

IS THE EQUINOX SCRIPTURAL?

“Calendar Part I”

**A Message Given On Sabbath
by Elder Mike Abbaduska**

We would like to acknowledge all the research that Herb Solinsky has shared with the brethren. He has spent well over thirty years compiling all this information about the calendar. This booklet would not have been possible except for all his research. Title of his research “Treatise on the Biblical Calendar”, second edition, completed on April 3, 2009, 335 pages. This is a free download, by Herb Solinsky, “biblicalcalendar.org/tbc2.pdf”.

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“Calendar Part I”

Elder Mike Abbaduska

(Also see study on Barley “Calendar Part II”)

Intro: Gen. 1:14-16 And Elohim said, “Let there be lights in the firmament of the heaven to divide the day from the night; and let them be for signs, and for seasons [*MOEDIM*], and for days, and years:

“And let them be for lights in the firmament of the heaven to give light upon the earth: and it was so.

“And Elohim made two great lights; the greater light to rule the day, and the lesser light to rule the night: *he made* the stars also.”

Some Elders say there is no equinox, and that the turn of the year does not exist. Actually it does, but not the way people think!

Others say that the turn of the year or seasons do not exist.

Still other Elders say that even though the tkufah and solstices exist, Israel did not use them. So, now they say we do not have to use them to find Abib 1, the start of the year. (‘Abib’ is a Hebrew word which came to be used for the first month of the lunar-solar scriptural year, and after the Babylonian Captivity the name became Nisan.)

The various congregations do acknowledge the change from winter to spring by taking a new moon before or after the turn of the year, whether they admit it or not.

Various assemblies erroneously use the presence of barley in Jerusalem in the Abib state of growth as a determinate for the start of the scriptural calendar. (See Part 2, “Is Barley Used to Determine the First Month”)

Gen. 1:14-16, And Elohim said, “Let there be lights in the firmament of the heaven to divide the day from the night; and let them be for signs, and for seasons [*MOEDIM*], and for days, and years:

“And let them be for lights in the firmament of the heaven to give light upon the earth: and it was so.

“And Elohim made two great lights; the greater light to rule the day, and the lesser light to rule the night: *he made* the stars also.”

Those scriptures show that mankind was given *three* visible celestial objects, (the Sun, Moon and stars (and star constellations) for *four* purposes (to divide the day from the night, for seasons, for days and years.).

But, notice that barley is not used as a sign in the calendar sign verses. The sun and moon are the only things Yahweh and Yahshua use!

Let us look at a major documented study and see the biblical and historical truth of the matter. This booklet will show from various sources...Did the High Priest, who was the one who determined the scriptural year, reckon it to the Spring Equinox (Hebrew equivalent=Tequphah)? Was barley a determinate for the start of the scriptural year, or rather for the Wave Sheaf Offering which occurs several weeks afterward?

This booklet will show the reader how to determine the start of the scriptural year the same way evidence shows it was determined by the High Priests.

This presentation will be a little technical, but try to follow this information, because we must be sure we are keeping the correct Holy Days.

To simplify: the main seasons are divided by the Spring and Autumnal Equinox or tkufah. The date of the Spring Equinox varies from March 20th to the 23rd. The Autumnal equinox, tkufah, which divides summer and fall, September 21st.

An equinox occurs when the center of the earth, the equator of the earth and the center of the sun come into instantaneous alignment. At that instant the apparent motion of the sun is to rise due east and set due west, depending upon where one is on the surface of the earth. Within 24 hours all on earth can note that the shadow of the sun behind a vertical object will be in an essentially straight line.

The Spring Equinox is the last day of winter until it ends

however, reckoned (midnight-to-midnight or sunset to sunset, etc.). That 24 hour solar ‘day,’ reckoned in the same way, began in the winter so is a day of winter. The USNO shows *only* two conditions for reckoning the season of winter or spring i.e., - “*On or before, or, after,*” the Spring Equinox.

Evidence is given in back of the booklet that the Babylonian year never began before the first new-moon crescent after the Spring Equinox. There is no recorded conflict in the bible which shows the Israelites did differently, and because there is not, it is obvious both reckoned the start of the new year after the Spring Equinox.

SIMPLE ASTRONOMY OF THE SUN, FROM GEN. 1:14

A reader of the bible may conclude that the two seasons principally mentioned in the bible are—*Plowing/planting* of barley and wheat when it rains, then is cold, and *Harvesting/gathering* which follows the latter rain, the soil warms and the temperature becomes hot. The two major divisions for the Holy Days are the two equinoxes only. The vernal, or spring equinox, is the one that Israel used to find spring and the new moon. The fall feasts were usually after the autumnal, September 21st, when the harvest is done. “Tkufah” is a better word and more accurate than “equinox” for change of the season.

Any exhaustive concordance, (James Strong’s Exhaustive Concordance for example), will show that summer and winter are used in the Tanak.

They are prominent as opposites in Genesis 8:22 and Psalm 74:17. These represent extremes of temperature and are used for contrasting purposes. The other two seasons are not extremes and are therefore not suitable for use as opposites.

The Hebrew word *tshuvah* [Strong's number 8666] is translated as *spring* in many translations. The entry for *tshuvah* in volume 2 on page 910 of TWOT (authored by Victor P. Hamilton) states that this Hebrew word, "Appears eight times, five times in reference to the spring as the 'turn' of the year (II Sam. 11:1; I Kgs. 20:22, 26; I Chron. 20:1; II Chron. 36:10); ...once 'return' to a place (I Sam. 7:17), and twice in the sense of 'answer, retort' (Job 21:34; 34:36)." On page 1000, at the top of column 2 of BDB, the second meaning of this word *tshuvah* is given as "of spring".

On page 1800 in volume 2 of *The Hebrew and Aramaic Lexicon of The Old Testament* (HALOT) by Koehler and Baumgartner, the second meaning of this word *tshuvah* is given as "spring"...

The boundary points of the four seasons are the two equinoxes and the two solstices. With words for the seasons in ancient Hebrew, there is necessarily an implication of a word or two for the boundary points of the seasons.

The Hebrew word *tkufah*, Strong's number 8622, occurs four times in the Bible, (Exo. 34:22; I Sam. 1:20; II Chronicles 24:23; Psa. 19:6). In 1907 when the BDB lexicon was published (see page 880 for *tkufah*), the Dead Sea Scrolls were not yet discovered. Insightful meanings into some ancient Hebrew

words were not yet available. But, Dead Sea Scrolls use the Hebrew word *tkufah* in contexts before the first century, this is the word 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 Leviticus 23 and for seasons in Genesis 1:14. (There is a major link here on *tkufah* and *moed* in the dead sea scrolls.)

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 *Shire Olat hash-Sabbath*, 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 (in the Psalms) are attached to the Sabbaths of one quarter or season (*tkufah*) 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.

The Intertestamental Apocryphal Book of Sirach (also known as Ecclesiasticus) contains the Hebrew word *tkufah*. This book was written in Hebrew about 190 BCE, but today, only incomplete sections of it have survived in the attic of a synagogue in Cairo, Egypt toward the end of the nineteenth century. 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.

Tkufah, turn of the year, and Tshuvah, Spring, are both used in the Scriptures!!!

The point is, that even non-canonized books make reference to Tkufah. The word was used many times and understood by the Hebrews in ancient Israel. Tkufah is also used in the Dead Sea Scrolls. These words were commonly used in Israel, but not today due to assembly tradition of using barley instead of the moon.

These contexts from the Dead Sea Scrolls and 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 the book by Holladay where he writes about *tkufah* “turning (of sun at solstice) Ps 19:6; (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* in the year”. If Nisan 1 occurs more that about seven days after the Spring Equinox, all of the set-apart days in the seventh month will be after the Autumnal Equinox.

In harmony with the astronomical uses shown above, this refers to the autumnal equinox.

DID ISRAEL HAVE KNOWLEDGE OF TKUFAH OR EQUINOX? YES...

Certainly Moses was aware of the equinoxes from the knowledge he gained in his upbringing in Egypt (Acts 7:22). The ancients were easily able to determine an east-west line. because 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. Therefore the equinoxes are visible signs of the sun in relation to the earth and 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”.

This is a key statement: equinox or *tkufah* is linked to and

defined by use of the sun, the great light in scripture.

THE MAIN POINTS ARE:

(1) Eccl. 1:5-6 demonstrates a knowledge of the annual cycle of the sun based upon its shadows, as a prior chapter explained.

Eccl. 1:5 “The sun also ariseth, and the sun goeth down, and hasteth to his place where he arose.

“The wind goeth toward the south, and turneth about unto the north; it whirleth about continually, and the wind returneth again according to his circuits.”

A natural study of these shadows without the use of mathematics leads to the determination of the equinoxes and the solstices. The use of the Hebrew word *tshuvah*, meaning spring, also demonstrates familiarity with the vernal equinox. The Hebrew word *tkufah* appears in the Tanak, and the concept of the vernal equinox in ancient Israelite society is also implied by Eccl. 1:5-6 and Acts 7:22, along with associated history.

(2) The Hebrew word *tkufah* found in Scripture does have use outside the Bible before Herod's Temple in Jerusalem was destroyed in 70 CE.

(3) 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.

(4) 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.

(5) The uses of *tkufah* in the Dead Sea Scrolls show the meaning of a point in time.

(6) In contrast to this, the harvest of fleshy fruits in ancient Israel is widely spread out over time, from mid-summer into almost late autumn. Thus, the meaning of *tkufah* best includes the boundary points of the four seasons as well as the other meanings demonstrated above.

The mention of the seasons of summer, winter, and spring in biblical Hebrew implies recognition of their boundary points, which are the equinoxes and the solstices. Reasoning from Gen. 1:14 strongly implies an annual sign of the sun, which can only be an equinox or a solstice. Even **if** the word *tkufah* did not exist at all in the Tanak, it would not defeat the implication of equinoxes and solstices from Gen. 1:14, because festivals are implied with the plural of the Hebrew word for *moed*, literally translated appointed-times [4150 *moed*], and this requires a knowledge of some method to determine the first month from the heavenly lights.

The scripture's use of “Moed” connects us to the word “Tkufah” in order to separate the seasons. The Bible uses this

word to divide the seasons, not the use of barley.

***Knowledge of the times of the festivals that are determined from the lights in the heaven, implies an annual sign from the sun, i.e., an equinox or solstice, regardless of whether *tkufah* occurs there.

Gen. 1:14 (along with related Scriptures) shows the following two examples of beginning a new time cycle when a direct signal from a heavenly body is seen.

WHAT IS A DAY?

The beginning of the daily cycle, that also begins the Sabbath day occurs with the transition from light to darkness, which is a direct signal from the sun.

WHAT IS A MONTH?

The monthly cycle begins with the first new light from the moon in the evening (when the new day begins, provided the new month is officially declared), which is a direct signal from the moon.

WHEN IS THE NEW YEAR?

This pattern of beginning a new time cycle with a direct signal from a heavenly body is extended to the determination of the first month. The only consistent visual annual sign of any light from a heavenly body at roughly the time of the year that “the Israelites went out of Egypt” (note Ex. 23:15; 34:18 with

Ex. 9:31-32) is the vernal equinox.

The extension of the pattern implies that the vernal equinox is the visual marker that separates the new moons of one year from the new moons of the next year.

SMOKING GUN: The beginning of the year is the first new moon after the equinox, tkufah, or Tshuvah, spring.

In other words, the vernal equinox is a *direct signal from the sun* to start looking for next new moon. The next new moon seen after this time, March 21st, is the first new moon of the year (ABIB 1). More specific biblical and historical details that corroborate this will be seen later.

Section [40] Equal Daytime and Nighttime is Not the Biblical Equinox!!

The word “equinox” comes from the Latin language and means “equal night” 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?

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’”).

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).

Pages 73-74 of Pannekoek, “*History of Astronomy*” 1961, agrees that equinox has nothing to do with equal day and night.

The paper by Otto Neugebauer 1980, “*On the Orientation of the Pyramids*” also agrees that *tkufah* does not mean equal day and night. This will be discussed further in the next chapter.

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. 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 of 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, “*The Dawn of Astronomy*”, 1894, 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.

MOSES KNEW HOW TO DETERMINE THE EQUINOX SEASON DIVIDER

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.

MOSES WOULD NOT THINK OF THE FIRST MONTH UNLESS...

The dividing line of winter and spring had already occurred...Tkufah. 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? NO...

But the real biblical evidence comes from Ezra and Nehemiah.

FURTHER PROOF FROM EZRA AND NEHEMIAH

Judah's biblical calendar was the same as the Babylonian calendar before and after the captivity. The use of the Babylonian word, "Nisan" is the same month as "Abib" in Hebrew. The name of the Babylonian months was adapted. They were adapted by Ezra. The name Adar, Elul, etc., as seen on Jewish calendars today is the adaptation. The name of the Babylonian months and several others, including the Hebrew adaptations, can be seen on page 26 of *Babylonian Chronology 626 B.C.-A.D. 75* by Parker and Dubberstein.

Gen. 1:14; Ezra 6:15; Neh. 6:15 Show the Vernal Equinox Starts the Year.

Ezra. 6:15 And this house was finished on the third day of

the month Adar, (12th month) which was in the sixth year of the reign of Darius the king. (Babylonian name)

Neh. 6:15 So the wall was finished in the twenty and fifth *day of the month* Elul, (6th month) in fifty and two days. (Babylonian names)

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 soonest new moon after, the day of the vernal equinox. (see appendix C on page 21).

For the Israelites, the tequphah begins and ends at sunset of that day. The first day of spring for a scriptural year determination begins at the sunset of the Day of the Spring Equinox.

The Babylonians defined the first month the same as Judah and Moses, the first new moon after tkufah. Judah never lost that knowledge till the Pharisees started changing the calendar in 150 BCE by taking a moon before tkufah, March 21st. (See

Herb's study, "*Treatise on the Biblical Calendar*", page 200, section 73.)

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 the new scriptural year.

Some assemblies 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, such as year 2007.

There is much more documentation than presented here.

See the free PDF download for the entire study.
(biblicalcalendar.org/tbc2.pdf)

CONCLUSIONS:

1. The sun determines a day, spring, and fall...the moon is used to start a month...exactly. (Moon, Exodus 12:2 is #2320/2318)

2. Tkufah, spring, is in the scripture.

3. Equinox, or turn of the year, is in the scripture. It does not mean “equal day/equal night”.

4. Moses knew and used the tkufah to define spring.

5. Judah used the Babylonian calendar for holy days.

6. Equinox is the boundary between winter and spring. Normally the day of the spring equinox is considered the first day of spring, but it is actually the last day of winter.

7. The month of Abib starts with the new moon after March 20th or 21st. The actual date of an equinox varies. They are shown on the United States Naval Observatory web page for years in the past and into the future.

8. The Pharisees changed this timing in 150 A .D. to the moon before the equinox.

9. Barley is not the factor to determine the moon before or after the change of the year. (See study on barley, June 2010).

10. When an assembly or individual chooses a new moon

before March 21, it is still in the winter and is therefore, the wrong timing. Abib is a complete month in the spring, after equinox.

11. Holy days must be observed on the correct date or else one is disobedient, especially he who has led his congregation wrongly and refuses to consider research from those who have expertise. Observance of the wrong calendar breaks seven annual sabbath days.

Question: Do we want to keep man's feasts or Yahweh's feasts?

Lev. 23:4-5 "These *are* the feasts of Yahweh, *even* holy convocations, which ye shall proclaim in their seasons.

"In the fourteenth *day* of the first month between the evenings *is* Yahweh's Passover."

Isa. 66:5 a "Hear the word of Yahweh, ye that tremble at his word;"

Appendix C:

Nisanu 1 in the Babylonian Calendar Compared to the Vernal Equinox during the Century of Ezra and Nehemiah. From Herb Solinsky's "*Treatise on the Biblical Calendar, April 3, 2009..*".

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 (*Babylonian Chronology 626 B.C.–A.D. 75*) 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 Coldstine 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 Herb Solinksy, 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, on page 26, 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 on page 27 & 28.

Ver- nal Equi nox BCE	Astro- Nomical New Moon	Sunset Nineveh (Green- wich Time)	Hours from Con- junction to sunset	Expected New Moon (from hours)	Parker & Dub. Prior New Moon	Num- ber of day 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 year	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

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.

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 Equinoxes compared to Nisanu 1 in Babylonian Calendar Table

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
<u>3-26-484</u>	<u>15:27</u>	<u>3-26</u>	<u>3-26-434</u>	<u>18:28</u>	<u>4-13</u>

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.

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