered on this island of Elephantine during the late 19th and early 20th centuries. These letters date from the fifth century BCE when the Jewish mercenaries were there. Page 35 of the book by Bickerman states, "The 'Jewish force' (as the regiment is officially styled) was divided into companies, the captains of which bear Babylonian or Persian names; a Persian was 'the chief of the force'." Since it was called a Jewish force, the bulk of the mercenaries were obviously Jewish, but it was under the command of Persians, so it was not autonomously controlled by Jews. This is a significant difference between Elephantine compared with Judea under the governorship of Nehemiah. Judea was autonomous, while Elephantine was totally funded by Persia, under Persian military command, and was not autonomous. This implies that the calendar in use at Elephantine was the Babylonian calendar rather than the Jewish calendar, although it is quite likely that nearly all of the time there was no difference between these calendars at that time. In the paper concerning Elephantine by Richard Parker 1955, on page 274 he wrote, "A Persian military garrison in a Persian satrapy would most probably use the Persian-Babylonian calendar". Concerning these letters, B. Porten 1996 wrote on page 152, "Virtually every contract bore a double date, the first usually being the Babylonian date and the second the Egyptian one."

One of the Aramaic letters found at Elephantine is known in scholarly circles today as the Passover Papyrus. The Hebrew-Aramaic alphabetic characters in this letter along with an English translation are found on pages 56-57 of Lindenberger. In the following quotations from the letter, the square brackets and the contents within them appear on page 57 of Lindenberger. The letter contains "This year, year five of King Darius", which dates the letter in 419/418 BCE. There are gaps in the letter because it is poorly preserved. The addressing of the letter says "[To] my brothers Yedanyah and his colleagues, the Jewish garrison, from your brother

Hananyah". It was written from one Jew in friendship to the Jews on the island with whom the author had familiarity. Part of the preserved text of the letter says, "Be scrupulously pure. Do not [do] any work [...]. Do not drink any [...] nor [eat] anything leavened [... at] sunset until the twenty-first day of Nisan [...]". Another translation of this same segment of this letter is on page 283 of Whitters where he adds in square brackets some guesses in gaps in the text as follows, "be pure and take heed. [Do n]o work [on the 15th and the 21st day, no]r drink [fermented drink, nor eat] anything [in] which the[re] is leaven [from the 14th at] sundown until the 21st of Nis". Note that the final letter of Nisan is missing in the poorly preserved papyrus so only "Nis" is shown. This provides historical evidence that after the return from exile under Ezra and Nehemiah, Jews named the first month Nisan as a substitute for Abib. On page 283 Whitters comments, "The letter came from one Hananiah, who apparently wanted the Jews in Egypt to celebrate Passover and Unleavened Bread appropriately. The address and greeting rule out a local Egyptian official or Persian overlord." If the name Nisan was not significant for the first month to Jews, the letter could simply have said the first month or Abib.

[42] Gen 1:14; Ezra 6:15; Neh 6:15 Show the Vernal Equinox Starts the Year

Ezra 6:15 and Neh 6:15 tie in with Gen 1:14 to give the biblical and archaeological evidence that together show explicit evidence that Gen 1:14 involves the vernal equinox. The Babylonian cuneiform inscriptions are archaeological clay records that are now mostly in the British Museum. These tablets have eclipse data as well as new moon sighting data that correlate with computerized astronomy to prove the dating of their calendar. From the knowledge of the Babylonian calendar with the use of these month names in Israel we can say that Nisan 1 is the new moon on or the soonest new moon after the day of the vernal equinox (see appendix B). In discussions above it was pointed out that by the process of logical elimination of choices, about the time of Ex 12:2 and within the parameters of Gen 1:14 involving the lights in the heavens, the vernal equinox is the only candidate for starting the year.

Some people have proposed that merely the 16th day of the first month need be on or after the equinox, and not the first day of the first month. Aside from the fact that this is not a natural thing for Moses to imagine, there is the practical problem of having to predict at the beginning of the month whether

the 16th day of the month will be on or after the equinox. From one equinox to the next is 365 or 366 days, and it is not an easy matter to predict between the two because there is no repetitive pattern. However, it is only in unusual cases when the first day of the month will be within a day of the vernal equinox.

If it had originally been true that merely the 16th day of the first month need be on or after the equinox to determine the first month, then about half the time the Israelite first month named Nisan would have been one month earlier than the Babylonian Nisan, and consider what confusion there would be in that case. The confusion would be unacceptable.

[43] The Zodiac and the Sign of Aries

The zodiac was already discussed in a prior chapter, but not in sufficient depth for discussions to come. As a brief review, the zodiac is the division of the annual path in the sky near the path of the sun into 12 equal parts. Each of these parts is called a sign of the zodiac. For this purpose the "year" is the solar year, that is, the average time from one vernal equinox to the next vernal equinox. Each sign has a name, which is also the name of a constellation of stars in the sky. At the time that the zodiac was being developed by the Babylonians about 460 BCE, each named constellation did appear in the sky during some of the time of the sign that had its same name. However, from one year to the next year these constellations do not appear at exactly the same time in the sky. There is a very slow drift of the time of appearance of each constellation in the sky each year. This slow drift in the time of the appearance of the stars each year has been named ***precession of the equinoxes***, and it takes about 25,800 years for the appearance of the stars to cycle around one complete year. The Greek astronomer Hipparchus discovered precession c. 140 BCE. There is no evidence that the Babylonians knew about precession.

The zodiac is divided up into 360 equal parts, each of which is called a degree. This shows that each degree is slightly longer than one day because there are about 365.25 days per year. Each of the 12 signs is 30 degrees, so that each sign is almost 30.5 days.

The time of appearance of the stars drift each year, but the 12 signs of the zodiac do not drift at all; they are fixed. The first of the 12 signs of the zodiac is named Aries, which is the Latin word meaning "ram", so that

sometimes this sign is called the Ram. The constellation of Aries is not the sign of Aries. The constellation drifts, but the sign does not drift. When writers are discussing time and they mention the name of a sign of the zodiac, they are never referring to the constellation. When does the sign of Aries begin each year? The answer is not as simple as one may think, because it depends upon the time in history, the location, and sometimes the person who is writing!!

The Roman author named Columella wrote a series of 12 books titled *On Agriculture* in Latin c. 50 CE, which is about the time that Philo of Alexandria died and Josephus was 13 years old. On page 481 of Columella in 9:14:1, he wrote, "From the first equinox, which takes place about the twenty-fourth of March in the eighth degree of the Ram …" He was using the Julian calendar, and in the first century the vernal equinox in the Julian calendar fell on March 22 or 23, so he was close in writing March 24. He wrote that the vernal equinox occurred in the 8th degree of the sign of Aries. This means that the first day of Aries was seven days before the vernal equinox for Columella. If we take the vernal equinox to be Julian March 23 in the first century, then the first day of Aries is on March 16.

On pages 487, 489 of Columella in 9:14:12, he wrote, "I am well acquainted with the reckoning of Hipparchus, which declares that the solstices and equinoxes occur not in the eighth but in the first degrees of the signs of the Zodiac; however, in these rural instructions I am now following the calendar of Eudoxus and Meto and the old astronomers, which are adapted to the public festivals, because this view, accepted in old times, is more familiar to farmers and, on the other hand, the authority of Hipparchus is not necessary for rustics of less refined education."

The Roman author Columella informs us here that the Greek astronomer Hipparchus began the sign of Aries on the vernal equinox, but he is beginning it seven days earlier.

The Roman architect Vitruvius wrote a series of 10 books titled *On Architecture* after 27 BCE. On page 233 of Vitruvius (translated by Granger) in 9:100:3, he wrote, "When he [the sun] enters the sign of the Ram and traverses the eighth degree, he makes the vernal equinox." Vitruvius is in perfect agreement with Columella.

The Roman writer Pliny the Elder (23-79) wrote his encyclopedia *Natural History* c. 50-77. This encompassed a vast array of ancient knowledge in 37 books, and it was highly esteemed for hundreds of years after his death. Roman Emperor Vespasian granted him a tract of land in Rome for his later years, just as Vespasian granted to Josephus in 70. During Pliny's last nine years of life, from 70 to 79, it is very likely that Pliny and Josephus met on a number of occasions since they had the same patron and lived near one another. On page 225 of Pliny_1 in 2:16:81, he wrote, "The sun itself has four differences, as there are two equinoxes, in spring and autumn, when it coincides with the center of the earth at the eighth degree of Aries and Libra …" On page 329 of Pliny_5 in 18:59:221, he wrote, "… all these changes occur at the eighth degree of the signs of the zodiac, midwinter at the eighth degree of Capricorn, about December 26, the equinox at the eighth of the Ram, the summer solstice at the eighth of the Crab and the other equinox at the eighth of the scales …" From these selections from Pliny we note that his agreed perfectly with Vitruvius and Columella.

The ancient Babylonians had two systems of mathematical astronomy for the moon, the earlier one called System A and the later one called System B. System A had the vernal equinox occur in the tenth degree of Aries and System B had the vernal equinox occur in the eighth degree of Aries. This is explained by Neugebauer on pages 594 and 596 of volume 2 of HAMA. Although the historical trail is not known, most of the Roman Empire in the first century followed the practice of Babylonian System B in placing the vernal equinox in the eighth degree of Aries. Page 600 of HAMA mentions that Hipparchus (c. 140 BCE), Ptolemy (c. 150 CE), and other earlier Greek astronomers placed the first day of Aries on the vernal equinox. It is reasonable to suppose that in the first century in Alexandria where the Greek astronomers were famous in their home city, the educated people placed the first day of Aries on the vernal equinox. The sign of Aries in Alexandria no doubt began seven days later than in most of the Roman Empire in the first century.

[44] Philo explains when the First Month of the Biblical Year begins

There is a Jewish witness whose writings date from the early first century who discusses the meaning of Gen 1:14 and Ex 12:2. This witness is Philo of Alexandria. This witness would be of no consequence and irrelevant if the applied calendar of Judaism at the Temple in the early first century was not correct. It is necessary to establish some relationship between the calendar of

Judaism at the Temple and Philo's thinking in order for Philo's comments on Gen 1:14 and Ex 12:2 to be relevant.

In Gen 1:14 where the Hebrew text has the plural of *moed*, which is typically translated seasons, or festivals, or appointed times, the Greek translation of the Hebrew Bible known as the Septuagint has the Greek word *kairos* (Strong's number 2540). The various versions of the Jewish Aramaic paraphrased translations of the Hebrew Bible known as the Aramaic Targums all interpret *moed* to include the meaning festivals. The Jewish commentaries of the middle ages also agree with this understanding of *moed*. In Lev 23 the Hebrew *moed* occurs six times: Lev 23:2, 2, 4, 4, 37, 44. The association of *moed* with festivals is clear from its use in Lev 23 as well as in Ps 104:19 and elsewhere. In contrast to this, *kairos* occurs in Lev 23:4, but nowhere else in the Septuagint of Lev 23. In Greek, *kairos* is a very general word for time, and it is not noted for being associated with the festivals or any other regular repetitive time. Thus one would not particularly expect Philo to interpret *kairos* as festivals, and indeed Philo does not interpret it that way. But he does use the word *kairos* in discussing this portion of Gen 1:14, indicating that his version of the Septuagint Gen 1:14 is similar to the one that is commonly available to us.

Philo discusses Gen 1:14-16 on pages 34-47 of Philo_1 (*On the Creation* 45-61). On pages 44-45 (paragraph 59) Philo wrote, “By ‘appointed times’ [*kairos*] Moses understood the four seasons of the year, and surely with good reason.”

It is a little humorous that he puts this interpretation in Moses’ mind as if to say this is what Moses knew it to mean rather than this is Philo's interpretation. Since the four seasons are bounded by the equinoxes and the solstices, he certainly believes that Gen 1:14 includes these astronomical events. On pages 46-47 (paragraph 60) Philo continues, “The heavenly bodies were created also to furnish measures of time: for it is by regular revolutions of sun, moon, and the other bodies that days, and months, and years were constituted.” Since the calendar is based on these units and he declares these units to be based on measures of time of the heavenly bodies, he leaves no place for the barley to be the determining factor for the first month. The reader might be curious about why Philo wrote here “and the other bodies”. While we know that the Greek astronomer Hipparchus proved that the stars drift very slowly from the equinoxes, and he discovered this about 100 years before Philo was born, this knowledge had not been

popularized and accepted, so that Philo does not know this. Thus Philo implies the thought that the cycle of the appearance of stars agrees with the sun's signs of the equinoxes and solstices that make the seasons. If Philo had been familiar with the Hebrew text of Gen 1:14, he would have made the association of the Greek *kairos* with the Hebrew *moed*, and then would have linked this to the festivals using the contexts of *moed* in Lev 23. Instead of linking *kairos* to the festivals, he links it to the four seasons, indicating the equinoxes and solstices.

Philo wrote on page 151 of Philo_7 (Special Laws I.90), "Who else could have shewn us nights and days and months and years and time in general except the revolutions, harmonious and grand beyond all description, of the sun and the moon and the other stars?" ***Notice that the way Philo asks this question emphatically shows that agriculture is not the way to determine years and the first month.*** Again Philo leaves no place for the use of barley in calendaric determinations. If, on an annual basis, the Jews in Alexandria had to wait for a report on the state of the barley from the priests in Judea in order to know when to leave for a journey to keep the feast of unleavened bread at the Temple in Jerusalem, Philo would not neglect such an important annual event in its role to determine the time of the first month. In this matter the Septuagint has no distortion that would give Philo a reason to have a prejudice against the use of barley, but he surely knows nothing of the role of barley in the early first century to determine the first month.

Having examined Gen 1:14 in Philo's writings, the next step is to consider his comments on Ex 12:2. In order to properly evaluate this, the reader should be familiar with the prior chapter on the zodiac and Aries (= Ram).

Philo was well educated, but not in the area of astronomy. Nevertheless it is probable that he would understand that the first day of Aries was the day of the vernal equinox as taught by the astronomers in Alexandria, which was unlike most of the Roman Empire in the first century where the eighth day of Aries was taken as the vernal equinox. Secular society outside of Alexandria also considered the autumnal equinox to occur on the eighth day of the sign of the zodiac called the Scales.

With the help of a little sloppiness in the existing translations it is easy for readers to become confused about what Philo means. To help explain one confusing part of Philo's writings I made a word for word translation from the Greek. Here is my literal translation of Philo's *On the Creation*,

paragraph 116 (in chapter 39) on pages 92-95 of Philo_1: “The sun, too, the great master of the day, bringing about two equinoxes each year, spring and autumn, the spring in [the] Ram and the autumn in [the] Scales, supplies very clear evidence of the sacred dignity of the seventh [number], for each of the equinoxes occurs [near a] seventh month, and during them [these seventh months] there is enjoined by the law the keeping of the greatest national festivals, since [during] both of them [these seventh months] fruits of the earth ripen, [in the] spring indeed grain produce and all else that is sown, and [in] autumn the [fruit] of the vine and most of the other fruit trees.”

One peculiar thing to notice here is that Philo uses the word “spring” twice as though it meant “spring equinox” and the word “autumn” twice as though it meant “autumn equinox”. Elsewhere he seems to use the word “equinox” to mean the season that it begins; for example, he writes separately of the feast of trumpets at/in the autumn equinox and the feast of tabernacles at/in the autumn equinox. Philo enjoys analogies, symmetry, and approximation in his writings.

Philo discusses Ex 12:2 on pages 2-5 of Philo_QE (Exodus, Book 1.1). On page 2 he wrote, “’This month (shall be) for you the beginning of months; it is the first in the months of the year.’ (Scripture) thinks it proper to reckon the cycle of months from the vernal equinox. Moreover, (this month) is said to be the ‘first’ and the ‘beginning’ by synonymy, since these (terms) are explained by each other, for it is said to be the first in order and in power; similarly that time which proceeds from the vernal equinox also appears (as) the beginning both in order and in power, in the same way as the head (is the beginning) of a living creature. And thus those who are learned in astronomy have given this name to the before-mentioned time. For they call the Ram the head of the zodiac since in it the sun appears to produce the vernal equinox.” Then on page 3 he writes, “And that (Scripture) presupposes the vernal equinox to be the beginning of the cycle of months is clear from the notions of time held in the ordinances and traditions of various nations.”

As a commentary to this last sentence, page 391 of Samuel 1988 states, “In the areas of Syria and the East controlled by the Seleucid kings, the Macedonian calendar was adjusted to make its months coincide with the months of the Babylonian calendar, which was in turn regulated locally by a nineteen-year cycle. The system was in general use in the East, and persisted in an adjusted form in cities all over the eastern regions well into the period

of Roman domination." The first day of Nisan in the Babylonian calendar since 499 BCE fell on or after the vernal equinox. Although Parker and Dubberstein show an exception to this in the year 384 (page 34), this alleged exception should be corrected because it is now regarded to be a faulty examination of a cuneiform text; see pp. 14 and 16 in Aaboe and others 1991.

When Philo speaks of the "traditions of various nations", from Samuel's statement he is referring to the continuation of the Babylonian calendar whose first month did not begin before the day of the vernal equinox. This is the only place where Philo makes a statement about the first month that is capable of some explicit comparison with the vernal equinox.

In none of this is there any use of barley to determine the first month, and the Septuagint does not force Philo to take his position. There is never a hint that the Jews in Alexandria waited with anticipation to hear the news of barley reports so they could begin their plans for the Passover.

[45] Declaration of the Vernal Equinox in Ancient Israel

Based upon Num 10 as discussed above, it should be accepted that the Levitical priesthood had the authority to declare the new moon days and thus regulate the calendar for ancient Israel. This priesthood performed specific animal sacrifices on the new moon days (Num 28:11-15; 10:10), so the priesthood had an essential role. This role was highly visible and authoritative before all the people as long as the Temple stood, but after it was destroyed in the year 70, the priesthood's prominence in Israelite society ceased. The reason for this cessation is indicated in John 12:42, "… because of the Pharisees they [the Jewish rulers] were not admitting, lest they should be put out of the synagogue." This shows that the Pharisees had much control over the people in the synagogues. The synagogues were away from the Temple where the priesthood dominated. The Temple was not a synagogue. As already shown above, the vernal equinox was significant to determine the first month, named Abib, and later named Nisan.

The first question is whether the vernal equinox was determined by observation or by a calculation in ancient Israel. To answer this question, a summary of several points from above along with a few related matters are now brought together.

(A) There is no word in biblical Hebrew for "astronomer", although there is a Hebrew word for "astrologer", *havar*, Strong's number 1895. This word only occurs once, in Isa 47:13, a negative statement against a practice in Babylon.

(B) Neither the Dead Sea Scrolls, nor archaeology from Israel, nor the Bible, nor Philo of Alexandria, nor Josephus indicates any native development of mathematical astronomy in Israel.

(C) Biblical Hebrew for the expression of numbers along with the Dead Sea Scrolls and archaeology indicate that ancient Israel had no positional numbering system with a zero, so that general multiplication and long division, especially of fractions, would have been prohibitive. This is a heavy strike against any suspicion that ancient Israel could have had a native mathematical astronomy.

(D) Ancient Egypt did not possess mathematical astronomy until the Greek astronomers moved to Alexandria after 330 BCE. Thus Israel could not have inherited such knowledge when Moses led them out of Egypt. On page 289 of Swerdlow 1993, he wrote that Otto Neugebauer studied the ancient Egyptian language; thus Neugebauer was able to read the original ancient Egyptian texts and thereby engage the primary sources directly. Review the above chapter titled, "Egyptian Astronomical Science before Alexander the Great" in order to see the scholarly opinions concerning the lack of ancient Egyptian mathematical astronomy despite the great Egyptian achievements in building construction. Expertise in one discipline (building construction) does not imply expertise in another discipline (mathematical astronomy). In that above chapter it was explained that Neugebauer 1980 proposed a specific method by which the ancient Egyptians could have used the shadow cast by the capstone of a pyramid on the ground to accurately determine the day of the equinoxes when it happened, yet without mathematics.

(E) Mathematical astronomy began in Babylon roughly 750 BCE. On pp. 51-52 of Britton and Walker we note, "Around 500 BC Babylonian astronomy began a process of transformation which led to the development of radically new techniques for predicting celestial phenomena. These techniques were mathematical in nature, rational in approach, and entailed separating complex phenomena into components which could be described by mathematical functions which could then be combined to predict the phenomena in question." In some ways the mathematical theory to predict

the position of the planets is less complicated than lunar theory, and David Brown's book concludes that during the period c. 750 BCE to c. 612 BCE the Babylonians first developed predictive planetary theory; see pages 8-9 of Brown. This mathematical astronomy was developed and recorded by the pagan priests of Babylon only in the Akkadian language, with its hundreds of symbols, at a time when this language was no longer in general use, having been supplanted by the Aramaic language. It was only after Alexander the Great defeated the Persian Empire in 331 BCE that Alexander apparently commanded that the Babylonians make their astrology-astronomy available to the Greeks for study. Not long after this, the Greeks were using Babylonian period relationships of the heavenly bodies, and also Babylonian horoscope techniques.

(F) Both Philo of Alexandria and Josephus were Jews from the first century who wrote extensively and were well educated. Neither of them implied any significant abilities in themselves or other Jews concerning mathematics or astronomy. Josephus likes to exaggerate the achievements of the Jews, and he only does this in science through bragging about Abraham's knowledge of arithmetic and astronomy, and that Abraham taught this to the Egyptians. This claim must be historically false because at the time of Abraham neither the Egyptians nor the Assyrians (later Babylonians) possessed mathematical astronomy, although the ancient Babylonians did record observed eclipses and other heavenly phenomena, and the ancient Egyptians did record the approximate time of certain appearances of heavenly bodies. Such recorded observations are not mathematical astronomy. Even in 2000 BCE the ancient Babylonians did perform division using the base 60 numbering system for simple accounting problems according to thousands of cuneiform tablets that have been examined by specialists in the field, but it was not until about 750 BCE that they began applying mathematics to astronomy. The Egyptians show no sign of using the base 60 numbering system before the time of Alexander the Great and the founding of the city of Alexandria in honor of him.

(G) The Rabbinic writings do not claim any advanced mathematical knowledge in their history. In the *Talmud*, Gamaliel II is claimed to give credit to his grandfather Gamaliel I for handing down the length of a month, yet this was derived by the Babylonian astrologer-astronomers as part of their astronomical System B in Babylon c. 300 BCE.

(H) Conclusion: It would be folly to think that ancient Israel had a calendar that was based on mathematical astronomy. The same conclusion should apply to the determination of the vernal equinox.

The vernal equinox is only known from the light of the sun or shadows from the sun. This can only occur during the daytime. Thus, while the new crescent is sighted near the time of sunset and most often during the middle of twilight, the vernal equinox must be determined during the daytime, based upon some commonly known definition.

(I) Limitations of Travel at Night. Cultural customs are established in any society by repeating a practice until it becomes an expected habit. For this to develop, the pattern must fit the varieties of circumstances. About half the months will have 30 days, so that at the end of the 29th day the pattern would be one of uncertainty for seeing the new crescent. The months do not always alternate in 29 and 30 days. In fact there can be three months in succession with the same number of days, even if the weather is clear. In the cases of cloudy weather or a borderline condition for sighting the new crescent in Jerusalem, witnesses for the sighting would have to travel from elsewhere for some hours. In ancient Israel, even in cities, travel was generally not done at night - see Judges 19:1-21 for the dangers and custom against travel by night. There is no mention in Scripture of any local police force to patrol the streets of a city at night for safety. People did not travel at night, so such a police force would be a waste of tax money. The priests who had the responsibility to interview potential witnesses for sighting the new crescent would not want to risk harm coming to potential witnesses through their traveling at night. The priests would also desire to obtain a normal night's sleep rather than have to stay awake waiting for witnesses to arrive and be questioned in the general case when there might be a 30-day month, or the weather was bad, or it was a borderline case of difficult visibility. To satisfy the most general circumstances and establish an expected custom, the priests would be in session to question potential witnesses on the daytime that followed the possible sighting of the new crescent. This reasoning is enhanced by the use of the Hebrew *machar* (“tomorrow”) in I Sam 20:5, 18.

(J) Overcoming Darkness at Night. Inside of a home, burning wood in a fireplace would no doubt be common to provide light for eating and other matters in ancient Israel. However, for traveling purposes, potential robbers would discourage a journey by night. Furthermore, there is the potential for a destructive fire that may be caused in an accident while moving and

transporting a burning object that provided light. This would also discourage a journey by night. There is every reason to expect that from the morning onward during the daytime, the priests would be in session to wait for witnesses to be heard rather than at night when the priests would want be sleeping. Beyond this, let us consider the use of fire signals on the hilltops to rapidly inform all of Israel that a new month had begun. It is difficult to imagine that people would want to walk to the tops of hills and wait there all night in the potential case that witnesses would appear at night and the two silver trumpets would be blown at night. If some such people who lit fires from hilltops were to fall asleep at night due to drowsiness, this would break the visual chain of announcement and stop the communication method from functioning. From the consideration of "tomorrow is the new moon [festivity]" in I Sam 20:5, 18 along with these various considerations of common sense, the daytime following the sighting of the new crescent would be the time for questioning witnesses rather than during the night.

(K) The Vernal Equinox would be judged in the Morning. The straight line that falls along the sun's shadow of a vertical object all of the daytime when the vernal equinox occurs is the east-west direction. In the morning of such a day, when the sun's shadow falls along this east-west line, there is no need to wait all of the daytime to see that the vernal equinox had occurred. The east-west direction is immediately sufficient to show the equinox. Once the east-west line has been marked at one location in a prior year, it is available for future observations for the vernal equinox that only require a morning observation.

If the need to question potential witnesses for possibly having seen the new crescent occurs on a morning when the vernal equinox also needs to be judged, it would be during that same daytime of questioning witnesses concerning the new crescent that the Levitical priesthood would also examine the sign of the sun for the vernal equinox.

(L) Practical Cultural Pattern that permits Public Participation. All the questioning of witnesses, the subsequent declaration of the new moon through the blowing of the two silver trumpets, the fire signals to spread the news, and the commanded sacrifices associated with the arrival of the new moon, along with singing praises at the Temple where all the nearby people could travel to witness and participate in the festivities through singing, would have to wait until the daytime.

The obvious correlation of Nisanu 1 with the vernal equinox acknowledges this day in the Babylonian calendar, and Philo is a historical witness that corroborates the same thing. Gen 1:14 also points to this through the process of elimination of other possibilities.

Previously, Pliny the Elder from the mid-first century was quoted to show that he regards the day on which "sunrise and sunset are seen on the same line", which means that the sun's shadow makes a straight line, as the day of the vernal equinox. This is the true east-west line and it shows the vernal equinox. The alignment of one wall along the east-west line for each of the most prestigious pyramids of Egypt shows that ancient Egypt knew how to determine the vernal equinox. Moses was trained in the knowledge of Egypt (Acts 7:22) and would be expected to know this. This only requires observation, no calculation, and no mathematical astronomy.

On page 158 of the book by Robert Newton there is a chart of 20 equinox observations by Hipparchus. These are dated from 162 to 128 BCE. He is considered to be the greatest of the ancient Greek mathematical astronomers. Even with his gifted application of trigonometry to attempt to use observation to calculate the time of the equinox, he is nevertheless off by an average of several hours. But ancient Israel did not use a calculation. By observation alone it is impossible to judge the hour of an equinox.

(M) The Borderline Situation. **Now consider the borderline situation of both the new crescent starting the day and the vernal equinox later on the same day in ancient Israel.** Suppose witnesses saw the new crescent at the beginning of the day, and on the next daytime they appear to testify as would be typical. Further suppose that the typical investigation of the sun's shadow line compared to an exact east-west line by the priesthood that next morning showed that the vernal equinox had arrived. Such an observation ***cannot*** be so precise that one can judge the hour of the equinox. Only its day is known. On the previous daytime there was no vernal equinox yet, but this next morning the vernal equinox is seen true. At the same time they also examine witnesses of the new crescent and this is determined true. They know that both occurred. This should be the first month because both arrived. The priests declare both simultaneously.

There is another example to consider as a precedent for accepting this reasoning. For 40 years in the wilderness, manna arrived in the morning each day except on the Sabbath. The arrival of manna was a morning

activity just as the examination for the vernal equinox would be sometime in the morning. That the morning is the arrival time for the manna is seen in Ex 16:8, 12, 21. Now note the literal translation of Ex 16:23, "And he [Moses] said to them, 'That is what YHWH said, tomorrow is a rest, a holy Sabbath to YHWH. Bake what you will bake and boil what you will boil. And all that remains lay up for yourselves to be kept until the morning.'"

On the ordinary six days, the manna would spoil and have worms in the morning, and there would be a new supply of manna on the ground in the morning. In Ex 16:23 note the word "tomorrow", which is translated from the Hebrew word *machar*, Strong's number 4279. This word refers the next daytime. The next daytime includes the morning, which is normally the time that any manna from the previous day would be seen spoiled and manna would be seen on the ground. Tomorrow would be an exception due to the Sabbath. Ex 16:23 states that "tomorrow is a rest, a holy Sabbath". Although the Sabbath is from sundown to sundown, in order to emphasize that tomorrow is when they would see the exception of no spoilage in the manna and no manna on the ground, Moses said, "tomorrow is a rest, a holy Sabbath". ***By what they would notice tomorrow, they would be able to verify that the whole day was the Sabbath.*** Similarly, by what the priests would notice on the morning of the day of the vernal equinox, they would be able to verify that the whole day was the day of the vernal equinox. The time of the equinox would have to be identified with one sundown-to-sundown day. The most obvious way to identify this is to take the day whose noontime is the closest to the time of the vernal equinox. That daytime would most be identified with the vernal equinox by visual inspection. This does agree with the conclusion from appendix B.

[46] The International Date Line, the Sabbath, and the New Moon

Beginning with this chapter, the subject of how to determine the first day of the month for the various parts of the world is treated. In order to avoid forcing the curious reader to wander ahead to discover the conclusion, I will give a brief summary of the next group of chapters here. Summary for the next group of chapters: The sighting of the new crescent for the purpose of defining the start of a new month should be from within the biblical boundaries of Israel, and sundown at the International Date Line should begin each first day of the month before anyone in Israel would be able to see it. This implies that on some occasions people to the east of Israel would begin a new month that later was determined to be one day prior to the new

month. This would primarily matter on the first day of the seventh month, when they might keep two successive days as was sometimes done in ancient Israel.

Many people do not realize that there is a need for an International Date Line (IDL), and they need to be convinced that there is such a need. During the 19th century the international community recognized the need for an IDL, and they established it in the Pacific Ocean by agreement of some of the most influential nations. Perhaps the most obvious need was seen in simply recording the date and time of events in various parts of the world. If it is noon on Saturday in England, what time and day is it in Australia? The answer partially depends upon where the IDL is placed. If the IDL is placed between Australia and Japan, you get one answer. If the IDL is placed between Australia and Hawaii, you get another answer. The IDL also affects the day for keeping the Sabbath in some parts of the world, as we shall explore next.

If a group of people in Israel performed the following experiment, consider the outcome. Let half of them travel east 1000 miles during the course of six days and rest on the seventh, and the other half travel west 1000 miles during the course of six days and rest on the seventh. Since there are about 24,000 miles around the earth at the latitude of Israel, each 1000 miles represents one hour of time. At the end of the six days in the experiment, the group that traveled east will start their Sabbath two hours earlier than the group that traveled west, because they are 2000 miles further east. If this is continued for another week in the same direction, the group that traveled east will be start their Sabbath four hours earlier. If this experiment is continued for 12 weeks and boats are available for water travel, the two groups will meet in the Pacific Ocean. The group that traveled east will start their Sabbath 24 hours sooner than the group that traveled west, so that while neither group lost track of the days and both groups had sincere intentions, if they got together on the same boat there would be confusion on which day to begin the Sabbath.

If ships had carried colonists from countries that had previously adopted the seven day weekly cycle to North America, and if they had originally traveled east across the Pacific Ocean instead of west across the Atlantic Ocean, then they would have given the name Sunday in North America to the day we now call Saturday, and their week would be shifted one day.

These examples show the absolute need for an IDL to officially start the day for the purpose of keeping the Sabbath and avoiding confusion on the day it begins. If an IDL were proposed that crossed land where people lived, then neighbors on one side of the line would keep a different day as the Sabbath compared to others across the line. This destroys spiritual unity and is a source of confusion.

Jewish scholars since Talmudic times have recognized that a spherical earth requires an IDL for the purpose of keeping the Sabbath. Pages xxiii-xxiv of Sternberg give his translation of a passage in the *Babylonian Talmud* (RH 20b) that relates to the IDL. Page xxv gives the opinion of Chazon Ish that this implies that the IDL occurs at the end of the Asian continental landmass. On page 343 of the article by Jakobovitz, he states, "The international dateline has also been endorsed by the rabbinate in Jerusalem in its reply of 1942 to the inquiry received from the refugees in Japan." This means that society's IDL has been accepted by Jewish authorities as the IDL for the Sabbath, thus overruling the *Babylonian Talmud*, a very rare event. It is interesting to note that modern Jews desired to have a ruling come from Jewish authorities in Jerusalem, and this occurred in 1942, before Israel was recognized as a nation in the geopolitical sense.

Scientists today believe that the land surface of the earth was once together as one mass of land with one very large ocean around it. This is evident from examining the globe's landmasses and noticing how they fit together, such as mentally pushing North America and South America into Europe and Africa. This is also noted by matching geological rock formations and plant species with corresponding parts of matching areas across the Atlantic Ocean. At the time when the world only had one land mass it was only sensible that the IDL run through the one ocean to avoid neighbors keeping the Sabbath on two different dates, thus avoiding confusion. As the one land mass separated, the IDL should not change. This would put the IDL in the middle of the Pacific Ocean as men have decided to do in the nineteenth century. But the creation shows the mind of the Creator in establishing the IDL at that place to avoid confusion on when to start the Sabbath day. The biblical principle is found in I Cor 14:33.

If it is confusing, annoying, or disruptive to run some line along a landmass and imagine that people on one side of the line keep the Sabbath on one day and people on the other side of the line keep the Sabbath on the next day, why shouldn't it also be equally confusing when the first day of a biblical

month is considered in the same way? In my mind it would be confusing to begin a month with a disruptive line on a landmass that separated the month start on one side of the line from the month start on the other side of the line. This is especially true if the line were to change from month to month, and it would even be more discomforting if the line was wide and fuzzy with pockets of exception in various places due to humidity, height above sea level, and bad weather. Considering the philosophical principle of avoiding confusion, it is natural to extend this from the Sabbath to the start of a month using the IDL.

The Sabbath cycle is much simpler than the monthly cycle because the former is always a seven day cycle, while the latter is a cycle of 29 or 30 days, which does not necessarily alternate between 29 and 30 days. There are some natural reasons for desiring to take simplifying concepts that apply to the Sabbath, such as the IDL, and also transfer them to the start of each month. Lev 23 discusses all of the days of holy convocation. Relating to all the festivals as well as to the seventh day Sabbath, the words *holy convocation(s)* occur in verses 2, 3, and 4 of Lev 23. Lumping the seventh day Sabbath together with the festivals in the same chapter under the larger umbrella of *holy convocations* does seem to be a reason to transfer simplifying concepts that apply to the Sabbath to the festivals as well.

It must be admitted that the confusion primarily stems from the fact that we have modern methods of communication today. Not only do we have the Internet and telephones, but we also have automobiles and jet planes, so that we may travel for attendance on the Sabbath and on the festivals. If modern technology was completely removed and each family was an island unto itself without contemplation of travel, the confusion would disappear. But no one expects society to give up modern technology for travel and communication, so there is a need to face and solve the resulting issues.

[47] How the MCJC achieves Spiritual Unity using the IDL

From a strictly mathematical viewpoint, the IDL is not part of the computation of the day of each month of each year that is performed according to the rules of the MCJC. But in a practical sense the Jewish use of the MCJC includes the Jewish adoption of the IDL, so that Jews in the modern world would have a method to determine when to keep the festivals in their area of the world. From this *applied* mainstream Jewish viewpoint, the MCJC is used with the IDL. Since spiritual unity on the holy

convocations is a philosophical goal, let us consider for a moment how the MCJC achieves spiritual unity. First it determines a specific date for the start of each numbered month. Once the beginning of the month is established, mainstream Judaism respects the IDL, so that the first place for the start of a new day (including the Sabbath, a festival day, or a new moon day) is at this IDL at sundown. Then sundown flows to the west on the earth, and each place begins the new day as sundown comes to that place. This achieves a simplicity and spiritual unity that is in harmony with Sabbath observance around the world by multitudes of groups that are motivated to keep the Sabbath. Moreover, this method extends to the festivals and the days of the new moon. The big problem with the MCJC is that the computation of the first day of each month is incorrect about 77.5 percent of the time within the borders of Israel (see appendix E), and the determination of the month number is off by one month in some years. One exceptional aspect was overlooked in this explanation. When people on the earth are near the North Pole or the South Pole, sundown as well as the ability to see the moon are greatly distorted, especially during certain long periods of the year. In such cases, people typically resort to choosing 6:00 pm on modern clocks as the time to begin each day.

The Jewish approved IDL-applied aspect with the MCJC has the advantages of (1) Attaining spiritual unity; (2) Respecting the universal method for observing the Sabbath; and (3) Being in agreement with the time that ancient Israel kept the Sabbath. In a certain sense the IDL is not arbitrary because some place for an International Date Line is a necessity and the Pacific Ocean is where the one major body of water on the earth was originally placed. The only aspect of the IDL that may be considered arbitrary is the specific way that it wiggles around certain groups of islands in the Pacific Ocean. If a correction would be made to the MCJC to arrive at the first day of each numbered month that was much more in harmony with the calendar of ancient Israel, then the philosophical goals originally expounded would be met.

[48] Avoiding Confusion (I Cor 14:33)

If there is a significant density of people around the earth desiring to keep the festivals, any boundary that began the new month that cut across a landmass would cause confusion among the people. Even though people may be organizationally independent, that should not hinder friendships and occasional visits away from one's normal attendance site during biblical

festival days whose dates depend upon determining the first day of the month. If there are different dates by different people who come together to keep the festivals, there are likely to be date conflicts and disunity. All biblical contexts that mention the festivals seem to take it for granted that there are no conflicts and that there is just one day that is holy for each specific commanded assembly. The only exception might be the start of the seventh month where ancient Israel could occasionally keep two successive days unless the first day of the two was confirmed to be the first day of the month.

Organizational independence need not require confusion on the determination of the start of the first and seventh months. In order to avoid confusion, the first day of each month should respect the IDL rather than cause it to change every month with a new curved line. Such a proposed curved line of first visibility is in reality a fiction because it depends on the observer's altitude above sea level, humidity (high humidity hinders visibility and low humidity favors it), air pollution, rain, etc. The approximate angle of such a curved line will change from month to month because the moon's path changes somewhat with respect to the earth's axis (the orbit of the moon does not lie in the plane of the earth's orbit, and in fact this approximately repeatable pattern follows the Saros eclipse cycle of 18.03 years). Any such curved line is not a sharp narrow line because it will depend on the eyesight of individual people who are striving to see it. There will be regions where some percentage of the people will see it and others will not. Such a curved line will not be one neat pattern because humidity variations will cause it to wiggle in significant ways, and oftentimes, altitudes that are at least above 4000 feet above sea level will produce geographical areas of visibility that are isolated from other larger regions of visibility. Regions of high humidity will sometimes cause local regions of non-visibility in the midst of much larger regions of visibility. When people do not see the crescent at their dwelling place and others some distance off do see it, the question remains concerning the conditions that would cause the individual to accept the sighting of others. It may matter to some people if others that attend the same congregation did see it, although such people may have traveled quite a distance to get to the meeting place. If two different organizations that had overlapping geographical areas of attendees came to different conclusions based upon who saw the crescent within each congregation, wouldn't that be a cause of confusion if they wanted to meet together for a festival?

For the purpose of establishing the beginning of the month, using so called local visibility of the new crescent from outside Israel leads to arbitrary decisions and confusion. The first aspect of arbitrary decisions and confusion is defining local visibility. Suppose the new crescent can be seen from Fort Worth, but cannot be seen from Dallas, which is 30 miles to the east. Should people in Dallas accept the testimony of people in Fort Worth for visibility of the new crescent to start a month? What distance should be the limit for accepting someone else's testimony? Suppose the only places in the United States from which people can see the new crescent are over 8000 feet above sea level in the Rocky Mountains. Should people elsewhere in the United States accept their testimony? If no one in the United States can see the new crescent, but some people in Baja, Mexico can see it, should their testimony be accepted in the United States? In order for local visibility of the new crescent to be applied in today's world, it must first be defined so that there is a principle to apply. In order to be practical it should be defined in some manner so that any proposed definition may be applied in different areas of the world, not merely on one small island.

If someone proposes that the first place on the earth that any two witnesses see the new crescent starts the new month for the whole world, there are still problems. The most significant philosophical problem is that whenever this place is to the west of Israel's time for sighting the new crescent and still before the IDL, Israel would be made to keep any festivals of that month one day sooner than Israel would keep it if the Levitical priesthood existed and functioned exclusively within the boundaries to which they were anciently confined among the original tribes. Another problem with this proposal is that people on one side of the sundown line at that time will not be in the same day as those on the other side of the sundown line. Thus people who are geographically very close will potentially be keeping the festivals one day apart, so that confusion will still exist by this method. Another potential problem is that if some two people in one very remote area of the world post a message on some web site that they saw the new crescent, how would people know whether they were not pranksters? In Israel today, those who are witnesses to the sighting of the new crescent are known by those who post the sightings, so the problem of pranksters is virtually eliminated. To some people, another problem with this proposal is that one segment of the world that did not see the crescent would be deprived of seeing the new crescent on the day that they would be expected to begin the month; this latter reason is the cause for those specific people today to be zealous supporters of their concept of "local" visibility, although there is a problem

in defining local visibility for various circumstances without inventing arbitrary rules.

If someone proposes that some mathematical calculation substitute for the actual sighting of the new crescent, there would be the objection that this would not always agree with actual sighting of the new crescent from Israel, which was anciently used. A mathematical calculation would only be attractive if modern methods of communication broke down, and this was attractive before timely web site postings of sightings of the new crescent were available.

[49] Dwelling in Spiritual Unity Through the Declaration of the Priesthood

Ps 133:1, "A song of the upward-steps, by David, Behold how good and how pleasant [is the] dwelling of brothers, yes-indeed in-unity."
Ps 133:2, "[It is] like the good oil upon the head, descending upon the beard, Aaron's beard, descending upon the edge of his garments."
Ps 133:3, "Like the dew of Hermon descending upon the mountains of Zion, because there YHWH commanded the blessing of life forever."

Verse 2 mentions Aaron, the first High Priest, who thus represents the Levitical priesthood. It also mentions good oil, which represents the holy spirit (Mat 25:3-4; Rom 8:11; John 8:12; I Cor 6:17; Mat 5:15-16; John 12:36). In flowery language this is saying that dwelling in spiritual unity is like the holy spirit upon the Levitical priesthood, because spiritual unity can only come if the priesthood properly teaches the law (Lev 10:8, 11; Mal 2:7), so that the people are motivated to keep it. Only then can there be spiritual unity, and this will result in the blessing of eternal life (note verse 3). The priesthood was supposed to promote spiritual unity by proper teaching. The appointed-times, the days of holy convocation, were announced by this priesthood through the blowing of the two silver trumpets (Num 10:1-2, 8-10), and this was a means of promoting unity in worship and unity of the days of holy convocation.

I Cor 14:33, "The Almighty is not of confusion, but-oppositely of peace, as in all the congregations of the saints." If knowledge to achieve spiritual unity is attained, it should produce uniformity in recognizing the days of holy convocation, the appointed-times. Once the ability for widespread communication exists to make spiritual unity possible, biblical principles that promote unity in recognizing the days of holy convocation should be

promoted. If people in their own areas around the world attempt to determine the start of a month by individually sighting the new crescent, it will most certainly lead some people who are relatively close to one another to have conflicting days for the appointed-times.

We do not have any Levitical priesthood today, but if we are given the same information that they could have through postings on a web site, then we could presumably arrive at the same decision they would.

[50] Does Deut 16:1 Command Everyone to Look for the New-Moon?

Deut 16:1 has been used by various peoples to promote highly specific viewpoints regarding the calendar, each of these viewpoints conflicting with the others, but all from the same verse. I have about a one inch thick folder with photocopies from a wide variety of sources just on this verse, and I have looked this up in about 40 different translations and many commentaries.

One basic principle of properly understanding the Bible is that a technical expression should have the same meaning wherever it is used. This is especially true if the writer is the same in all instances of its use. All of the six places that *chodesh ha aveev* occurs were written by Moses, and two of these places are in Deut 16:1. This technical expression *chodesh ha aveev* should mean the same thing in both places of its use in Deut 16:1.

In the second instance of its use in Deut 16:1, *chodesh ha aveev* refers to the time that the Israelites were freed from Egypt in the middle of the first month, not at the start of the month. Consequently, although the word *chodesh* in the general situation can mean either new-moon or month, in the specific expression *chodesh ha aveev* it needs to have one fixed meaning, and from its second use in Deut 16:1, its meaning must be “month”, not “new-moon”.

From the above reasoning, Deut 16:1 should NOT mean approximately “Go out looking [in the sky] for the new crescent of Abib”. Otherwise the second half of this same verse would mean that in the new crescent of Abib the Israelites were freed from Egypt, and this is not true according to Num 33:3. Those who interpret Deut 16:1 in the sense of a commandment to watch for the new crescent would use the examples of I Sam 19:11; Ps 59:1; 130:6;

Eccl 11:4 where the Hebrew word *shamar*, Strong's number 8104, could mean to watch with one's eyes.

One conclusion is that Deut 16:1 is not a specific commandment for everyone to go out looking for the new-moon that begins the first month.

[51] Ancient Israel did not Practice Local Visibility

Knowing that two priests in ancient Israel were commanded to blow two silver trumpets on the first day of each month to officially declare the beginning of the month (Num 10: 1-2, 8-10), when the time arrived at which the Israelites were to keep the three annual festivals in one place (Deut 16: 5-6, 10-11, 13-16; 12:5-21), Israel did not practice "local" visibility to begin the month and determine the festival dates since, when gathered together at the festivals they were all together in one place with one High Priest. Thus Israel was united in keeping the festivals on the same days and united on beginning the months on the same days, which is against local visibility in different parts of Israel.

[52] Confusion of a Difference of a Whole Month in the Calendar

In some years local visibility (assuming this may be defined in a satisfactory way) could make the difference between a month being considered as the 13th month for part of the earth and as the first month for the remainder of the earth. This would cause the festivals to be kept one month apart for different parts of the earth in such a year, resulting in greater confusion. The year 2007 provides an example.

[53] The Role of the Land of Israel

The role of the land of Israel must be appreciated in the plan of Scripture. This land is called the inheritance of Israel (Num 26:51-56; Deut 4:21; 31:7) while the resurrection to eternal life is called the inheritance of the saints (I Pet 1:3-6). Entering the land of Israel is called a rest (Deut 12:9; 25:19; Josh 22:4; Ps 95:11; Heb 3:11), which is a type of the rest of the resurrection to eternal life (Heb 4:1, 8, 11). Among the adults in Israel who left Egypt, only Joshua and Caleb were allowed to receive the inheritance by faith (Num 14:6-9, 24, 30, 38; Heb 4:2), which is a type of the faith of the saints that is needed to receive eternal life. The land promise to Abraham, Isaac, and Jacob (Gen 12:1; 15:7, 18; 17:8; 26:1-3; 28:10-15; 35:12; Deut 34:4) was a

theme for over 430 years (Ex 12:41; Gal 3:16-17) before the beginning of its literal fulfillment. A stranger could become a full citizen in Israel through fleshy circumcision, which made him become like a native of the land (Ex 12:48), which is a type of the circumcision of Christ (Col 2:11-12). The land was to have a Sabbath rest (Lev 25) which is a type of the Sabbath rest of the saints (Heb 4:4). Finally, according to Deut 11:11-12, the eyes of YHWH are always upon this specific land. From time to time through the history of Israel in this land, the priesthood moved from place to place. The first Passover in the land was kept at Gilgal by all of Israel (Josh 5:10). Soon Shiloh became the political center (Josh 18; I Sam 1:3, 24). At first King David reigned from Hebron (II Sam 2:11), but afterward he reigned from Jerusalem (II Sam 5:5). For approximately the first 400 years of Israel's history in the land, the political headquarters was not Jerusalem, but the calendar continued regardless of the political center.

There is a biblical principle that in the mouth of two or three witnesses a matter shall be established (Deut 17:6; 19:15; Mat 18:16; II Cor 13:1; I Tim 5:19). Does it make sense that if the weather is rainy at wherever the political center of Israel happens to be, no citizens of Israel from elsewhere in Israel may appear as witnesses before the priests for having observed the new crescent? No.

[54] The Boundary of Israel

Since Israel is prominent in the eyes of YHWH according to Deut 11:11-12, the subject of its boundaries is now discussed.

In a covenant with Abraham, the southwest border of Israel is stated in Gen 15:18. There, for the southwest, it states the River of Egypt. J. H. Hertz comments on this verse that the River of Egypt is “the Wady-el-Arish, which is the boundary between Egypt and Palestine”. A map on page 71 of the atlas by J. Carl Laney shows the Wadi el-Arish at the place where other maps show the Wadi of Egypt or Brook of Egypt that starts at the Mediterranean Sea and goes toward Eilat (also spelled Elath or Eloth), but appears to stop in the desert before reaching Eilat.

The Tanakh translation of I Ki 9:26 states, “King Solomon also built a fleet of ships at Ezion-geber, which is near Eloth on the shore of the Sea of Reeds [Red Sea which goes into the Gulf of Aqaba] in the land of Edom”. Ex 23:31 states, “I will set your borders from the Sea of Reeds [Red Sea at Elath] to

the Sea of Philistia [Mediterranean Sea], and ...". Map 4 in the NIV shows the region labeled Edom and continuing down through Elath (using a color marking and an identifying legend) to be part of the Empire of David and Solomon. Because the southern desert down toward Elath was not populated due to lack of rain and opportunity for crops, most maps ignore it and even cut off the map before it reaches Elath. The use of Beersheba in II Sam 24:2 in the expression "from Dan to Beersheba" indicates that Beersheba was the most southern populated city, not that the territory of the kingdom ended there.

Some years ago when Israel agreed to give back the Sinai region to Egypt for a peace treaty, I was very surprised until I investigated and learned that according to Jewish scholars (as summarized in Gen 15:18; Ex 23:31; I Ki 9:26, mentioned above), Israel was only giving Egypt what Israel considered to be reaching up to the boundary specified in Scripture. The modern southwest boundary of Israel is believed to be the boundary stated or directly implied by the three verses.

[55] The law will go forth from Zion - Isaiah 2:3 and Micah 4:2

Scripture does not give an explicit comprehensive discussion of the biblical calendar as it applies to the entire world with modern technology, but those who recognize the need to observe the festivals, desire to understand when to keep the festivals. In an effort to understand the will of YHWH concerning the biblical calendar, certain principles of application are sought. Attention is now turned to one biblical principle that has been used by various people who discuss the biblical calendar, including the *Jerusalem Talmud* and the *Babylonian Talmud*.

Isa 2:3 and Micah 4:2 say, "... the law will go forth from Zion and the word of YHWH from Jerusalem." This is a prophecy of the future when the Messiah will reign. It relates to the seat of government where decisions are made.

John 4:21 says, "Woman, believe Me, the hour is coming when you will neither on this mountain, nor in Jerusalem, worship the Father." In a very narrow sense the "you" in this verse refers to the woman, but the nature of the statement in its context implies that it refers to people in general. More specifically the context is worship, and this brings to mind such Scriptures as Jer 7:1-2 and Zech 14:16-17, which relate to holy convocations on the

Sabbath and the festivals. John 4:21 is a prophecy (not a commandment) that was fulfilled when Jerusalem was destroyed by the Romans in 70 CE, and was more strictly fulfilled in 135 CE when the Jewish rebellion under Bar Kochba was defeated by the Romans. Nevertheless, eventually Jews returned to Jerusalem. Since Israel became an independent nation in 1948, even some Sabbath keeping Christians have settled in Jerusalem and Israel. Thus the period of the relevance of this prophecy has been fading. Historically, when the prophecy of John 4:21 was in fulfillment, the law did not go forth from Zion (Isa 2:3 and Micah 4:2), because Zion was not the seat of priestly or theocratic government.

When seeking guidance from the Scriptures on any matter, there are examples of biblical derivation and interpretation that provide a pattern. Three examples are now presented.

Mat 22:40, "On these two commandments hang all the Law and the Prophets."

In other words, all of the teaching of the Hebrew Scriptures contains laws and principles that grow out from the two general commandments found in Deut 6:5 and Lev 19:18. A narrow contextual view is not taken of these two verses of the Hebrew Scriptures in Mat 22:40.

I Cor 9:9-10, "For it is written in the law of Moses [Deut 25:4], 'You shall not muzzle an ox while it treads out the grain.' Is it oxen the Almighty is concerned about? Or does He say it altogether for our sakes? For our sakes, no doubt, this is written, that he who plows should plow in hope, and he who threshes in hope should be partaker of this hope."

In other words, Paul is not taking a narrow contextual view of Deut 25:4, but is broadly applying it beyond the animal realm to those who devote full-time energies to preaching and teaching.

Gal 3:8, "And the Scripture, foreseeing that the Almighty would justify the nations by faith, preached the gospel to Abraham beforehand, saying, 'In you all the nations shall be blessed'".
Gal 3:16, "Now to Abraham and his seed were the promises made. He does not say, 'And to seeds', as of many, but as of one, 'And to your seed', who is Christ."

The above two verses extract quotations from the following.
Gen 22:17, “blessing I will bless you, and multiplying I will multiply your seed as the stars of the heaven and as the sand which is on the seashore; and your seed shall possess the gate of their enemies.”
Gen 22:18, “In your seed all the nations of the earth shall be blessed, because you have obeyed My voice.”
Gen 26:4, “And I will make your seed multiply as the stars of heaven; I will give to your seed all these lands; and in your seed all the nations of the earth will be blessed;”
Gen 26:5, “because Abraham obeyed My voice and kept My charge, My commandments, My statutes, and My laws.”

The Hebrew word *zerah* (Strong's number 2233), is the word translated “seed” that occurs twice in verse 17, once in verse 18, and three times in verse 4. In all these places the form of the word *zerah* is the same. Page 253 of volume 1 of TWOT makes the following comment, “Commencing with Gen 3:15, the word ‘seed’ is regularly used as a collective noun in the singular (never plural). This technical term is an important aspect of the promise doctrine, for Hebrew never uses the plural of this root to refer to ‘posterity’ or ‘offspring.’” Although Gen 22:17 and Gen 26:4 relate the number of the stars to the number of “seed”, so that the context implies that a plural number is intended, the Hebrew word occurs in the singular form regardless of whether the intended number is singular or plural. The apostle Paul was inspired to use this grammatical aspect of the Hebrew word in Gal 3:16 in order to attach the word “seed” to the singular “Christ”. Nevertheless, the original context implies that the intended original use is plural. Hence the New Testament interprets the literal context of the promise to Abraham in a non-contextual way.

These three examples of the use of quotations of the Hebrew Scriptures in the New Testament show that when using the Scriptures, one is not required to use a narrow contextual interpretation if none is available. If there is no Scripture that applies like a hand in a glove in its natural context, then one has the liberty of generalizing and broadening the context of the Scripture in order to find guidance in an attempt to avoid arbitrary subjective decisions.

The explanation above provides one reason that Isa 2:3 and Micah 4:2 may be used with regard to the biblical calendar before the arrival of Messianic rule from Jerusalem. However there is yet another reason that should be given some thought. Both the *Jerusalem Talmud* (c. 400 CE) and the

Babylonian Talmud (c. 600 CE) give parallel yet slightly different accounts of the same incident involving the Jewish sage Hananiah. Jacob Neusner dates this event c. 145 CE (see page 120 within pages 113-121 of the original 1965 discourse by Neusner, and page 129 within pages 122-130 of the 1984 reprint). The account of this event in both Talmuds uses Isa 2:3 and Micah 4:2 to settle this calendaric dispute c. 145. They use these verses as the single greatest factor, as a general principle, as a biblical weapon to decide the issue.

Since I will shortly discuss this incident involving Hananiah occurring in both Talmuds, which quote from Isa 2:3 and Micah 4:2, the reader may well ask for some justification for quoting from the *Talmud*. Understand that my goal here is to explore a ***method of reasoning*** from these verses, not whether the incident from the *Talmud* is historically accurate. The reader must decide whether the method of reasoning is sensible. How do I view the Talmuds? This is explained in appendix A.

Rabbinic writings say absolutely nothing about any Jewish sage before 70 having any abilities in mathematical astronomy, and this even includes Daniel and Abraham. When Gamaliel II is said to have mentioned the length of a synodic month in the *Babylonian Talmud*, this exact time period including the fraction of a second comes from Babylonian astronomer-astrologers whose calculation originated c. 330 to 300 BCE. The *Talmud* does not claim that Gamaliel II himself directly possessed such mathematical and astronomical skills, although some later Orthodox Jewish commentators interpret a text in the *Mishnah* so as to infer that Gamaliel II possessed such skills. The *Babylonian Talmud* does ascribe much mathematical skill to Mar Samuel (c. 250 CE), who is said to have had the ability to compute a calendar for many years into the future. Commentators on this matter claim that Mar Samuel's proposed calendar was not accepted.

I believe that the Talmuds contain some remnants of historical value from the first century, but with some fabricated embellishments. Some of it represents false tradition and some true tradition. In some cases Josephus and the *Talmud* do agree on legal details not directly discussed in Scripture, but this may reflect only the Pharisaical position rather than practiced reality. In general, I do not accept Talmudic teachings as binding.

My primary reasons for introducing the account of Hananiah (c. 145) are to provide the reader with additional thoughts regarding the use of Isa 2:3 and

Micah 4:2, as well as to provide the Orthodox Jewish viewpoint on how these verses may be applied to the calendar. With regard to the sighting of the new crescent in order to establish the day of the new moon, the Karaites in Israel today only accept witnesses who sight the new moon from within Israel. There are significant matters concerning which I disagree with the Karaites from Israel.

An interesting source and commentary on the Hananiah event is pages 106-111 of the book by Gafni. Hananiah was a Jewish sage (scholar) who was a native of Palestine and educated there. A rough guess of the year of his birth is 100. Due to unfavorable conditions for the Jews after the Bar Kochba revolt against the Romans began in 132, Hananiah emigrated to Babylonia where he continued to gain respect as a sage. The setting of the event is with Hananiah in Babylonia. On page 108 Gafni has a translation of the account from the *Jerusalem Talmud* (Sanhedrin 1.19a), and he provides useful comments of his own in ordinary parentheses as follows. "Hananiah the nephew of R. Joshua intercalated (i.e. proclaimed leap-years) abroad. Rabbi (here the term means the Patriarch, most probably Rabban Shimon b. Gamaliel [Simon II], circa 150 CE) sent him three letters with R. Isaac and R. Nathan. In one he wrote: 'To his holiness Hananiah', in one he wrote: 'The lambs you left behind [in Palestine] have become rams [scholars]', and in one he wrote: 'If you do not accept upon yourself (our authority), go out to the desert of Atad and there be a slaughterer [no longer a sage], and Nehunion a sprinkler.' He [Hananiah] read the first [letter] and honored them, the second and honored them, the third – and wished to dishonor them. They told him: You cannot [dishonor us now], for you have already honored us. R. Isaac stood up and read in the Torah: 'These are the festivals of Hananiah the nephew of R. Joshua!' They [with Hananiah] said: 'These are the festivals of the Lord!' (Lev. 23:4). He [R. Isaac] replied: By us! R. Nathan arose and completed (read the *haftarah* from the prophets): 'For out of Babylonia shall come Torah and the word of God from Nehar Pekod.' They [with Hananiah] said: 'From out of Zion shall come Torah and the word of God from Jerusalem' (Isa. 2:3). He [R. Nathan] said to them: By us! He (Hananiah) went and complained about them [R. Isaac and R. Nathan] to R. Judah b. Bathyra at Nisibis [for advice]. He (Judah) said to him [Hananiah]: After them, after them ... He (Hananiah) rose up and rode on his horse. Whither he reached he reached (and corrected the local calendar), and whither he did not reach – they observe in error."

One obvious important point here is that the *Jerusalem Talmud* (as well as the *Babylonian Talmud*'s account of the same incident) accept the application of Isa 2:3 and Micah 4:2 to the situation. In this context this implies that some sage in Israel must make the decision rather than some sage in Babylonia. To what extent this is a fully true account we do not know, but it does portray the acceptance of the sages in Babylonia to the reasoning based upon Isa 2:3 and Micah 4:2. Modern Jewish commentators such as Gafni and Neusner (and others that I have seen) do not question the reasoning based upon these prophetic Messianic contexts applied to a non-Messianic age.

My conclusion to this discussion concerning Isa 2:3 and Micah 4:2 is that because the New Testament does not require an exact contextual match in order to apply a verse in the Hebrew Bible to some situation, and since Jews generally have no problem applying the principle in these verses to give weight to the testimony of those who have situated themselves in the land of Israel, neither do I have any problem with applying this principle in limited ways. Certainly if a clearly illogical ruling comes from someone in Israel, I do not have any motivation to accept such a ruling.

In 1997 someone asked me whether I would accept the calendaric decisions of a new Jewish Sanhedrin in Israel if it began to function and make rulings on the calendar. My response was that if such a Sanhedrin made rulings that were based upon the biblical calendar, I would accept those rulings. But, for example, if arbitrary postponement rules were adopted by that Sanhedrin, I would not accept it. Nevertheless, a reconstituted Levitical priesthood should perform the determination of the calendar based on Num 10, not a Sanhedrin. It does bother me that Jews go to the *Talmud* to substantiate a Sanhedrin rather than to the Bible. The *Talmud* views the choosing of the 70 elders in Num 11:16-17, 24-25 as the first Sanhedrin, and uses this to show that the ideal body of elders for Israel is the Sanhedrin. This command for Moses to select 70 elders was a response to Moses' complaint to have the burden of dealing with all the problems of all the people lifted from him (Num 11:14-15). These 70 were to be disbursed throughout the people to deal with individual problems and disputes between parties, not to convene as one body as a substitute for Moses. You never see any example of this body of 70 meeting together in one place.

[56] Two Days for the Start of the Seventh Month

Should there occasionally be times that the first day of the seventh month will be celebrated for two successive days today? This is the subject of the present chapter. This partially concerns the question of whether people to the east of Israel up to the IDL should begin to observe the first day of the seventh month before anyone in Israel has an opportunity to observe the new crescent.

Isa 2:3; Micah 4:2 says, “the law will go forth from Zion”. I take this to imply that when the Messianic kingdom is established, the declaration of the first day of the numbered new moons will be made from Zion. I also take this to imply that witnesses for the visibility of the new crescent from Israel will be accepted by the governing authority in Zion, and that such witnesses will have to testify that they saw the new crescent before the governing authority in Zion. It might happen that some audiovisual technology may be used so that witnesses may appear before some technology station away from Zion and be questioned from Zion. Maybe some transportation device will convey witnesses to Zion using automation so that they will not have to ride a horse or a camel. Maybe a biometric device for identification along with the Internet will be used, and no travel will be necessary.

In today’s society witnesses for having seen the new crescent communicate to at least one of two web site hosts. Then the result is sent out via email to individuals who have signed on to the emailings. In other words the Internet is used as a modern technology tool to inform people concerning witnesses for the sighting of the new crescent.

If the astronomical conditions for sighting the new crescent are borderline so that no one can accurately predict whether the new crescent will be seen (if the weather is clear), then all people who live to the east of Israel up to the IDL should begin to celebrate the first day of the seventh month in advance of receiving Internet reports. It may turn out that such people will indeed celebrate two successive days for the first day of the seventh month, just as would occasionally have happened to ancient Israel as indicated by I Sam 20:27, 34.

In ancient times transportation methods were slow, so that if witnesses of the new moon had to travel from far off in Israel, the priesthood might have to wait several days for the witnesses to arrive. If no witnesses testify for the first day and the second day, how long should the priesthood wait? Why not wait up to the time of the ninth day of the month to accommodate the fast

day, the tenth day of the seventh month? Priests can accept the testimony of witnesses retroactively before the tenth day of the seventh month and thus avoid artificially limiting the location of witnesses within Israel. This is sensible and workable in ancient times. Anciently camels could run at 40 miles per hour and walk for long periods at half that speed so that within a couple of days it would be possible to travel from the southernmost part of ancient Israel to Jerusalem.

Without predictive mathematical astronomy in ancient Israel, there was often uncertainty of the first day of the new month during several days of waiting for witnesses to testify for having seen the new crescent. In the case of the first day of the seventh month, it is virtually certain that they often kept two successive days for that festival because of no reports of visibility on the first of the two possible days for sighting the crescent. Today, due to computer calculations, there is uncertainty under rare circumstances, assuming we accept visibility from desert regions of Israel where it almost never rains. When actual witnesses from Israel are available, if we reject their testimony and only use a computer calculation, it is certainly true that we make matters easy for ourselves, but then we set ourselves up as an authority that contradicts the ancient use of human instruments for sighting as originally intended. In this modern age, people often want to be able to plan everything precisely in advance. If we have uncertainty due to a borderline case in a rare circumstance, we can still plan for two successive days and have ourselves covered. People can plan an airplane trip one extra day ahead of time so that either event will work out okay.

[57] What if the Whole Earth may Sight the Crescent to start the Month?

If the boundary for ending the sighting point for visibility of the new crescent does not stop at the borders of the land of Israel, where does it stop? The further to the west one goes, the easier it becomes to see the new crescent, although higher than about 4000 feet above sea level it gradually becomes ever easier to see the crescent, and low humidity favors seeing the new crescent. How far to the west can one go? The natural answer based upon its modern acceptance is the IDL in the Pacific Ocean. If one goes there, then everyone's attention would be focused on the IDL to give the very last look to the most western line before deciding that that day will not suffice for starting the new month. In other words, some islands in the Pacific Ocean would get all the attention instead of the land of Israel or its headquarters, Jerusalem. That would mean that local or worldwide visibility

to determine the new crescent would be redefined to visibility at some islands in the Pacific Ocean. This makes no sense.

If one proposes that the IDL should be totally ignored and the exact moment of the first sighted crescent should be used to determine the start of the new crescent for the whole earth, this method will often cause some line along a landmass to separate one day beginning at sundown from the next day on the eastern side of the line. The reason for this is that a new day begins at sundown rather than some random time within a day. Thus neighbors will not be in harmony on the day that begins the new month and confusion will result. Another problem is that this method will sometimes produce a one day difference with the day that would have been selected for the new moon day in Israel under ancient circumstances of the Levitical priesthood.

[58] The Ancient Situation Outside of Israel

Suppose some ancient Israelites went exploring on a ship to North America. How would they begin a month? Without the Internet, without long distance telephone service, et cetera, they could not contact (even through intermediaries) the High Priest for a knowledge of when each month began. They would have no choice but to use visibility of the crescent from wherever they were. If such a ship gave rise to two colonies separated by 100 miles, and if these colonies remained isolated from one another, there would no doubt be months in which they began a month one day apart. If they kept in contact with one another, then it is reasonable to think that the colony with rainy weather would accept the witness of the other colony, so that both would be in harmony on the start of a month. As we add more colonies it becomes ever more difficult to hypothesize how one could define local visibility. Nevertheless, with primitive isolation of settlements outside of ancient Israel, there is no confusion so that I Cor 14:33 would not apply. It is only after significant communication is possible and the modern age enters the scene that confusion enters.

[59] Modern Technology makes a difference

Anciently, if appropriate technology were available, the ideal situation implied by Num 10:10; Isa 2:3, Micah 4:2 would result in all people everywhere accepting the word of the High Priest, whose responsibility would include questioning witnesses who came from the Israel. Some people imagine that it is “not fair” to use modern technology to report on

such visibility, and instead we must pretend we only have what people had in the days of ancient Israel. Such pretending should also include pretending we have no telephones, pretending we have no automobiles, pretending we do not have modern computers, pretending there is no Internet, even pretending we are in ancient Israel, i.e., in the Promised Land because that is where people had access to Scripture. Certainly in Israel all were united on the day, following the lead of the High Priest. Hence rainy areas accepted testimony from clear weather areas in Israel.

[60] Num 10:10 Avoids Confusion

According to Num 10:1-2, 8-10 the Levitical priesthood is commanded to blow two silver trumpets on the first day of each month. The Levites were commanded to be disbursed in 48 cities throughout the 12 tribes (Num 35:2-8), not all over the world. The priests must observe, or reliable witnesses must inform them where they are, concerning the new crescent (Deut 17:6; 19:15; Mat 18:16; II Cor 13:1; I Tim 5:19). In concept, even though we do not have the Levitical priesthood functioning today, one must still view matters from the standpoint of the priesthood blowing trumpets on the first day of the month using two silver trumpets, implying they were being blown from one location. The biblical focus of attention for world government is on Israel, and specifically Jerusalem (Deut 11: 11-12; Ps 132: 13-14; Isa 2:3; Micah 4:2).

[61] Differences between the Sabbath and the New Moon

In ancient Israel there was certainly a difference between how each Sabbath began throughout Israel and how each month began throughout Israel. Each Sabbath began based on sundown for each person. While the time of sundown might vary by a minute throughout Israel, the beginning of the month did not begin this way. According to Num 10:10 the Levitical priesthood was commanded to blow two silver trumpets to officially announce the beginning of each new month. If someone and his neighbor observed the new crescent together in a difficult to observe circumstance and they neglected to appear as a witness before the appropriate priests, and if no one else appeared before the priests to testify for having seen the new crescent, the priests would not have blown the trumpets and the new month would start a day later. Thus those two witnesses who failed to appear before the priests would not begin the new month when “it came to them”, but would have to use the starting of the new month according to the

determination by the priests, when they blew the silver trumpets. In ancient Israel when the holy days were kept in one central place (Jerusalem after the first six years of King David's reign), those two witnesses could not argue with the priests when they appeared for the festival at the middle of the month. The priests would have no choice but to say to the two witnesses: "Why didn't you come to us near the start of the month and testify at that time? If you had done so, then we would be starting the feast one day sooner. Now it is too late to testify."

The point being made here is that merely because we keep the Sabbath when it comes to us according to the IDL, that is not a deep enough or thorough enough examination and explanation of the different issues involved with the start of the month. The concepts for the month start and the Sabbath start were different in ancient Israel, yet the need for avoiding confusion is the same. Levitical priests did not have to blow the trumpets to officially notify everyone in Israel that the Sabbath had begun. It is certainly true that the Levitical priesthood does not exist today, but one must consider how one might sensibly approach this matter today given what we do know and the ever present need to avoid confusion among saints that are spread out in the world, often in close proximity to one another (I Cor 14:33).

Since we cannot define "local visibility" to cover all circumstances away from the north and south poles, and since our Creator who wants us to worship Him on the festivals is not the author of confusion (I Cor 14:33), the way to avoid it is to use the implication of Paul in Acts 18:21 in which he showed respect for the determination of the calendar by the Levitical priesthood by wanting to be there for the feast. Num 10:10 is there to achieve unity in ancient Israel. The central declaration of the new moon by the priesthood was not needed for the Sabbath even though the trumpets were still blown on the Sabbath as well because they are also appointed times according to Lev 23:1-4. The announcement for the new moon of the seventh month had to reach all of Israel quickly if the ending month had only 29 days, or else people would needlessly keep two days as the new moon of the seventh month. Such an announcement all over Israel was not needed for the Sabbath.

When people live some distance outside the temperate zones, even with clear weather there will occasionally be a 31 day month based upon the concept of only personal eyeballs doing the looking (no phone calls, no Internet, no automobiles, no carrier pigeon communication, no fire signals,

etc.). Thus the basic principle of a maximum 30-day month can no longer be used from outside of Israel with only personal eyeballs doing the looking. Then what does one do when it is raining or very cloudy and only depending on personal eyeballs (do you sometimes have a 32 or 33 day month)?

[62] Does the priesthood of all saints (I Pet 2:9) change the calendar?

The Levitical priesthood is a genealogical priesthood with physical duties, physical objects, and a physical service, although it was expected to teach spiritual laws and principles. The priesthood of all saints is a spiritual priesthood without the physical objects such as the silver trumpets to blow and announce the new months. Just as the priesthood of all believers does not have the authority to wave the sheaf during the Days of Unleavened Bread, it does not have authority to blow the two silver trumpets and announce the start of each month. If two different organizations of believers were in the same geographical area outside of Israel and observers in both organizations came to different conclusions of the day to start the month based upon what they saw separately in each organization, and then members within each organization separately blew their silver trumpets on two different days, wouldn't that have to be regarded as confusion in the same area?

Heb 7:12 points out that there is a change in the priesthood and a change in the law relating to it for the saints. Yet Heb 9:7 points out that when this was written, the High Priest still functioned and entered the holy of holies once per year, showing that this was still a continuing practice of the Levitical priesthood, which was not shown disrespect by the author of the letter to the Hebrews. Heb 10:11 shows the continuation of the Levitical priesthood, yet with its limitations of effectiveness.

If different members of the priesthood of all saints were to blow two silver trumpets on the days that they thought the new moons were, but they differed from one another, perhaps when even a few miles apart, is this not confusion and is this what YHWH wants? Does He desire to sanctify multiple pairs of days for the same festivals when people have modern communication? Num 10:10 was there to avoid this in ancient times. Since we can know whether the new moon was sighted in Israel today by means of mass communication, this is a unifying principle and taken out of the hands of one human organization or authority.

It is true that there is no Levitical priesthood functioning today, yet the principle in the law is that in the mouth of two or three witnesses a matter is to is established (Deut 19:15), and this principle was applied in other situations later (Mat 18:16). To avoid confusion the witnesses should be drawn from where the Levitical priesthood was to reside, namely the boundaries of ancient Israel.

[63] Historical Evidence for Sighting the New Crescent

In the early first century, Philo of Alexandria reported that the new month for Jews began with the sighting of the new crescent after the conjunction (see page 333 of Philo_7, Special Laws 2:41). Historical evidence concerning testifying about having witnessed the new moon does not exist before the *Mishnah*, which dates from about 200 CE. While I do not accept the *Mishnah* as an inspired document or for an accurate valid statement concerning Jewish history, by combining the written witness of Philo with corroboration from the *Mishnah*, it is sensible that witnesses of the sighting of the new crescent were expected to testify.

[64] Should only Jerusalem be used to Sight the New Crescent?

If we today were to propose that only the sighting of the crescent from Jerusalem mattered (avoiding areas of Israel outside of Jerusalem), then since there are people today who report on the sighting of the crescent on the Internet, we would often be changing at the beginning of the first and seventh months based on rain or heavy clouds over Jerusalem, even if other areas of Israel were clear, it was not a borderline case, and humidity was not an issue. This shows that Jerusalem sighting does not make matters easier, but actually complicates matters because there would be more uncertainty on more occasions than using visibility throughout Israel, which includes desert regions so that computer predictions would only fail in some rare borderline cases.

If we had no reports of actual sighting from Israel in the modern world, but wanted to avoid confusion and utilize the concept of sighting the crescent based upon Gen 1:14-18, then a calculation of the high probability of sighting the crescent is the only choice, and the vast majority of the time (no borderline condition or slightly under borderline where low humidity is a question) the calculation and actual sighting will agree. The calculated dates

will work over 90 percent of the time in the latitude of Israel under 4000 feet above sea level.

[65] Starting the Month when it comes to you

Today the part of the world east of Israel always starts the Sabbath before Israel, and the part of the world west of Israel always starts the Sabbath after Israel. Thus India starts the Sabbath before Israel and the United States starts the Sabbath after Israel. To be consistent with the way we keep the Sabbath, we should also begin the start of the month according to the same principle: the people in India begin the start of the month before the people in Israel and the people in the United States begin the start of the month after the people in Israel. This principle extends to the IDL and is what mainstream Judaism uses.

[66] Actual Sighting from Israel Today

In September 2004 a new problem arose when the Karaites in Israel introduced a new concept of what constituted a valid observation. They allowed momentary sightings of something that would not even have been recognizable anciently as a crescent to be validly considered a sighting of a crescent. This was done on the basis of having observed the moon with binoculars and a tripod for steady viewing for some time, so that they "knew" it was the crescent, although no one in ancient times could have known it was the crescent. If an alleged sighting from the Karaites is more than half of one degree below Karl Schoch's curve, then I do not trust that sighting as having been acceptable in ancient times, most especially if the sighting is not done from a place of low humidity. Details must be provided by those who issue reports in such unusual circumstances.

[67] The Process of Declaring the New Moon

(A) Israel as the Geographical Anchor

Num 10:10 shows that the Levitical priesthood was to blow two silver trumpets to declare that a new month had begun. Through this brief statement we can at least say that the priesthood had the responsibility to gather testimony concerning the sighting of the new moon and make a decision of whether to declare it. Since the priesthood was commanded to dwell within the boundaries of ancient Israel, that place is the region from

which testimony would have been taken as long as the Levitical priesthood existed. Jumping to today's society in the modern world, if multiple peoples around the world were to arrive at an independent determination based upon individual arbitrary regional decisions of "locally" sighting the new crescent, that implies that YHWH declares regional feast days that may overlap and conflict in certain geographical areas, making two different days holy even in the same place where two different organizations may overlap in geography. This makes YHWH the author of confusion, contrary to I Cor 14:33. Different people may invent different concepts of how to determine a new moon in their own area in terms of distance and height above sea level, and there is no biblical guideline for such a definition. As long as people elsewhere are able to communicate with people in Israel, the only way to avoid making YHWH the author of confusion and also respect the concept of Num 10:10 (even recognizing that the Levitical priesthood no longer exists), is to use the boundaries of Israel as the geographical anchor for visibility of the crescent.

(B) A minimum of Two Witnesses for sighting the New Crescent

Deut 17:6; 19:15 declares, "on the mouth of two witnesses or on the mouth of three witnesses a matter shall be established". This is quoted in Mat 18:16 and II Cor 13:1 as applying to other situations.

(C) Only a continuous Naked Eye sighting should be admitted as a Witness

As an avid student of the history of ancient astronomy I can say that the invention of the telescope is not provable before 1608, but in that year several Europeans constructed telescopes about the same time. Galileo first constructed one in 1609 and made important improvements. See pages 326-329 in the book by John North. Ancient peoples showed great interest in the moon, yet there is no ancient drawing that shows details of the surface of the moon that would require a telescope, nor is there any historical evidence that ancient peoples invented a telescope.

When people discuss the sighting of the crescent today, it seems generally agreed that evidence for the new crescent should not be accepted by methods that were not available in the days of the functioning of the Levitical priesthood. This means that if an individual is in an airplane flying over Israel, that altitude would prevent accepting such a testimony for having seen the new crescent. In fact, it means that the observer should be standing

on the ground or sitting on some object that is on the ground, and certainly using naked eye observation at the time of declaring having seen the new crescent. Furthermore, the sighting should be a continuous one rather than one that lasted only about a second, even if separately repeated later for about a second. This prevents a vivid imagination from fooling a sincere mind. The question of how much use of a telescope or binoculars may be acceptable is treated next.

(D) Partial use of a Telescope or Binoculars

The principle that evidence for the new crescent should not be accepted by methods that were not available in the days of the functioning of the Levitical priesthood is generally accepted, although there are exceptions to almost everything when human opinions are taken. But sometimes observers go to great lengths to enhance the likelihood that they will see a new crescent with the naked eye. For example, they will use a knowledge of modern astronomy and mathematics to correctly predict where and when in the sky the crescent should be seen, and then focus a telescope upon an accurate mounting pointing to that location. When they finally see it at that location through the telescope, they will then try to locate it with binoculars. Then they will periodically remove the binoculars to try to see it with the naked eye. Then upon seeing it continuously with the naked eye, they will declare they have seen the new crescent. Obviously different people will have different opinions about this process.

One aspect that relates to mathematics and binoculars deserves special comment. This has to do with the refraction of light from an astronomical body as it travels to the eye of an observer. Having watched some new crescents as they lowered down to the horizon from my sighting location that has been near the latitude of Israel (especially the area around Dallas, Texas), I noted that they changed shape significantly during last part of the descent. This change of shape is due to the increasing effect of refraction as the light from that object neared the surface of the earth. The density of the earth's atmosphere increases as one approaches sea level. As the density of the atmosphere increases, refraction also increases. This increasing refraction distorts the shape of what one sees. When it gets low enough, it ceases to have the characteristic appearance of the new crescent, and what one sees can be confused with a cloud or a piece of a cloud. If one sees this for the first time in its very low position in the sky, one will be very uncertain that this is the new crescent, but if one has seen it that way all

along for the previous 15 minutes, there will be no reason to doubt that it is the new crescent.

When the crescent is seen from the northern hemisphere, it looks different near the time of the vernal equinox compared to near the time of the autumnal equinox. Near the vernal equinox it looks somewhat like a bowl whose bottom is horizontal and down. Near the autumnal equinox it looks somewhat like a backwards letter "C". In the spring when it gets near the horizon, the bowl shaped crescent gets flattened to a very short horizontal straight line, and anyone seeing this who had not already been watching it before would not think this was a crescent since all the curvature would be gone. In the autumn when it gets near the horizon, the backwards "C" shaped crescent gets flattened to the outline of what appears to be an extremely narrow squashed tip of a cigar, but not filled internally, and anyone seeing this who had not already been watching it before could easily mistake it for the outline of a cloud.

Armed with the above information, let us contemplate the following. Consider two observers, observer "A" using the sophisticated modern techniques of an aimed mounted telescope and binoculars, and observer "B" who is nearby with only his eyes to see, but "B" is not in contact with "A". If this is a very difficult case in which to imagine seeing the new crescent and both of them happen to first see it with their naked eye at the same time, and moreover, the moon is very close to the horizon, the thoughts in their minds are likely to be quite different. Observer "A" is likely to think as follows. I have been watching this crescent all along for many minutes with binoculars and now I finally see with my naked eyes what I have been looking at all along, so I know it is the new crescent. Observer "B" is likely to think as follows. I see something out there, but I'm not quite sure what I am looking at, because it doesn't have the typical characteristic appearance of the new moon; it could be the latter stage of what a new moon looks like, but it is so low that it's difficult to be sure if this is a crescent or perhaps a piece of cloud.

If one accepts the principle that evidence for the new crescent should not be accepted by methods that were not available in the days of the functioning of the Levitical priesthood, then one must consider the difference between the thinking of observer "A" and the thinking of observer "B". While I would not object to an observer knowing where to look and even using a telescope and binoculars to pinpoint the direction to look, upon seeing the object with

my naked eye, I would have to make a judgment of whether the appearance of the object is sufficiently close to a crescent that if I were seeing this for the first time, I would be convinced this is a crescent rather than a piece of cloud. If the appearance alone is not convincing, even though I would in reality know it is the new crescent because I had been observing it for a number of minutes with binoculars, it should not be admitted as evidence for seeing the new crescent because it would be unconvincing to an ancient observer.

This means that when a report is given by observers of the new moon in a difficult situation where binoculars or a telescope was used, the report should include details of approximately how long it was seen continuously with the naked eye, how its shape appeared to the naked eye, and a judgment of whether it would have been convincing to an ancient observer who knew approximately how it ought to appear at this time of the year. If it would not have been convincing to an ancient observer, then it should not be accepted as a witness to the new crescent.

Summary: The problems with using local visibility are:
(1) How is it defined in today's world?
(2) How is it consistent with Num 10:10 where the priests determine the new month from Israel?
(3) How can it avoid confusion (I Cor 14:33)?
(4) Does it avoid arbitrary decisions of distance for accepting witnesses?
The advantages of using visibility of the new crescent within Israel are:
(1) The definition is simple.
(2) It is consistent with Num 10:10.
(3) It avoids confusion.
(4) Over 90 percent of the time it is not a borderline situation and it is predictable.
(5) This, along with the IDL, best fulfills the philosophical principles stated at the beginning of this study.

The use of the IDL for the 24-hour day, starting with sundown as it gradually sweeps across the globe, has attained worldwide acceptance by keepers of the Sabbath, and this principle for the start of a month has been accepted by mainstream Judaism (Orthodox, Conservative, and Reformed), and the Karaites also accept it, but typically starting one or two days later than the MCJC. This method does cause people to the east of Israel up to the IDL to begin to observe the first day of the seventh month prematurely,

perhaps on some occasions causing two days of observance. In ancient times Israel did the same thing as indicated in I Sam 20:27, 34. Hence this is not a significant fault. The sighting of the new crescent from within the boundaries of Israel should determine the day, and this day should be accepted around the world based upon the IDL with sundown as it sweeps across the globe.

[68] Two Web Sites with New Crescent Reports from Israel

There are two web sites hosted from Israel that report on new moon sightings from Israel, and they do not consider reports from outside Israel to be significant. One of them is hosted by Dr. Roy Hoffman, who works for the Department of Organic Chemistry of The Hebrew University in Jerusalem (see www.geocities.com/royh_il/). I have seen some emails forwarded to me that make it clear that Dr. Hoffman favors the Rabbinic writings and the commentaries by Orthodox Jewish sources. Some of his reports of borderline sightings of the new crescent are more detailed than the other web site. The other one is hosted by Nehemia Gordon, a spokesman for the Karaites in Israel (see www.karaite-korner.org). These web sites provide information of sightings, and then those that receive the emails are free to decide whatever they want on the basis of these reports. Nehemia Gorden tends to make statements that state what month this is on the basis of his tenets, but no one is forced to agree with his conclusions.

[69] Saadia Gaon and the Origin of the Modern Jewish Calendar

The main focus of this treatise is the biblical calendar. This calendar was maintained utilizing the performances of the Levitical priesthood from the time of Moses until the destruction of the Second Temple in 70 CE; however, the Babylonian captivity caused a temporary disruption. In an earlier chapter abundant evidence was presented from the New Testament, Tacitus, and Trogus to show that during the first century before the war broke out in 66, the Levitical priesthood controlled the Temple.

In Deut 33:10 we note the important role allotted to some of those in the tribe of Levi, “They shall teach Jacob Your judgments and Israel Your law. They shall put incense before You and a whole burnt sacrifice on Your alter.” After the destruction of the Temple, as far as history provides evidence, the priesthood ceased to function and its ability to provide guidance to the application of the biblical calendar ceased. Thus Deut 33:10

was no longer applied after the destruction of the Temple in 70. Therefore, after 70, I would no longer consider the calendar used by the mainstream of Jewish people to be the biblical calendar; instead I would call it the Jewish calendar.

With the change from the biblical calendar to the Jewish calendar after 70 as I understand history, my method of presenting evidence is now altered for this unique chapter that deals with the distant post-70 changing Jewish calendar. My approach here changes away from an analysis based upon primary sources (in translation) as far as is possible, to a very sketchy account with reliance on secondary sources. This is only a temporary departure in method. This chapter is in part a continuation of the theme that the biblical calendar did not employ mathematical astronomy. Saadia Gaon represents a challenge to that claim, and that is a reason for dealing with this matter.

Saadia Gaon (882-942) wrote the oldest known dictionary of biblical Hebrew and the oldest known grammar book of biblical Hebrew. He translated most if not all of the Tanak (the Hebrew Bible) into Arabic. He is considered one of the greatest Jewish philosophers during the post-Talmudic period. He was given the title Gaon because he became the head of the Jewish academy in the city of Sura (in modern Iraq). He championed Rabbinic Judaism against his Jewish sectarian opponents and was a fierce debater. In the history of the Karaite movement in Judaism he is considered their most famous enemy because he engaged in heated arguments with the Karaites and he sought to dissuade Jews from joining the ranks of the Karaites. On page 86 of the chapter by Alexander Marx we read, "Numerous [Jewish] sects arose in the East [Iraq/Iran], and while most of them were of ephemeral character, they inaugurated a movement which finally led to the rise of Karaism, a sect which was founded in the second half of the eighth century and is still in existence." Saadia was born in 882, about 100 years after the Karaite movement began.

Saadia's most frequent topic of debate with the Karaites is that of the religious calendar. Saadia championed the modern calculated calendar. The Karaites did not follow the calculated calendar of the Jews and sought to use phenomena that were observable to determine the beginning of each month and to determine which month is the first. One category of Saadia's works is known as polemical works. These are writings whose primary purpose was to defeat the positions of his enemies before some audience. If the audience

is lacking in knowledge, a debater may be able to make invalid claims and still win the hearts of the audience. When evaluating any polemical work, the reader must be on guard to determine whether the writer is being objective and fair with history and all available evidence. Evidence will be presented to show that Saadia was neither objective nor fair with history.

On page 159, Samuel Poznanski 1898 wrote, "The Sectaries, especially the Karaites, by their attacks on the [calculated] Calendar, misled so illustrious a genius as Saadiah into anachronisms, logical fallacies, and egregious blunders. The Gaon claims that the [calculated] Calendar is of Sinaitic origin [given to Moses at Mt. Sinai], and that its rules [concerning postponements, mathematics, etc.] existed in the days of Moses. It was easy for his [Karaite] opponent to demonstrate the utter absurdity of this contention. And Hai Gaon had to admit that Saadiah did not really intend the assertion to be taken seriously. His [Saadia Gaon's] object was to snatch a momentary triumph in the verbal combat."

On page 393 Solomon Zeitlin wrote, "Already Hai Gaon had noticed that Saadia Gaon's arguments were only for the purpose of dismissing the [Karaite] heretic. Isaac ben Baruch, who quoted Saadia's contentions at length, refuted him on every point and showed from the *Talmud* the fallacy of Saadia's ideas. Maimonides was even stronger in his utterance against Saadia. Maimonides said that he wondered how a man could say that the Jewish religion was not [originally] based on the observation of the moon but on calculation only; he continued that Saadia, regardless of true or false statements, was only interested in refuting his opponent. Abraham Ibn Ezra also maintained that what the Gaon (Saadia) said about the Jews [originally] intercalating the months according to calculation was not true." On pages 393-394 Zeitlin continued, "Indeed everyone who is acquainted with the Talmud knows that in the time of the Tannaim [Talmudic sages who were alive through c. 250] the Jews did not have a fixed [calculated] calendar: Passover [Nisan 15] did fall on Fridays; *Rosh ha-Shanah* [first day of the seventh month] fell on Sundays; the Day of Atonement fell on Fridays and on Sundays." On page 394 Zeitlin wrote, "However, Saadia Gaon believed that *the end justifies the means*. He had a righteous cause and he fought with all the means he thought necessary."

On page 37 Salo Baron wrote, "However, in the rage of controversy he [Saadia] did not hesitate to reinterpret history in a way which, although

violating historic facts, would serve his major historic purpose of combating heresy."

From the above quotations we note that in Saadia Gaon's debates with certain Karaites in which a Jewish audience is assumed to be present, he had claimed that the rules of the calculated Jewish calendar were given to Moses at Mt. Sinai, but leading Jewish sages shortly after him recognized that these claims were absurd because there was nothing in history to back up such claims and the *Talmud* contradicted such claims in several ways. This implies that Saadia did not think his Jewish audience would possess any knowledge of the origin of the calculated calendar that they were following. Thus the origin of the calculated calendar must already have been somewhat of a historical secret among the laity of Judaism shortly after 900 when these debates occurred. It is at least clear that the rabbis in the Rabbinic synagogues did not actively teach the history of the calculated calendar because if they did, the Jewish audience would know its history and the famous Saadia would be a laughing stock among common Jews.

In a previous chapter it was explained that the average length of the month as mathematically expressed in the modern calculated Jewish calendar was stated in the *Babylonian Talmud* (published c. 600), and this exact value was first determined by the ancient Babylonians about 330 to 300 BCE. It does not make sense to imagine that this value was given to Moses over 1000 before this Babylonian invention, as Saadia Gaon would have his Jewish audience believe. This is the only mathematical parameter within the rules of the calculated calendar that appears in the *Talmud*, but there are several other mathematical parameters that comprise the calculated calendar. The *Talmud* itself does not claim that this value is used or will be used in the Jewish calendar. The *Talmud* never claims that the Jewish calendar is to be calculated.

On page 48 of Wiesenberg we note the following concerning the Patriarch Hillel II who lived in Palestine and who is mentioned in several places in the *Babylonian Talmud*, "According to a tradition quoted in the name of Hai Gaon (d. 1038), the present Jewish calendar was introduced by the patriarch Hillel II in 670 Era of the Seleucids – 4119 Era of the Creation = 358/59 C.E. (500 C.E., claimed to derive from another version, seems to rest on a mistake)." This quotation, put in simple terms, says that the claim that the modern calculated Jewish calendar originated with Hillel II in 358/359 is

based upon one writing by Hai Gaon (died 1038, Gaon of the academy of Pumbedita). Nothing knowm before Hai Gaon alleges this.

On page 158, Samuel Poznanski 1898 wrote, "If [shortly after 900] it had been generally believed that the [calculated] Calendar was fixed by Hillel II, it would have been not merely idle and futile, but probably foolish on the part of Ben Meir [a major Jewish leader and scholar in Palestine], who, rightly or wrongly, styled himself a descendant of the Patriarch [Hillel II], to revolt against the Calendar [with regard to only one aspect of one of its postponement rules], of which his own ancestor [Hillel II] had been the author, and in regard to which Palestine [the dwelling place of Hillel II] had laid down the law for all Israel." Here Poznanski presents a strong argument that Ben Meir did not believe that Hillel II established the rules of the calculated calendar!! This is an argument that Hillel II did not establish the calculated calendar.

A second argument that Hillel II did not establish the calculated calendar is that the *Babylonian Talmud*, published c. 600, states much about Hillel II, but nothing about Hillel II in relation to the calendar. While this is an argument from silence, and is therefore subject to criticism on that ground, matters associated with the calendar are often mentioned in the *Talmud*, so it would be surprising if such an important matter were totally neglected in the *Talmud*. The *Talmud* mentions nothing about there being an authoritative calculated Jewish calendar.

A third reason that Hillel II did not establish the calculated calendar is presented on page 118 of Poznanski 1911. There he points out that in the years 506 and 776 there are dates in the Jewish calendar that contradict the modern calculated calendar. In fact this implies that the modern calculated calendar was established in its near current form on or after 776.

On page 254 of Stemberger 2000 he translates the following from a work of Maimonides (1135-1204), "And when did Israel begin to calculate according to this calculation [the one used in the modern calendar]? Since the end of the scholars of the Gemara, in the time when Israel was laid waste and no fixed court remained there." This is vaguely sometime after the *Talmud* was completed c. 600. Stemberger wrote on page 255, "However, if he [Maimonides] had been aware of the tradition about a fixed calendar introduced by Hillel II, he would certainly have expressed himself with greater precision." Maimonides wrote a complete exposition on the

calculated calendar including explanatory remarks, so he would have made an effort to be precise if he had knowledge. This is a fourth reason that Hillel II did not establish the calculated calendar.

On page 118 Poznanski wrote, "In point of fact, everything goes to indicate that the calendar, like all other productions of the kind, passed through a developing series of forms, and that it assumed its final shape in the schools of the official representatives of Judaism (called Geonim) in Babylonia." There were two leading Jewish academies in Babylonia, one in Sura and the other in Pumbedita. The head of each academy was given the title Gaon. Qualifications of a Gaon were to be both a significant scholar and a respected leader within Judaism. In a sense it was a political feat to become a Gaon, although Jews did not have their own country. The two leading Babylonian academies were held in very high esteem by the rabbis in that era. Important rabbis were often trained there.

In the biographical sketch of the life of Hayyim J. Bornstein (1845-1928) by Abraham Fraenkel (see the reference under Fraenkel), on page 1252 we note, "Bornstein's knowledge of chronology, history, and mathematics enabled him to open new avenues in the study of the development of the Jewish calendar. He based his theories on several documents in the Cairo *Genizah*, the importance of which he was the first to recognize. Bornstein advanced the novel claim that the details of the Jewish calendar, with its small cycle of 19 lunar years and its method of reckoning the conjunction of the planets ["sun and moon" should replace the word *planets*], had not been calculated and accepted until sometime between the mid-eighth and mid-ninth century C.E., and not in the period of the *amoraim* [sages of the Talmud after 250] under Hillel II as had been generally believed – much less in the first century C.E., as claimed by the German chronologist F. K. Ginzel."

There is some speculation that perhaps only the fixing of the 19-year cycle was achieved by Hillel II. If this were true, the question remains as to why the Talmud and other authorities are completely silent on such a weighty matter.

My conclusion is that the origin of the modern calculated Jewish calendar was between c. 750 and c. 850, and it was agreed upon by the Gaonim of the Jewish academies at Sura and Pumbedita.

[70] Authority in Israel Distorted by Josephus

(A) Josephus on the Biblical Court System and the Biblical King

In matters pertaining to human authority over the Israelite people concerning the biblical court system, it is instructive to see how Scripture compares with Josephus. Deut 17:8-13 discusses what to do when difficult legal cases arise and the local judges cannot decide. Verse 8 together with Deut 12:5 (as interpreted in the later context when Jerusalem would be the capital city), indicate that such cases would be transferred to Jerusalem. Deut 17:9 explains what should happen next. The authority figures are mentioned in Deut 17:9 [NKJV], "And you shall come to the priests, the Levites, and to the judge there in those days, and inquire of them; they shall pronounce upon you the sentence of judgment." Verse 12 states that the verdict is given by "the priest" or "the judge". This should be understood in light of Deut 19:17 where a single case is brought before "the priests and the judges". When this is read by itself without looking outside the Bible for interpretation, we do not read about one national body meeting under one roof (one Sanhedrin), but instead, individuals from among priests, Levites, and "the judge"; however, an unstated quantity of these people judge each case. Verse 9 indicates a plurality of people in authority with emphasis on priests and others of the tribe of Levi, but people from other tribes are not excluded from serving on the court. In Deut 21:5 where the cities all over the country are in the context (verses 1-9), the priests are said to be involved in settling every dispute. There is nothing specific in the Tanak to cause one to insist that the same single body of people in Jerusalem is to judge every case that cannot be decided by local courts throughout the land.

Note that Deut 17:8 does say "gates", which means courts, and it should be accepted that Deut 17:9 necessarily implies at least one court for judging civil cases brought to it from local courts. This permits the likelihood, especially if the population is large, that there would be a group of high-level courts in Jerusalem, and any case that is too difficult for the local courts may be assigned to one of these courts. On the other hand, this may also be interpreted so that if the population were large, Jerusalem would have an intermediate level of courts that would first consider cases brought to it from local courts, and then any cases that could not be resolved by these intermediate level courts would go to one highest court. The Pentateuch does not assign any specific role to the high priest within the court system, but

priests do have a prominent role throughout the court system (Deut 17:9; 19:17; 21:5).

When reading Josephus concerning the court system, we must carefully distinguish between his portrayal of the law of Moses and his statement of what actually happened in Jerusalem according to his personal experience as he chooses to tell it. After devoting a considerable number of pages to history, Josephus returns to discussing the law of Moses, and provides a preparatory comment as follows in Ant 4:196 (pages 569, 571 in Josephus_4), "But here I am fain first to describe this constitution, consonant as it was with the reputation of the virtue of Moses, and withal to enable my readers thereby to learn what was the nature of our laws from the first, and then to revert to the rest of the narrative. All is here written as he left it: nothing have we added for the sake of embellishment, nothing which has not been bequeathed by Moses." The readers of Josephus understand the constitution to be the laws by which the country is governed, and he uses this word to refer to the laws of Moses that pertain to the government and possibly some other laws as well.

In Josephus's version of the local courts in the law of Moses, he wrote (page 579 in Josephus_4), Ant 4:214, "As rulers let each city have seven men long exercised in virtue and in the pursuit of justice; and to each magistracy let there be assigned two subordinate officers of the tribe of Levi." Here Josephus adds specific numbers of people to serve as rulers, and he certainly does not leave out the tribe of Levi entirely, but he does not require any role for priests and insists on at least a minor role for Levites. This is clearly a distortion of the major biblical role for priests.

We next examine the situation in which a case is too difficult for a local court. This is parallel to Deut 17:9. A careful translation of Josephus's Ant 4:218 is given on page 32 of Pearce, "But if the judges do not understand how they should give judgment about the things that have been laid before them - and many such things happen to people - let them send the case up untouched to the holy city, and when the chief priest and the prophet and the senate [Greek: *sunedrion* (Sanhedrin)] have come together, let them give judgment as to what seems fit." Note that Deut 17:9 gave a primary role to the priests and Levites without mentioning the high priest. Josephus adds the high priest, but does not insist on any other priests, although he may assume this is to be included in the Sanhedrin. He also maintains that Moses intends there to be only one high court, the one national Sanhedrin. Josephus also

includes “the prophet” within the meeting of the Sanhedrin, a matter about which Moses wrote nothing. In several ways Josephus distorts the natural meaning of the biblical account.

Several years after Josephus wrote his *Antiquities of the Jews*, he wrote his last work, *Against Apion*. In this last work he was not giving a thorough treatise on the law of Moses, but he did mention the attitude of the Jews toward this law, and then he made a few statements about the law in relation to the court system. In AA 2:183 (page 367 of Josephus_1) he wrote, “To us [Jews], on the other hand, the only wisdom, the only virtue, consists in refraining absolutely from every action, from every thought that is contrary to the laws originally laid down.” Concerning the court system he contradicted his earlier statements above where he previously diminished the role of the priests in the court system and governing in general, except for the high priest. In AA 2:187 (pages 367, 369 of Josephus_1) he wrote, “But this charge [for the priests] further embraced a strict superintendence of the Law and of the pursuits of everyday life; for the appointed duties of the priests included general supervision, the trial of cases of litigation, and the punishment of condemned persons.” In AA 2:193-194 (page 371 of Josephus_1) he wrote, “The priests are continually engaged in His worship, under the leadership of him who for the time is head of the line. With his colleagues he will sacrifice to God, safeguard the laws, adjudicate in cases of dispute, and punish those convicted of crime. Any who disobey him will pay the penalty as for impiety towards God Himself.” In this context Josephus is summarizing the ideal form of government as a theocracy controlled by priests as it was supposed to be in the sacred writings of the Jews. Here he makes no explicit mention of what happened in his lifetime, but the assumption is that this did parallel what occurred in his lifetime. Of course he knew the correct biblical role of the priests in the court system when he wrote his earlier work, but in that earlier work he deflated the role of the priesthood within the court system. This does show inconsistency in Josephus. However, even in his last work he did not mention Levites, but only the subgroup of the Levites called priests. Often scholars disagree with one another in their conjectures for his motives.

In Deut 17:14-20 Moses describes the appropriate behavior for future kings of Israel, and this does not show that the king should share his rulership with other men. Comparing this to the corresponding description in Josephus, we see the following on page 583 of Josephus_4, Ant 4:224, “Let him [any future king of Israel] concede to the laws and to God the possession of

superior wisdom, and let him do nothing without the high priest and the counsel of his senators ...” Here Josephus puts a non-biblical restraint upon the king's authority so as to force him to share it with the high priest and a body of officials. This is a significant distortion of the authority of the king in ancient Israel.

Josh 2 describes the spying mission of two men into Jericho, and verse 23 states [NKJV], “So the two men returned, descended from the mountain, and crossed over; and they came to Joshua the son of Nun, and told him all that had befallen them.” Comparing this to the corresponding description in Josephus, we see the following on page 9 of Josephus_5, Ant 5:15, “So having made this compact, they departed, letting themselves down the wall by a rope and, when safely restored to their friends, they recounted their adventures in the city. Joshua thereupon reported to Eleazar the high priest and to the council of elders what the spies had sworn to Rahab; and they ratified the oath.” Here Josephus portrays an authoritative decision to accept the private agreement between the two spies and Rahab being officially accepted only by mutual agreement of Joshua along with the high priest and a senate. Thus Josephus shows Joshua as unable to make this authoritative decision alone. Josephus reduces the authority of Joshua, implying that one leader hearing directly from YHWH and thus making a decision without other human beings is not proper. Hence Josephus distorts the Bible.

Josephus took a theocracy in Israel under the leadership of YHWH and transformed it into rule by a committee with a high priest.

These several examples of biblically distorted interpretation from Josephus show a bias of elevating the authority of the high priest and one national senate or Sanhedrin so that Joshua and future kings are expected to share authority with them rather than act alone in political or civil matters. This had the effect of weakening the authority of Joshua and the kings of Israel, all having one-man rulership. But in *Antiquities of the Jews* Josephus diminished the role of the priests and Levites in the court system of Israel compared to the Tanak. Yet in *Against Apion* Josephus gave proper emphasis to the priesthood, but still neglected the Levites.

(B) Resolving Contradictions in Josephus over who had greater Authority

Let us summarize some of the contradictions in Josephus concerning his portrayal of the biblical court system and authority in general. In *Against*

Apion (published c. 100) the court system gives much authority to the priesthood, and even outside the court system the priesthood has the greatest visible authority. Notice the next passage.

In AA 2:188-189, Josephus wrote, "Could there be a more saintly government than that? Could God be more worthily honoured than by such a scheme, under which religion is the end and aim of the training of the entire community, ***the priests are entrusted with the special charge of it***, and the whole administration of the state resembles some sacred ceremony?" Here Josephus gives the priests the sole authority over the religion and sacred ceremony. Of course this assumes that Jewish society is normal, i.e., that the priesthood is practicing in the Temple.

In *Wars of the Jews*, published c. 79, Josephus makes no clear statement concerning whether the Pharisees or Sadducees have control over one another.

In contrast to this, in *Antiquities of the Jews* (published in 93/94), the court system greatly reduces the role of the priesthood, gives much place to the Levites in general, and also gives prominence to the judge whose lineage is not mentioned. When discussing the court system in his paraphrase of the Bible, which is sometimes distorted, he does not explicitly mention the words *Sadducee* and *Pharisee*. However, in *Antiquities of the Jews* there are several places in which he compares the Sadducees, the Pharisees, and the Essences. In these places he claims that the Pharisees have more authority and power than the Sadducees, and from the viewpoint of authority he leaves the Essenes in the background. Note the following example.

In Ant 18:16-17, Josephus wrote, "The Sadducees hold that the soul perishes along with the body. They own no observance of any sort apart from the laws; in fact, they reckon it a virtue to dispute with the teachers of the path of wisdom that they pursue. There are but few men to whom this doctrine has been made known, but these are men of the highest standing. They accomplish practically nothing, however. For whenever they assume some office, though they submit willingly and perforce, ***yet submit they do to the formulas of the Pharisees, since otherwise the masses would not tolerate them***."

This section from Ant 18 in bold is a sharp contrast with the prior section from AA 2 in bold.

One way to reconcile this contradiction is to presume that in *Against Apion* he was referring to the time before 66 when the priesthood still functioned in a normal fashion, and in *Antiquities of the Jews* he was referring to the time after 70 when the Sadducees lost its power base associated with the Temple because it no longer existed, it lost the tithe money because the Temple no longer existed, and it lost the recognition that was previously given to it by the Roman authorities. Thus all the grandeur was gone from the Sadducees. This approach has the advantage of obtaining an agreement with the New Testament. Ant 18 above contradicts the New Testament as seen during the early first century.

Notice John 12:42, "… because of the Pharisees they [the Jewish rulers] were not admitting, lest they should be put out of the synagogue." This shows the sway of the Pharisees over the people in the synagogues. The Temple was not a synagogue.

On page 445 of Deines, he gives the following careful translation of Josephus' Life 12, "In the nineteenth year of my life I began to lead a public/ political life, whereby I joined with the program of the Pharisees, which is comparable to that which the Greeks call stoicism." The sweep of the life of Josephus shows that he was a political opportunist, and in Life 12 he wrote that at the age of 19 he decided to follow the program of the Pharisees. It is reasonable to conjecture that he was not a fully recognized Pharisee because he did not personally comply with all the requirements necessary for that. Thus his wording is merely that he decided to follow its principles, not that he was a member. As a political opportunist, he would have recognized the essential long-term reality indicated in John 12:42, and thus knew that there was power in having the loyalty of the masses behind him as the Pharisees had, even if this power was checked in the environment of the Temple. It appears that Josephus preferred the political power from the people compared to the money and grandeur from the contributions.

On pages 198-199 of Grabbe 2000 we see the following concerning Josephus's remarks about Jewish leadership, "Those sources [in Josephus] which give the Pharisees a general dominance of a religious belief and practice are those which come later in relation to parallel sources [*Antiquities of the Jews* compared to *Wars of the Jews*]. Thus, it is only two later passages in the *Antiquities* which state that public worship is carried out according to Pharisaic regulations and that the Sadducees are required to

follow them even when they hold office. This is not stated in the *War* and is not borne out in Josephus's other passages on the Pharisees [in the first century]."

A flagrant distortion of Scripture in the writings of Josephus is his fabrication of the existence of a national decision making body called a senate or Sanhedrin from the time of Moses and throughout the subsequent history of Israel. While it is true that in Num 11:16-17, 24-25, there was a selection of 70 elders to help decide and lead in some unspecified matters, this is not described as one chamber or unified body meeting in one place. Only the plural word "elders" is mentioned, and from this time onward there is silence about them. Josephus fabricates consultations of Joshua and of Israel's kings with this Sanhedrin. He reads this institution from his lifetime into prior Israelite history, yet claiming he is merely repeating what is in the Bible.

(C) General Conclusions about Josephus

On page 290 in the concluding chapter of his second book about Josephus, McLaren wrote the following:

"This study has focused on the implications of trying to make use of the gold-mine [the writings of Josephus], particularly in terms of the nature of the relationship between Josephus, his narrative of events, and contemporary scholarship, in the reconstruction of first-century CE Judaea. Scholars have increasingly voiced the need to display caution in the application of Josephus's narrative in an effort to understand the dynamic of the society. In fact, reference to Josephus without some introductory words of caution is now extremely rare. With Josephus we are dealing with a biased source. In itself, such a statement should not be a concern. Josephus has provided his own understanding of what happened and scholarship has labeled this his bias."

"The gold-mine begins to take on the appearance of a minefield. The one and only substantial narrative of events pertaining to the first century CE is biased. If we are to establish a means of understanding the data it is of fundamental importance that we be able to distinguish between the bias and the narrative of actual events. Where the real problem lies is being able to stop before we become dependent on Josephus's interpretation."

The following are my conclusions about Josephus, and these concern my overall view, not merely the view based on the above examples.
(1) Josephus goes out of his way to exaggerate and boast about his own abilities in intelligence and knowledge of Jewish and biblical matters. He never claims to have any particular knowledge of mathematics or astronomy.
(2) Josephus goes out of his way to exaggerate and boast about the accomplishments of the Jewish people through history.
(3) Josephus portrays the actions of the Roman generals Vespasian and his son Titus in a manner that makes them appear more virtuous than reality. These men provided for the needs of Josephus, and he returns their favor.
(4) The primary audience for the writings of Josephus is the nobility in Rome whose culture included the Greek language and famous Greek writers and themes. He is writing to them with their definitions of terms in his mind. Josephus is biased toward the thought process and appeal of this audience.
(5) Near the beginning of his autobiography, which is called "Life", Josephus wrote that before he was 20 years old he made the decision to follow the position of the Pharisees in his public life. Therefore, in Jewish doctrinal matters, we should expect Josephus to be biased toward the sectarian views of the Pharisees.
(6) For matters that pertain to things that happened before the birth of Josephus, there were many writings that claimed to be historical in nature, concerning the Jews. Josephus picked whatever he wanted from these writings and used them for his purposes. Some of these are false, though Josephus has no way to know this.
(7) Josephus sometimes purposely distorts the biblical account for his own purposes. Therefore, one must be very cautious to accept what he writes as definitely true. He makes general statements that he will not distort anything, yet he boldly makes distortions, sometimes even contradicting himself.

Whenever there seems to be a desire to quote Josephus for some purpose, it is necessary to review the above list of biases in order to help to understand any possible way in which Josephus might be less than reliable. In the case of discussing I Samuel 20, it does not seem that the biases would affect what he had to say here. In the case of discussing the claim that Abraham taught the Egyptians mathematical astronomy, the biases of both (2) and (6) enter the picture. This claim appears to praise an important Jew, Abraham, as possessing knowledge that was highly respected among the nobility in Rome. Writings exist from before the birth of Josephus that claim Abraham taught the Egyptians astrology, but Josephus changed this to astronomy.

Scholars see no need to reject all of the writings of Josephus merely because there are biases in his writings. They seek to understand his biases so that they may evaluate where to accept and where to reject what he wrote. He is a mixed bag and must be read with caution and evaluation. There is no need to completely avoid him merely because some of what he wrote is not trustworthy. One may also scrutinize all of Philo's writings and find something objectionable, but that does not imply that Philo may not be used for anything.

[71] Destruction of the Temple and Nisan 1 moves into the Winter

In an earlier chapter abundant evidence was presented from the New Testament, Tacitus, and Trogus to show that that the priesthood controlled the Temple in the first century before the war broke out in 66. Num 10:10 shows a responsibility of the Levitical priesthood in declaring the "beginning of the months", and Num 28 and 29 show the responsibility of the priesthood to perform sacrifices on the new moons and on the festivals. This makes it clear that the priesthood controlled the calendar before the war broke out in 66.

The Jews began a war with the Romans in the year 66 and they were defeated in 70 when Jerusalem's walls were broken, the city was burned, and the Temple was burned and destroyed. Early in the war the Jews captured the southeastern fortress known as Masada at the top of a high plateau, and due to its natural protective position, the Jews defended this until 73 when the Romans scaled its walls and the Jews who were isolated there committed suicide.

The four most significant results of this devastating war were: (1) The anti-Jewish sentiment in the Roman Empire; (2) The destruction of the Temple, which was the Second Temple; the first Temple was Solomon's Temple; (3) The disappearance of the Levitical priesthood from history; and (4) The opportunity for the victors of the political struggle between the Pharisees and the Sadducean priests to determine the direction of written Judaism in later times.

The destruction of the Temple had significant consequences for Judaism. The Temple was much more than a physical structure. It was the symbol of the world headquarters of Judaism where YHWH was thought to dwell.

Pious Jews from many lands sent contributions there for the upkeep of the Temple and they sent tithe money to the Levitical priesthood. Many Jews traveled there three times each year for the festivals. Even non-Jews who visited the Temple admired the grandeur of the Temple and the impressive performance of the priesthood accompanied with many musical instruments and the singing of multitudes. When the Temple was destroyed, the physical symbol and the associated mental concept of Judaism was removed. Mental depression among many Jews continued for years, and they no longer had one primary place to visit for the festivals.

The Romans did not want the Temple to be rebuilt because in their eyes the zealous fanatical masses of Jews began the war from that focal point. The loss of the Temple was a punishment, although the Jews maintained a hope that the Temple would be rebuilt just as the Second Temple replaced Solomon's Temple. The Romans no longer wanted to officially recognize any central body of Jews that represented the Jewish population, such as a Sanhedrin. In fact, since the Levitical priesthood did not prevent the war, the Romans had a negative attitude toward the priesthood, and they no longer officially recognized it as having authority in relation to the Roman governor and the other Jews in Judea. This meant that the only support the priesthood could get had to come from the Jews, not the Romans.

Before the war, the Roman government worked with the priesthood and recognized the priesthood. The priesthood had jurisdiction over the physical things of the Temple, and the Romans recognized this. The New Testament shows the Roman governor Pilate conversing with the chief priests (Luke 23:13). Pilate recognized their position of authority concerning the Jews, especially in the Sanhedrin and particularly the high priest. After the war, the Romans turned their back to the priesthood and gave it no recognition. This was only one of several heavy blows to the priesthood after the war.

The Temple at which they performed their rituals was gone, and although it was technically possible for them to imagine to perform rituals without a Temple as was done before Solomon's Temple was built, that would require money for their support such as tithe money, and it would require a Jewish audience that had a desire to watch them perform without the presence of the Temple. Note the reality seen from John 12:42, "… because of the Pharisees they [the Jewish rulers] were not admitting, lest they [the rulers] should be put out of the synagogue [by the Pharisees]." This shows that the Pharisees had much control over the people in the synagogues. The synagogues were

away from the Temple, but now there was no Temple. It is obvious that the priesthood would need the active support and cooperation from the Pharisees if they were to continue to perform their priestly rituals. That support would have to include the desire of the Pharisees to urge the people to send monetary contributions to the priesthood and to attend functions of the priesthood.

The authority of the priesthood came from the Tanak (the commanded function and respect indicated in Deut 33:10), partly from their genealogy, partly because of the desire of the Jews to watch them perform their duties, and partly from recognition by the Roman authorities. Any Pharisee who did not have the proper genealogy from Levi could not be a priest, and thus there was a barrier of lineage between the Pharisees and the priests. If the Pharisees were to encourage the people to give support to the priesthood, it would detract from their own authority.

Concerning the Sadducees, note Acts 5:17 [NKJV], "Then the high priest rose up, and all those who [were] with him (which is the sect of the Sadducees), and they were filled with indignation." This shows the chief priests to be included within the Sadducees at that time, although it is unclear how many Sadducees might be from outside the priesthood. Acts 26 shows that there was doctrinal antagonism between the Pharisees and the Sadducees (largely the priestly party), which led to a physical tumult. Many places in the writings of Josephus show that there was political antagonism between the Pharisees and the Sadducees. This friction was due to the permanent gulf of genealogy, doctrinal differences in both details and overall approach, their different relationships with the Jews of the land (the ordinary people), and their separate association of friendships. In the Temple environment and with the Roman governor the Pharisees did not have the authority that they enjoyed in the synagogues. From this it should be clear that the Pharisees could not be expected to support the priesthood in the sense of urging the people to send them contributions and going to watch them perform their rituals. The loss of the priesthood from history is the clear evidence that the Pharisees let the priesthood vanish.

In Acts 15 and Gal 1:19; 2:9 James is mentioned. The death of this man James is described by Josephus in Ant 20:197-203. Page 32 of the article by Smallwood states that the high priest Ananus mentioned in this episode had James killed in 62 CE, only four years before the war broke out. This episode is an instructive example that shows who had authority. On pages

495, 497 in Josephus_9, we see in Ant 20:199-203, "He [Ananus the high priest] followed the school of the Sadducees, who are indeed more heartless than any of the other Jews, as I have already explained, when they sit in judgment. Possessed of such a character, Ananus thought that he had a favourable opportunity because Festus was dead and Albinus was still on the way. And so he convened the judges of the Sanhedrin and brought before them a man named James … [he was stoned] … Those of the inhabitants of the city who were considered the most fair-minded and who were strict in observance of the law were offended at this. They therefore secretly sent to King Agrippa urging him, for Ananus had not even been correct in his first step, to order him to desist from any further actions. Certain of them even went to meet Albinus, who was on his way from Alexandria, and informed him that Ananus had no authority to convene the Sanhedrin without his consent … King Agrippa … deposed him from the high priesthood …"

On page 26 Smallwood makes the following comment on this, "In doing so he [Ananus] acted *ultra vires*, and thus alarmed some of the more moderate Jews and 'men learned in the law' (i.e., the Pharisees) so much that they sent secretly to Agrippa …" The point here is that the Pharisees were not able to prevent the death of James by the Sadducean high priest who was able to convene a Sanhedrin. It does show that while the Temple stood the Sadducees did have authority that the Pharisees could not overturn by themselves. It does cause me to believe that the passage quoted in the previous chapter in bold in Ant 18 describes the situation after the destruction of the Temple rather than before 66. Otherwise it would contradict the New Testament and the example of Ananus.

[72] Josephus and his Aries Approximation

One passage from Josephus is referenced by some of the Early Church Fathers, and they claim it helps to determine when the first biblical month occurs. This passage is now our subject. Josephus made the following statement in his *Antiquities of the Jews* (Ant 3:248, also referenced Ant 3, 10, 5) as very literally translated on page 302 of Feldman 2000, "In the month of Xanthicus, which among us is called Nisan and is the beginning of the year, on the fourteenth, according to the moon, the sun being in Aries, because in this month we were liberated from slavery under the Egyptians …" This is typically simplified to the supposed rule that the 14th day of Nisan must be in Aries. Yet the word Xanthicus occurs in the passage.

Let us first consider whether any further clarification of Ant 3:248 might be attained by investigating the word Xanthicus. This word is the Greek (more accurately, Macedonian) name for a month. Ptolemy of Alexandria c. 150 CE wrote his Almagest in which he used Macedonian lunar month names. Ptolemy often gave credit for significant parts of his work to his Greek predecessor Hipparchus (c. 150 BCE), and we know that Hipparchus obtained many of his mathematical parameters used in astronomy from the Babylonians. On page 13 of Toomer 1984 he wrote, "The use of Macedonian month names [by Ptolemy] has rightly been taken to show that the Babylonian lunar months were simply called by the names of the Macedonian months by the Greeks under the Seleucid empire: if one computes the date of the first day of the 'Macedonian' month from the equivalent date in the era Nabonassar given by Ptolemy, it coincides (with an error of no more than one day) with the computed day of first visibility of the lunar crescent at Babylon. There is other evidence for the assimilation of the month names, but this is the strongest." In a footnote on this page Toomer says that some of the Babylonian astronomical writings were translated into Greek using Macedonian month names perhaps as late as the time of Hipparchus, which was almost 200 years before Josephus was born. It is doubtful that the astronomical works of Hipparchus were available outside Alexandria where the advanced Greek astronomers lived, though Hipparchus spent much of his life on the island of Rhodes in the Mediterranean Sea some distance from off the coast of Alexandria. Such astronomical works works were very difficult to comprehend and required an advanced education in astronomical terminology and mathematics to understand. Such an education was not available outside Alexandra. Josephus never hints that he ever visited Alexandria, nor does he indicate any special ability in mathematics or astronomy. On pages 142-143 of Samuel 1972, based on evidence from data on coins and a horoscope, he proposes a chart showing an equivalence from the Babylonian month names to the Macedonian month names, and then using the approximately two dozen examples of month name equivalents in Josephus, he shows the equivalence from the Macedonian month names to the Jewish month names. Using these two translation charts, Samuel proposes that in the time of Josephus he was equating the Babylonian month name with the identical timing of the similar sounding Jewish month name, but using Greek names instead of Babylonian names for the sake of his Greek readers. This is merely a theory because we do not know what Josephus knew, nor do we know his intent by his month name equivalents. The greatest problem with this speculative theory is that it contradicts the section of Ant 3:248

involving the meaning of Aries, which we investigate next. Page 138 of Hannah concludes that the overall evidence does not lead to any strong conviction on any precise meaning from his use of Xanthicus in Ant 3:248. I agree that a study of Xanthicus does not help us to understand Josephus here.

In two previous chapters the zodiac was discussed, and the reader should be aware of these now. Quotations from Pliny the Elder (who knew Josephus) and two other Roman writers from his approximate time agree that Aries began seven days before the vernal equinox. In the first century it was only in the area near Alexandria that Aries was used in a manner that recognized its first day was on the vernal equinox. Josephus's primary audience was the Roman nobility who knew Greek and with whom he was able to socialize in Rome. That audience would expect Josephus to use the terminology expected in Rome and used by Pliny, who also socialized with the same nobility as Josephus.

On page 120 of Varneda, he comments on Ant 3:248 as follows, "… the sun is in Aries, which indicates the days half-way through March to half-way through April …" This is correct. If we subtract seven days from the vernal equinox we are at the middle of March.

Ant 3:248 is saying that the 14th day of Nisan must fall between mid-March and mid-April. This means that Nisan 1 must fall anywhere in March, so that it may fall up to three weeks before the vernal equinox. This rule does not neatly fit with any astronomical principle. It ties Nisan 1 into the Julian month of March. It cannot be biblically correct because it occurs at an astronomically awkward time that would be difficult to judge unless you simply compare the new moon to the artificial Julian March 1.

Ant 3:248 is an Aries approximation that is astronomically awkward and cannot be biblically correct. Yet it is astronomical in concept rather than agricultural.

Josephus published his *Antiquities* in 93/94, about 23 years after the Temple was destroyed. This was sufficient time for the Levitical priesthood to crumble due to lack of funds and lack of backing by the Pharisees. In Ant 18 as quoted previously we saw, "***yet submit they [Sadducees] do to the formulas of the Pharisees, since otherwise the masses would not tolerate***

them". In light of the New Testament this can only make sense after the Temple was destroyed.

Just as Josephus mentions the recent (near 93/94) domination of the Pharisees over the Sadducees without stating that it is recent, he also mentions the Aries approximation without stating that it is recent!!

Gen 1:14 provides a very general statement that the heavenly bodies, or lights in the sky, determine the calendar. We have seen from Isa 47:13 that the beginning of the month, *chodesh*, was conceptually the same in the Babylonian calendar and in Israel's calendar. We have seen the use of the Babylonian month names by Ezra and Nehemiah in the context of Jerusalem in the fifth century BCE, which shows that in order that confusion within that empire be avoided, the first month in both calendars should almost always be expected at the same time, with perhaps one day's difference on some occasions. The Babylonian calendar began its first month in the fifth century BCE, the century of Ezra and Nehemiah, so that the new crescent that was seen on or first after the vernal equinox began the first month of the year. We have seen that this biblically based evidence correlated with primary archaeological evidence of astronomy from the ancient Babylonians provides simple astronomical rules for the calendar. Philo of Alexandria provides written corroborating evidence from the first century before the war in 66 that these simple astronomical principles guided the calendar in the early first century.

In contrast to the above simple astronomical principle, the method to determine the first month according to Rabbinic literature is described in subjective terms with differences of opinion, thus leaving the reader with uncertainty and confusion. From simplicity before the destruction of the Temple, we find ambiguity and the need for subjective judgments later. These elusive principles involve weighing a combination of factors such as the state of the barley, the time of the vernal equinox, the state of the fruit trees, and even the development of the wings of young pigeons. The location of these phenomena within Israel are also relevant in the Rabbinic sources. One would have to conclude that knowledge of when the first month should occur became lost sometime after 70.

The Aries approximation by Josephus is not so much a black mark against Josephus as it is a black mark against changing practice by the Pharisees in

their struggle with the Sadducees. Josephus is merely reporting on the practice of when the first month has been falling in recent years.

The logical explanation is that after the Temple was destroyed, there was a doctrinal difference over the method to determine the start of the first month. This difference would be between the leaders of the priests and the non-priestly leaders who had authority among Jews, i.e., the successors of the Pharisees. It is reasonable to think that there was a power struggle between the priests and the non-priestly Jewish sages, and the calendar became an issue in this struggle. The method to properly determine the first month was lost within subsequent Jewish writings. No doubt this happened soon after the Temple was destroyed when a struggle for authority would be natural. No written records describe it. Eventually the news filtered down to Josephus in Rome where he lived. Josephus had to notice that the first month was no longer falling where it had been falling before the Temple was destroyed. If the primary audience of Josephus, the Roman nobles who prized the Greek language, wanted to know when the first month of the Jewish calendar fell, what would Josephus tell them? Would he tell them of a recent power struggle among Jews and a change in the placement of the first month? Certainly not! The Jews would not want to inform Josephus of their internal problems because they considered him to be a traitor due to his role in the war after he surrendered. There were synagogues in Rome where Josephus lived, so he could know when their festivals fell. Josephus would want to supply his readers with an approximation to the current practice of the Jews, not what had been the practice before the Temple was destroyed.

Josephus was a very practical person subject to biases as a politician, certainly not an idealist in truth. Josephus is not a good source to know when the first month fell before the Temple was destroyed because he wrote after it was destroyed and after the leadership of the greater mass of Jews in greater Judea changed. The Aries approximation was a poisoned pill of deception for the future of calendar study.

[73] The Easter Calendar Deception from Josephus

On pages 30-31 of Pedersen 1984 we note, “There is no doubt whatever that the only place where these [mathematical calendric] problems [to determine the first month for the Church] could be properly tackled was Alexandria, the intellectual capital of the Hellenistic world where was, all through the first Christian centuries, a competent school of astronomers and experts in

time reckoning. Its best known representatives were the non-Christian scholars Ptolemy in the second and Theon on the fourth century. We do not know whether the Metropolitan Bishop of Alexandria consulted these experts. But it is certain that the Early Church in many places looked to Alexandria as the city where information about Easter could be obtained. In the third century we hear of Alexandrian bishops sending letters to other Churches before Easter, announcing the date on which the feast was going to be observed in Alexandria. This was the case of Bishop Demetrius (d.c. 232) who wrote such Pashal letters to the bishops of Rome, Antioch and Jerusalem, and also of Bishop Dionysius the Great (d.c. 264) who wrote to the otherwise unknown Flavius, Domitius and Didymus, presumably suffragan bishops in Egypt. This custom prevailed long after the Easter problem had been settled, and the universal practice of bishops sending pastoral letters to their clergy during Lent is a direct outcome of the dependence of the Early Church on Alexandria for obtaining information on Easter." On page 31 Pedersen wrote, "… spring begins at the vernal equinox which the Alexandrians placed on March 21 (in the Julian calendar)." On page 31, "The earliest indication of how the Alexandrian Church went about this business is found in Eusebius's account of Dionysius's letter to Domitius and Didymus in which he *published an eight year Easter Canon at the same time as he stated that Easter should never be celebrated until after the vernal equinox* [Eusebius's Ecclesiastical History 7:20]."

This above rule from c. 250 allows Nisan 1 to occur about two weeks before the vernal equinox. From this we see that 75 years before the Council of Nicea in 325, there was already an established tradition of when to determine the first month based on reckoning from Alexandria, which placed the vernal equinox on the first day of Aries, March 21 instead of on the eighth day of Aries. In other words, scholars from Alexandria (such as Anatolius c. 270) who read the Aries approximation by Josephus would understand Josephus differently from how Pliny the Elder would understand it because they would interpret the beginning of Aries differently. The Council of Nicea did not have the purpose to determine when to begin the first month because it had already had a tradition from Alexandria. The Easter rule using the full moon was a corruption of what Josephus meant in the context of Rome compared to Alexandria where the beginning of Aries began differently. Thus the astronomically awkward Aries approximation in first century Rome was transformed into a full moon rule from later Alexandria, which the Council of Nicea accepted from Church tradition as interpreted from Josephus.

[74] Appendix A: Rabbinic Literature and History

What is called Rabbinic literature spans the period from c. 200 CE to c. 600. Only the most significant documents in this literature will be mentioned here. The first document in this written collection is called the *Mishnah*, and it was published c. 200. The next document is called *The Fathers According to Rabbi Nathan*, and it was published c. 230. Next came the *Tosefta*, which was published c. 250. Next came the *Jerusalem Talmud* c. 400. Next came the *Babylonian Talmud* c. 600. The *Talmud* is collectively both the *Jerusalem Talmud* and the *Babylonian Talmud*. The *Mishnah* is the first part of the *Talmud*. The *Mishnah*, the *Tosefta*, and the *Talmud* contain various statements concerning the Jewish calendar.

(A) Conflict of Interest in the Lineage of the Author of the *Mishnah*

The *Mishnah* is roughly the size of the Bible, and it is primarily a Jewish legal document. It is not written in a manner that is easy to grasp without a commentary. I am convinced that when the *Mishnah* was first released to its scholarly audience (i.e., "published", in the primitive sense) c. 200, that its contents reflected the opinions of its primary author, Judah the Nasi, at that moment in time, and it was not largely based upon extensive and detailed written records that were carefully preserved from before the destruction of the Second Temple in 70 CE. The elite among the Jews were trapped in Jerusalem during the war from 66 to 70 CE, and the relatively few that escaped did not have the luxury to take extensive writings with them. The severe famine during the final year within the walls of Jerusalem and the final fire there made mere survival difficult. Jerusalem and the Temple were burned by the Romans, and according to Josephus, only a small number of writings survived. The Jewish scholars who survived the destruction of the Second Temple did not have reason to quickly imagine that there would be no substitute for the Temple within a reasonable amount of time. After Solomon's Temple was destroyed in 586 BCE, it took 70 years to initially complete the Second Temple in 516 BCE (see Ezra 6:15 and commentary notes there from various sources). Beginning in the second century BCE Herod the Great magnificently enhanced the Second Temple. There was no motivation for the immediate scholarly survivors of the destruction of Jerusalem to rush to write down everything they could remember of the details of how the priesthood and the Sanhedrin did everything; this was not

done during the Babylonian captivity except for the survival of the Pentateuch and the rest of the Hebrew Scriptures.

The years 132 to 135 saw the second great Jewish war with the Romans known as the Bar Kochba revolt, and it is not known whether more Romans died in this war or the war from 66 to 70. When Judah the Nasi published the *Mishnah* c. 200, he no doubt had sources that could give him reliable history since the year 135, but the Temple did not function in this period, so that time did not include eyewitness accounts of the proceedings of the Levitical priesthood in the Temple. There were probably some reasonably reliable legends from the years between 70 and 135. But it is very doubtful that there were a very large number of legal details that survived without any change from before 70. We do not know with confidence. Some of the many traditions of the elders implied in Mat 15 and Mark 7 would likely find its way into the *Mishnah*, but this is conjecture.

In the name "Judah the Nasi" as the primary author of the *Mishnah*, the title Nasi is sometimes translated Prince, and it is a biblical Hebrew word that refers to a primary leader. It is used in the latter chapters of Ezekiel to refer to a unique future leader of Israel. Jewish history suffers from a lack of documents that represents a broad based history as well as a very credible history after 70.

Jewish scholars debate the issue of whether there was any primary Sanhedrin within Judaism after the Temple was destroyed. On page 236 Catherine Hezser wrote, "While Alon and Mantel believed that the Sanhedrin or central rabbinic council under the leadership of the Patriarch was reconstituted as early as a quarter of a century after the destruction of the Temple, most scholars nowadays dismiss the possibility of a central rabbinic court after 70 and interpret the few rabbinic references to such a court in Tannaitic and Amoraic [Rabbinic] literature as anachronistic reminders of a distant past. Several rabbinic texts explicitly refer to the cessation of the Sanhedrin in 70. Only at the beginning of the fifth century, after the abolition of the patriarchal office, does the *Codex Theodosianus* [in 438] provide external evidence on an institution called 'sanhedrin' in Palestine, but this institution is referred to in the plural and might indicate a number of local sanhedrins rather than a central convocation of rabbis."

The Hebrew word ***nasi*** in Rabbinic writings is typically translated Patriarch or Prince, and it is the office of the primary decision maker and leader

concerning Jews in the greater Mediterranean region including Europe and Asia. This concept of *nasi* assumes that Judaism as whole is mentally united as one body, but without governmental control over any geographical territory. The writings of Josephus, Philo, and the New Testament show that there were separate parties (Pharisees, Sadducees, Essenes) with differing interpretations of the law and different philosophies, so that no one "Patriarch" had the authority of decision on principle matters to which almost all Jews actually agreed. Hence the Rabbinic concept of Patriarch is a fabrication of real history due to its assumption of approximate unity when there was no unity. On page 6 of Strack and Stemberger we note, "The [Rabbinic] sources for a description of the rabbinic period are so biased that the historical picture gained from them remains largely insecure – thus e.g. the notion of a 'normative' Judaism derives from these sources."

There were several Gamaliel's in a genealogical succession beginning with Gamaliel the Elder (Gamaliel I), who taught the apostle Paul, and this line was descended from King David according to the Rabbinc writings
The line of Gamaliel was given a greatly exaggerated role in the Rabbinic writings, especially for the first century, compared to what is justified in historical reality. In Rabbinic writings Gamaliel I, a Pharisee according to Acts 5:34, is given the role of the Patriarch (both President of the Sanhedrin in Jerusalem and general leader of Judaism), contrary to the Gospels and Acts in the New Testament, which, except for Acts 5:34-40 generally gives the greatest attention, in the sense of chairman, to whoever is serving as the High Priest in the context. Near the beginning of the Rabbinc writing known as the *Fathers According to Rabbi Nathan*, the primary line of succession of the transmission of the Oral Law went through Gamaliel the Elder, then his son, and this continued in the lineage down to Judah the Nasi. Judah the Nasi had control over the contents of the *Mishnah*, and his motivations were varied concerning what to include and why to include it..

All of them were supposedly the Patriarch of Israel in their time. Many Jewish scholars have recognized the conflict between the New Testament (with Josephus included) and the Rabbinc writings concerning leadership and have postulated the existence of at least two most prominent Sanhedrins having different roles before 70, so that the apparent conflict between the New Testament and the Rabbinic writings could be resolved with the latter retaining its credibility. But the existence of such multiple primary Sanhedrins in the area of the Temple has not withstood the test of scholarly debate, and the Rabbinic writings have suffered a great credibility gap in the

process. Of course the Orthodox Jewish position is that all Rabbinic writings are inspired and fully true, and by "Orthodox", I refer to its meaning as held by Jewish culture in the United States, not Israel, where "Orthodox" has come to have a different meaning. The male succession in the line of Gamaliel is Gamaliel I, Simon I, Gamaliel II, Simon II, Judah the Nasi, etc. From this lineage is it obvious that Judah the Nasi, the primary author of the *Mishnah*, might have some motivation (conflict of interest) to exaggerate the importance of his own lineage in his account of the snippets of supposed history of Judaism from the first century onward. The first two members of this lineage were both Pharisees; the first is stated to be a Pharisee in Acts 5 and the second is stated to be a Pharisee by Josephus. With the base of this tree of lineage shown to be Pharisaic, it is reasonable to accept the view that the *Mishnah* represents a near-Pharasaic approach to the law.

(B) Can the Talmudic Concept of the Oral Law be Historically True?

Mat 15:3, 6; Mark 7:8-9, 13 does show that from the perspective of the writers of the New Testament, the tradition of the Pharisees invalidates the original intent of the law of Moses. Josh 8:32-35 shows that all the law that was given to Moses was written down, so that the concept that there was an Oral Law that was spoken to Moses but never written down until the time of the *Mishnah*, but was instead accurately handed down only by Oral transmission from the time of Moses is a historically false concept, assuming that the reader accepts the Tanak and the New Testament as reliable. The concept of the truth of the Oral Law is promoted in the Rabbinic writings, and it is an example of false history in the Rabbinic writings. This is one reason for mistrusting history in the Rabbinic writings.

(C) Summary of some Reasons for Lack of Reliability in the Historical accuracy of the *Mishnah*

The *Mishnah* and its closely related Rabbinic writings cannot generally be trusted for historical accuracy concerning the early first century and earlier for at least the following reasons:

(1) According to Rabbinc literature, the primary leader, the Patriarch of Israel or President of the Sanhedrin, is supposedly in the lineage of Judah the Nasi, but this fabrication of history is contradicted by the New Testament. Josephus, who discusses politics during his lifetime, does not know of the occupation of the sole leadership of the Sanhedrin by this line. Josephus

does mention Simon, the son of Gamaliel the Elder, and mentions him as a respected and prominent Pharisee, but does not go beyond that.
(2) One should expect doctrinal bias by Judah the Nasi concerning remnants of the "tradition of the elders" that survived from the first century, and some of these traditions are likely to have only been accepted by a segment of society from the first century because there were sects with differing beliefs according to the New Testament, the Dead Sea Scrolls, and Josephus.
(3) While the Rabbinic writings mention some doctrinal conflicts between the priests and the Pharisees (or some other leaders who are not identified by any party label), they have no sustained discussion of different sects during the first century. The Rabbinc writings show no interest in providing its readers with any general history of Jewish politics or sects, and assumes that there always was only one mainstream Judaism that agrees with the Oral Law. These writings are set in a dream world of its own culture.
(4) Neither Philo, nor Josephus, nor the New Testament mentions the concept of an unchanged Oral Law since Moses. This does not mean the same thing as "tradition of the elders", which only goes back for a limited time. Mat 15 and Mark 7 show this to be a false concept. It is not feasible that a body of law as large as the *Mishnah* was memorized unchanged without any mention of it by these sources.
(5) There is great doubt that written records of a vast law could have survived the destruction of the Temple by fire. It is difficult to imagine that no changes in thinking would occur in 130 years, so that this vast body of law would remain intact. Josephus never mentions any written law outside the law of Moses. He does mention the names of the biblical books familiar to us, and does not mention other books. Of course the Oral Law directly implies that it is not written, so that we should not expect it to be found written down from the Talmudic viewpoint, but instead we should at least expect it to be mentioned as a clear concept with its origin to Moses. This is contrary to the phrase "tradition of the elders" because "tradition" has a nebulous origin.
(6) Some of the legal statements in the *Mishnah* and the rest of the *Talmud*, such as the day upon which to begin the count to Pentecost, seem to be politically motivated against the priesthood, which vanished from history soon after the Temple was destroyed in 70. This anti-priesthood bias in some of the laws and discussions shows legal statements based upon the defeat of the priesthood, which had not yet been defeated before 70. This bias is a distortion of history in the sense that it portrays its present position as the original position from the days of Moses. With such a bias in this context,

how could anyone trust it in other areas that very briefly allude to some event of history?
(7) The Talmudic story of the escape from Jerusalem by Yochanan ben Zakkai, the first leader of the Jews at Yavnah after 70, claims that during the severe famine in Jerusalem near the end of the war, Yochanan was carried to the Roman General Vespasian in a coffin. However, according to Josephus, at the end of the first two years, before the famine had set in, Vespasian became emperor and went to Rome leaving his son Titus in command. This is a glaring historical factual error. Further details are available on pages 264-270 of Jonathan Price.
(8) There are hundreds of legal rulings in the *Mishnah* and *Talmud* that are stated as having been given by certain named sages, yet in different places there are different named sages who are given credit for the same laws. These voluminous apparent contradictions are called false attributions. In the past, scholars had written biographical sketches of individual sages based upon what they are claimed to have said. But today this method of writing Talmudic biography is recognized by Conservative Jewish scholars as virtually worthless for true biography. This makes the concept of history for named sages very problematic.

(D) Talmudic Decisions on the Calendar by the Gamaliel's and Simon

When the *Talmud* mentions that a Gamaliel or a Simon made an official proclamation that he was adding an extra month to the calendar for a combination of reasons, I do not at all believe in the historical validity of such a claim, nor do I believe that the combination of reasons stated were in fact operative before the Temple was destroyed. Philo of Alexandria only mentions the vernal equinox. The *Mishnah* claims that a select committee within the Sanhedrin made such a decision, so this contradicts Talmudic claims that a Gamaliel or a Simon made the decision. The *Mishnah* is the first part of the *Talmud*; thus the *Talmud* is self-contradictory. Based upon the authority that I see vested in the chief priests in the Temple area according to the New Testament, it seems to me that the chief priests made such calendaric decisions rather than a select committee that was heavily represented by non-priests.

In order for the Talmudic portrayal of the Pharisees from before the destruction of the Temple to demonstrate the alleged authority of the Pharisees, the *Talmud* uses the illustration of the control of the calendar by specific primary leaders of the Pharisees. The *Talmud* asserts the authority

of Gamaliel the Elder, his son Simon, and his grandson Gamaliel II by employing a calendric method that requires the judgment of an authority figure. No explicit statement exists that Gamaliel II was a Pharisee, but there is little reason to doubt it unless the need for the party vanished. As if merely using the ripeness of barley were not complicated enough (what variety, where to look, how to define ripeness, et cetera), they even included other criteria that required a judgment based upon a combination of factors (even ripeness of fruit trees along with considering the date of the equinox). No precisely defined formula is given by the *Mishnah*, so that an authority figure becomes a requirement.

(E) Modern Conservative Jewish Views concerning Rabbinic Literature

Jacob Neusner is an internationally recognized authority on the *Talmud* and a Conservative Jewish scholar. On page 13 of Neusner 1994, we find the following concerning the Rabbinic literature, "Sayings and stories were made up and attributed to prior times or authorities." On page 68 Neusner wrote, "Ample evidence in virtually every document of rabbinic literature sustains the proposition that it was quite common for sages to make up sayings and stories and attribute the sayings to, or tell stories about, other prior authorities. Considerations of historical fact did not impede the search for religious truth: the norms of belief and behavior. That is why, if all we want are historical facts, we cannot believe everything we read except as evidence of what was in the mind of the person who wrote up the passage: opinion held at the time of the closure of a document."

David Kraemer, a Conservative professor at the Jewish Theological Seminary of America in New York wrote the following two paragraphs at the start of his chapter on page 201:

"Scholars, mostly Jewish but also non-Jewish, have been using Rabbinic sources for historical study for well over a century. These studies - one 'History of the Jews in the Talmudic Period' or another - have been, almost without exception, what Jacob Neusner terms 'gullible.' They have assumed, in other words, that the Rabbinic record can, more or less, be taken at its word and that, once one has determined the 'original version' of a teaching and discounted obvious fabulous material, one may accept that teaching as historically reliable.

"By this stage in the development of Judaic scholarship, the folly of these earlier habits is broadly recognized. Neusner and others have pointed to a

variety of crucial and even fatal flaws in the approach just described, and there is hardly a scholar writing today about the history of Jews in late antiquity who does not at least pay lip service (though often no more than lip service!) to the much repeated critique. But even the critical questions that have been articulated - Can we believe Rabbinic attributions for purposes of dating a tradition? Why should we believe what any given tradition reports? and so forth - do not capture the full scope of the problem of using such records for writing history. In the following pages, I will describe the obstacles that would have to be overcome before we could be sure that a Rabbinic record contains historically reliable evidence. I will conclude that these obstacles are effectively insurmountable, and that most sorts of political, social, or religious histories cannot be constructed on the basis of Rabbinic testimony."

Note that at the end of the above quotation Kraemer states that Jewish political history cannot be constructed from Rabbinic writings which especially includes the *Talmud*, the first part of which is the *Mishnah*, dated about 200 CE.

In footnote 38 on page 98 of Grabbe 1997 we find, "[Talmudic tractate] Rosh ha-Shanah normally assumes that the sages [generally non-priests] sat to receive witnesses [of having seen the new moon]. However, [*Mishnah*] M. Rosh ha-Shanah 1.7 mentions that the witnesses reported to the priests; this datum which goes against the views of the rest of the tractate is likely to have been a genuine memory of pre-70 times when the priests - not the rabbis - declared the sacred calendar."

On pages 35-36 of Green we read, "Before the fall of the Jerusalem temple in A.D. 70, the priests proclaimed the sacred times of the year. In the aftermath of the temple's destruction, the new rabbinic movement appropriated that priestly task to itself."

On page 81 of Neusner 1984 we have, "The Pharisees before 70 did not control the Temple and did not make laws to govern its cult [the Levitical priesthood]. But afterward, they made plans for the conduct of the Temple when it would be restored."

On page 39 of Cohen 1986 we see, "Our methodological dilemma is heightened when we confront a contradiction between rabbinic and nonrabbinic sources. The most prominent example of this sort of difficulty is

the nature and composition of the sanhedrin. Rabbinic texts, both legal and anecdotal, regard the sanhedrin as a supreme court *cum* senate, populated by rabbis and chaired by two rabbinic [non-priestly] figures. Josephus refers to a *koinon* and *boule* as well as a *synedrion*. From Josephus we do not know whether these are all one and the same institution and whether these are permanent or ad hoc bodies, but we see that aristocrats and high priests as well as Pharisees figure prominently in the discussion of these matters. The testimony of the NT matches that of Josephus (except that the NT does not use *koinon* and *boule* to refer to a supreme council in Jerusalem). How do we resolve this contradiction? Should we conclude that the composition and leadership of the Jewish supreme council changed over the centuries and that the rabbinic and Greek sources reflect different stages in this development? Or should we conclude that Josephus and the NT present a basically accurate picture which the rabbis have 'corrected' and improved either through wishful thinking or intentional distortion?"

[75] Appendix B: Nisanu 1 in the Babylonian Calendar Compared to the Vernal Equinox during the Century of Ezra and Nehemiah

The use of Babylonian month names in Ezra 6:15 and Neh 6:15 in the context of Jerusalem makes it relevant to examine the actual dates of the vernal equinox compared to Nisanu 1 of the Babylonian calendar during the 100 years from 499 to 400 BCE, which is the century of Ezra and Nehemiah. The month name Nisanu was transliterated to Nisan by the Jews in the context of Jerusalem. The first chart shown in this appendix makes it clear that the vernal equinox separated the first month Nisanu from the last month of the old year. The adoption of the Babylonian month names in Scripture shows the acceptance of the rule of the vernal equinox in the calendar of Jerusalem.

Before the year 499 BCE the Babylonian calendar year's first month named Nisanu did not follow any regular pattern with respect to the vernal equinox. From that date onward a 19-year cycle was accepted for Nisanu by the Babylonians. By this I mean that there were 235 lunar months in each successive 19 years, and among these 235 months, the month numbers that were called Nisanu were numerically repeated. Each 19 years in the cycle had 12 years that contained 12 months and 7 years that contained 13 months. The sequence of the years among the 19 that had 13 months was repeated in each successive 19 years. In the years that had 13 months, the extra month is called the intercalary month. This cycle was begun by the Babylonians.

The first day of Nisan in the Babylonian calendar since 499 BCE fell on or after the vernal equinox. Although Parker and Dubberstein show an exception to this in the year 384 (page 34), this alleged exception should be corrected because it is now regarded to be a faulty examination of a cuneiform text; see pp. 14 and 16 in Aaboe and others 1991

This appendix features a chart consisting of the 100 years from 499 to 400 BCE. For each year the date and time of the vernal equinox is stated and the date of the first day of the first month, Nisanu 1, is stated. Both dates are according to the Julian calendar. For each Julian date given, the Babylonian day began on the evening that came before the Julian date (the latter is based upon a midnight-to-midnight day). Determination of the vernal equinox for these 100 years was made using the computer program BRESIM (see the bibliography). This program is noted for its accuracy into ancient times for the vernal equinox, but not for the position of the moon.

The book by Richard Parker and Waldo Dubberstein 1956 contains data that has its origin in the writings on the cuneiform inscriptions on ancient clay tablets from Babylon, most of which are in the British museum. The two keys to the whole enterprise are: (1) The eclipse records on the clay tablets; and (2) The number of years of the reign each of the of the kings who ruled over the Mesopotamian region. The lengths of reign of these kings are in the writings of Claudius Ptolemy (c. 150). The results of this book are based upon modern astronomy and calculations that go backwards in time to verify the accuracy in time of the data on the clay tablets. The Julian calendar dates that equate to Nisanu 1 during these 100 years are taken from pages 29 –33 of this book.

The book by Richard Parker and Waldo Dubberstein provides Julian calendar dates for the ancient Babylonian calendar. Eclipse records from ancient Babylon were used to determine those years that had 13 months rather than 12 months. The underlying data that was used by Parker and Dubberstein was examined by Fatoohi and others in a paper from 1999. The conclusion on page 52 is that only 209 out of about 8670 new moons in this book are provably based upon actual sighting by the Babylonians. All the other new moons in this book are calculated based upon the methods of Karl Schoch (see page 57 of Fatoohi and others). None of the 100 months that began Nisanu in the chart below are among these 209 actual sightings of the new crescent from Babylon. One day errors in Parker and Dubberstein may

be due to: (1) Any borderline case in Schoch's curve at the end of the 29th day where the true result is different (this might be true about 7 percent of the time); (2) Poor weather that caused an otherwise visible crescent at the end of the 29th day to not be seen; and (3) A mistake in calculation noting that this book was prepared before the general availability of computers.

The chart does verify that the vernal equinox is indeed the borderline that determines the beginning of Nisanu, the first month in the Babylonian calendar. But additional care must be exercised in the small number of cases where Nisanu 1 occurs on the vernal equinox or one day away from it. The critical cases are examined separately in another chart afterward. For this second purpose the time of the astronomical new moon that is published in Goldstine is first used. This source takes into consideration the value of delta T, which is the cumulative effect of the change of the length of the day, which is the result of the slowing of the earth's rate of rotation on its axis due to tides, the wind against the land, the drag of the earth's semi-liquid core against its outer mantel, etc. According to page 60 of Fatoohi and others, the estimate of delta T is 4.66 hours in 501 BCE. Most computer programs do not have great accuracy that far back in time.

Then the number of hours from the astronomical new moon to sunset is computed, and this is used to check the reasonableness of the date in Parker and Dubberstein.

A friend of mine, Rob Anderson, wrote a computer program based upon the Hewlett-Packard 3000 minicomputer and its unique operating system in 1980-1982. This program was modeled after Schoch's curve, and all the months of the 20th century near the equinoxes were used in order to determine the minimum required time from the astronomical new moon to sunset in order to be able to see the new crescent, but only the latitude of Jerusalem was used. This program determined that during the vernal equinox the minimum required time varied from 16 to 24 hours, and during the autumnal equinox the minimum required time varied from 18 to 48 hours. This is corroborated by page 46 of Wiesenberg. This range of hours depends on the angle between the ecliptic (the angle of the path of the sun) and the western horizon. This means that for Nisanu 1 the benchmark for comparison is the time interval between 16 and 24 hours. For the critical years in our situation, it happens that this rule alone is sufficient to determine the first day of visibility of the new crescent, provided the weather was clear.

The journey of Ezra to Jerusalem mentioned in Ezra 7:7-9 is stated there to have occurred in the seventh year of Artaxerxes. According to page 32 of Parker and Dubberstein this was in the year 458 BCE, accepting that Ezra entered Jerusalem before Nehemiah. The books by Horn and Wood, by Bo Reicke, and by Kenneth Hoglund, accept or favor Ezra as settling in Jerusalem before Nehemiah, and this is the traditional understanding. Eventually Ezra and Nehemiah are in Jerusalem together (Neh 8:9; 12:26). While opinions may be found that favor the opposite (Nehemiah preceding Ezra), such opinions doubt the veracity of the stated accounts in Ezra and Nehemiah. Discussion of this may be found on pages 89-93 of Horn and Wood, pages 14-19 of Reicke, pages 40-44 of Hoglund, and pages 98-106 of Grabbe 1991. Since Ezra 7:7 mentions the seventh year of King Artaxerxes and Neh 2:1 mentions the 20th year of King Artaxerxes, it appears that Nehemiah journeyed to Jerusalem about 13 years after Ezra. I accept Ezra's entry in 458 BCE and Nehemiah's entry about 445 BCE, but only with the understanding that if the method of numbering the year of reign was shifted by half a year in Judah compared to Babylon, then these years might instead be 457 BCE and 444 BCE. The commentaries differ on this and I do not have a firm opinion.

In the table below the time is based on Greenwich, England as given in the program BRESIM. Conversion to the time zone of Babylon could be accomplished by adding three hours. The critical years for the vernal equinox compared to the new moon in this table are 484, 465, 446, 427, and 408. These years are used for further analysis in the second table below.

There are three times in the 100 years when the day prior to the vernal equinox was a new moon day. All three times this new moon day began an intercalary month (a month added beyond the 12 normal months) called the second Adar, the 13th month. These dates are March 25, 454 BCE, March 25, 435 BCE, and March 25, 416 BCE.

Vernal Equinoxes compared to Nisanu 1in Babylonian Calendar

Date BCE	Time V.E.	Nisanu 1	Date BCE	Time V.E.	Nisanu 1
3-27-499	00:29	4-11	3-26-449	03:07	3-29
3-27-498	06:22	3-31	3-26-448	08:50	4-16
3-26-497	12:10	4-18	3-26-447	14:36	4-06
3-26-496	18:04	4-08	3-26-446	20:30	3-26

3-26-495	23:43	3-28	3-26-445	02:26	4-13
3-27-494	05:36	4-16	3-26-444	08:14	4-03
3-26-493	11:35	4-04	3-26-443	14:02	4-22
3-26-492	17:13	4-23	3-26-442	20:00	4-11
3-26-491	23:06	4-12	3-26-441	01:50	3-31
3-27-490	04:56	4-02	3-26-440	07:37	4-18
3-26-489	10:40	4-19	3-26-439	13:27	4-07
3-26-488	16:30	4-09	3-26-438	19:17	3-28
3-26-487	22:08	3-30	3-26-437	01:06	4-14
3-27-486	03:57	4-18	3-26-436	06:48	4-04
3-26-485	09:52	4-06	3-26-435	12:33	4-23
3-26-484	15:27	3-26	3-26-434	18:28	4-13
3-26-483	21:17	4-14	3-26-433	00:20	4-01
3-27-482	03:15	4-03	3-26-432	06:04	4-20
3-26-481	09:05	4-21	3-26-431	11:50	4-09
3-26-480	15:03	4-11	3-26-430	17:39	3-29
3-26-479	20:50	3-31	3-25-429	23:26	4-16
3-27-478	02:40	4-19	3-26-428	05:09	4-05
3-26-477	08:38	4-08	3-26-427	10:56	3-26
3-26-476	14:16	3-28	3-26-426	16:50	4-14
3-26-475	20:04	4-15	3-25-425	22:42	4-03
3-27-474	01:59	4-05	3-26-424	04:27	4-22
3-26-473	07:42	4-22	3-26-423	10:18	4-11
3-26-472	13:30	4-12	3-26-422	16:18	3-31
3-26-471	19:13	4-01	3-25-421	22:10	4-18
3-27-470	01:01	4-21	3-26-420	03:59	4-07
3-26-469	06:59	4-09	3-26-419	09:47	3-27
3-26-468	12:40	3-29	3-26-418	15:37	4-15
3-26-467	18:27	4-17	3-25-417	21:28	4-04
3-27-466	00:22	4-06	3-26-416	03:09	4-23
3-26-465	06:07	3:25	3-26-415	08:53	4-13
3-26-464	11:56	4-13	3-26-414	14:44	4-02
3-26-463	17:43	4-03	3-25-413	20:25	4-19
3-26-462	23:32	4-22	3-26-412	02:07	4-08
3-26-461	05:28	4-11	3-26-411	07:55	3-29
3-26-460	11:09	3-31	3-26-410	13:50	4-17
3-26-459	16:58	4-19	3-25-409	19:46	4-05

3-26-458	22:57	4-08	3-26-408	01:34	3-26
3-26-457	04:49	3-27	3-26-407	07:22	4-14
3-26-456	10:40	4-15	3-26-406	13:20	4-03
3-26-455	16:29	4-04	3-25-405	19:07	4-21
3-26-454	22:16	4-23	3-26-404	00:52	4-10
3-26-453	04:06	4-12	3-26-403	06:45	3-30
3-26-452	09:46	4-02	3-26-402	12:34	4-18
3-26-451	15:29	4-20	3-25-401	18:25	4-07
3-26-450	21:22	4-10	3-26-400	00:10	3-27

The table below has the five critical years from the above table that the new moon occurs in close proximity to the vernal equinox. The column headed "Astronomical New Moon" has data that comes from the reference Goldstine (its computation is based on the time zone from Babylon), but three hours were subtracted to convert from the time zone of Nineveh to Greenwich time. The column headed "Sunset" has data that comes from the computer program "LoadStar Professional"; this has an adjustment for delta T and it verifies the dates for Nisanu 1 according to Schoch's curve for the years below as given in Parker and Dubberstein. The ancient city of Nineveh was used as the location in Babylon. It is located where Mosul, Iraq is today, and its coordinates are longitude 43 degrees east, latitude 36 degrees 9 minutes north.

Vernal Equinox BCE	Astro-nomical New Moon	Sunset Nineveh (Green-wich time)	Hours from conjunc-tion to sunset	Expected New Moon (from hours)	Parker & Dub. Prior New Moon	Number of days in the prior month
3-26-484 15:27	3-24-484 02:02	3-24 15:18	13:16	3-26	2-24	30
3-26-465 06:07	3-23-465 14:55	3-24 15:18	24:23	3-25	2-25 leap yr	29
3-26-446 20:30	3-24-446 11:35	3-25 15:19	24:44	3-26	2-25	29
3-26-427 10:56	3-24-427 12:09	3-25 15:19	27:10	3-26	2-25	29
3-26-408 01:34	3-24-408 11:07	3-25 15:19	28:12	3-26	2-25	29

In the above table the expected new moon always agrees with the computed date from Schoch's curve as given in Parker and Dubberstein. In all cases except 465 BCE the expected new moon is the date of the vernal equinox. In 465 BCE it is possible that bad weather did not allow the new crescent to be seen, so that the old month had 30 days instead of 29 days, and the actual Nisanu 1 was March 26 instead of March 25. Three hours would have to be added to attain the time zone of Nineveh. In all of these cases the following rule would work out correctly. Find the date of the noontime which is closest to the time of the vernal equinox. That date is counted as the date of the vernal equinox.

[76] Appendix C: Karl Schoch's Table for Visibility of the New Crescent

This chart is taken from page 162 of Fotheringham. It was created using apparent geocentric coordinate positions. I usually use LoadStar software.

The azimuth of the sun at the time of sunset is taken. Then the azimuth of the moon at the time of sunset is taken. The smaller of these two numbers is subtracted from the larger, and the result is called the azimuth difference. For a given azimuth difference, if the altitude (= angular height) of the moon at sunset is greater than the table value, the moon is likely to be visible in that evening. Plus or minus half a degree in altitude is considered borderline.

Azimuth difference in degrees, at sunset	Altitude of the moon in degrees, at sunset	Azimuth difference in degrees, at sunset	Altitude of the moon in degrees, at sunset
0	10.4	11	9.1
1	10.4	12	8.9
2	10.3	13	8.6
3	10.2	14	8.3
4	10.1	15	8.0
5	10.0	16	7.7
6	9.8	17	7.4
7	9.7	18	7.0
8	9.5	19	6.6
9	9.4	20	6.2
10	9.3	21	5.7

Borderline example 1: Cisco, Texas. Latitude: 32 degrees 30 minutes north. Longitude: 99 degrees 0 minutes west. Date: Friday, March 31, 1995. A group of people were together in Cisco, and all were looking for the new crescent. About half of them were able to see it and point to it, but the others with them could not see it. The humidity was about 35 percent, and the skies were clear. Sunset converted to Greenwich time was 0:55 April 1, 1995. The azimuth of the sun at sunset was 275 degrees 36’ 39” (= 275.61 degrees). The azimuth of the moon at sunset was 275 degrees 1’ 47” (= 275.03 degrees). Hence the azimuth difference is 0.58 degrees. The altitude of the moon at sunset was 10 degrees 10’ 0” (= 10.17 degrees). According to Schoch’s curve, for an azimuth difference of 0.58 degrees the moon’s

altitude needs to be 10.4 degrees, but it was only 10.17 degrees, which is 0.23 degrees below Schoch's curve. This borderline case for sighting was achieved at 0.23 degrees under Schoch's curve.

Borderline example 2: Location is 20 miles northwest of Eilat, Israel. Latitude: 29 degrees 48 minutes north. Longitude: 34 degrees 53 minutes 24 seconds east. Date: Thursday, September 28, 2000. A group of 10 people were together with tripods and binoculars in the dry desert on top of a small hill, and all were looking for the new crescent. Only three of the 10 were able to see the crescent with the naked eye although they all knew exactly where to look. The humidity was low, perhaps 20 percent, and the skies were clear. Sunset converted to Greenwich time was 15:29. The azimuth of the sun at sunset was 267 degrees 45' 45" (= 267.7625 degrees). The azimuth of the moon at sunset was 262 degrees 17' 56" (= 262.2989 degrees). Hence the azimuth difference is 5.4636 degrees. The altitude of the moon at sunset was 9 degrees 36' 44" (= 9.612 degrees). According to Schoch's curve, for an azimuth difference of 5.4636 degrees the moon's altitude needs to be 9.907 degrees, but it was only 9.612 degrees, which is 0.295 degrees below Schoch's curve. This borderline case for sighting was achieved at 0.295 degrees under Schoch's curve.

Conclusion: It would seem to be very difficult to see the new crescent with the naked eye from the latitudes of Israel below 4000 feet above sea level when the altitude of the moon is below 0.3 degrees under Schoch's curve. The likelihood of seeing the new crescent with the naked eye clearly recognizable for a while below 0.5 degrees under Schoch's curve seems almost impossible.

[77] Appendix D: Time from Sunrise to Sunset to compare with the Vernal Equinox

This table has the number of hours of daylight for four cities that represent four latitudes in the United States. The time of daylight is the time from sunrise to sunset. Only the dates near the two equinoxes are shown.

	New Orleans 30 deg N	Memphis 35 deg N	Philadelphia 40 deg N	Minneapolis 45 deg N
Mar.15	11:57	11:57	11:55	11:53
Mar.16	12:00	11:58	11:57	11:55
Mar.17	12:02	12:00	12:00	11:58
Mar.18	12:03	12:03	12:03	12:03
Mar.19	12:05	12:05	12:05	12:05
Mar.20	12:07	12:08	12:08	12:08
Mar.21	12:09	12:10	12:11	12:12
Sep.22	12:09	12:09	12:11	12:11
Sep.23	12:07	12:07	12:08	12:08
Sep.24	12:06	12:06	12:05	12:06
Sep.25	12:03	12:03	12:03	12:03
Sep.26	12:01	12:01	12:00	11:59
Sep.27	12:00	11:58	11:57	11:56
Sep.28	11:58	11:57	11:55	11:53
Sep.29	11:57	11:54	11:52	11:50

The above data is calculated from tables in SUNRISE. This data is based upon values for 1966, which may vary by one or two minutes in certain years. The vernal equinox occurred on March 21, 1966 at 01:53 Greenwich time. The autumnal equinox occurred on September 23, 1966 at 11:43. This shows the influence of refraction near the eastern and western horizons at varying latitudes. Equal day and night do not occur on the same dates for all latitudes. Equal day and night occur a few days before the vernal equinox and a few days after the autumnal equinox.

[78] Appendix E: Comparing the Sighting of the New Crescent with MCJC

This appendix compares the theoretical sighting of the new crescent from Jerusalem with the first day of the first and seventh months in the modern calculated Jewish calendar (= MCJC) using the software written by Rob Anderson (see the Preface). This study is based upon 200 months in the years 1901 to 2000 inclusive. In order for a month to be included in the table, it had to be declared the first month (Nisan) or the seventh month (Tishri) according to the MCJC.

In the table below each year has six columns to its right, the first three relate to the first day of the first month based upon the MCJC, and the last three relate to the first day of the seventh month based upon the MCJC. All of the dates are based upon the daylight part of the day, although the biblical day begins the previous numbered day at sundown. The date of a conjunction is the sundown-to-sundown day upon which the astronomical new moon occurred, but the date of the daylight part of the day is used. To make the comparison with the MCJC simpler, the columns with the conjunction show the number of days of adjustment to the MCJC that must be made to obtain the conjunction. The columns that are labeled "New crescent" are based upon the daylight part of the day for which the new crescent was theoretically visible the previous evening based upon Karl Schoch's curve as computed by Rob Anderson's computer program. The number in that column shows the number of days to add to the MCJC column at its left in order to obtain the date of the new crescent.

The conjunction agrees with the MCJC 26 times out of 200, which is 13 percent. The new crescent agrees with the MCJC 45 times out of 200, which is 22.5 percent.

Year	Conjunc-tion	MCJC	New crescent	Conjunc-tion	MCJC	New crescent
1901	-1	Mar.21	1	-2	Sep.14	1
1902	0	Apr.8	2	-1	Oct.2	2
1903	0	Mar.29	2	-1	Sep.22	1
1904	0	Mar.17	2	-1	Sep.10	2
1905	-2	Apr.6	1	-2	Sep.30	1
1906	-3	Mar.27	0	-2	Sep.20	0

1907	-2	Mar.16	0	-2	Sep.9	1
1908	-1	Apr.2	1	-1	Sep.26	1
1909	-2	Mar.23	0	-2	Sep.16	0
1910	-1	Apr.10	1	-1	Oct.4	1
1911	0	Mar.30	2	-1	Sep.23	2
1912	-1	Mar.19	2	-1	Sep.12	1
1913	-2	Apr.8	0	-2	Oct.2	0
1914	-2	Mar.28	1	-2	Sep.21	1
1915	-1	Mar.16	2	0	Sep.9	3
1916	-2	Apr.4	0	-1	Sep.28	2
1917	-1	Mar.24	1	-1	Sep.17	2
1918	-2	Mar.14	0	-2	Sep.7	1
1919	-1	Apr.1	1	-1	Sep.25	2
1920	0	Mar.20	2	-1	Sep.13	2
1921	-1	Apr.9	1	-2	Oct.3	0
1922	-2	Mar.30	0	-2	Sep.23	0
1923	-1	Mar.18	1	-1	Sep.11	2
1924	-1	Apr.5	1	-1	Sep.29	2
1925	-2	Mar.26	0	-1	Sep.19	1
1926	-2	Mar.16	0	-2	Sep.9	0
1927	-1	Apr.3	1	-2	Sep.27	1
1928	-1	Mar.22	1	-1	Sep.15	1
1929	-2	Apr.11	0	-3	Oct.5	0
1930	0	Mar.30	2	-1	Sep.23	1
1931	0	Mar.19	2	0	Sep.12	2
1932	-1	Apr.7	1	-1	Oct.1	1
1933	-2	Mar.28	0	-2	Sep.21	1
1934	-2	Mar.17	0	-1	Sep.10	1
1935	-1	Apr.4	1	-1	Sep.28	2
1936	-1	Mar.24	1	-2	Sep.17	1
1937	-1	Mar.13	1	-2	Sep.6	1
1938	-2	Apr.2	0	-3	Sep.26	0
1939	0	Mar.21	2	-1	Sep.14	2
1940	-2	Apr.9	1	-2	Oct.3	0
1941	-2	Mar.29	1	-1	Sep.22	1
1942	-3	Mar.19	0	-2	Sep.12	1
1943	-2	Apr.6	1	-1	Sep.30	1
1944	-1	Mar.25	1	-1	Sep.18	1
1945	-1	Mar.15	1	-2	Sep.8	0

1946	0	Apr.2	2	-1	Sep.26	1
1947	0	Mar.22	2	-1	Sep.15	1
1948	-1	Apr.10	1	-2	Oct.4	1
1949	-2	Mar.31	0	-2	Sep.24	0
1950	-1	Mar.19	1	0	Sep.12	2
1951	-1	Apr.7	1	0	Oct.1	2
1952	-2	Mar.27	0	-1	Sep.20	2
1953	-2	Mar.17	0	-2	Sep.10	1
1954	-1	Apr.4	1	-1	Sep.28	2
1955	0	Mar.24	2	-1	Sep.17	2
1956	-1	Mar.13	1	-2	Sep.6	1
1957	-2	Apr.2	0	-3	Sep.26	0
1958	-2	Mar.22	0	-2	Sep.15	1
1959	-1	Apr.9	1	-1	Oct.3	1
1960	-2	Mar.29	0	-2	Sep.22	1
1961	-2	Mar.18	0	-1	Sep.11	1
1962	-1	Apr.5	1	-1	Sep.29	2
1963	-1	Mar.26	1	-2	Sep.19	1
1964	0	Mar.14	2	-1	Sep.7	1
1965	-1	Apr.3	1	-2	Sep.27	0
1966	0	Mar.22	2	-1	Sep.15	1
1967	-2	Apr.11	1	-2	Oct.5	1
1968	-2	Mar.30	1	-1	Sep.23	2
1969	-2	Mar.20	0	-2	Sep.13	1
1970	-1	Apr.7	1	-1	Oct.1	2
1971	-1	Mar.27	1	-1	Sep.20	2
1972	-1	Mar.16	1	-2	Sep.9	1
1973	0	Apr.3	2	-1	Sep.27	2
1974	-1	Mar.24	2	-1	Sep.17	1
1975	-1	Mar.13	2	-1	Sep.6	2
1976	-2	Apr.1	0	-2	Sep.25	1
1977	-1	Mar.20	2	0	Sep.13	2
1978	-1	Apr.8	1	0	Oct.2	2
1979	-1	Mar.29	1	-1	Sep.22	1
1980	-2	Mar.18	0	-2	Sep.11	0
1981	-1	Apr.5	1	-1	Sep.29	1
1982	0	Mar.25	2	-1	Sep.18	1
1983	-1	Mar.15	1	-1	Sep.8	1
1984	-2	Apr.3	0	-2	Sep.27	0

1985	-2	Mar.23	0	-2	Sep.16	1
1986	-1	Apr.10	1	-1	Oct.4	2
1987	-2	Mar.31	0	-1	Sep.24	1
1988	-1	Mar.19	1	-1	Sep.12	2
1989	0	Apr.6	2	-1	Sep.30	3
1990	-1	Mar.27	1	-1	Sep.20	2
1991	0	Mar.16	2	-1	Sep.9	2
1992	-1	Apr.4	1	-2	Sep.28	1
1993	0	Mar.23	2	0	Sep.16	2
1994	-1	Mar.13	1	-1	Sep.6	2
1995	-1	Apr.1	1	-1	Sep.25	2
1996	-2	Mar.21	0	-2	Sep.14	1
1997	-1	Apr.8	1	-1	Oct.2	2
1998	0	Mar.28	2	-1	Sep.21	2
1999	-1	Mar.18	1	-2	Sep.11	1
2000	-2	Apr.6	0	-3	Sep.30	0

On the evening that ends September 28, 2000 the new crescent was seen by three people in a group of 10 that specifically went to a good sighting location about 20 miles northwest of Eilat, Israel (see appendix C). This made September 29 the day of the new crescent, so that for the year 2000, the actual number was –1 instead of 0.

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