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CALENDAR AND ECLIPSE INTERRELATIONSHIPS

A Study of the Problems Faced by Early Calendar Makers
When They Changed from the Lunar-Solar Principle to
a Solar-Sidereal System Disregarding Lunar Phases

A Thesis

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F O R E W O R D

Astronomy is a most popular subject and there is no lack of fascinating information that today's layman might study. Yet few are aware of the type of knowledge men in the second millennium B.C. had access to, nor could the average man care less. "Our ancestors were frightened by the phenomena of the heavens . . . " and that is close to the sum total of a modern educated scholar's knowledge.

Little of the astronomy of the ancients was set down in words; nor can modern astronomy be described only in words. Thus it has proven to be a difficult task to tie the necessary information together into a verbally intelligible whole. One must visualize the patterns of the heavens, and that mental picture can then only be presented in the uncommon language of astronomy. Right Ascension, precession, nodes, anomalistic, tropical, First Point of Aries, declination, azimuth, amplitude, and a dozen other very specific terms must not only be understood but be fluently grasped as the reader "sees" the movements of the heavens as they appeared to early man.

"Whether these things are so" is not always clear as research progresses. Nor is it practical to undo the pattern of discovery by presenting final conclusions as fact in Chapter One. Theory is intended to point out areas of potentially profitable search; in this respect it avoids the pitfalls of blind, random research. The intent of research on the perimeter of knowledge is to provoke the next one who passes by to set things in more perfect order.

In doing the final editing and revising, the thought that comes to the fore is that a research paper must be a communication. If written in technical language of astronomy alone, it tends to be incomprehensible to the researchers in other fields. And they are the ones who might profit most by the implications of an astronomy theme. On the other hand, any oversimplification can be a "cure" worse than the ailment. Words like precession and ecliptic must be understood. There is no suitable substitute for the active participation of the reader. A passive approach, treating the facts as the "dead, dry calculations of astronomy" that they are, yields that passive type of reward.

The interrelationships of the heavens are endless. By selecting certain God-given patterns, one branch of mankind has kept its calendar "house" in order; by the selection of an equally logical (from man's viewpoint) set of patterns in the heavens, the nations of earth have been led "to worship the host of heaven" and were eventually confounded in even their most precise calculations. A solar year of 365 days worked fine in Egypt and in the Mayan culture of Central America; yet we have the command to the children of Israel as they were preparing to leave Egypt, "This month shall be unto you the beginning of months: it shall be the first month of the year to you." And the calendar they were given was a lunar-solar in structure. A simple principle of keeping time has separated the courses of nations. What are the implications of this parting of ways to a modern time-regimented world?

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P U R P O S E

TO EXPLORE AND RELATE THE FOLLOWING PROPOSITIONS WITH EMPHASIS ON THE KNOWLEDGE OF THE HEAVENS AVAILABLE TO THE EARLY CALENDAR MAKERS

(1) That dissention in timekeeping arose soon after the Flood with Cush and Nimrod as the perpetrators. Separation from the authority of Noah and Shem demanded a separate timekeeping system.

(2) That they (Cush and Nimrod) changed from the intended lunar-solar system to a simpler, purely solar calendar. Twelve thirty-day months in a year, then a short five or six day wait for the beginning of the new year with no need for any intercalary month.

(3) That the present day Roman calendar originated in Egypt with Nimrod. The Egyptians oriented their temples toward the northeast for the June 21 sunrise, the solstice, which coincided closely with the mid-summer overflow of the Nile. They also discovered that Sirius arose just before the sun (heliacally) on this day.

(4) That the Arabs today use the 354-day, 12-month lunar calendar that has also degenerated from the early proper system. Egypt had gone the opposite direction preferring a solar calendar.

(5) That the Babylonians and others in the Tigris-Euphrates valley also used a solar calendar but tied it to the spring overflow of their river. For them the observance of the spring equinox was important and temples were thus oriented toward the east.

(6) That Jacob (and possibly Joseph) certainly brought the lunar-solar Sacred Calendar to Egypt. From that time forward the orientation of Egyptian temples was equinoctial, toward the east. Four types of years would be in use at this time in Egypt: A 365-day calendar year, a 360-day agricultural year +5 or 6 days, a Sirius year approximating 365.2564 (a siderial year) but continually changing because of the precession of the quinoxes, and finally the God-ordained lunar-solar calendar with its 19-year pattern.

(7) That a type of the Passover occurred in the offering of Isaac 430 years prior to the Exodus. Isaac had been selected on the tenth day of the month; they went a three-day journey, they "saw" the place. To see a place it must have a peculiar appearance. The geological formation at Golgotha is recognizable today 1900 years after the Crucifixion. It might have been recognizable as "the Place of the Skull" 1900 years earlier in the time of Abraham. The offering of Isaac and the Crucifixion of Christ then both occurred at the same place and both on the same day of the year of the same lunar-solar Sacred Calendar.

(8) The Exodus was 430 years to the very day. Since 430 is not evenly divisible by 19 the date would vary slightly in the season if the lunar-solar calendar were used; but would vary 107 days if the 365-day Egyptian calendar were used. The offering of Isaac, the promise to Abraham, the Exodus and the Crucifixion should be the same time on the same calendar. Which calendar?

(9) That there were thus two basic calendars in Egypt, one originating with Osiris, the other having been brought in by Joseph or his father Jacob. Israel in Egypt may have used the Egyptian calendar as we today use the Roman calendar. Weeks were known by Jacob.

(10) Joseph married the daughter of the royal astronomer and himself held an even higher position. Imhotep (Joseph) was called the High Priest of Heliopolis. Pharaoh put Joseph over all Egypt so that "without thee shall no man lift up his hand or foot in all the land of Egypt." He was well acquainted with the Egyptian solar calendar.

(11) The calendar is a mathematical arrangement intended to keep the year in line with the seasons for religious and agricultural purposes and to provide for shorter periods, seasons, months, days. Equinoxes or solstices might serve equally well as beginning points for the year.

(12) The Egyptians, however, used the heliacal rising of Sirius to keep the seasons and calendar year in line. Their Sirius year very closely approximated the 365.25 Julian calendar year, about 11 minutes longer than the tropical year. The beginning of their astronomical Sirius year thus moved forward in the tropical year (the year of the seasons) 23 days in 3000 years, but 1 day forward in their too-short 365-day calendar year every 4 years.

(13) The Egyptians only later became aware of the precession of the equinoxes. The true sidereal year is not 11 but 20½ minutes longer than the tropical year. The westward precession of the equinoxes causes the stars to be displaced eastward from the First Point of Aries parallel to the ecliptic, and the celestial longitude thus varied while the celestial latitude (ecliptic system) remained the same. However, on the equatorial system both the Right Ascension and declination would change. And these changes on the latter system changed the calendar date and azimuth at which the star would rise heliacally. Other stars were used also by the Egyptians. Each would give a different reading because each was affected by precession differently. Temple alignments for the rise of each star were found faulty as centuries passed.

(14) The average date of Nile rise was equal to the tropical year, but the actual rise was different each year because of differing climatic conditions. Both Nile rise and Sirius rise were earlier for the southern cities, later for the northern cities near the mouth of the river, yet the crest and beginning day of rise moved at different rates, and the rates of both differed year by year.

(15) The daily change of the sun's amplitude (using terminology of the horizon system) near the equinox is much greater than at the time of the solstice, therefore the moment of the equinox can be determined with greater accuracy than the moment of the solstice. (Amplitude would also vary with the observer's latitude.)

(16) The one-degree-per-day eastward movement of the sun along the ecliptic is even more rapid than the change in the sun's amplitude at the equinox. The Egyptians made use of this fact in depending on the heliacal rising of Sirius to pinpoint the end of their astronomical year. While they used the 365-day calendar year, they held the correct length to be 365.25.

(17) That Egyptian astronomical records need not always be observations, but could be calculations into the past. The Maya Indians also have "records" which supposedly go back to 3113 B.C. Certainly Egyptian astronomers enjoyed calculating the movements of the heavens backwards as well as forwards, just as we do today.

(18) That in early Egypt the agricultural year had 360 days, divided into three seasons of 120 days each, each season again divided into four months of 30 days each, plus a five day waiting period to form the calendar year. Every fourth year an additional day should have been added to agree with the 365.25 day Sirius (astronomical) year. The 1460-year Sothic cycle resulted from their failure to intercalate in the calendar; 1461, 365-day Egyptian years equal 1460 Julian years.

(19) The moon's rapid, thirteen-degree-per-day, eastward movement allows an even more accurate measurement of time. Astronomers might have closely determined the relative positions of the sun, moon and "stellar sphere" at the central moment of a lunar eclipse.

(20) The building of Stonehenge must have followed the discovery of the 56-year eclipse cycle, which implied a knowledge of both the 235-month Metonic cycle and the 223-month Saros cycle plus a knowledge of the regression of moon's nodes in 18.61 years (roughly 1/3 of 56).

(21) That by closely watching eclipses astronomers in the time of Joshua were attempting to put the Sacred Calendar on a more sure mathematical basis, having lost their use of the Egyptian observatory alignments.

(22) That the typical modern astronomy book is strangely silent with regard to the 19-year Metonic cycle, failing to describe it as either as eclipse predictor or as the basis for the Jewish (Sacred) Calendar. There is an occasional reference to a short eclipse cycle exactly one-fifth as long, and to an eclipse cycle of 76 years less 29 days, which with those 29 days is exactly four Metonic cycles and becomes thus an invaluable tool for calendar makers.

(23) Calendar reformers of today likewise ignore the beauty and accuracy of the 19-year cycle and instead refer in a derisive manner to a difficult and complicated system that the Jews follow. This same attitude persists in dealing with the seven-day week, the only unchanged unit remaining in the present Roman calendar. Their goal, to stamp out every last vestige of the God-ordained Way of keeping time and to substitute instead a totally pagan calendar!

CHAPTER I

MAN'S SEARCH FOR UNITY IN THE MEASUREMENT OF TIME

Today's emphasis is on extreme accuracy in minute units of time. Our modern world depends upon split second coordination, upon the precise definition of When? and How long? An international conference in 1956 established a new length for one second of time defining it as a fraction of the length of the year. The second had previously been defined as 1/86,400 of a mean solar day. Still earlier 1/86,400 of any solar day was precise enough.

Extremely exacting measurements had determined that our day was lengthening 10 to 15 microseconds per year. Thus the mean solar day was not a stable constant. The second has now been redefined as 1/31,556,925.9747 of the year which began at noon January, 1900. Expressed as days and hours, that year contained 365 days, 5 hours, 48 minutes, 45.9747 seconds. The older value was 46.08 seconds.

Small variations in and a progressive slowing of the rotational speed of the earth made this redefinition of the second of time necessary. New, extremely accurate timing devices were allowing the measurement of time in microseconds (a millionth of a second), nanoseconds (a thousand times smaller), and picoseconds (a millionth of a millionth of a second).

Information for Calendar Designers

The most uniform measure of time known to us is the tropical year. It is one revolution of the earth about the sun using the vernal equinox (the moment spring begins) as a marker to tell us that we have completed a revolution. The return of the seasons is our standard year.

In terms of the Sacred Calendar, we think of the return of Festivals and Holy Days that were meant to be kept "in their season." Without a knowledge of the length of the year, the Sacred Calendar would have drifted from its tie with the spring and fall harvest seasons.

Our purpose is to determine how earlier calendar designers measured the relative lengths of the day, the month, and the year. What were the builders of Stonehenge determined to understand? How does the Metonic cycle reveal time measurements? What vital information does the Saros cycle offer?

> "Eclipses of the moon give more accurately than any other kind of observation the actual time when sun and moon are in opposition. From an early date, the Babylonian astronomers must have deduced from them not only the mean interval between two conjunctions, but the principle inequality in the motion of the moon and . . . as on their geocentric theory they conceived it, of the sun, and they were able to define the periods of these inequalities, which astronomers call the anomalistic month and year. . . . By assuming, what is approximately true, that the Saros of 6,585 1/3 days contained an exact number (a) of synodic months . . . (b) of anomalistic months . . . (c) of draconic months . . . the early astronomers, perhaps in the 6th century B.C., computed the relative motions of the sun and moon, the lunar perigee and apogee, and the nodes. (Encyclopedia Britannica, article "Eclipse.")

How early were men aware of eclipses? They would have been an invaluable aid to any people using a lunar-solar calendar such as the Sacred Calendar preserved today by the Jewish people.

The work of Gerald S. Hawkins pointing out Stonehenge as an early astronomical observatory capable of predicting the year, month and even day of solar and lunar eclipses has awakened this generation to the level of intelligence of these early men. Why did men 1500 B.C. care to predict eclipses?

360-Day Calendars

Two methods of keeping time trace their origins back to a time shortly this side of the Flood. The one most familiar to us is the Egyptian system, an easy pattern of 30 days in a month and 12 months in a year. This 360-day "agricultural year" was followed by a waiting period of 5 days for the heliacal rising of a star. The calendar year was thus 365 days in length. No provision was made for "leap year."

Only a single observation of the heavens had to be made during the entire year to keep the calendar in order, a single sighting toward the east. First the beauty of dawn, then the sudden appearance of the brilliant star, Sirius, in the southeast, following by the "first flash" of the rising sun at the solstice located in the northeast.

A new year had begun. Each succeeding morning Sirius would rise four minutes earlier, easily observed before the rising of the sun. It was an event that every schoolboy might witness and testify to.

Four-Month Seasons

In Egypt the four-month harvest season had officially terminated 5 days earlier. Now the flood of the Nile would inundate the lowlands for a four-month flood season beginning the agricultural year. Planting season followed immediately to insure harvest time prior to the next flood of the Nile. Egypt had a year of three seasons, each 120 days in length. This same 12-month, 30-days-in-a-month principle was employed in the Tigris-Euphrates valley but with a different twist. Six years of 360 days were followed by an intercalary month of 30 days, giving a 365-day average. A four-season (rather than three) year suited the agricultural economy, and the flood time of their river was at the spring equinox rather than the summer solstice.

The Egyptian Model in Central America

The Mayas of Central America also had their basic 360-day calendar, but with 18 months each containing 20 days; then an additional 5-day period at the end to complete the solar year. "The year began when the sun crossed the zenith on July 16, and consisted of 365 days, divided into 18 months of 20 days each and an extra week, the days being grouped into weeks of 5 days each." The Universal Standard Encyclopedia, article "Maya."

These three calendars (from Egypt, the Tigris-Euphrates valley and Central America) have a common origin. The same spirit of simplicity and uniformity pervades all three. A 360-day work year could be divided into either 3 or 4 seasons. Twelve months of 30 days each could be divided into thirds, fourths, fifths, sixths, tenths, and twelfths. But the 7-day week was not followed by these people. Nor did their months follow the moon in its phases.

A Calendar for Tomorrow?

The New World Calendar is based on this same desire for a uniform system to promote commerce and bring "order." Four seasons would contain 91 days each, with the first month of each season having 31 days; the following two months 30 days each, producing a 364-day year. An additional day following December 30 would complete the normal 365-day year. Every fourth year a day would follow June 30 to take the place of our present February 29 that shows up each leap year.

The beauty of this system lies in its monotony. Each month would contain 26 working days. Each quarter would begin with a Sunday, and contain 3 months, 13 weeks, or 91 days.

The principle of this New World Calendar betrays its origin in ancient Egypt. It is a neat system, ideally suited to commerce. Its single tie with the heavens is the solar year. Its beginning would be near the winter solstice, December 22, rather than the June 21 summer solstice used in Egypt. The unbroken, 7-day week, the lunar month, and other "primitive" concepts would have been conveniently forgotten.

CHAPTER II

WHY GOD ORDAINED A DIFFERENT WAY!

A markedly different system has remained practically unknown even among the educated elite of today. A few slighting comments refer to a "very complex . . . calendar (that) evolved through the ages for religious purposes" and "a grouping of days into weeks of seven days (that) has no single historical origin." A belittling description of this type disposes of this "other" system. Why?

Why is the 7-day week termed "a time measurement problem that has plagued the world"? (Page 212 Sun, Earth, Time and Man by Harrison.)

When the children of Israel left Egypt, God insisted, "this month (Nisan) shall be unto you the beginning of months: it shall be the first month of the year to you." (Exodus 12:2.) The children of Israel were commanded to follow a lunar-solar calendar replacing the solar calendar of Egypt.

If the moon and sun are in conjunction at noon and the sun centered directly on the spring equinox, then by sunset (6 o'clock) the sun will have moved $\frac{1}{4}^{\circ}$ eastward through the stars and its western edge would just touch the equinox. The moon would move about $3\frac{1}{4}^{\circ}$ eastward and be visible as a crescent in the western sky just after sunset. (If the conjunction is at noon or earlier, the first day of the month begins the previous sunset by present day rules.)

Why Observe the New Moons?

"Thirty days hath September . . ." goes the rhyme that we learned as children, but why was it necessary to learn that pattern? Because the Roman month is longer than the interval between full moons and does not follow in step with the moon. Note also that man looks east in the evening for that full moon to rise, just after sunset. He looks east for sunrise. The Egyptians looked east to begin their year.

We take note of the full moon in the sky, even as Job did, but probably not with the same extreme self-righteous concern. "If I beheld the sun when it shined, or the moon walking in brightness; and my heart hath been secretly enticed, or my mouth hath kissed my hand." (Job 31:26, 27.)

Worship Toward the East

The most (self-) righteous man who ever lived was concerned lest he lift up his eyes to the sun or moon and behold them in an attitude of worship. Centuries later Ezekiel wrote of people with an opposite attitude, people "with their backs toward the temple of the Eternal and their faces toward the east; and they worshiped the sun toward the east." (Ezekiel 8:16.) The women had observed a period of "weeping for Tammuz" (identified by Hislop as Nimrod in his book The Two Babylons).

Ezekiel gives a further description of the events of that spring celebration. "The children gather wood, and the fathers kindle the fire, and the women knead their dough, to make cakes (the original Hebrew word used here is boun or buns) to the Queen of Heaven, and to pour out drink offerings unto other gods, that they may provoke me to anger." (Jeremiah 7:18.)

The time here referred to is not the summer solstice observed in Egypt but the equinox observance in the Tigris-Euphrates valley. The Queen of Heaven is none other than Astarte (or Easter, or Öster in the German language), the mother of Tammuz (Nimrod). These people faced the east and continued to follow a practice of keeping time originated by Nimrod and his father Cush just shortly after the Flood.

Why does it make any difference which way a man looks at the heavens? The year, the month, and the day could be determined from the east as easily as from the west, but would the end result be the same?

Rather than looking toward the east some people by nature and training look west. A common slogan today is "Go West, Young Man, Go West." What event in the western sky would be used to keep time? How would it differ from looking east toward the rising sun? What difference would it make?

While Egypt dropped the objectionable lunar month, the Muslems retained it. Their calendar today is totally lunar, a calendar of 12 lunar months without an intercalary 13th month. They do not keep Festivals "in their season." The beginning of the year works its way backward through the seasons by about 11 days each year, making a complete cycle in about 34 years.

Out of Step With the Heavens

God's Way was not to be a yoke of bondage but an easy "yoke," not a temptation but a deliverance from temptation. We've grown up with the Roman days that begin at midnight as the sun reaches its lowest point in its circle around the earth. Then at sunrise we again say the day begins!

We look to the blinding sphere of light in the east. We follow it through the heavens, and the day continues once more to midnight, and we are left in perfect darkness.

The Roman year too is intended to start when the sun has reached it southernmost point of rising. Bonfires are lit even today to encourage the waning sungod so he will turn once more to warm the earth.

Winter has officially begun on this day, December 21, but the returning sun promises summertime again. The year begins in darkness (as the day did) and continues through twelve months to end once more in darkness.

Resolutions, tax time and perhaps an aching head from celebrating the New Year are the order of the day. What better example of a "yoke of bondage."

The months roll by 31, 28 or 29, 31, 30, 31, 30, with the old rhyme, "Thirty days hath September, April, June, and November, all the rest . . ." But there is no order. (The average must be held to 30.43685 days, a solar month, 1/12 of a tropical year.)

Though the word month comes from moon and the length of the month was originally set by the moon's 29½-day path eastward through the stars, today there is no agreement between the moon's phases and the month. Hardly anyone is at all sure where the moon rises, whether it does every day, whether it ever rises in the west and sets in the east or what. Man is certainly out of step with this "hand" of his "celestial clock."

Why Look West?

An epitaph "Sundowners" is used by the less tactful in describing a system of keeping time by a people who have their "backs to the east" and are watching for some event in the western skies.

Just as the Egyptians watched the east for the appearance of Sirius just before the "first flash" of sunrise, so this "other people" looked west just after the "last flash" of sunset, to catch a glimpse of a crescent moon, a moon that minutes later would drop from view. What remained as a temptation to worship? "My yoke is easy, my burden is light." No temptation remained.

If this crescent "new moon" belonged to the first month of the year, this moment of sunset was also the beginning of a new year. Sunset! Not the Egyptian splendor of sunrise, nor the Maya moment of noon, nor the Roman choice of the blackness of midnight. But the quiet moments when the day of man's work is over, he returns to the campfire, to his evening meal. An hour or so later the sky fills with stars as darkness falls. "The heavens declare the glory of God."

A Seven-Day Week

A day of rest commenced with evening. Here is a gift to man, a Sabbath that "was made for man." But doesn't the Roman calendar include a week of seven days?

Do calendar makers like the division of time into sevens? Notice its insertion into the Roman system of timekeeping.

A 7-day week period was inserted into the calendar by the Counsel of Nicea, "a time-measurement problem that has plagued the world since that day." (Page 212 of Sun, Earth, Time and Man by Harrison.)

Fractional Parts of The Day

Could divisions of the day give us any clue as to the basic knowledge available to early astronomers? Daylight and darkness make obvious divisions into day and night. But is there any good reason for 12 hours in a day?

Consider a morning of 6 hours. It might be easily divided in half, in thirds, and even in quarters of an hour and a half apiece. The entire 12-hour daylight part might be divided in the same fashion. The "dozen" system has its merits.

The Roman calendar divides the hour into 60 minutes, and each minute into 60 seconds. The additional advantage of 60 over the dozen system is that 60 is divisible by five as well as the previously listed factors. The origin seems related to the 360-day agricultural year and the 360° into which a circle is divided. The sun moves eastward through the stars 1° per day, 360° per year.

Why 1080 Parts in an Hour?

The Jewish calendar divides the hour into 1080 parts. Is there also a logical basis? A moment's thought reveals that 1080 is 360 times 3. A few moments further reflection reveals that 1080 is divisible by every number from one through twelve, except seven and eleven.

These parts (or Halakim) are then further divided into 76 moments (or Regaim). A part would correspond to 3 1/3 seconds while a moment would equal 5/114 seconds. The choice of the number 76 seems unusual. It is divisible only by 19, 4, and 2. Of what significance is 19 to calendar makers?

It seems certain that the 19-year Metonic cycle must have been known as far back as the division of parts (1080 to an hour) into 76 moments. One might also assume that the 365¼ day Julian (or Sirius) year provided the factor of four. The factors of four and nineteen would easily account for the 76 "moments" in a "part."

Instead of dealing with a single Metonic cycle, suppose four cycles were put together giving a 76-year period (the Callippic cycle) of 27,759 days. This total of four Metonic cycles (6940, 6940, 6940 & 6939) could be divided evenly by 19 to form four-year periods of exactly 1,461 days each. Any measurement of the 76-year cycle in parts could be distributed evenly among the shorter periods in terms of moments.

We are assuming here an "even" 6,939.75 days in a 19-year cycle. Early calculations just after the Flood would not have been as exact as they are today.

The following table shows the elements of the cycle as determined today and are listed in descending order of length.

Elements of the Metonic Cycle

19	Sidereal years	(365.2563604 days)	6939.87085
19	Julian years	(365.25)	6939.75000
254	Sidereal months	(27.32166)	6939.70164
235	Synodic months	(29.5305879)	6939.68818
19	Tropical years	(365.24220)	6939.60180
255	Nodical months	(27.21222)	6939.11610
20	Eclipse years	(346.620031)	6932.40062

(See pp. 97-102 for the effect of this too-short eclipse period)

Note that 19 Julian calendar years (the approximate equal of 19 Sirius years in Egypt, the Sirius year being a sidereal year modified by precessional factors) are .06 of a day longer than the 235 Synodic months of the cycle.

Any nation wishing to keep its holy days "in their season" could profitably compare the 235 Synodic months with 19 Tropical years which are .09 of a day shorter.

This difference between the Julian and Tropical years initiated work on the

Gregorian calendar, where the year is considered 365.2425 days (still a trifle too long).

The 19-year cycle would have been recognized shortly or immediately after the Flood. I believe we can almost prove that it was recognized. Whether the day, month, and year were the same length before the Flood is unknown. Longevity of life would have enabled pre-Flood man to discover long, accurate eclipse cycles. Variations in the length of the day, month and year in the centuries after the Flood must also be watched for in historical accounts and observations made at that time.

A Pharaoh's Oath

We are going to show evidence that a lunar-solar calendar was in use shortly after the Flood. History records that the new Egyptian Pharaoh was forced to take an oath not to intercalate days or months. Yet a lunar-solar calendar would require such intercalation. Nimrod and Cush rebelled against the authority of Shem in this matter of the calendar and set up their own system both at Babylon and in Egypt.

Solar-Lunar Simplicity

The 19-year cycle does not demand a complex system of keeping time as some authors of modern astronomy books insist. Consider the simplicity of its rules. The final month of the year always has 29 days, whether that month is an intercalary 13th month or a normal 12th month.

The next seven months, which contain Holy Days, are a standard series of 30, 29, 30, 29, 30, 29 and 30. Thus we have a stable 8-month section vital to national unity in the matter of Festival observance.

At the time of the Feast of Tabernacles in the 7th month, the priests could give instructions to the people whether to add a 30th day to the normal 29 days of the 8th month, or to subtract a single day from the normal 30-day length of the 9th month.

Adding a 13th Month

Instructions would also have to be given whether to add a 30th day to the 12th month and then add an additional 29-day intercalary 13th month. Observations to determine this would have been completed on the first day of the 7th month, on the date of the Feast of Trumpets.

The entire calendar for the next 12 or 13 months would have been set in order at this time. Anyone on a far journey missing these instructions might have found himself in doubt as to the proper month for Passover. In line with this we find instruction as to the keeping of the Passover one month late.

Was the intercalary 13th month always added prior to Nisan? In the centuries B.C. we do find evidence of adding an intercalary month prior to the 7th month in fall. There are accounts of Hammurabi also following this pattern. Early calendar authorities did not follow exactly the strict mathematical pattern which forms the Sacred Calendar today.

The priests at times would be unable to notify distant regions of the need for a 13th month. Rather than have disunity, the addition of this intercalary month was delayed. The net effect was to observe the spring festivals and Pentecost one month early. There is also the provision in Numbers 9:6-11 for a Passover to be observed one month late. Some variation was allowed at this spring festival. Yet the Feast of Trumpets, Day of Atonement, Feast of Tabernacles and Last Great Day allow no such postponement.

Delayed Festivals

There is, however, a record of the "keeping of a feast of tabernacles" in the eighth month, instituted after the death of Solomon, by Jeroboam for the northern kingdom. He had fled to Egypt in the time of Solomon fearing for his life. Upon his return with an Egyptian wife, Jeroboam seized control of the rebellious northern tribes. (I Kings 12.)

It is Jeroboam who "ordained a feast _in the eighth month_, on the fifteenth day of the month, like unto the feast that is in Judah" (the proper Feast of Tabernacles). The reason for this change: "if the people go up to do sacrifice in the house of the LORD at Jerusalem, then shall the heart of this people turn again unto their lord, even unto Rehoboam king of Judah, and they shall kill me, and go again to Rehoboam king of Judah." _His rule would have come to an end unless he could change their religious observances_.

There is also evidence that it was Jeroboam who changed the weekly day of rest from the Sabbath to the first day of the week. The "statutes of Omri" and the "sins of Jeroboam the son of Nebat" are repeatedly mentioned in the following centuries until the destruction of the northern kingdom and captivity of its people in 721 B.C. by King Shalmaneser of Assyria. When we again find these people they are keeping a late fall festival (Halloween), Sunday and the religious concepts of Nimrod. Sunday is also _late_ by one day and at times called _eighth_!

The urgency of national religious unity was recognized by early religious leaders. Nimrod recognized that by changing the calendar he could keep his people separate from the leadership of Shem. Moses led Israel out of Egypt under a calendar different from that of the Egyptians. Jeroboam knew he had to change "times and seasons" to hold his control over the people. The effect of any new world calendar in our time would be to create a sharp distinction between the people of God and those following the priests of Baal.

Quartodecimans Preserve Passover

Religious leaders (and politicians too) have changed the date for observance of festivals to insure that people would be cut off from their former habits.

Note the case of Passover, which occurs on the 14th day of Nisan and might properly fall on various days of the week.

> "Most Christian sects agree that Easter (Passover) should be celebrated on a Sunday. Others follow the example of the Jews, and adhered to the 14th day of the moon (of the month Nisan); but these, the minority, were accounted heretics, and received the appellation of Quartodecimans. The council of Nicea, in the year 325, ordained that the celebration of Easter (Passover) should thenceforth always take place on the Sunday which immediately follows the full moon that happens upon, or next after, the day of the vernal equinox. Should the 14th of the moon, which is regarded as the day of the full moon, happen on a Sunday, the celebration of Easter was deferred to the Sunday following, in order to avoid concurrence with the Jews and the above-mentioned heretics." (Encyclopedia Britannica, article "Calendar." Parenthetical material and underlining added.)

To ensure that their converts would be following faithfully after them, these religious leaders simply changed the day of observance. The article continues:

> "The complicated, though highly ingenious method, invented by Lilius for the determination of Easter . . . is entirely independent of astronomical tables or indeed of any celestial phenomena whatsoever . . . the equinox is fixed on the 21st of March, though the sun enters Aries generally on the 20th of that month, sometimes even on the 19th. . . . the intention of the council of Nice (was not) rigidly followed . . . epacts are also placed to indicate the full moons generally one or two days after the true full moons; but this was done to avoid the chance of concurring with the Jewish Passover, which the framers of the calendar seem to have considered a greater evil than that of celebrating Easter a week too late."

A Goal Almost Achieved

The subtle, step-by-step approach goes by unrecognized; the final goal to destroy every time-keeping principle that God gave Adam is slowly achieved, yet a vestige of the original way remains. The day, week, month, season and year all are recognizable in even the New World Calendar, yet NOT ONE IS PROPERLY OBSERVED. "Your new moons, your sabbath days . . ."

CHAPTER III

THE EARLY SACRED CALENDAR

In this chapter evidence is presented that leads to a rather startling conclusion. The full answer to the problem is not yet available. Questions: Does the Sacred Calendar with its 19-year lunar-solar pattern go back only to the Exodus? Or does it go back to Creation? The Jews consider that it goes back to Creation.

What of the 360-day year that is apparent in Noah's account of the Flood and in prophecy? Did the moon actually go around the earth in 30 days? Or did both Abraham and Moses ignore the moon and use the Egyptian system until the Exodus? More questions are asked than answered by the material presented. The conclusion reached is to be considered tentative. It is intended to provoke further study by those who have specialized in the various areas.

Type of Passover Before Exodus?

Was the Sacred Calendar in existence prior to the Exodus? Or did it only begin when God said to Moses, "This month shall be unto you the beginning of months: it shall be the first month of the year to you." How then could it be said, "Now the sojourning of the children of Israel, who dwelt in Egypt, was 430 years. And it came to pass at the end of the 430 years, even the selfsame day it came to pass, that all the hosts of the Eternal went out from the land of Egypt"? (Exodus 12:40, 41.)

How could the children of Israel leave Egypt 430 years (from the date of the covenant with Abraham when he was 99) even to the selfsame day, unless a very careful count of days as well as years had been kept? Which calendar was used for the count of days and years? The Egyptian solar calendar? Then would we assume that even Abraham 430 years earlier counted time apart from the lunar months which Egypt's calendar lacked?

Weigh the significance of the following calculations carefully. If 430 tropical years were meant, the product would be 157,054.1484 days or (divided by 29.5300588) 5,318.4501442 synodic months. The .45 of a month is about 13 1/3 days, meaning that the trial of Abraham (and of Isaac) would have been a few days after a new moon, and thus not near the 15th day of a lunar-solar calendar.

Suppose the Julian calendar year of 365.25 days is used. The result is 157,057.5 days and 5,318.5637408 synodic months. The .56 of a month would be about 16 3/4 days, putting the event of the offering of Isaac a few days before the new moon.

If on the other hand Moses was referring to the Egyptian calendar year of 365 days (with no leap year) then the product is 156,950 days. The number of months now is 5,314.9233824 bringing us close to another full moon but the .92 is about 27 1/3 days, not the required 29 or 30. And what is worse is that the too-short Egyptian calendar has allowed this date to drift 2 1/2 months away from the spring equinox, certainly an untenable result. And it would imply that the patriarchs used this pagan Egyptian calendar to record two of the most vital moments in the history of Israel.

Only a lunar-solar calendar would bring us to another full moon (15th day of the month) close to a spring equinox 430 years earlier! The fact that 430 is not evenly divisible by 19 proves this conclusively.

We know Israel left Egypt the night of the 15th of Nisan in the light of the full moon and that every Passover since has been held at the time of the full moon. Only a lunar-solar calendar would put the time of Abraham's trial on the 15th day of a lunar month.

Geology and Golgotha

Consider the time and place of the Crucifixion. What does Golgotha look like today? How did it appear nineteen hundred years ago? thirty-eight hundred years ago? Where was Isaac offered "in the land of Moriah . . . upon one of the mountains which I tell thee of." (Genesis 22:2.)

The Place of the Skull

The crucifixion of Christ took place at the "place of a skull" or Golgotha. (Matthew 27:33.) The location of Golgotha north of the temple area seems rather obvious today for it still has the appearance of a skull. Geology (and some quarrying) has had 1900 years to alter the appearance, yet it remains basically unchanged. Why?

The erosion and weathering of this geological formation depends on the structure and the hardness of the rocks that constitute it. If we were to look 1900 years into the future, would it still have the shape of a skull? Probably so. Unless some unknown geological event were to take place, we would expect the appearance to be basically the same.

"The Latin calvaria ("a bare skull") is a translation of the word kranion, which the Greek Evangelists used to interpret the Hebrew Golgotha." (The Universal Standard Encyclopedia, article "Golgotha.")

What then was the appearance of Golgotha 1900 years prior to the crucifixion? Assuming a measure of uniformity, it might have had the appearance of a skull then too. It could have been selected for that very reason. Quarrying has been done in this region. Had early inhabitants of Jerusalem obtained building stone here?

The Mosque of Omar

Muslems today claim that Abraham offered Isaac on the spot where the temple was later built. They have built the Mosque of Omar on this place. It had originally been a threshing floor on the outskirts of the original city of Jerusalem. Abraham saw this city as he passed by on the way to Egypt.

Was Isaac actually offered on the site of the Mosque of Omar? Was Isaac offered on this hill and Christ on a hill to the north? Would any threshing floor be used for a sacrifice? Did Abraham spill the blood of a ram on this area set aside to accomodate grain, human food?

Set Aside on the Tenth

Consider that Abraham went a 3-day journey and saw the place from afar. (Genesis 22:4.) To be seen from afar a place must have a distinctive appearance. Abraham made camp and left his servants (verse 5), then took Isaac and went to this appointed place. Was it Golgotha? The alternatives are other nearby hilltops. The Mosque of Omar is visible from Golgotha today even with buildings between. Both are elevations above the surrounding area.

Was Isaac selected as a type of the "Passover Lamb" on the tenth day of Nisan? If so, then we have direct evidence of the Sacred Calendar before the time of Moses. We can also understand how Israel left Egypt 430 years, "even to the selfsame day," from the time of the covenant with Abraham. The day referred to was the time of Isaac's sacrifice, not the time 24 years earlier when God said to Abraham, "Walk before me and be perfect." (Genesis 17:1.)

Alternative Locations

We then question whether Isaac was selected on the 10th day of the month, spent three days traveling with Abraham to the vicinity of Jerusalem, then was offered on the 14th day of the month as a type of Christ. Nineteen centuries later the same scene is re-enacted. Christ is selected by the people as the Passover Lamb on so-called "Palm Sunday" (which was really a Sabbath). Christ's crucifixion took place on the 14th of Nisan.

The alternative is to believe without evidence that the offering of Isaac by Abram was not at the site of the crucifixion, and that it was not on the 14th of Nisan. The evidence in favor is that God does not change.

A Feast of Tabernacles for Egypt

The children of Israel had been slaves under the Egyptian 360-day calendar, enjoying no Sabbath and no pattern of festival observance other than a 5-day festive period held prior to the June 21 appearance of Sirius. Consider the reasons for this Egyptian calendar pattern. Weigh also the fact of prophecy that it is Egypt that will hesitate to "come up to Jerusalem . . . to keep the Feast of Tabernacles."

The flood time of the Nile made a solar calendar ideal. Irrigation rather than rainfall waters the Nile valley. Egypt does not depend upon seasonal rainfall today! The rainfall predicted for many areas is zero! And the building of dams has ensured a continual supply of water.

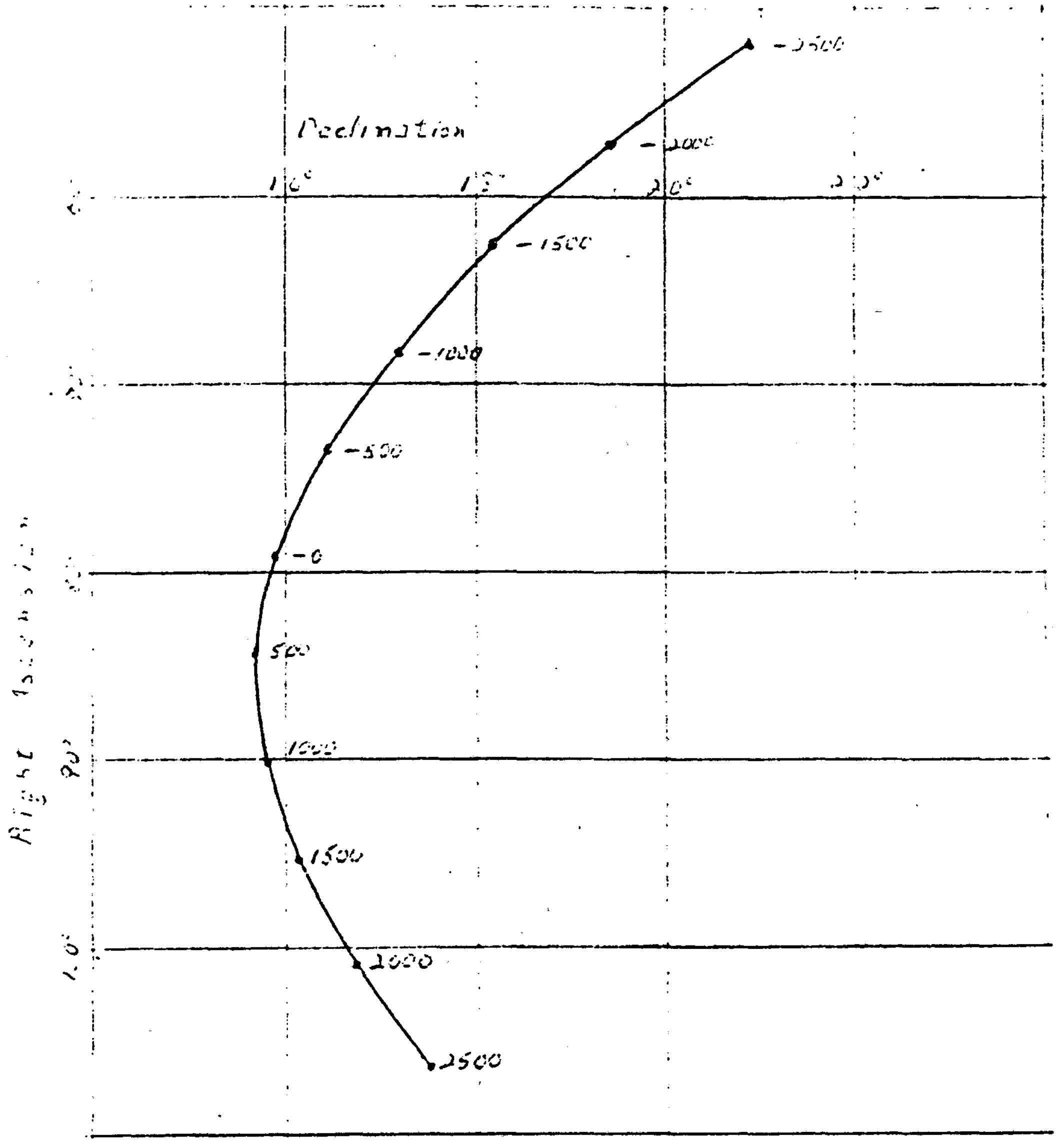
But note Zechariah 14:17, 18. "And it shall be, that whoso will not come up of all the families of the earth unto Jerusalem to worship the King, the Lord of hosts, even upon them shall be no rain. And if the <u>family of Egypt</u> go not up, and come not, that have no rain; there shall be the plague, wherewith the Lord will smite the heathen that come not up to keep the feast of tabernacles."

Egypt is singled out and threatened with "plague" as well as "no rain." Egypt doesn't depend on rainfall <u>in Egypt</u> but the Nile waters are certainly the result of rain. Earthquakes and climatic change accompany Christ's arrival.

What if the mountains were pushed down and the heavy rains in Abysinnia which cause the Nile to flood fell elsewhere? What if earthquakes changed the course of the Nile before it reached Egypt?

So long as the Nile floods on time and dams can be built, rainless Egypt is not going to want to keep any Feast of Tabernacles tied to a lunar-solar calendar.

THE CHANGE IN THE LENGTH OF THE SIRIUS YEAR AS SEEN FROM EGYPT



The Egyptians used their eastern horizon and the heliacal rise of stars (especially Sirius) to indicate the time of year. Had they used the celestial meridian (as we do to indicate whether the sun is A.M. or P.M.) the fluctuating declination (due to the precession of the equinoxes) would have been of far less consequence. The rise of Sirius (and other stars) heliacally with the sun would then have approximated the sidereal year (365.256304) rather closely.

Because they used the eastern horizon and (at Heliopolis) were situated at 30 degrees north latitude, their Sirius year was measurably shorter during the year -2500 to - 1000 during which time it followed the length of the Julian calendar (365.25) closely. The Nile rise however averaged 365.2422 (the length of the tropical year) in that the rise is caused by the return of the seasons.

For the next two millennia the Sirius year approximated the sidereal year. Declination reached a minimum in the seventh century and has been increasing since that time. The length of the Sirius year since the year 1000 has been longer than the sidereal year by about the same amount it had previously been too short.

CHAPTER IV

EGYPT'S NILE

A Description of the Egypt's Nile and the Heavens as Seen From the Land of Egypt

To really grasp the problems faced by calendar makers in Egypt and the situation that confronted Moses and Joshua as they led Israel from this land, it will be helpful to pick up some background material from two sources. One by Emil Ludwig entitled The Nile, describes the effect of the river on the people living along its banks.

The other by G. Norman Lockyer entitled The Dawn of Astronomy contains a wealth of detail on the astronomical aspects of Egypt's temples. The value of his research into an understanding of man's past is only beginning to be realized. Part of the prodding of this generation has come from writings by Gerald S. Hawkins, who forcibly presents ancient man (1500 B.C.) as very qualified to understand eclipses, mathematics, computers and what have you.

Quotes from The Nile

First a number of quotes from Emil Ludwig in his widely read book, The Nile.

> "Suddenly, though the sky is clear blue, there is a rumble of distant thunder. All the thousands of men and women emcamped in the river bed rush out, carrying their tents and their household goods with them to take flight. A confused clamor arises--El Bahr! The river! . . . A thousand miles downstream hourly telegrams warn the engineer how far the river has travelled, how high it is, and how muddy . . . A moving wall, the river approaches, fifteen hundred feet wide, pouring downward in brown waves, full of trees, bamboo, and mud, and so it hurries past. . . . Already rain is on its heels, and together they call forth buds . . . the leaves immediately afterwards--they seem to unfold before one's very eyes." (Page 104.)

Thus the Blue Nile begins its rush to the sea as it did in the days of Osiris At places the rise of the Nile is more gradual, at others a spectacular event.

What causes the Nile to flood in summer and when does it reach its peak?

The time and the height attained are not the same each year. The seven years of famine in Egypt were seven low years, not years with no water at all. Rainfall in Egypt was not involved in this famine for it does not normally rain in Egypt.

> "But the rain is the real mother of the Blue Nile, the mountains are its father . . . If Abyssinia bore no alps, if these alps were not volcanoes, and if the wind did not break against them, to send the rain streaming from the sky, there would be no stream on earth to 'hurry snakewise to the plain,' carrying with it metallic detritus from the mountains to fertilize the desert a thousand miles away." (Page 101.)

> "For a hundred and fifty days, the wave of the Nile has been travelling from the equator to Cairo; it has flowed through thousands of miles, more than thirty degrees of latitude. Is it going simply to pour into the sea like a wave of any of the thousand rivers which link the earth to the sea? Nature's last stroke pours fresh vitality, for the last time, into the Nile's creative power: just above its mouth, it divides." (Page 437.)

This richest of all lands is the area given by Pharaoh to Joseph and his brethren. The eastern portion of this delta provided grazing for their cattle.

Prior to the arrival of the river, hot dry winds threaten Egypt. The harvest must be completed before this time. Priest astronomers who knew the "day" for the arrival of the flood could promise the people a proper planting and harvest time, plus some relief from the hot dry days. Ludwig describes the rainless climate of Egypt and the rise of the river:

> "The wholesome dryness (of Egypt) is troubled only in spring by the Chamsin, the hot south-east wind which suddenly darkens the earth . . . suddenly raises the temperature of the air to over 118^{o} F., the water to nearly 80, drying up the lungs of men and of plants . . . annual rainfall figures: at the source of the Blue Nile in the Abyssinian Alps, over 50 inches . . . in Upper Egypt, 0; in Cairo, 1.2; in Alexandria, 6 (inches)." (Page 318.)

> "For three to four months, from June to September, (the Nile) rises 13 to 14 ells in Upper Egypt, 7 to 8 in the Delta. In these hundred days, the virile river takes possession of the expectant land, then, every inch a god, withdraws into the

> unknown, leaving behind only the symbolic priest, who represents it and guards its temples. Thus, as a god, it has been worshipped by all men dwelling on its banks, by all who have conquered it, down to our own day." (Page 325.)

Yet the rise of the Nile is not the same year after year. "In close succession--in 1904 and 1908--one flood was twice as high as the other." (Page 103.) Who could predict the rise of the Nile? Pharaoh Zoser in the time of Joseph knew that "only God can know" and he entrusted the future of his kingdom and his own future to the man who interpreted a dream of seven years of plenty and seven years of famine. The height of the Nile rise was a matter of life and death to Pharaoh's nation.

> "Today that secret (of what makes the Nile rise) is the secret of the monsoons that break against the Alps of Abyssinia. No one knows their strength, nor can anyone reckon in advance the conditions of cloud-formation; hence neither the volume of the Ethiopian rain nor the force of the flood rolling down the Blue Nile at the Atbara can be known. . . . Once it is there, we can measure the flood exactly and distribute it . . . but so could the Pharaohs . . . men knew the numbers and prayed for 16 ells: that is the high flood, and that is the meaning of sixteen 'children' on the statue of the bearded Nile in the Vatican. Pliny expressed this with Roman terseness: '12 ells mean hunger, 13 sufficiency, 14 joy, 15 security, 16 abundance.'" (Pages 326, 327.)

Why did the children of Israel worship "the golden calf" so readily while Moses was in the mount receiving the Ten Commandments? Does the following cast any light on the subject?

> "Sometimes, during the anxious period of drought just before the flood, Pharaoh came in person up the Nile to Silsileh, where the river seems to vanish in the narrows between the rocks. There he sought to propitiate the Nile god with gifts, particularly a white ox, and if he threw a roll of papyrus with magic formulas into the water, the river was certain to rise again from the earth." (Page 396.)

It is a commonly accepted belief that the Nile rose on a certain day and we are led to accept a simple picture of a river flooding one day and then slowly tapering off. A study of the problem shows a <u>river</u> that <u>rose at a different day</u>

for every point along its course, and that day was by no means the same one each year. Once the river began to rise it continued that rise for three months. Thus the high point of rise was in September not the June 21 date of the solstice and rise of Sirius. (Century by century Sirius rises later, today's date being July 19.)

> "Of the three Egyptian seasons, Nili, Shitwi, and Sefi--flood, winter, and summer--summer and flood merge, for though the flood sets in from June on, it reaches its height only at the beginning of September." (Page 335.)

So firm is the belief of the historians in the validity of Egypt's history that another quote from Ludwig is urgent. Did Egypt's calendar begin a first cycle in the days of Zoser or 1460 years earlier? Or did Egyptian astronomers enjoy our modern pastime of figuring backwards?

We must not forget the principle used in our own time of setting some remote arbitrary date in the past as a starting point. "The Renaisance scholar Joseph Justus Scaliger suggested in 1582 that all dates be referred to an arbitrary initial date, January 1, 4713 B.C., which he chose in connection with his work on early chronology. The date thus reckoned is known as the Julian day . . . in honor of his father . . . and not to be confused with the Julian calendar." (Page 47 of Introduction to Astronomy by Cecilia Payne-Gaposchkin. The choice of 3113 B.C. by the Mayas is possibly of similar origin.)

Quoting again from The Nile by Ludwig:

> "For aeons these sons of the desert must have observed the stars, seeing that, a thousand years before the first Pharaoh, they had already invented the calendar. It has been proved that they possessed it in the year 4236 before our era. Since they divided the year into three parts, Flood, Seedtime, and Harvest, and into twelve months of thirty days each, a few *days remained over every year, which had accumulated in five hundred years to such an extent that the Flood season actually fell in harvesttime. To eliminate this error, that is, to bring the whole year round to its starting-point again, it would take 1460 years; and in the epochs of Egyptian history, this 'wandering year' first arrived in 2776 under Pharaoh Zoser, who built the step-pyramid, then again in 1316 under a successor of

*Six hours is the actual length of time involved in the Sothic cycle. A $5\frac{1}{4}$ day remainder would give a 70-year cycle.

> Ikhnaton, and still in time to find the Pharaohs in the Nile valley, but the third time the wandering year came round, it encountered Ptolemy, the greatest mathematician of his time, in 144 A.D.; the fourth time it met Mamelukes, and there was still two centuries to wait for General Bonaparte." (Page 406.)

The above quote begins cycles in 4236, 2776, 1316 B.C. and also in 144 A.D. If the 1460 year Sothic cycle began in Pharaoh Zoser's time, the previous 1460 years were merely a chronologer's effort to run the calendar backwards before his time.

Will modern Egypt really solve its problems with the new Aswan High Dam and the older Aswan Dam? What of the problem of "no rain" and a "plague" in the millennium on an Egypt that does not want to follow the lunar-solar calendar and come up to "keep the Feast of Tabernacles"? How has the idea of damming the Nile actually worked so far?

> "And little devils actually co-operate . . . to frustrate a great idea . . . First, the storage-water has no silt . . . and yields smaller crops . . . for the first time since thousands of years, the fellah has to manure the soil of Egypt . . . The land that was kept healthy by its dryness breeds insects when it perpetually lies under water; new diseases such as bilharziasis, rise from the widened Nile like Egyptian plagues, and from a thousand mouths rises the cry: 'No more dams! No more water!'" (Pages 336, 7.)

<u>The Dawn of Astronomy</u> by Lockyer

The following quotations from <u>The Dawn of Astronomy</u> by G. Norman Lockyer point out the relationships of the heavens, the Egyptian calendar and Egyptian agriculture.

> "In Egypt the year was always, as it is now, associated with the rise of the river." (Page 225.) "The great difficulty experienced in understanding the statements generally made concerning the Nile rise is due to the fact that the maximum flood, is, as a rule, registered in Cairo upwards of 40 days after the maximum at Aswan." (Page 240.)

> "If the solstice had been taken alone, the date of it would have been the same for all parts of the valley . . . it was

> chiefly a matter of the arrival of the Nile flood, and the date of the commencement of the Nile flood, was, by no means, common to all parts of Egypt." (Page 240.)

Thus we see that the year was associated with the rise of the river, but that the further down stream a city was, the later the rise would be.

> "In the 1878 flood . . . the river rose in the most abnormal fashion . . . the wheat was sown too late, and got badly scorched by the hot winds of March and April . . . the modern Egyptians still hold to the old months for irrigation . . . 30th Misra is the last safe date for sowing maize in the delta." (Page 242.)

A successful agricultural year would depend upon a calendar successfully tied to the tropical year. Various authorities give the length of the Egyptian year at 360, 365, and 365¼ days. If they had used the solstice alone, the length of the year would have been close to our Gregorian year, 365.2425. Instead, the Egyptians chose the heliacal rising of the star, Sirius, which, due to the precession of the equinoxes and its declination, gave a 365¼ day year. The exact length of the sidereal year is 365.2563604; the precessional movement affected the declination as well as the Right Ascension of each star.

> "The Sirius year, like the Julian, was about 11 minutes longer than the true year, so that in 3000 years we should have a difference of about 23 days." (Page 253.)

The sidereal year, 365.2563604 days, was about 9 minutes and 13 seconds longer than the Sirius year due to the precessional factor.

> "During 3000 years of Egyptian history the beginning of the year was marked by the rising of Sirius, which took place nearly coincidentally with the rise of the Nile and the summer solstice . . . <u>the commencement of the inundation was later</u> as the place of observation <u>was nearer the mouth of the river</u> . . . Of the three coincident, or nearly coincident, phenomena, the rise of the Nile, the summer solstice, and the rising of Sirius, they at first chose the last." (Page 249.)

An additional complicating factor was the taboo on adding intercalary days or months, as the Jewish calendar today does, or as we do with Roman calendar by by adding a February 29th every four years.

> "Each Egyptian king, on his accession to the throne, bound himself by an oath before the priest of Isis, in the temple of Ptah at Memphis, not to intercalate either days or months, but to retain the year of 365 as established by the Antiqui. The text of the Latin translation . . . cannot be accurately restored; only thus much can be seen with certainty." (Page 248.)

The Egyptian king was thus bound by oath not to observe a lunar-solar calendar, but to observe a purely solar calendar of whole days.

There was a 360-day work year plus "a 'little month' of 5 days . . . interpolated at the end of the year between Mesori of one year and Thoth of the next." But apparently there was no additional "February 29th" every four years.

> "They had a vague year (365 days) in the Sirius year (365.25 days), so related, as we have seen, that the successive coincidences of the first of Thoth in both years took place after an interval of 1460 years. Now, for calendar purposes . . . the easiest way would be to conceive of a great year or Annus Magnus, consisting of 1460 years, each day of which would represent four years in actual time . . . to consider everything . . . to take place on the first of Thoth in each year . . . as the cycle swept onward, the date would sweep backward among the months of the great Sacred Year until its end." (Page 257.)

Compare this with the system of the Mayas where a 365-day year was observed in conjunction with a 260-day year, making a great cycle of 52 (365-day) years or 73 (260-day) years. There should be further study of the Maya and Egyptian calendars, of their similar pyramids, and of their similar hieroglyphs.

It is obvious that the Egyptians recognized an astronomical year of 365¼ days, tied to the heliacal rising of Sirius.

> "Now it is clear, that if the Egyptians really worked in this fashion . . . this calendar system . . . is good only for groups of four years. Now, a system that went no further than this would be a very coarse one. We find, however, that special precautions were taken to define which year of the four was in question . . . Brugsch, indeed, shows that a special sign was employed to mark the first year of a series of four." (Page 259.)

Thus we have the Egyptians setting up a 360-day work year, followed by a five-day period of festivities, yet understanding that their year was one quarter day short of the astronomical Sirius year. The first day of Thoth was gradually moving backward in the seasons, one day in four years, 25 days in a century, a full revolution in the year to its original position in 1460 years, which is termed a Sothic cycle.

The astronomer in Egypt thus made his calculations on the basis of the Sirius year of 365.25 days while the king was bound to follow a 365-day year. The priest-astronomer was thus able to hold his position of authority over the king of Egypt. The beginning of the calendar year moved gradually backward through the seasons, yet everyone who cared to might observe the rising of Sirius in the east on about June 21 (Gregorian date).

But there are two other complicating factors.

> "The heliacal rising of the star would not take place on the same day for the whole of Egypt, the difference between Thebes and Memphis (because of their latitudes), amounting to about 4 days; and, further still, the almost constant mists in the mornings in the Nile valley prevent accurate observations of the moment of rising." (Page 247.)

The Egyptians had aligned their calendar with the summer solstice, the rise of the Nile, and the heliacal rising of Sirius. Astronomers in the Tigris-Euphrates valley, however, were concerned with the equinox.

> "The Euphrates and Tigris rise at the Spring Equinox--the religion was equinoxial. The temples were directed to the east. The Nile rises at a solstice--the religion was solstitial and the solar temples were directed no longer to the east." (Page 229.)

Rather their direction was toward the northeast for the summer solstice. Our next step will be to determine the method Moses and Joshua used to side step the confusion of Egypt.

CHAPTER V

TIMEKEEPING PROBLEMS AFTER THE EXODUS

What were Stonehenge astronomers searching for? That would depend upon who they were. Personal discussions with historians point out the possibility that they were Israelites in the time of Joshua. If this is the case we should thoroughly search early British history for the accomplishments of "Hugh the Great," whom some consider to be the Joshua of Scripture.

If Israelites under Joshua did indeed build Stonehenge, the motives to be considered are limited to a fairly narrow range. Pagan motives (human sacrifice, fear of eclipses, sun worship, moon worship) are immediately cancelled.

We know Israel had now begun keeping a seven-day week ending with the Sabbath, that they followed lunar months with the month beginning with the appearance of the crescent of a new moon, a lunar-solar calendar with holy days kept "in their season," and that they almost certainly had a knowledge of the 19-year Metonic cycle.

Early Approximations

They would have known from Egypt the approximate length of the year to be 365¼ days thus giving a length of 6939 3/4 days to the 19-tropical-year period of the Metonic cycle. Could we assume that Moses and Joshua were attempting to relate 19 years very carefully to the length of 235 synodic months, which we now set (about an hour and a half shorter) at 6939 days, 16 hours, 33 minutes and 3 1/3 seconds? (See reprint article "How to prove the Crucifixion was NOT on Friday!" by Dr. Herman L. Hoeh.) The difference amounts to 1 hour, 26 minutes, 56 2/3 seconds.

Still Earlier Evidence

It was God who revealed to Moses, "this month shall be the beginning of months, it shall be the first month of the year to you." Was this a change from the Egyptian way? Yes, the Egyptian year began at the summer solstice, near June 21, with the rise of the Nile, and the heliacal rise of Sirius. There are only three seasons in Egypt, the inundating, the planting and the harvest season. Any delay in planting would delay the harvest, which would then be endangered by both the rise of the Nile and the hot drying winds which preceded it. A successful agricultural economy in Egypt was closely tied to the proper beginning of a year.

The correct beginning of the agricultural year was a critical item in Egypt. It had to be timed precisely. Tourists normally visit Egypt when it is green or in harvest but . . .

> "through the summer . . . those same fields (are) parched and burned under a pitiless sun . . . dust devils driving across the arid surface . . . the muddy yellow river giving an almost sinister aspect . . . then see the country again with water across the whole land . . . the dark-red river running bank high; then the sinking of the flood and almost incredibly swift burst of verdure." (Page xxii; The Splendor that was Egypt by Margaret A. Murray.)

Pharaohs began their year of reign counting from the date of heliacal rise of Sirius and the rise of the Nile. A five-day festival preceded this rise. The harvest was over and thus any celebration was certainly a harvest festival. The 360-work days of the year were conveniently divided into 3 seasons of 120 days, then into 4 months of 30 days each. The 30-day month could be divided evenly into sixths, fifths, thirds, and tenths. A ten day "week" was used.

The suggestion of Egyptiologist today that the 360-day year was allowed to progress through the seasons without the addition of five days at the end is an insult to the intelligence of the men who built Egypt, and the fellah as well who tilled the soil of Egypt. Five and sometimes (every fourth year) six days had to be added to keep this 360-day agricultural year in step with the Nile and Sirius as well.

A Lunar-Solar Calendar before the Exodus?

The Exodus of the children of Israel from Egypt took place 430 years after the covenant with Abraham when he was age 99. This covenant was a year prior to the birth of Isaac. Historians point out that Isaac was about 25 years old at the time his father placed him upon the altar as a sacrifice. Jewish tradition states that this event took place on the same day the Passover was later instituted! Arab tradition holds that he was offered at the site of the temple.

Now note the amazing statement from Scripture. The children of Israel left Egypt 430 years "<u>even to the selfsame day</u>"! We now have four events; the covenant with Abraham, the offering of Isaac, the Passover in Egypt and Exodus, and the Crucifixion of Jesus Christ all apparently on the 14th and 15th of Nisan. Yet the events cover almost two millennia. Does a single calendar span the entire time?

The following excerpts from Scripture emphasize a strong similarity between events long separated in time. Are they to be dated one on an Egyptian system and the other two on a God-given Sacred Calendar? Or all events on one Calendar? First, Abraham (and Isaac)'s trial:

> ". . . Take now thy son, . . . <u>into the land of Moriah</u>: and offer there . . . upon <u>one of the mountains</u> which <u>I will tell thee of</u> . . . <u>on the third day</u> Abraham <u>lifted up his eyes</u>, and <u>saw the place afar off</u>. And Abraham said unto his young men, Abide ye here . . . I <u>and</u> the lad will go yonder and worship, and come again to you . . . My son, God will provide himself a lamb . . . Abraham stretched forth his hand, and <u>took the knife to slay his son</u>. . . . the angel of the LORD called unto him . . . behold behind him <u>a ram caught in a thicket</u> by his horns: and Abraham . . . offered him up . . . instead of his son." Genesis 22:2-13.

Second, the Exodus:

> ". . . In the tenth day of this month they shall take every man a lamb . . . without blemish, a male . . . ye shall keep it up until the fourteenth day of the same month." Exodus 12:3-6.

Third, the Crucifixion:

> "And he bearing his cross went forth into a place called the place of a skull, which is called in the Hebrew Golgotha: where they crucified him, and two other with him, on either side one, and Jesus in the midst." John 19:17, 18.

> "And many women were there beholding afar off which followed Jesus from Galilee, ministering unto him:" Matthew 27:55.

> "The soldiers . . . when they came to Jesus . . . saw that he was dead already . . . one of the soldiers with a spear (had) pierced his side . . . that the scripture should be fulfilled, a bone of him shall not be broken." John 19:32-36.

Four days earlier on the tenth of Nisan, on the weekly Sabbath, Christ had been selected by the people of Jerusalem hopefully as their deliverer from Roman bondage, yet in reality as their Passover Lamb.

Geology fills in additional details of these events of these days. Golgotha, the site of Christ's crucifixion, today has the appearance of a skull. It was called the "place of the skull" 1900 years ago at the time of the Crucifixion. While the original rock surface has slowly eroded away, the appearance remains rather constant because it is due to the geologic structure in the limestone beneath.

A Sacrifice on a Threshing Floor?

Arab tradition is that Isaac was offered on the site of the Mosque of Omar, on the rock, the threshing floor that was in use prior to the use of the site for the temple of Solomon. But is Arab tradition correct? Would Isaac have been offered here and Jesus Christ half mile to the north?

The Scriptures supposedly say he was offered on Mount Moriah. But do they? A closer examination shows Abraham was to take his son to the mountains of Moriah, to the place "which I will tell thee of."

Consider that they went a three-day journey, then camped, where they "saw the place" and leaving the servants behind went further to that place. How many days does three plus an additional move make?

If Isaac was offered by Abram on the 14th of Nisan, then on what day was he, in type, selected to be sacrificed? Obviously on the tenth. They travelled three days, camped possibly near the site of the present Mosque of Omar, then after sunset in the early evening on the fourteenth day of the month, Abraham and his son, Isaac, were on Golgotha. The time and place were the same as those 1900 years later when God the Father saw His Son being offered as the Passover Lamb.

Why not on the site of the temple? Would a human sacrifice be asked on a threshing floor where human blood would mix with human food? Would even a lamb be offered and its blood allowed to run on a rock surface that grain would later cover?

The answer seems obvious. Any sacrifice would be made outside the camp. But the significance with regard to the calendar is also startling.

Even to the Selfsame Day

How could a 430-year period pass and time be counted to the selfsame day unless the timekeeping system Abraham used was identical to that revealed to Moses at the time of the Exodus?

Now the mystery of the Stonehenge will solve itself. Leaving the stone temples of Egypt where the heavens could be watched closely and compared with earlier alignments, the children of Israel were going out into the desert into a new land.

The agricultural seasons were going to be different. There would be four seasons instead of three. The year would begin in spring as Abraham had previously observed it. A week with a seventh day of rest would be observed. The 360-day year of the Egyptians would be discarded. The original lunar-solar calendar would displace the solar calendar of Egypt.

Praise given the New World Calendar with its neat four seasons, each 91 days in length, with its 12 months each with the same number of working days, its disregard for the continuity of the seven-day week and the Sabbath, is turning our nation back once more to the calendar of Osiris.

The New World Calendar is merely a modification of the original 360-day work year with a five-day period of festivities. Yet the "spirit" behind it is the same. A week with a rest period on its first day has been added. That day was observed in honor of the sun by the Babylonians. Was it also observed in Egypt?

Thus we complete the picture, one calendar dating at least back to Abraham. The other with its origin in Egypt and going back to Cush and Nimrod.

CHAPTER VI

THE REASON FOR STONEHENGE

How did early man keep time? First, what do we mean by early man? Historians take us back to Egypt and to the valley of the Tigris-Euphrates. The time before this supposedly belong to the cavemen. These early men were gradually becoming aware of the world about them; first superstitiously, later in a more civilized way.

A legion of errors has crept into modern studies. Egyptian chronology was altered by Manetho to give the appearance of great antiquity; the chronologies of other nations were warped to suit the Egyptian model.

The evolution of man is assumed, and artifacts are arranged from the simple to the complex in the approved pattern. "Stone Age" cultures of the past are assumed to be more ancient than their contemporary but more advanced neighbors. Whole civilizations are placed in backward order.

Recent declarations by astronomer Gerald S. Hawkins startled the world by insisting that these "Stone Age" men designed Stonehenge as an astronomical observatory in Britain about 1800 B.C., and that with that design were able to predict both solar and lunar eclipses.

What is even more disturbing to the modern scholar is that these men supposedly knew of a 56-year eclipse cycle that modern astronomers do not acknowledge. By calling their device a computer, Dr. Hawkins has captured the imagination of the public, so fascinated by the electronic marvels of this age.

Here then is the starting point for our search into just what these early men knew and what they were attempting to learn, not only at Stonehenge but at other early "observatories." Egyptian temples and pyramids were supposed to have both solar and stellar allignments. Early "Indians" in North America set up "henges," huge circles of posts to learn something from the heavens.

Sundance, Wyoming is located at an ideal spot for watching the location of the sunrise. At this site an almost perfectly level, barren horizon stretches from the southeast to the northeast. A mountain near the city of Sundance was used as an observation point. What could man have learned in this way?

A Fifty-Six Year Eclipse Cycle

The research of Gerald S. Hawkins purported to find a 56-year eclipse cycle. Other astronomers deny that such a cycle exists. The available evidence is simply 56 "Aubrey Holes" dug in a circular pattern on the Salisbury plain for some unknown reason and then quickly filled in again. They seem to have served as markers.

We could assume as Dr. Hawkins does, that these early men spaced six stones (8 and 9 holes apart) on these 56 spots, rotating them (clockwise or counterclockwise, take your choice) one position a year, and thus were "warned" of impending eclipses. Dr. Hawkins assumes as do many scholars that early men "worshipped" the moon, the sun, the stars; that they were terrified by the commencement of any eclipse, and willingly rewarded any savant well who could ward off evil the eclipse was certain to bring. Eclipse prediction would have been a blessing to these superstitious folk.

But is that what these men were doing? Does the 56-year eclipse cycle even exist? It is also known that the 19-year Metonic cycle, which forms the basis for the Sacred Calendar perpetuated by the Jewish people, is an eclipse cycle. Yet astronomy books mention neither of these cycles.

We do find a 3.8-year cycle, the shortest practical one; another cycle 18 years, 11 1/3 days long called a Saros (a very accurate predictor of eclipses). Others are generally mentioned in terms of the number of eclipse years (346.62 days each) they contain, and are called the 23, 42, 61, 342 and 385-year cycles. The latter contains 365 tropical years (our year of the seasons) plus four months and 13 days.

The obvious fact is that astronomy books do not mention any 56-year cycle; nor is there any allusion to the 19-year cycle. The reason for this will become apparent as we continue our research for the reason for Stonehenge.

Eclipse Tables Give the Answer

The scientific approach to any problem is 1) determine that a problem exists, 2) formulate a possible means of arriving at a solution, 3) carry out an experiment to discover new facts. Eclipse tables are available in various books. One entitled Eclipses in the Second Millennium B.C. gave calculations for the years 1600 B.C. to 1200 B.C. These are not actual historical observations of eclipses but rather the backward extrapolation of our modern observations.

A solar eclipse took place March 19, 1558 B.C. (Julian calendar) and 56 years later the table failed to show any March eclipse of the sun. Several tries with other dates led to the same expected failure. Dr. Hawkins' method was not working. Perhaps our approach to the problem was wrong. A table of lunar eclipses was available in the same book. Stonehenge was supposedly able to predict both. I wonder if . . .

Curiosity rightly directed was sure to bear fruit. Could a solar eclipse be followed by a lunar one 56 years later? The following table was obtained by turning from the solar eclipse of 1558 to the lunar eclipse of 1502, to the solar eclipse of 1446, to the lunar of 1390 to the solar of 1334, to the lunar of 1278, all dates B.C. An unrecognized cycle was "in the book" all the while! The FIFTY-SIX YEAR CYCLE of alternating solar-lunar eclipses was a reality, but it was about 4 days short of 56 full years. (Note: 1558 B.C. is equal to the astronomer's notation -1557.)

Stonehenge Sequence of Eclipses

The following series shows that there is a FIFTY-SIX year cycle, that "stone age" man was successful in relating the tropical year, the synodic month and the recession of the moon's nodes.

The 18-Year Saros Cycle

ynodic Months	6585.32 days	(or 12 Synodic Months shorter than the Sacred Calendar)
clipse Years	6585.78	
nomalistic Months	6585.53745	
365 day years)+15	6585.	
ears, 11 1/3 days	6585.33 1/3	

near equality in the anomalistic months (measured from perigee to causes the eclipses to be very similar. The apparent size of the ılmost the same as in the previous eclipse because it is at almost : on the orbit. The moon will thus cover (or fail to cover) the :he same degree.

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CHAPTER VII

ECLIPSES DURING A CALENDAR YEAR

Before we can solve the logic of the 56-year cycle and its implications, we must see eclipses as a phenomena occurring regularly during the year. They can occur only at certain specified times. Solar eclipses occur only at the very moment of the new moon (the molad or conjunction), lunar eclipses 14.765 days (on the average) later, at the time of the full moon (or opposition).

A people following a lunar calendar would soon be aware of occasional solar eclipses on the final day of the month, and lunar eclipses in mid-month. They would hardly become frightened at this expected "sign in the heavens."

Saros Related to Metonic Cycle

The Saros cycle was supposedly known by early Chinese and Egyptians. Did they also know of the Metonic cycle? It is but a single eclipse year longer. The goal of an astronomer dealing with time would be to find a cycle where the year, the month and the day come out even. The Saros cycle would likely have been discovered first because it produces very similar solar eclipses slightly over 18 years apart. It would have been a simple step to note another eclipse 346.62 days later at the completion of a Metonic cycle. The unusual fact that 19 tropical years (almost exactly) were then complete, would make this latter eclipse stand out as being of great importance to calendar makers.

From this time forward both Saros and Metonic cycles could have been used to predict eclipses. Cycles might have been added together. Take three Metonic cycles for example. The total would be 57 years. Subtracting a single eclipse year would bring us close but slightly short of the 56-year (less four days) Stonehenge cycle. It would require but half a synodic month more.

Eclipses in Sequence

Are eclipses so infrequent that 18-, 19- and 56-year cycles are needed to keep track of them? Not at all. Eight have been known to occur in just over a year We might have three eclipses in less than a month's time! Consider the sequence that started with an eclipse of the sun on January 5, 1935:

Season	Roman Date Jewish Date	Ascending or Descending Node	Phase of the Moon	Solar - Lunar and Type	Days -	Synodic Months after 1st Eclipse
First Season	January 5 Shebat 1	Ascending Node	New Moon	(1) Solar (partial)	0	0
First Season	January 19 Shebat 15	Descending Node	Full Moon	(2) Lunar (total)	14.765	½
First Season	February 3 Shebat 30	Ascending Node	New Moon	(3) Solar (partial)	29.53	1
Second Season	June 30 Sivan 29	Descending Node	New Moon	(4) Solar (partial)	177.18	6
Second Season	July 16 Tammuz 15	Ascending Node	Full Moon	(5) Lunar (total)	191.945	6½
Second Season	July 30 Tammuz 29	Descending Node	New Moon	(6) Solar (partial)	206.71	7
Third Season	December 25 Keslev 29	Ascending Node	New Moon	(7) Solar (regular)	354.36	12
Third Season	Jan. 8, 1936 Tebeth 13	Descending Node	Full Moon	(8) Lunar (total)	369.125	12½
	Jan. 22, 1936		New Moon too late for an eclipse		383.89	13

This series of eight eclipses in a 369-day period shows a startling frequency in a phenomenon that we are apt to think of as occurring only at widely spaced intervals. Five are eclipses of the moon, most valuable to Stonehenge astronomers in noting the exact relative positions of moon and stars at the central moment of the eclipse with the sun exactly 180° away at that moment. The hour of the day would give the fraction of the earth's revolution.

Conditions for an Eclipse

Let's consider lunar eclipses first because they are of greatest value in timekeeping. A lunar eclipse will occur only at the time of full moon, but not at every full moon. It must be a full moon during an "eclipse season."

For lunar eclipses this is only a 25-day period of time, centered on the crossing place of the moon's orbit and the ecliptic, called a node.

These 25-day eclipse seasons (there are two of them, 173.31 days apart, one at the ascending and one at the descending node) for lunar eclipses drift slowly backwards through the calendar year. They come about 18.6 days earlier each year because the "eclipse year" (346.62) is that much shorter than the tropical year.

Will there be a lunar eclipse during each of these "eclipse seasons" each year? No, because the 29.53-day synodic month is longer than the 25-day season.

We might have a full moon three days before the season began and thus no eclipse; then the following full moon would arrive one day after the season ended and again no lunar eclipse. In most cases, however, the 25-day season would contain one lunar (and one solar) eclipse, and that lunar eclipse could be seen by more than half the people on earth. At the next eclipse season six lunar months later another lunar eclipse would usually occur, again visible to over half the earth's population.

The new moon half way between these two full moons would produce a central solar eclipse in that the new moon crossed the sun's path (the ecliptic) about in the center of the season.

Years Without Lunar Eclipses

There is however the possibility that the full moons might "straddle the eclipse season at consecutive seasons (173.31 days apart) and thus we might go an entire calendar year without a lunar eclipse. Examples are 1929, '40, '51, '62, '66, '69 and '80.

The synodic month is only 2.32 days longer than the 27.21-day nodical month and thus at the second season, the full moon would arrive just before the eclipse season and the following full moon about three days after. In this case also the intervening new moon would produce a central solar eclipse with its track near the equator.

Years without lunar eclipses would make it urgent for calendar makers to be aware of impending (not menacing) eclipses, hence the building of Stonehenge.

Solar Eclipse Frequency

Solar eclipses are more frequent than lunar eclipses because the eclipse seasons for them is 37 days long, again centered on the ascending and descending nodes. These eclipses of the sun will occur at the very moment of the molad, or conjunction of the moon and the sun in the sky. This is the astronomer's new moon and will also (normally) precede the "new moon" day of the Sacred Calendar by six hours to several days.

Five solar eclipses might occur in a single calendar year. How is this possible? Each 37-day eclipse season must contain at least one solar eclipse, and may contain two. The synodic month is only 29.53 days long; thus two new moons could occur during the season and both would produce solar eclipses. Both however would be partial eclipses, the shadow cone crossing above the north pole in one, and below the south pole in the other.

How many seasons might occur in a single calendar year? Three; if one began early in January, the next would begin 173.31 days later in July, and a third season late in December. With conditions just right we can have 3 eclipses in the first season, 3 in the second and 2 in the third, all in a single calendar year.

Despite the abundance of eclipses the value to calendar makers is in the lunar eclipse for two reasons. First it is much more widely visible being seen from over half the earth. Second because it marks the very midpoint of the synodic month whereas a solar eclipse would mark the moment of the conjunction (the new moon) for that longitude only. This moment would sweep eastward over the earth just as the moon's shadow (umbra) would follow an easterly track. The observation of the lunar eclipse does not suffer from this variable. It points out midmonth to all observers.

A similar situation exists with regard to observing the sun at the equinox. It rises due east (and sets due west) for <u>every</u> observer on earth on the day of the equinox. Selection of the solstice as a beginning point has advantages but requires a different azimuth at different latitudes.

CHAPTER VIII

ECLIPSES AND THE SACRED CALENDAR

No attempt was made in the listing of eclipses in the previous chapter to determine their date on the Jewish calendar on a sunset-to-sunset basis, nor has the factor of a round earth been taken into consideration which would allow the eclipse to occur on two different calendar dates for observers with different longitudes.

The purpose was merely to show the frequency with which eclipses may occur, and that solar eclipses occur at the end of or first day of a lunar calendar, while lunar eclipses are scheduled near midmonth.

People using a lunar-solar calendar would thus expect solar eclipses to occur as a natural phenomena preceding (or on) the first day of a new month and lunar eclipses just preceding the middle of the month. The word month means moon. The moon causes eclipses. It is with regard to the heathen using a solar calendar that Jeremiah warns Israel of in Chapter 10:2: "Learn not the way of the heathen, and be not dismayed at the signs of the heavens; for the heathen are dismayed at them." Neither the 30-day Egyptian "month" nor the 20-day Mayan "month" follow the phases of the moon. Nor do the irregular months of the Roman calendar (which average 30.43683) stay in step with the God-ordained timekeeper.

Thumb Rule for Eclipse Prediction

As a "rule of thumb" astronomers (and common people alike) had only to watch for an eclipse on the days of the astronomical new and full moons during an "eclipse season." This season is a 37-day period for solar eclipses (and a shorter 25-day period for lunar eclipses) centered on both the ascending and descending nodes, points where the moon's path crosses the ecliptic (the sun's eastward yearly path through the stars).

Lunar nodes "precess" westward along the ecliptic, the same (westward moving) node meeting the (eastward moving) sun every 346.62 days, an eclipse year. Thus these "eclipse seasons" arrive 8 or 9 days earlier each year in our present Gregorian calendar, which is fixed in relation to the seasons and equinoxes.

In 18.61 years the node has moved completely around to its starting place. It is the fact that three complete revolutions of the moon's nodes closely equals 56 years, that allows the 56-year Stonehenge eclipse cycle to function for centuries without resetting (as one might express it in computer language).

The Amplitude of Moonrise

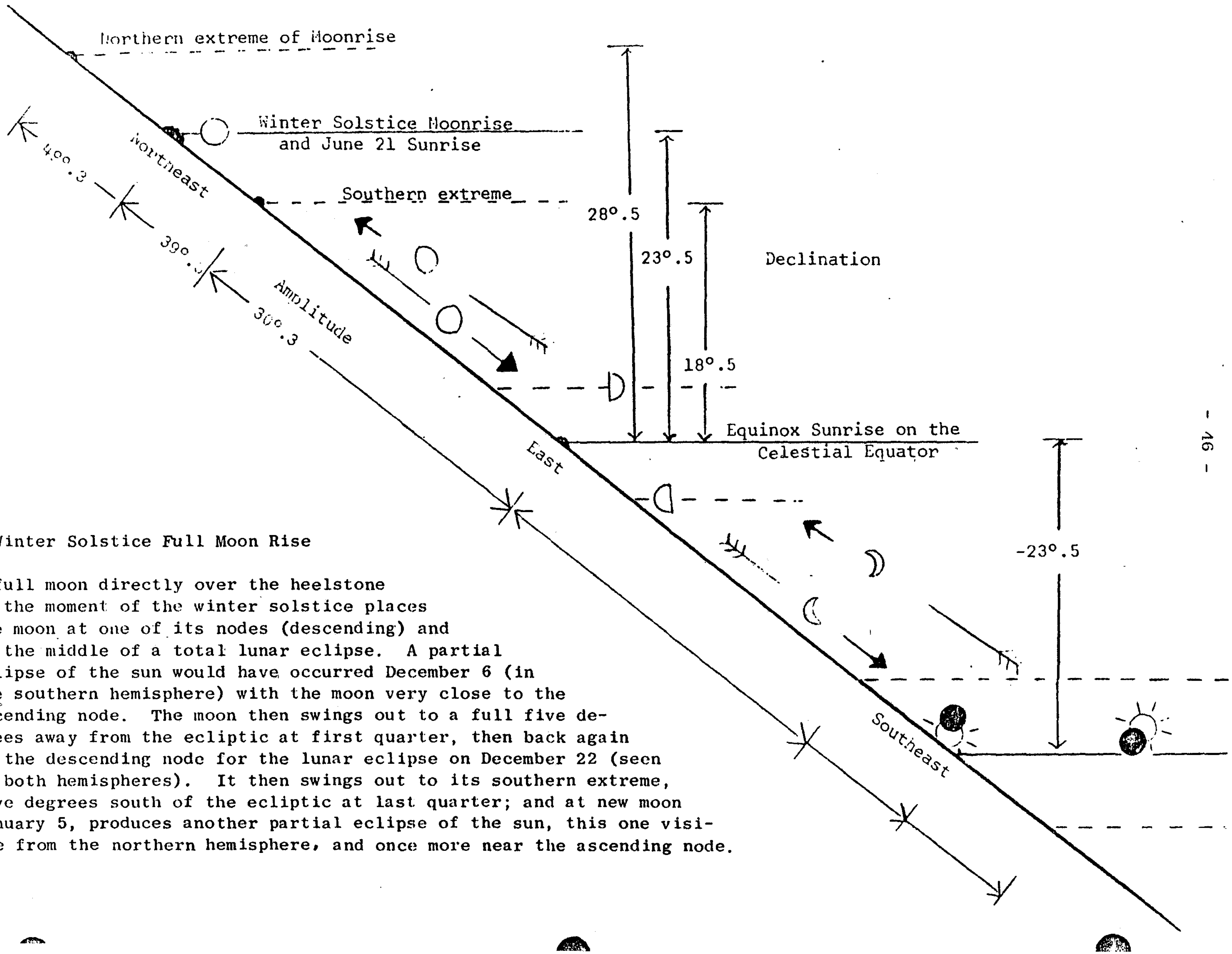
Suppose we were to select that July 16 total eclipse of the moon (p. 40). At what point on the eastern horizon would that eclipsed full moon rise for an observer with the latitude of Stonehenge? Amplitude is measured in degrees north or south of the east and west points.

On July 16 we are 25 days past the solstice. The sun's declination will have dropped back to 21.5 degrees (from 23.5 degrees). The sunset will be 36 degrees north of the west point, sunrise 36 degrees north of the east point.

Where will the eclipsed full moon rise for an observer with the latitude of Stonehenge? Exactly 180 degrees away from the point of sunset, or at a point on the eastern horizon 36 degrees south of the east point.

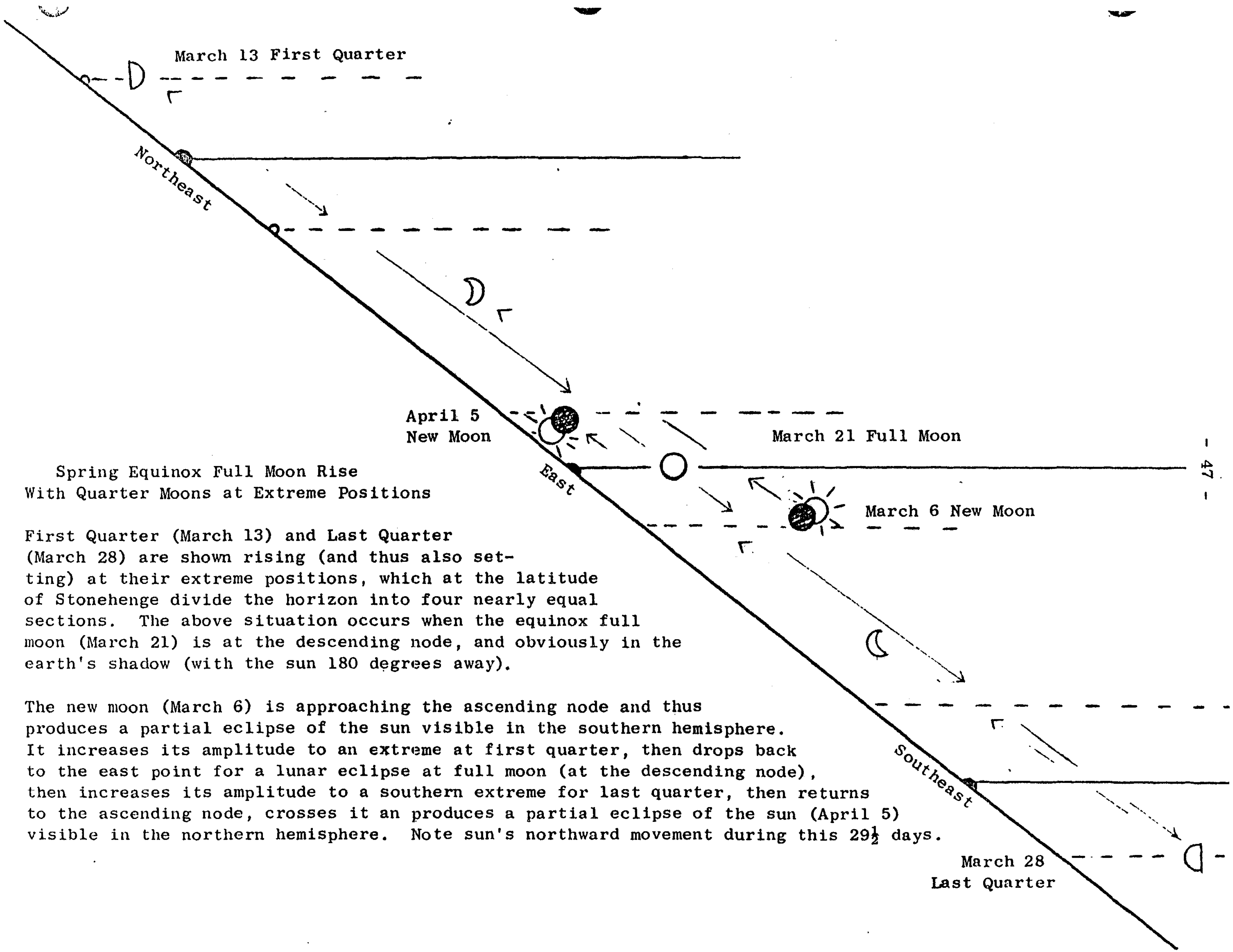
On the day of the summer solstice, June 21, the sun had set about 40 degrees north of the west point. An eclipsed full moon on that date would have risen on the eastern horizon 40 degrees south of the east point.

It is to these solstical eclipses that Dr. Hawkins assigns great importance in research on stonehenge. Illustrations on the following two pages show hypothetical Winter Solstice and Spring Equinox solar and lunar eclipses.



Winter Solstice Full Moon Rise

A full moon directly over the heelstone at the moment of the winter solstice places the moon at one of its nodes (descending) and in the middle of a total lunar eclipse. A partial eclipse of the sun would have occurred December 6 (in the southern hemisphere) with the moon very close to the ascending node. The moon then swings out to a full five degrees away from the ecliptic at first quarter, then back again to the descending node for the lunar eclipse on December 22 (seen by both hemispheres). It then swings out to its southern extreme, five degrees south of the ecliptic at last quarter; and at new moon January 5, produces another partial eclipse of the sun, this one visible from the northern hemisphere, and once more near the ascending node.



Spring Equinox Full Moon Rise
With Quarter Moons at Extreme Positions

First Quarter (March 13) and Last Quarter (March 28) are shown rising (and thus also setting) at their extreme positions, which at the latitude of Stonehenge divide the horizon into four nearly equal sections. The above situation occurs when the equinox full moon (March 21) is at the descending node, and obviously in the earth's shadow (with the sun 180 degrees away).

The new moon (March 6) is approaching the ascending node and thus produces a partial eclipse of the sun visible in the southern hemisphere. It increases its amplitude to an extreme at first quarter, then drops back to the east point for a lunar eclipse at full moon (at the descending node), then increases its amplitude to a southern extreme for last quarter, then returns to the ascending node, crosses it an produces a partial eclipse of the sun (April 5) visible in the northern hemisphere. Note sun's northward movement during this 29½ days.

Choice of Latitude Fifty-One Degrees

On the following page is a diagram showing the path of the moon (and sun) across the sky at the time of the equinoxes and solstices, and also showing the extreme positions of the moon for these times. The moon's path is inclined a little over 5 degrees to the plane of the ecliptic while the ecliptic is inclined about 23.5 degrees to the plane of the earth's equator.

By selecting latitude 51.2, astronomers were able to have a situation where the extreme positions (amplitudes) of the rising and setting of the sun and moon would divide the heavens into four almost equal sections. A greater obliquity of the ecliptic circa 1500 B.C. would make these sections even more nearly equal.

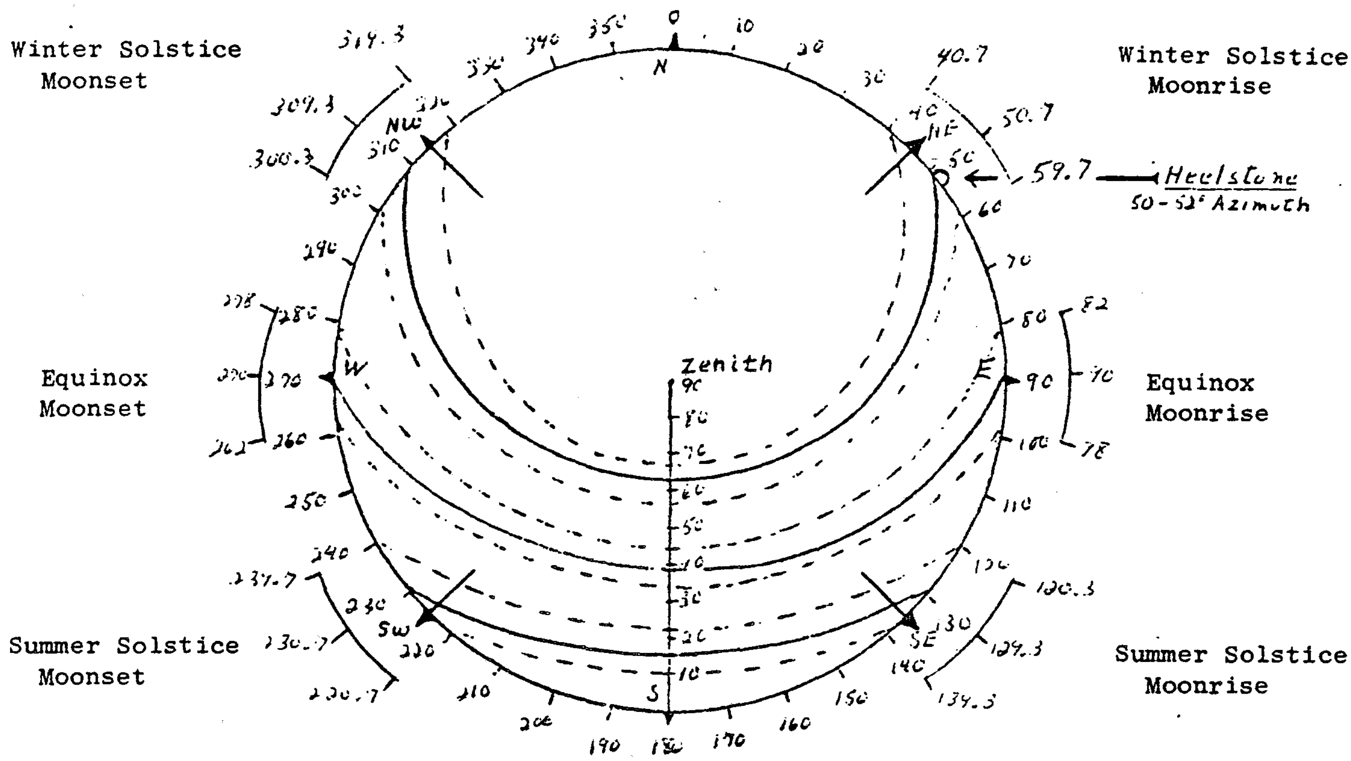
The diagram and table below correlate the information from the "Horizon system" with the "Equatorial system." The navigator's practice of counting azimuth from the North point has been used rather than the astronomer's normal count from the South point. Rounded figures of 51, 23.5 and 5 degrees have been used for clarity of illustration.

Taking the times of the equinoxes or solstices, note that the full moon will swing from a northern to a southern extremity (always rising about opposite to the direction of the setting sun). The moon will attain its northerly limit, then return toward a perfect 180-degree opposition to the sun (at which time eclipses could occur) then to a southern limit and back again completing a circuit in 18.61 years. Three such circuits total 55.83 (the 56-year Stonehenge cycle).

The midpoints of the circuit, every 9.305 years, would center on eclipse seasons in that the moon was rising directly opposite the sun and thus at a node crossing the ecliptic. Any new or full moon close to this node would produce an eclipse. And the close agreement between 9.305 years and half a Saros cycle (9 years 5 2/3 days) and half a Metonic cycle (9.5 years) related the Stonehenge cycle to them also.

The Path of the Moon and Sun across the Heavens

at the Latitude of Stonehenge



	DIRECTION OF MOONSET			Altitude of Lunar Moon	DIRECTION OF MOONRISE		
	Azimuth	Amplitude	Declination		Declination	Amplitude	Azimuth
WINTER SOLSTICE							
Northern Limit	319.3	+49.3	+28.5	67.5	+28.5	+49.3	40.7
Eclipse Season	309.3	+39.3	+23.5	62.5	+23.5	+39.3	50.7
Southern Limit	300.3	+30.3	+18.5	57.5	+18.5	+30.3	59.7
EQUINOX							
Northern Limit	278.	+ 8	+ 5	44.	+ 5	+ 8	82.
Eclipse Season	270.	0	0	39.	0	0	90.
Southern Limit	262.	- 8	- 5	34.	- 5	- 8	98.
SUMMER SOLSTICE							
Northern Limit	239.7	-30.3	-18.5	20.5	-18.5	-30.3	120.3
Eclipse Season	230.7	-39.3	-23.5	15.5	-23.5	-39.3	129.3
Southern Limit	220.7	-49.3	-28.5	10.5	-28.5	-49.3	139.3

moon's path over the ecliptic (sun's path). In this case it was the ascending node.

We thus have an exact location of the sun (25/365.25 of a tropical year past the solstice point), an exact location of the moon (near the node and at the very midpoint of a synodic month) and the exact position of a revolution of the earth (5/24 of a day past the midnight hour, or 17/24 of a day past the normal six o'clock mean sunset time used for the Jewish calendar). Thus the day, month and year are brought into alignment where they can be compared with the sequence of days, months and seasons of the calendar.

Questions Answered

Problems that needed to be solved were these: What pattern should be adopted for adding a 13th month to keep the calendar in line with the tropical year? In the second century a scheduled 13th month had to be dropped and a new cycle of 12- and 13-month years begun. What pattern of 30- and 29-day months should be used to keep the calendar months following the new moons of the heavens?

Even in our own time there is concern because the Sacred Calendar is based on a synodic month and tropical year both estimated somewhat too long. Quoting from The Comprehensive Hebrew Calendar by Arthur Speer,

"the traditional figures . . . in our present time units are:

M - 29d 12h 44 min. 3 1/3 sec. (lunation period)
29d 12h 793 parts)

S - 365d 5h 55 min. 25.438 sec. (tropical year)
(365d 5h 997 parts 48 moments)

The more exact astronomical magnitudes are:

M*- 29d 12h 44 min. 2.841 sec.

S*-365d 5h 48 min. 46.069 sec.

"The deviation . . . is very slight . . . (for) the lunar month . . . The difference . . . (for) the sun year . . . is, however, not negligible and causes the Hebrew months to advance against the sun $4\frac{1}{2}$ days in a thousand years . . . The rebirth of Israel rekindles in us the hope that a new Sanhedrin . . . will be established . . . (and) make a decision as to when and how the sanctified calendar of Hillel II is to be modified in accordance with the requirements of astronomy and the Torah." (Pages 226, 227.)

By contrast the Julian calendar in use by the western non-Jewish world until the year 1582 assumed the tropical year to be $365\frac{1}{4}$ days, an error of 11 minutes 14 seconds which caused the March 21 "equinox" (from which the date of Easter was reckoned) to advance from the true equinox 3 days in every 400 years.

The length of the year has been variously computed as follows:

Julian calendar	365 days	5 hours	60 min.	
Jewish Calendar	365	5	55	25.438 sec.
Hipparchus (circa 200 B.C.)	365	5	53	
Modern value	365	5	48	46.069

Thus a most critical reason for the observation of the position of the eclipsed full moon comes to light. By noting its position in the background of stars and also the hour of the night, it would be possible to determine whether the calendar (an artificial sequence of years, months and days) was gaining or losing on the heavens. This observation would then be compared with earlier ones in an attempt to establish a correct length for the average month and year.

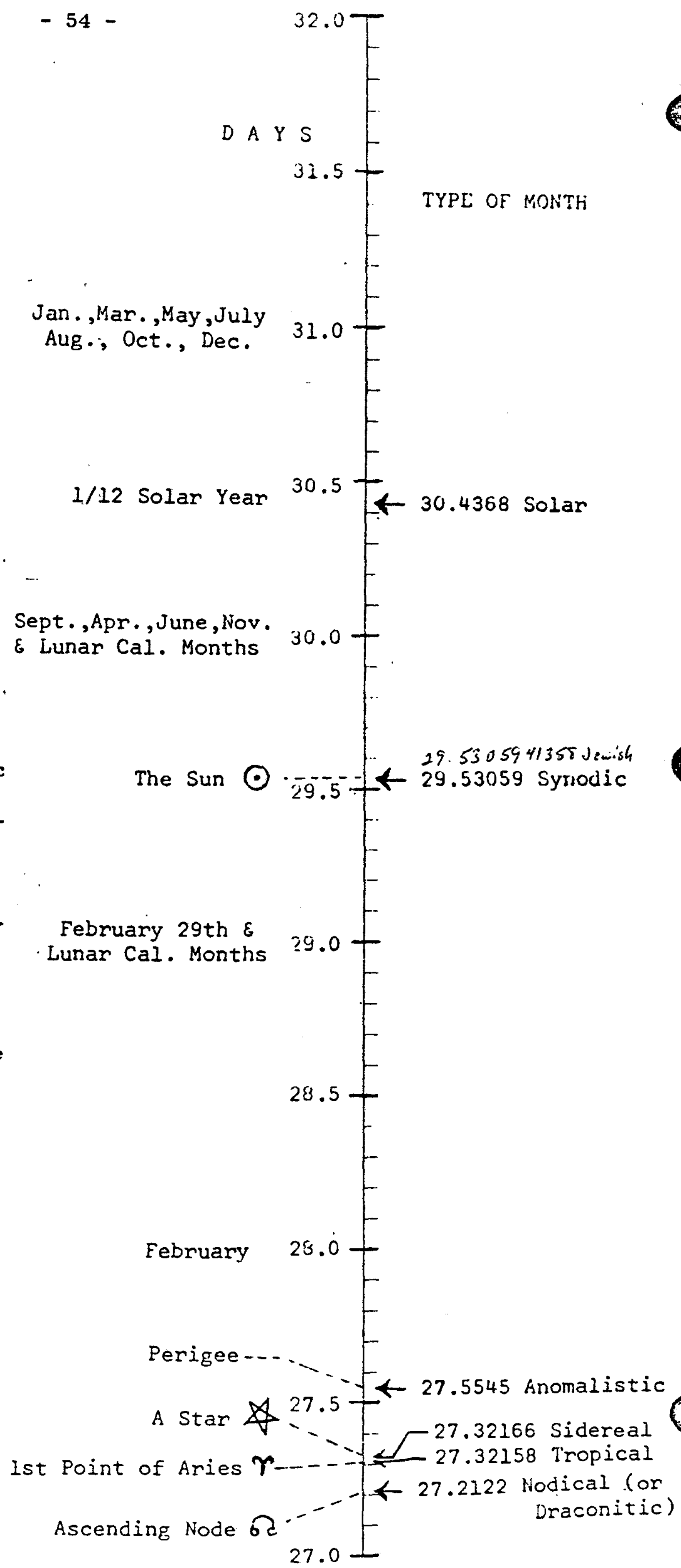
Information from the Saros

Suppose we assumed the Saros to be exactly 18 years 11 1/3 days (6585 1/3) and that it contained exactly 223 synodic months, 239 anomalistic months, 242 nodical months and 19 eclipse years. How close to the currently accepted figures could we come? Dividing 6585 1/3 by 242, 239, 223 and 19 we obtain:

	Calculated Value	Modern Value
242 draconitic months	27.2121212 days	27.21222 days
239 anomalistic months	27.5536959	27.554550
223 synodic months	29.5306427	29.5305879
19 eclipse years	346.5964912	346.620031

LENGTH OF THE MONTH

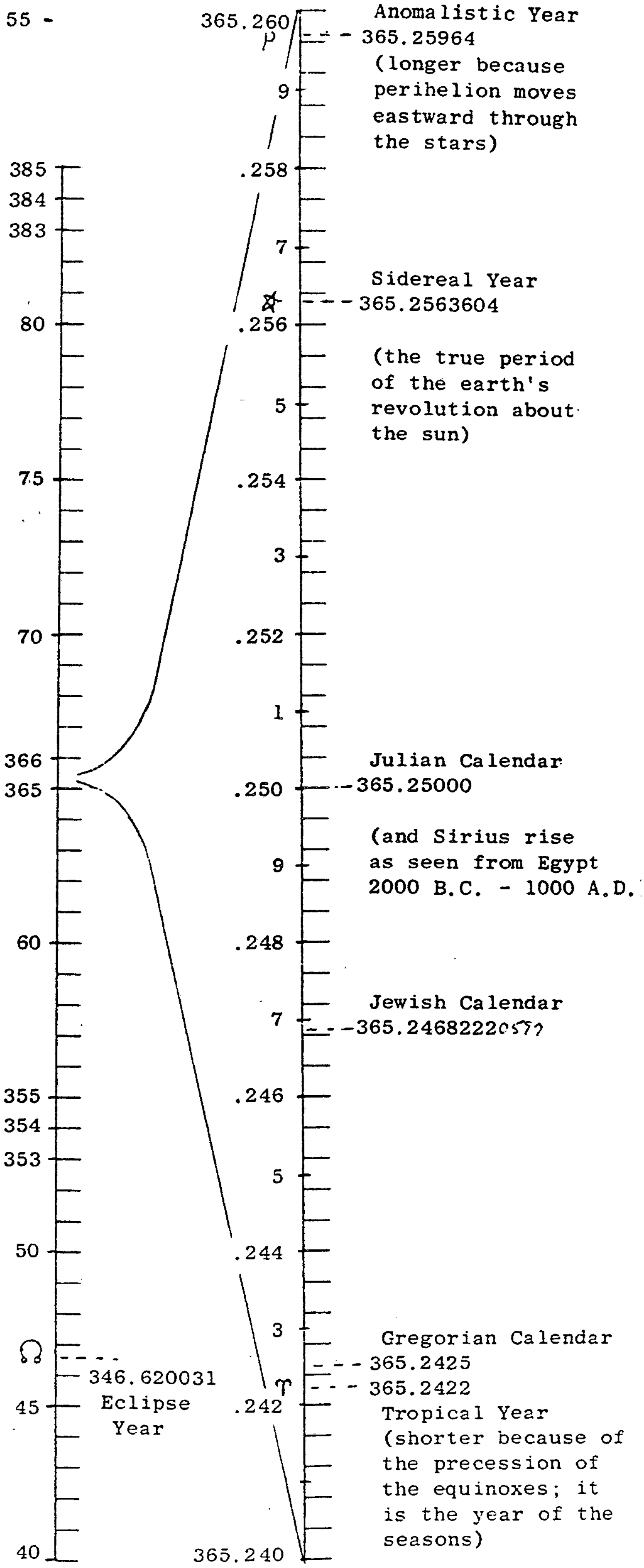
How long is a month? Calendar months are made of whole days and can be 28, 29, 30 or 31 days. The Solar Month is 1/12 of a year and is thus the length of the average month in the Roman Calendar. The Synodic Month is shorter and stays in step with the phases of the moon. The pattern of 29 and 30 day months of the Sacred Calendar must average out to this 29.53059 length. The Anomalistic Month is associated with the elliptical shape of the moon's orbit. It is usually measured from perigee to perigee. Since this point moves eastward through the stars, the Anomalistic Month is slightly longer than the Sidereal Month, which is a revolution of the moon with regard to a star, and thus the true period of the moon's revolution about the earth. Precession of the equinoxes causes the 1st Point of Aries to move westward; the Tropical Month is thus shorter than the Sidereal. The moon's nodes precess westward even faster than the equinoxes; thus the Nodical (or Draconitic) Month is shortest of all ten types of months.



LENGTH OF THE YEAR

Calendar years are made up of whole days. The Roman calendar 365 or 366; the Sacred Calendar 353,4,5 or 383,4,5; the Mohammedan calendar 354 or 355; the Egyptian and the Maya Haab years 365; while the Maya Tzolkin year has but 260. The Julian calendar added a day every fourth year. The Gregorian adds a day to years divisible by four, but not to century years unless divisible by 400.

The Egyptian and the Maya Haab years were always 365 and being too short started about 1/4 day earlier in the seasons each year. The Egyptian 365 day official calendar compared with the heliacal rise of Sirius every 365.25 days produced the Sothic cycle of 1460 Sirius (Julian) years.



Quoting again from the Britannica,

> "By assuming what is approximately true, that the saros of 6,585 1/3 days contained an exact number of . . . synodic months . . . anomalistic months . . . and draconitic months (also eclipse years) . . . early astronomers . . . computed the relative motions of the sun and moon, the lunar perigee and apogee, and the nodes."

Varied Length of the Saros

A table (from Oppolzer's Canon) given on page 11 of Dr. Van den Bergh's Eclipses in the Second Millennium B.C. gives the length of 25 Saros measurements 1207-1192 B.C. through 1189-1174 B.C. The mean value of the Saros is 6585 days, 7 hours, and 46 minutes.

But the mean value is not the value of every Saros. The shortest listed is 6 hours, 33 minutes; while the longest is 8 hours, 51 minutes over 6585 days. These variations would have been of great significance to any calendar supervisor.

What Changes the Saros?

Why the deviations?

> "If the solar system consisted of only two perfectly spherical homogeneous gravitating bodies, the motions would be simple and repeat themselves exactly . . . The interplay of sun, moon and earth produce a motion so complex that the relative positions of the three are never exactly repeated. The motion of the moon can be broken down into about 150 principal periodic motions along the ecliptic, and about the same number perpendicular to it: There are also about five hundred smaller terms." (Pages 129-131, Introduction to Astronomy by Cecilia Payne-Gaposchkin.)

Information from the Metonic Cycle

The 6939 3/4 day Metonic cycle yields the same type of information. This time rather than the anomalistic month, the sidereal month is included.

	Calculated Value	Modern Value
255 draconitic months	27.2147058 days	27.21222 days
254 sidereal months	27.3218503	27.32166
235 synodic months	29.5308510	29.5305879
20 eclipse years	346.9875	346.620031
19 tropical years	365.25	365.2421988

In both cycles we have used "round numbers" 6939 3/4 and 6585 1/3 in addition to assuming whole months and whole years. Good results can be obtained even in this "crude" fashion.

To put a fine polish on these figures would require the observation of repeated Saros and Metonic cycles.

A Changing Calendar

The conclusion for calendar makers is obvious. NO LUNAR-SOLAR CALENDAR CAN CONTINUE UNCHANGED! Even a strictly solar calendar such as the Sirius (or Julian), or even its improved form, the Gregorian, cannot be used perpetually. Yet the desire for uniform, perpetually recurring time-units is basic in the plans of men to discard any remnant of God's system and adopt instead the New World Calendar.

The sun and moon were intended to give us days, months, seasons, and years. They provide a variable pattern of life, morning and evening, sunrise, increasing length of daylight, planting and harvest. A glance at the moon's phase gives the time of month; a glance at the sun, the time of day. A moment's consideration of the amplitude of sunset tells the progress of the season. What improvement could man make?

Man was intended to arrange and regulate the number of days in each month, and number of months in each year. That is what the builders of Stonehenge were apparently attempting to do.

The seven-day week and proper place for its beginning had been predetermined for man. Yet it is this week of seven days that makes those who think they could have designed the heavens better fret and chafe because its length cannot be reconciled with that of the month or year.

Perhaps a year might be evenly divided into 100 days, each with 100 hours, each hour having 100 minutes. Electric lighting could do away with day and night.

The length of the minute in this new system would be cut approximately in half. There are presently 31,556,925.9747 seconds in a tropical year; the new system would change that (with 100 seconds to the minute) to 100,000,000. And the week could have an even ten days. Would man ever follow such a system?

50 MILLION FRENCHMEN CAN BE WRONG

> In 1795, just when the Gregorian calendar was well on its way to universal use, France revived the original calendar of Egypt dating back to 4246 B.C. They called it The Calendar of Reason.
>
> There were twelve months of thirty days, each month divided into ten day periods. The five extra days at the end of the year were set aside as holidays and called Sans Culottes--after the poor people of France, meaning without pants.
>
> The Calendar of Reason lasted only 12 years.
>
> (Quoted from Work-A-Day Calendar refill)

Not only can 50 million Frenchmen be wrong but it is evident that that the Roman calendar did not begin in Rome. Its longevity of life suggests a more persistant, longer-lived backer.

CHAPTER IX

WHOLE AND FRACTIONAL UNITS

We have become so accustomed to a decimal system (tenths, hundreths, thousandths), especially since the advent of IBM, that it seems strange to think only in whole units. Even our monetary system in the United States is partial to 10's and 100's, dimes and cents. Yet it retains a measure of "halves" and "quarters." The two-cent place and the two-dollar bill are now officially relics of the past; the half dollar is disappearing. Yet the five-cent piece (a half dime) and the quarter are still with us.

Why is the quarter called two bits? The original silver dollars used in this country were chisseled into eight equal pieces termed "bits." A quarter of a dollar is thus two-eighths or two bits.

Contrast the British monetary system. To those of us accustomed to the decimal system it is quite a shock to count out, not ten, but twelve pence to make a shilling; then discover coins valued at $\frac{1}{4}$, $\frac{1}{2}$, 3 and 6 pence. The shilling could be divided into 48 farthings, though the farthing is no longer used. Decimal thinking is rather ingrained in our own thought patterns. But the convenience of being able to divide a dozen pence (a shilling) into thirds, quarters, halves and sixths more than compensates for the difficulty the newcomer experiences. The "mite" (Mark 7:42), half a farthing, is 1/96 shilling.

The British pound of 20 shillings divides neatly in halves, in fourths, eighths, and tenths. The quarter pound is termed a "crown," the eighth pound "half a crown" (or 2 shillings 6 pence).

Another coin, the guinea (now obsolete though the monetary term is used), worth 21 shillings, was divisible into thirds and even sevenths.

Dividing into Basic Units

This ability to divide into many fractional quantities (yet each quantity a whole in itself) would be of utmost importance in any calendar calculations. Consider once more the quantities of 76 moments to the part, and 1080 parts to the hour.

A 365¼ day tropical year multiplied by four would give us a whole number of days, 1461 days. But the problem of the 29.53-day month had to be solved also for any people using a lunar-solar calendar.

Nineteen years (6939 3/4 days) would equal 235 months very closely, but the number of days is a fraction. An easy way to make this come out as a whole number is to multiply by four also. Four times 19 is 76! That is the number of moments in a part.

Division of Time Units

The second and most exacting reason for searching out lunar eclipses was to determine the length of the month and year in terms of days, hours, parts and moments. (In the tables in the previous chapter we used a modern calculator and thus the decimal system.) Note also that the rotation of the earth on its axis can be expressed as a day divisible into 24 hours, or in terms of 360 degrees (15 per hour). Sidereal time could be used rather than solar time.

The hour, for the Sacred Calendar, is divisible into 1080 parts (360 x 3). Parts are then divisible into 76 moments (19 x 4).

It was necessary for lunar-solar calendar makers to relate the 19-year Metonic cycle, the 4-year "February 29th cycle," the 360-degree division of the heavens, the sequence of 12- and 13-month years, and the sequence of 29- and 30-day months.

Seventy-Six Moments

Why does the Sacred Calendar divide days into 24 hours, hours into 1080 parts and parts into 76 moments. Each part is equal to 3 1/3 seconds in our system; a moment equals 5/114 seconds.

Why such a strange choice for fractional units? Do these go back into antiquity? A search should be made. If men shortly after the Flood were aware of both the 19-year Metonic cycle and the 365¼ day tropical year, these unusual division of time almost explain themselves.

The solar calendar used by the Sumerians divided its hours into 30 ges. But a lunar-solar calendar presented a different problem.

A Seventy-Six Year Cycle

Could all the divisions of a 76-year cycle be measured accurately in whole parts? Would it divide out evenly into whole units per day, per month, per year and per Metonic cycle? This would have formed the basis for an early calendar. (The seven-day week would remain independent of the month and year.)

Note how 1080 parts can be divided. By 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 27, 30, 36, 40, 54, 60, 72, 90, 108, 120, 135, 216, 270, and 540. But neither the omitted 7 nor 11 will divide evenly. Nor is there need.

No provision was made to allow the day to be divided into sevenths. Neither the 24 hours, the 1080 parts nor the 76 moments took the week into consideration. The intent was to deal in whole units and to distribute the units in the year and month.

Post-Flood Calculations

The first step in finding order in the heavens might have been the discovery of the 19-year Metonic cycle (5 of the 3.8-year "short cycles"), and the 365¼-day tropical year. Multiplying this 19-year cycle by four would give us a 76-year cycle with a whole number of days, 27,759 days.

The next step would be dividing this quantity of time into months of 29 and 30 days, and years of 12 and 13 months.

Allowance would have to be made to refine the length of the 76-year cycle. If this refinement were always expressed as a whole part, then its 76 moments could be evenly distributed by year and by 19-year cycle.

The total length of the 76-year cycle is 27,759 days (365¼ x 4 x 19). Or it could be expressed as 940 months (235 x 4). Any refinement in the length of the 76-year cycle by a single part could be divided one moment to a year, 19 moments to a 19-year cycle, 4 moments to a "February 29th cycle."

Length of the Month

The Pharaohs of Egypt swore by an oath not to intercalate days or months. Their practice stemmed from the first Pharaoh Menes (Cush) and his son Osiris (Nimrod).

Shem faced a problem of intercalating both months and days. The calculations were not too difficult. There were 940 months (235 x 4) in a 76-year cycle. If each month had 30 days, the total would be 28,200 or 441 days too many. Obviously 441 of these months had to be shortened to 29 days, while the other 499 would have 30.

The length of the average month would be thus 27,759 / 940 or 29.530851 6/94. Our modern measurements give 29.530588. If they did their calculations in hours, parts and moments the answer would be 29 days, 12 hours, 799 parts 50 120/940 moments. The Sacred Calendar today is based on 29 days, 12 hours, 793 parts, almost 7 parts shorter (or about 23 seconds shorter). Note that the Sacred Calendar month is based on a whole number of parts.

The Callippic Cycle

Is there any evidence that such a 76-year cycle was known and that it bore any relationship to calendar calculations? The following quote tells of a slightly shorter eclipse cycle and the importance of adding a single synodic month.

> "Other periods, too, were known in ancient times, for instance one of the 939 lunations (76 years minus 29 days[3]), which together with the saros was frequently used in connection with predictions."

And the footnote adds this information:

> "[3]One additional synodic month (940 lunations) makes this period practically equal to 76 years. In olden times it was already known that 940 lunations correspond to 76 solar years, a fact of great importance for the calendar of that era." (Page 13, Periodicity and Variation of Solar (and Lunar) Eclipses by Prof. Dr. G. Van den Bergh.)

The Callippic cycle as it pertained to the Sacred Calendar and expressed in terms of whole days was 6940, 6940, 6940, and 6939 days totalling 27,759. Or 365.25 times 76 again 27,759 days.

The 19-year Metonic cycle by itself does not yield an even number of days. The decimal is close to .75 and thus suggests multiplying by four.

a) 19 times 365.2422	equals	6939.6018
b) 235 times 29.530588	equals	6939.6882

The more exacting figures of both the eclipse cycle and the Callippic calendar cycle then become:

76 Julian calendar years	27,759	days
76 tropical years (a times 4)	27,758.4072	
940 synodic months (b times 4)	27,758.7528	
939 synodic months	27,729.232212	
80 eclipse years	27,729.60248	

It is important to understand that to begin with early calendar makers lacked these long term observations. While sources we might quote for the "discovery" of these various eclipse and calendar cycles do not refer to early post-Flood man, yet the implication of this research is that even pre-Flood man was conversant with the subject.

China's Ssu-fen Calendar

Were the Metonic and Callippic Cycles discovered in the 4th century B.C. by the Greeks?

> "While we are not justified in denying absolutely to the Greek and Babylonian astronomers the credit of an independent origin for the Metonic Cycle, we are bound to admit that by the second millennium B.C. the Chinese calendar had been framed with a scientific accuracy which neither Babylon nor Egypt could rival." (Page 686, History of Mankind Vol I by Jacquetta Hawkes and Sir Leonard Woolley.)

The basic problem is the dogma of the historian that our ancestors were illiterate, uneducated, ignorant men, that modern man has evolution and the "survival of the fittest" to thank for his superior intellect.

> "The conclusion, then is that the Ssu-fen Calendar, having its basic feature the chang unit of 19 years or 235 moons (228 lunar months of 29-30 days plus 7 intercalary months) anticipates by more than a thousand years the famous Metonic Cycle." (Page 686, Ibid.)

Is it unthinkable that anyone but the Greeks have thought of the idea of putting together four such Metonic (chang) units to form a Callippic Cycle?

> "The Chinese calendrist, therefore, recognized time-units longer than a year, namely the chang or 'chapter' of 19 years or 235 moons, and the fu or 'cycle' of 76 years or 940 moons or 27,759 days." (Page 685, Ibid.)

Proof is given that this knowledge was, not discovered, but already in use in the year 1384 B.C. and logic insists that a long period of observation preceded its discovery. The conclusion with regard to Greek astronomy seems obvious enough:

> "Egypt was the Home-land of Science as we know it; it was passed on to the Greeks who recorded it in writing and so gave it to the world." (Page xxiii, The Splendor that was Egypt.)

CHAPTER X

WHY AVOID ECLIPSES?

In pursuing the topic of Calendar and Eclipses Interrelationships we have come face to face with a multitude of problems. Historians are too sure of themselves in assigning the motivation "sun worship" to any primitive astronomical alignment. They are too sure our ancestors were "primitive" and "stone-age" in their thinking.

Who Sees an Eclipse?

The immediate conclusion jumped to by some investigators is that any close solar or lunar alignments at Stonehenge would have constituted sun worship or or moon worship.

The fact of the matter is that few people even see a lunar eclipse, and that it occasions no fright in any normal person. Possibly two per year might be seen at the locality of Stonehenge. All would be between sundown and sunrise; people awake and watching only in the early evening with continual good weather might see as few as 1/10 of those that do occur.

Yet these very reasons point out the use of the "Stonehenge machine" as an eclipse predictor for an entirely different purpose. The very fact that bad weather, infrequent lunar eclipses, and that the entire night would have to be watched proves that the builders were determined to WATCH ECLIPSES, not AVOID THEM.

Search Out Eclipses

Solar eclipses occur with greater frequency than lunar (37/25 as often), yet their value in calendar keeping is of lesser importance. The path of totality is narrow, even the path of partial coverage is limited, while a lunar eclipse might be seen from any place on the side of the earth facing the moon.

A lunar eclipse is the earth's shadow on the moon, visible to all who can see our satellite. The middle of the lunar eclipse seen toward the west at sunrise (as in our July 16 eclipse) from the longitude of Stonehenge, would be seen overhead (and at midnight) by a viewer in the central United States, at the same moment; but just after sunset by those halfway across the Pacific, who would be seeing the eclipsed moon on their eastern horizon.

The lunar eclipse occurs at the same moment for all who can see it, though their local time varies from sunset to sunrise as one goes further west.

The solar eclipse, on the other hand, is a narrow cone of the moon's shadow sweeping eastward across the earth. Like lunar eclipses it is seen by relatively few. Except for those directly in the path of a total eclipse, only a partial eclipse would be seen. Unless publicized ahead of time, few people in a modern world would take note. A total solar eclipse would be visible only once in an average of 350 years for any one point on earth. This would be a spectacular event with the sky darkening, the stars appearing and the sun's corona visible.

The obvious conclusion is that eclipses (apart from the rare total solar eclipse) would scare almost no one, and that any structure involving the labor of thousands of men over years of time is not intended to alleviate the fears of a few. Stonehenge's purpose was to enable men to avoid missing eclipses that were vital in keeping an ideal calendar.

Primitive Knowledge

We know Stonehenge astronomers were observing the summer solstice. If we assume their 56 Aubrey positions were used as Dr. Hawkins suggests, we might almost conclude that they were aware of BOTH the Metonic and Saros cycles centuries earlier than any historian has allowed even for "civilized nations." Is this conclusion justified? Or are we seeing "56 spots" arranged in a circle that might have had an altogether different purpose?

Suppose we assumed that they had a knowledge of both cycles? Would that have been unusual for a "primitive" people with a lunar-solar calendar? The typical college student today is not at all sure the moon always rises to the east at some point along the eastern horizon, let alone possess a working knowledge of eclipse prediction.

Even today's astronomy students in college are unconcerned about the basic astronomy but are searching far out on the twigs. However, an agricultural people concerned with crops were surely acquainted with the sky. Their leaders, concerned with holy days and national unity, might have treated both Metonic and Saros cycles as everyday knowledge, not even necessary to write down. Such technical knowledge was normally kept from the common people.

Two Metonic Cycles Plus a Saros

Suppose three Metonic cycles were added together, then subtract an eclipse year (346.62 days) to give a cycle of just over 20,450 days. (The Saros is just one eclipse year shorter than the Metonic cycle.)

The fact that this cycle would be just a few days short of 56 tropical years would have tied in closely with their agricultural year. Or they might have approached the problem by adding two Metonic cycles and a Saros cycle.

The Stonehenge Cycle

56 year	470	Synodic Months	13,879.37636 days	Two 19-year Metonic cycles
(-4 days)	+223	Synodic Months	+ 6,585.32112	+ one 18-year 11 1/3 day
Stone-	693		20,464.69748	Saros cycle.
henge				
cycle	-1/2	Synodic Month	- 14.76529	- 1/2 Synodic Month
	-692.5	Synodic Months	20,449.93219 days	

59 Eclipse Years (20, 20 + 19)	20,450.5812 days	(.69964 longer)
56 Tropical Years (19, 19 + 18)	20,453.5531328	(3.6209428 longer)
56 Julian Calendar Years	20,454.0000000	(4.06781 longer)
55.83 Tropical Years equals (3 revolutions of the Moon's Nodes)	20,391.462	(18.61 times 3)

Comparing the 692.5 synodic months with the 59 eclipse years, a difference of about .65 of a day occurs over the period, insuring a long sequence of eclipses. Comparing with the 56 tropical years, the difference will cause the eclipses to be 3.6 days early in the year and 3 days early in the 37-day eclipse season over the period. The .5 of a synodic month means solar and lunar eclipses will alternate. Comparing with the Julian calendar the 692.5 synodic months show a difference of over 4 days causing the eclipses to retreat 4 and sometimes 5 days in the Julian calendar (which itself being too long progresses forward 3/4 of a day per century in the seasons, the equinox in 1500 B.C. would thus be April 4).

Early Accuracy

It is obvious that early post-Flood astronomers did not have the accurate measurements we have today. Yet regarding Saros we have an unusual statement,

> "Each cycle of the moon's eclipses is completed in a period of 223 months . . . they (the Chaldeans) computed the length of the Synodic and periodic months so accurately that modern astronomers have found the calculation to fall short of less than 5 seconds of our time . . . From Babylon a series of . . . astronomical observations dating as far back as 1903 years before the year 331 B.C., the year Alexander entered that city." (Page 140, Sixty Centuries of Progress.)

The knowledge available to those early observers is going to have a bearing on why Stonehenge was built. History tells us of a 360-day year in Egypt. It states that the Egyptians also had a festival period of five days at the end of their year, that they knew the length of the year should have been $365\frac{1}{4}$ days because of the heliacal rising of Sirius. Records show they had discovered the precession of the equinoxes, though they were not aware of the cause. Early astronomers might also have had misgivings as to the length of the synodic month, as it is not a constant measure.

> "The length of the synodic month may vary by as much as 13 hours, chiefly because of the eccentricity of the orbit and the consequent nonuniformity of motion . . . Because the moon's motion undergoes many disturbances (perturbations), the sidereal month may vary by as much as seven hours." (Page 120, Introduction to Astronomy by Payne-Gaposchkin.)

These variations even out to a stable length for the month when considered over a long period of time. If we can prove that eclipse cycles were common knowledge to early man, then they might also have known the mean length of the month with great accuracy.

At the same time we have found good reason for building Stonehenge (as well as "henges" throughout the world and the "star temples" in Egypt). Knowing when to watch for an eclipse, they could very carefully note the time of the beginning, the midpoint, the place in the heavens, and carefully bring a calendar into accurate measure.

Earth's Rotation Varies

What factors control the number of hours in a day, the number of days in a tropical year, sidereal year or synodic month? A pre-Flood calendar might have required repeated adjustments to suit a changing post-Flood heavens.

The rotation of the earth seems like a stable item. Yet even today there are minor variations. For a series of years the earth will run slow (or fast) until a number of seconds accumulate:

> "The earth is not a perfect clock. . . The day is steadily lengthening about a thousandth of a second a century as a result of the action of tides . . . There are also very small erratic changes in the rate of rotation . . . The earth may 'run' fast by twenty seconds or so for a couple of decades, then become 'slow.' These small irregularities are incompletely understood." (Pages 39, 40, Introduction to Astronomy by Cecilia Payne-Gaposchkin.)

Did larger variations occur in the past? If the earth were to have picked up its Flood waters from outer space, its rotational speed would obviously have been slowed down. The source of the Flood waters might have been ice crystals found in comet and meteor trains today.

There is speculation that a great meteor, which fell in Siberia in 1908 causing widespread damage but leaving only small craters and no meteorite fragments, might have been composed of frozen gases or ice crystals. Flood waters too could have come from outer space.

Any shift of mass from the polar regions to the equatorial regions would slow earth's rotation and without having to add any mass from outer space. A year would contain fewer but longer days.

The "Ice Ages" began with the beginning of Noah's Flood. In the following centuries additional ice continued to pile up and gave rise to the Wisconsin advance. During these years when mass was transferred to the northern regions, the rotational speed would have increased. Days would be shortened and the number of days in a year increased.

Isostacy Affects the Year

The continents would then sag under the load of ice and in so doing tend to cancel out that increase in rotational speed. As the ice melted and returned to the oceans, mass would shift the equatorial regions with a consequent slowing of earth's rotation. Then Canada, Alaska and Greenland would slowly rise once more cancelling out the rotational change.

Ways to Change the Year's Length

There has been considerable speculation that at some time in the past our earth turned on its axis an even 360 rotations in the time it took to revolve about the sun, thus producing a year with an exact 360 days. (With regard to the stars it would rotate 361 times giving an exact 361 sidereal days in a year.) Some ancient records actually claim such a 360-day year and a 30-day month. How could this be accomplished?

One way would be to slow the rotation of the earth; however, the number of days in a synodic month as a consequence would drop from the present 29.53 to 29.11. Obviously that single solution is not going to produce the neat "30 days in a month" needed to make an exact 12 synodic months in a year.

A More Massive Sun

A second way would be to increase the mass of the sun. The result is that the earth and all the planets (but not their moons) would increase their orbital velocities. Earth's rotation would remain the same. The number of days required to make a revolution about the sun could be cut from 365¼ down to 360 rather easily.

Side effects? Yes, while the sidereal day (24 hours less 4 minutes for a star to return to our meridian) would remain the same because our rotation was unchanged, there would be a slight lengthening of the solar day (24 hours) by a few minutes because of our increased orbital velocity. Our meridian would require a bit more time to catch up with the faster, eastward-moving sun on its yearly course through the stars. The synodic month would also be slightly lengthened by this same factor. A lessening of earth's mass would be needed to achieve a 30-day month to go with the 12-month year.

A Smaller Earth Orbit

A third way would be to move the earth into a smaller orbit thus allowing it to complete its revolution about the sun in less time. The distance to the sun would be .919 Astronomical Unit rather than its present 1 Unit. To make the moon go around in 30 days would mean a larger orbit, about 1.2% greater than its present 238,857 mile distance from the earth.

A Fixed Calendar or Unending Variety?

The end of obtaining a "fixed" calendar might be accomplished by all three of the above methods each applied in part. Yet is the goal of a "fixed" calendar one that can actually be achieved? The answer is, No! Perturbations from the other planets, the effect of the moon's (and sun's) gravitational pull on the earth's equatorial bulge, ice caps, isostacy, tides, wind, weather, a host of minor influences slowly and gradually would cause it to drift from this "perfect" system.

Our wish for a fixed calendar is the same as the Egyptian and Maya desire that has been proven to be of pagan origin. The correct calendar is one that requires intercalation of both days and months.

From a psychological standpoint would it be good to have a fixed calendar? Or is God's Way better? He offers a calendar visible in the heavens. No two years are alike. Seven times in 19 years we have an additional month to catch up with our affairs, or to undertake some new venture, to squeeze in a vacation to some far off corner of the earth. Unending variety. Or vain repetition?

CHAPTER XI

HISTORICAL RECORD OF A 360-DAY YEAR?

A number of quotations from Immanuel Velikovsky's Worlds in Collision, containing quotes from many ancient sources, should be considered.

> "The texts of the Veda period know a year of only 360 days. 'All Veda texts speak uniformly and exclusively of a year of 360 days. Passages in which this length of year is directly stated are found in all the Brahmanas.' 'It is striking that the Vedas nowhere mention an intercalary period, and while repeatedly stating that the year consists of 360 days, nowhere refer to the five or six days that actually are a part of the solar year.' This Hindu year of 360 days is divided into twelve months of thirty days each." (Pages 330,331.)

How can we reconcile a historical record of twelve thirty-day months with what we see in today's heavens?

> "Here is a passage from the Aryabhatiyz, an old Indian work on mathematics and astronomy: 'A year consists of twelve months. A month consists of 30 days. A day consists of 60 nadis. A nadi consists of 60 vinadikas." (Page 331.)

> "The Persian year was composed of 360 days or twelve months of thirty days each." (Page 332.)

> "That the ancient Babylonia year had only 360 days was known before the cuneiform script was deciphered: Ctesias wrote that the walls of Babylon were 360 furlongs in compass, 'as many as there had been days in the year.'" (Page 333.)

But notice the next quote. It will play a vital part in the deciphering of these unusual "day" counts. What is a decade, a year, a decan, a day?

> "The zodiac of the Babylonians was divided into thirty-six decans, a decan being the space the sun covered in relation to fixed stars during a ten day period. 'However, the 36 decans with their decades require a year of only 360 days.'" (Page 333.)

The decan was a space the sun covered, not 10 (or 11) revolutions of the ear on its axis. Here is the solution to the problem. But continue:

> "The Assyrian year consisted of 360 days; a decade was called a sarus; a sarus consisted of 3,600 days."

Surely convincing evidence has been presented that our earth was turning at a different speed and/or in a different orbit. Or was it? Or was the text corrupted in all these cases?

Remember the quotation from the Mayas that their calendar was tied to the synodic periods of Venus and Mars, and that it went back to the date 3113 B.C.? The Mayas were depending upon synodic periods as well as rotation of the earth.

Hindu Observations

Consider one more quote from Velikovsky; this one with regard synodic periods, for if the earth's rotation on its axis or its velocity in orbit were to change, the synodic periods of all the planets would be affected!

> "The old Hindu astronomical observations offer a set of calculations different from those of the present day. 'What is extraordinary are the durations assigned to the synodic revolutions. . . . To meet in Hindu astronomy with a set of numerical quantities widely differing from those generally accepted is indeed so startling that one at first feels strongly inclined to doubt the soundness of the text. . . . Moreover, each figure is given twice over.'

> "In the astronomical work of Varaha Mihira, the recorded synodical revolutions of the planets, which are easy to calculate against the background of the fixed stars, are about five days too short for Saturn, over five days too short for Jupiter, eleven days too short for Mars, eight or nine days too short for Venus, less than two days too short for Mercury. (Pages 354, 355.)

These quantities must be accounted for in some way! "About five days too short for Saturn, over five . . . for Jupiter, eleven . . . for Mars, eight or nine . . . for Venus, less than two . . . for Mercury." And do not forget the year for earth must be shorter by $5\frac{1}{4}$ and the month longer by exactly .47 of a day.

"In a solar system in which the earth revolves about the sun in 360 days, the synodical periods of Jupiter and Saturn would be about five days shorter than they are at present, and that of Mercury less than two days shorter. But Mars and Venus of the synodical table of Varaha Mihira must have had orbits different from their present ones, even if the terrestrial year was only 360 days." (Page 335.)

The problem is whether to adjust the orbits of the earth, moon and several planets to fit this unusual set of figures, or whether to admit that man's knowledge of astronomy has suffered greatly through the Middle Ages.

What is a Day? A Decan?

Could a day be anything but an exact 24 hours? Why of course, we answer. Our modern world has sidereal, solar, mean solar, lunar, 12-hour, 24-hour, sunrise to-sunset, school, office, 8-hour and obviously other "days."

What we are faced with is Assyrian, Babylonia, Egyptian, and Persian counts of days (and other fractional portions of the year) that disagree with the way we count.

What is a decade, a year, a decan, a day, a nadis, a vinadikas? The answer: Ten years, one year, ten days, one day, a sixtieth of a day, a 3600th of a day; but what kind of "days"? Do we have a corruption of the texts from all these sources? Or a corruption of a once "perfect" solar system? Or a corruption in the comprehension of astronomy as a result of the Dark Ages?

360 "Day-grees" in a Tropical Year?

Suppose we were to set down Dr. Velikovsky's figures in a table and watch what happens when we clearly understand what the Hindus were counting. Synodic periods of the planets, Yes; but solar days? No! These men were astronomers and using the word day in a peculiar fashion.

Let's ask the question of how many degrees the sun moves eastward through the stars in a year. A perfect 360; it was set that way by the men who invented the degree. And the men who invented the decan said the decan was "the space the sun covered" in 1/36 of a year. A decan is a measure of space covered, it is 10 degrees! And the ten "days" that compose a decan are thus 10 degrees. "The 36 decans . . . require a year of only 360 days." Both decan and days are slightly longer than assumed (365.25/360 longer).

Now question how many degrees the sun moves through the stars during the synodic period of each of the "naked eye" planets. Include the sun as a "planet" for it was considered such until the Copernican system.

The calculation is simple (synodic period in days divided by 365.2422 and multiplied by 360). The observation was as simple as the heliacal rising of Sirius. They simply observed the heliacal rising (or setting) of these planets or their return to the same background of stars. Then they measured out the number of degrees not days that the sun covered. ("Planets" are listed in descending order of their "radial velocity.") How many decans, how many degrees did the sun cover in each synodic period? Not the number of earth's revolutions!

Hindu Synodic Periods

	Modern Synodic Period in days		Hindu Synodic Period expressed in "days"	Modern Synodic Period expressed in degrees
Moon	29.53		30	---
Mercury	115.88	- less than 2 =	114	114.21
Venus	583.92	- 8 or 9 =	575,576	575.54
Sun (1 year)	(365.2422)		(360)	(360.00)
Mars	779.94	- 11 =	769	768.744
Jupiter	398.88	- over 5 =	393	393.15
Saturn	378.09	- 5 =	373	372.66
Solar Month (1/12 year)	(30.43683)		(30)	(30.00)

The problem is solved! The Hindus were <u>measuring time in degrees</u>, 1/360 of a tropical year.. (Or possibly a sidereal year until they became aware of the precession of the equinoxes.) There is <u>no need whatsoever to change the orbits of the planets</u> or <u>rotational speed</u> of the earth.

Compare the figures in the three columns. Saturn is 5 shorter, Jupiter is <u>over</u> 5 shorter, ~~Saturn~~ Mars is 11 shorter, Venus 8 or 9 ($8\frac{1}{2}$) shorter, and Mercury less than 2 shorter!

And the tropical year now has exactly 360 "days" and the tropical month (1/12 year) has exactly 30 "days."

<u>Now</u> we can reconcile a <u>historical</u> record of twelve 30-day months with what we sce in today's heavens. Requoting from Velikowsky's quote from the Aryābhatiy and adding the correct definitions, we have:

> "'A year consists of twelve (solar) months (or twelve signs of the zodiac through which the sun moves). A (solar) month (or sign of the zodiac) consists of 30 days ("day-grees"). A day (degree) consists of 60 nadis (minutes of an arc). A nadi (minute of an arc) consists of 60 vinadikas (seconds of an arc).'" (Page 331, <u>World's in Collision</u>.)

Primitive Astronomy

But how could primitive man . . .? Here is part of the problem; "primitive man" wasn't primitive! Early astronomers were highly skilled, careful observers. They were using the sun as a "year hand" on the "clock of the heavens." A fictitious moon (or <u>solar</u> month) served to divide the heavens into twelfths, a decan was a 36th, and a "day" or degree a 360th of a year. "The <u>solar</u> month is the 12th part of one solar (tropical) year, or, 30.4368 days." (<u>Encyclopedia Americana</u>, article "Month.")

Our modern timekeeping system employs a "mean" sun to make sure each "mean solar day" has exactly 24 hours. Our watches are geared to this time, not to the passage of the real (apparent) sun across our celestial meridian. "There is nothing new under the sun." Primitive man had done a similar thing millennia ago.

Sidereal Time and Orbital Time

In order to determine where this "mean" sun is and when it crosses our meridian (to give us hours, ante meridiem, noon and post meridiem) man points his telescope toward the meridian, watches for the transit of a star, knows the number of degrees the star is from the vernal equinox, determines sidereal time, then changes it to mean solar time to regulate the clocks of our modern world.

The final step of the problem of perfect timekeeping was solved only in the last few years by our modern measurers of time using the tropical year (rather than the sidereal day) as the basis for uniform time. Orbital time depends on the motion of the earth in its orbit about the sun.

The rotation of the earth is not the best timekeeper. True, it has been reasonably uniform these past centuries (and only gets off an accumulated twenty seconds one way or the other now). But what of Joshua's long day? And the return of the shadow on the sundial in Hezekiah's day? Had there also been earlier evidences of the power of God over the rotation of the earth and His ability to set "the dayspring" when and where He wanted it?

Early man counted days (sunset to sunset) and seven-day periods by the sun's daily course. But for longer periods of time he depended upon the return of the seasons, "the place of the dayspring," the heliacal rising of the stars and synodic (and sidereal) periods of the planets. He divided his year by 360 degrees and found it to contain 365.25 days. He used a form of "orbital time" in calculating the synodic periods of the planets. It was not based on counting the rotations of the earth but rather on the sun's eastward progress through the stars, which in turn is caused by earth's progress revolving about the sun.

Division of the Heavens

Basically man has divided the heavens into 360 degrees. Then each degree is divided into 60 minutes (of arc) and each minute into 60 seconds (of arc). But this leads to a measure of confusion in that 60 minutes of arc (a degree) is equal to 4 minutes of time. Each time zone on earth is 15 degrees wide and an hour different in time. Each hour of R. A. in the heavens is 15° wide.

Suppose we review the problem of 1080 parts in an hour of time. Would it clear up the confusion? Earlier we found 1080 an ideal number because it was evenly divisible by 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 20, 30, 40, 60, 90, and 108 though not by 7 or 11. Suppose we were to divide the heavens into degrees and then into parts instead of the confusing terms of minutes and seconds of arc? The whole circuit of the heavens is 360 degrees or 24 hours of sidereal time. Our clocks are controlled today by this system. (There are 24 hours and 4 minutes of sidereal time in a mean solar day.)

If we were to question the number of parts in a degree, it also is a whole number! There are 72 parts in a degree, 432 parts in 1/60 of a circle (the standard 6-degree division in the Arabic world), 720 parts in a decan (the 10-degree division of the Babylonians), 1080 degrees in an hour of Right Ascension (the 15-degree division of the western world), 2160 parts in a sign (the 30-degree division today primarily associated with astrology) and 25,920 parts in a day (the entire 360-degree circuit of the heavens), to form one complete sidereal day. (A solar day requires one extra degree of sidereal time in that the sun moves eastward a degree per day through the stars, thus 25,920 plus 72 parts or 25,992.)

We had previously found 76 (4 x 19) moments in a part and related it to the 19-year cycle and the 4-year February 29th cycle. Now we find the heavens divided into 360 degrees (6 x 6 x 10) and each degree divided into 72 parts (6 x 6 x 2). The width of the sun is 1/2 degree requiring 720 suns (or moons) to fill a circle. Are these coincidences, or were they planned, and if so how early in man's history?

Degrees, Minutes and Parts

The following table relates measurement of time to angular measurement.

Unit	Degrees	Minutes of Arc	Minutes of Time	Parts
degree	1	60	4	72
half decan	5	300	20	360
1/60 circle	6	360	24	432
decan	10	600	40	720
hr. of R.A.	15	900	60	1,080
sign	30	1,800	120	2,160
circle	360	21,600	1,440	25,920

The suggestion is that 1) the division of the heavens into 1080 parts per hour was a normal, natural one, and that 2) measuring time by the eastward movement of the sun could profitably use this system also because of its 72 parts per degree, 72 being easily factorable and related to the 1/720 of a circle that is the sun's angular measure.

CHAPTER XII

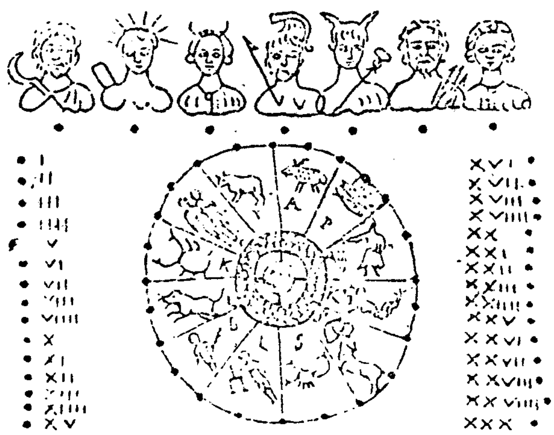
A 360-DAY CALENDAR FOR THE COMMON MAN

It is one thing to conclude that astronomers might divide the heavens into twelve signs for the solar months, and then divide each sign into a neat thirty degrees or "days." But what use would the common man actually make of such a solar calendar? It would be completely divorced from the moon and its phases and from the earth's rotation as well, in that the count of "days" in a year would be only 360.

Consider the needs of the common man. Planting time, harvest time, a need to keep whatever holy days his priest might prescribe, a count of time to deal with his neighbor and pay his landlord. The seven-day week might be included or omitted. The ten-day week of ancient Egypt or even the twenty-day week of ancien Mexico might be used.

An Old Roman Calendar

The following calendar stone is proof of a 4-season, 12-month, 360-day syste



"Old Roman Calendar, cut in stone, with peg-holes to mark the months, days of the week, and monthly dates. Reprinted from an old book by courtesy New York American Weekly." (Page 111, Unveiling the Universe by Norton Wagner.)

The seven days of the week across the top (Saturday through Friday) are identified by a pagan god or goddess. Their names are still associated with the days of our modern week. The month has 30 days, no more. For 31 it would be possible to place a peg in both the XXX and the I. A month with 29 days would skip the XXX.

The year is divided into four seasons and since these are unequal some adjustment would have to be made in the number of days in each sign (or month). Autumn today has 90, Winter 89 or 90, Spring 92 and Summer 94.

The month of February would be cut short a day from its normal 30 three times in four years. Two of the Spring months would need a 31st day. And Summer has four extra days to distribute. This system would keep man in close step with the seasons (the equinoxes, the solstices), with the eastward progress of the sun sign by sign.

Alterations by Soisgenes

The Julian calendar as set up by Julius Caesar and Soisgenes in 46 B.C. was a modification of what is actually seen in the heavens. The length of seasons and months was changed. Alternate months now would have 31 days with February being defective (from the standard 30) three years in four.

30	31	30	31	29,30	31	30	31	30	31	30	31
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Autumn 91			Winter 91,92			Spring 91			Summer 92		

Thus each season was supposed to contain 91 days with Winter having an extra day every four years, Summer an extra day every year. Note the problem of August (then named Sextilis) having only 30 days while Quintilis (to be named July) had a full 31. February was the ideal source for an extra day for August.

Using the peg board would be simple in that every other sign (or month) now contained 31 days. Six months fit the 30-day pattern perfectly with the exception of February.

Thus we have a simple 360-day year, 30-day month calendar for the common man and it is tied closely to the seasons and the twelve signs of the zodiac. The decision to begin the Julian calendar with January 1 moved forward from the winter solstice was a concession to the people in the Roman empire who had been keeping a lunar calendar. That first year then began with a new moon in deference to their tradition.

Noah's 360-Day Year

Did Noah have such a 12-month, 30-day-in-a-month timekeeping system? Was it in addition to the 19-year pattern of a lunar-solar calendar?

The answer of the Eternal to Job "Canst thou bring forth Mazzoroth in his season?" (Job 38:32) is a reference to the twelve signs of the zodiac apart from any pagan symbols or meaning.

Jupiter Counts Years

The planet Jupiter moves year-by-year slowly eastward from one sign to another completing its circuit of the heavens in twelve years. Did Adam take knowledge of this? Was it pointed out to him? Jupiter would make a fine count of years, a fine "hour hand" for the clock of the heavens to count by twelves.

Consider the statement in Genesis 6:3, "My spirit shall not always strive with man, for that he also is flesh: yet his days shall be an hundred and twenty years." Ten circuits of Jupiter as an hour hand! Six conjunctions of Jupiter with Saturn! Coincidence or planned?

Is there more to the heavens than meets the eye in its proper use "for signs and seasons, days and years"?

An Xmas Solstice

A feature of the Gregorian calendar deserves a comment in line with the use of signs for months, and beginning the year with the beginning of a sign. The Gregorian reform restored the equinox to March 21, the position it held at the time of the Council of Nicea, 325 A.D. But if they had restored it to the position it held in 46 B.C. it would have moved forward in the month another 3 days to March 24. December 25 would then fall on the day of the winter solstice! Six months earlier on the evening of June 23, the fires of St. John are lit, supposedly to commemorate the birth of John the Baptist six months prior to Christ's birth. But these are "birthdays" (solstices) of the sun!

Motivation for a Perpetual Calendar

The hope for a perpetual calendar based on the framework of a system that originates in Egypt with Menes (Cush) and his son, Osiris (Nimrod) needs to be given more than a casual glance. A multitude of pagan concepts lies beneath the surface polish. More is involved than just a need that . . .

> "in these modern days of specialization and standardisation the non-uniform Julian months, with their consequent overlapping weeks are not only declared to be defective, inadequate, and inconvenient, but are consequently crudely burdening all commercial, civil, and religious affairs." (Page 111, Ibid.)

The entire history of man's attempt to produce a uniform system of time-keeping is tied to astronomy, eclipses, astrology and the worship of pagan gods.

Called for Calendar Service

The final problem is the one of a desire for a fixed calendar, a desire that began with Osiris shortly after the Flood and has persisted for more than four millennia. Surely no human mind is backing this long-term venture.

Consider what Elizabeth Achelis experienced when she accepted the opportunity to work for the New World Calendar, which discards the continuity of the seven-day week, accepts for "eternity" the 30-, 31-day calendar month rather than a month tied to the moon's phases, and except for the one point of intercalating a day every four years, accepts the oath taken by the Pharaoh's of Egypt.

The following is from Calendar Change--A Challenge, a pamphlet by the World Calendar Association:

> "I was reading in my room . . . and found there a letter describing . . . the 'twelve-month equal-quarter plan,' and I was immediately attracted by its simplicity, order and symmetry. As I was contemplating it, I heard a clear voice'You must work for this plan.'
>
> "Although the call was distinct and convincing, my first reaction was 'How can I? I have no experience.' Then I remembered the doubting Zachariah and the believing Mary, and I knew I had to accede. With no more hesitation my decision was made by answering aloud, 'If You wish me to do this Lord, I will do my best."

A fascinating account, similar in the ways to the experience of Joseph Smith. Yet in neither case were the "spirits tried" to "see if they were of God." A tragic error(and with only a moment of hesitation) on the part of the now President of The World Calendar Association, her answer, "Yes, Lord" to an unknown, unidentified and untested voice.

She "recalled . . . Moses (but no cautious wait for any identification, "I am the God of thy father, the God of Abraham . . ." nor does her visitor even volunteer his name) . . . Samuel (but no trace of a careful tutoring by an Eli) . . . Paul (but no trace of "Who art thou?" nor thought of Isaiah's warning, "if they speak not according to this Word," (the Bible) . . . knew that clergymen, teachers, doctors and reformers had been called to their professions and now . . . had experienced a 'calling.'"

But from whom? Isn't this question worth asking? From whom had she received this call. Who has guided the solar calendar since the time of the Pharoahs of Egypt?

Who is this that demands the end of the seven-day week as it has been observed by the servants of God from Creation? Who "shall think to change times and seasons"? And change from what God-given standard?

"Let Them Be For Signs"

Is there any cause to doubt that a lunar-solar calendar with its unrelated seven-day week was that standard from the time of Moses? from the time of Abraham? from the time of Noah? from the time of Adam?

Does any doubt remain as to the Author of that Sacred Calendar that requires a priesthood of astronomers to "intercalate days and months" and that uses the "signs in the heavens" for days, for months, for seasons and for years?

Unanswered Problems

The question of why Biblical prophecy uses a year of 360 days and why Noah appears to have used a 30-day month in calculating time during the Deluge has been left largely unanswered. There are those who will insist that the moon went around the earth in 30 days and the earth around the sun in 360 days prior to the Flood and that it will do so again when Christ "restores all things." If the objection to a year of 365 days is purely mathematical, it might be pointed out that 365 is the sum of 10^2, 11^2 and 12^2 and that it is also the sum of 13^2 and 14^2.

It might also be suggested that as God used the gods of Egypt to destroy that nation, so He might use the calendar of Osiris (12 months of 30 days equaling 360 plus five days of service to Egyptian gods) to measure out the time of punishment and destruction to all of civilization. Did He use the day-for-a-year principle of witholding the blessings and birthright from the ten tribes of Israel in the same way, punishing them for their sins in using the statutes of Omri, which included calendar principles brought from Egypt by Jeroboam and his Egyptian wife?

The solution to these problems is not available at the moment. The purpose of this paper has been to provide tools to search out the answers, to provoke further study into a neglected field. What is abundantly clear is that step by step every timekeeping principle of the Scriptures is being set aside and a counterfeit substituted in its place. The sunset beginning of days, the month tied to lunar phases, intercalary days, the year beginning in the spring, intercalary months, all have disappeared as "civilization" has taken over. One last vestige, the uninterrupted seven-day week is destined to be challenged in this end time, ironically just prior to its fulfillment as a 1000-year period of rest for all mankind.

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A P P E N D I X

Comments on lecture given by Dr. Hoyle at Cal Tech's Beckman Auditorium.

A summary of the sequence of eclipses in the following table.

A table demonstrating the continuity of the 19-year cycle, and how four such cycles shortened by a synodic month produce a pattern of eclipses.

INTER-OFFICE

AMBASSADOR COLLEGE

To: Dr. Hoeh | Date: January 12, 1967

Department: Dean of Faculty

Subject: Stonehenge Lecture by Dr. Fred Hoyle | From: Kenneth C. Herrmann

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What were these early builders of Stonehenge looking for and how did they operate their "machine"? Dr. Hoyle is a very unusual man and not above teasing his colleagues in a pedantic manner. Does he really believe the theories he puts out? Of course not, only the general public believes. Rather theories are stepping stones to more solid ground.

If as you state these were Israelites in the time of Joshua putting a fine polish on their calendar calculations, then we can come to certain conclusions, tentative at least. They were watching the sun along the eastern horizon carefully determining the date of the summer solstice by means of the heelstone. Some source of smoke was used to cut out the ultraviolet and blue light, making it possible to look directly into the rising sun and see its outline clearly.

Why go north to Britain? Because the calculations could then be more exact. Watching the solstices from a position near the equator, one would see them with an amplitude (distance in degrees north and south of the east or west point) of 23½ degrees. By going north to Britain the amplitude increases to 40 degrees. This would be the most northern practical location to build this observatory. If one were to go further north to the arctic circle, sunrise would be due north on June 21 and due south on December 22. On June 21 the day would be 24 hours long--on December 22 the length of the day would have diminished to zero. These builders of Stonehenge chose a northern area free from ice early after the Flood, an area where the horizon in these critical directions at least was level and relatively free from trees.

At Stonehenge the two stones set for marking the solstices are not quite far enough apart, and yet this seems to be deliberate as Dr. Hoyle pointed out. As with an eclipse of the sun, there would be the "first contact" of the northward moving sun with the heelstone (about June 2). This would occur some nineteen days prior to the solstice. The sun would still be making quite rapid progress northward at this point. A second calibration would be the morning when the sun rose directly behind the heelstone (June 5) and could be compared to the beginning of totality. A "third contact" would be June 12, nine days before the equinox with the sun's northern edge touching the northern edge of the heelstone. The fourth calibration would be the morning when the sun was fully clear of the heelstone and rising to the north of it, the "last contact" of an eclipse. The sun's northward movement (and return, June 19-23) would be very slow during these days and it would be difficult to determine just the exact day when its northward progress reversed. It would then go through this given sequence in reverse order. The date of the solstice could be very accurately established by a comparison of these four contacts. Dr. Hawkins, on the other hand, is convinced that only the northern most rising on June 21 was sought.

The reason for the northern location of Stonehenge was to increase the amplitude of the sun's swing from 23½ degrees to 40 degrees northward from the east point. Setting these stones several degrees short of that 40 degree mark where the sun would reverse, would increase the accuracy of the observation because the sun would be moving northward faster in these days prior to the day of the solstice. The early contact with the heelstone (and the final contact) plus the magnified effect in a northern latitude would give much greater accuracy than could be obtained in Palestine. The additional fact that an even more northerly circle was built in Scotland is convincing evidence that men would use this feature of increased amplitude to get a more accurate measurement.

The pattern of 56 Aubury holes is a puzzle and its actual purpose is difficult to prove. If they were merely dividing a circle halving it repeatedly, they would have come out with 64. We can make repeated guesses as to the purpose of these 56 positions and if we guess right can almost prove that that was its use. Absolute proof is another matter. One might space eight stones at even intervals and move them once a day in order to determine the arrival of the weekly Sabbath. That seems a doubtful guess.

The 56 could be a rough estimation of three revolutions of the moon's nodes, since they make a revolution in 18.61 years. Or they might refer to a 56-year eclipse cycle including two 19-year Metonic cycles, plus a Saros cycle, minus half a synodic month. An eclipse of the sun on say July 20 one year would be followed by an eclipse of the moon on July 16 fifty-six years later. That July 16 eclipse would stand a better than 60 percent chance of being visible from Stonehenge, or any spot on earth. Lunar eclipses during the winter would stand an even higher chance of being seen from Stonehenge because this moon would rise in the northeast and set in the northwest being above the horizon for far longer than the average 12 hours. Thus we see the logic of the observations toward the northeast. In summer they were observing the sun and the summer solstice. In winter they were observing the moon in that same northeast location measuring its distance north of the heelstone by four additional markers and also watching for lunar eclipses.

Suppose that July 20 solar eclipse was central (but not necessarily total) then the July 16 lunar eclipse would be both preceded and followed by solar eclipses 14.765 days earlier and later than the moment of the new moon. The chances of these solar eclipses being seen from Stonehenge are rather slim, but the chances of one of the two being seen from the area of Europe or the Mediterranean are considerably greater.

Lunar eclipses visible from Stonehenge would occur almost yearly. Thus if these observers wanted to "see" an eclipse they would do well to predict lunar ones. If they were to depend on solar eclipses, they would want to hear of the eclipse and be told of the time of day that it reached its mid-point. For this they could have depended upon news from Europe and the Mediterranean region.

The vital statistics that we assume they were looking for would be the length of the tropical year and the length of the synodic month. The tropical year is a stable unit. Yet there was a factor in those early years following the Flood of melting ice caps (or changes in the size of the ice cap) and that these changes would have shifted mass to the equatorial regions slowing the rotation of the earth and thus putting more days in the tropical year (and months also). Our tropical year today is stable as a length of time, yet the rotation of the earth has minor fractional variations. Our present day "second" is based on a fractional length of the tropical year, not a 3600th of a 24th of a day.

The synodic month presents a much more difficult problem. Its length varies considerably but one of its major variations could be corrected by knowledge of the Saros cycle. This major variation would be due to the fractional portion of the anomalistic month that was included in any period of time. Using the Saros cycle however would cause another error in that the missing portion of the tropical year in this 18-year, 11 1/3-day cycle might affect the average length obtained for the tropical year. If that missing section were at or near the perihelion point, it would represent a different portion of time than if it were near aphelion.

Dr. Hoyle's comment that the early scientific observation at Stonehenge later deteriorated into pagan practices was good. Note the modern "Druids" that gather at Stonehenge today. Were later structures actually inferior in design and logic? Probably so.

The four postholes to the left of the heelstone must have been used for lunar observations for the sun never moved that far north. If we watched for the full moons nearest the winter solstice, they would rise near the heelstone. At the winter solstice, the sun would have reached its farthest point south on the eastern horizon, but the moon would reach its farthest point north and be rising in the direction of the heelstone. If an eclipse season were to coincide with the winter solstice then these full moons would rise over the heelstone and an eclipse of the moon would take place on the day of the full moon. Observers in Britain would normally have about a 60 percent chance of seeing every eclipse of the moon. But they would have a far better chance of seeing an eclipse of the moon occurring in the winter.

If the eclipse season were to be occurring near the equinoxes, then the full moons at the time of the winter solstice would swing out to their widest limit north or south of the heelstone. By carefully observing the amount of swing northward or southward from the heelstone, the observer would be able to determine the location of the eclipse season in the year. No smoke would be needed to cut the brightness of the full moons and thus the "slaughter" stone is only needed in its alignment with the heelstone and used only for solar observation.

The Station Stones allowed two "witnesses" for each observation, and even a third witness for the critical summer solstice points. This procedure would also allow the training of additional observers to take over in succeeding generations.

Obviously these heavier stones were moved in the winter on ice when the effort needed would have been so much less and the energy of the men (or beasts) supplying the muscle so much greater. A wooden sled-like affair supporting only the front half of the long stone would have worked well and is a standard method of skidding logs, apart from dragging them directly over the ground. The people of Easter Island demonstrated their ability by dragging a huge stone over dry ground and setting it up without the elaborate platform these booklets picture. No one would use rollers to transport rocks 20 miles. The Egyptians skidded boats around cataracts in the Nile by using mud as a lubricant and manpower as the motive force.

If we were to watch the midwinter moon rise year by year in the vicinity of the heelstone, we would see it move from an extreme northerly position to an extreme southerly position in a period of nine years. Nine years later it would have returned to its northern position once more. An additional fractional year would bring the total cycle to 18.61 years. This is the period of the regression of the moon's nodes.

If we assume that the 56 Aubury holes were stations on which to set stones, then we might logically assume that six stones were used spaced nine and ten positions apart giving an average spacing of half the 18.61-year cycle. A spacing of nine followed by nine would equal the 18-year Saros cycle and be a valuable eclipse predictor. A spacing of nine followed by ten would be the Metonic cycle and would also be an eclipse cycle. If every other stone were of a different color or type the arrival of one color might be used to indicate an eclipse of the sun, the other the eclipse of the moon. The moon's nodes move westward 1½ degrees per month or about one 56th of a circle in a year. These six stones might then logically be moved clockwise, one stone might represent the ascending node, the following node a descending node. Every nine or ten years a node and thus an eclipse season would be indicated with a stone in position before the heelstone, indicating either an eclipse of the sun or an eclipse of the moon depending on which stone it was. Indication of an eclipse would also be evident if one of the six stones were to be near any of the Station positions.

Dr. Gerald Hawkins also indicates 30 stones arranged in a smaller central circle and uses these with a moon stone indicating the date of the synodic month. Logically this moon stone should move counterclockwise in that the moon moves eastward through the stars. The full moon position would be toward the heelstone. The new moon position would be in the southwest where the observer would be watching to see for that first crescent of a new moon.

Rather than follow the pattern of Dr. Gerald Hawkins in using six stones, Dr. Hoyle uses only one set of stones to represent the nodes of the moon. He has these revolving in a counterclockwise direction, moving three positions per year. We might choose the moments of the winter solstice, the spring equinox and the summer solstice to move these stones each one position. They would thus make three revolutions in 56 years or one revolution in 18.67 years. Since the period of revolution of the moon's nodes is 18.61 years, after a period of several centuries both stones would have to be advanced an extra notch. Dr. Hoyle also used a sun stone which revolved counterclockwise and might be moved one position per week plus three extra moves per year because there are only 53 weeks in a year. Whenever the sun would catch up with either of the node stones the sun would obviously be entering an eclipse season. A moon stone was also added to this arrangement. It would also revolve counterclockwise moving two positions per day, thus making the full revolution in 28 days. Since the synodic month is 29½ days, obviously this stone would have to hold and wait for the actual moment of the new or full moon.

If we begin with one of the node stones in position 56 in line with the heelstone, and if the sun stone and the moon stone are also at this position, and if we have an eclipse of the sun at the moment we are beginning our Stonehenge mechanism, then we should be able to make these stones predict the approximate time of the occurrence of eclipses. The counterclockwise moving sun would meet the clockwise moving node every 346 days. The moon stone could be moved at such a rate so as to catch up with the sun every synodic month. If the sun at this time were also in time with the node stone an eclipse would occur. In 56 years minus four days all four stones would line up again except that the moon stone would be one-half cycle further around and in conjunction with the opposite node stone. Since we began our cycle with an eclipse of the sun we would now have an eclipse of the moon.

There would be numerous ways in which this 56-position circle might be used to indicate eclipses. But was this the basic intent of the builder or were they using solstice measurements and eclipse measurements to carefully build the framework of a calendar?

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76-Year Cycle Eclipses in Sequence--
38 B.C. through 2051 A.D.

A summary of the sequence of eclipses in the following table. Note that each eclipse is one month earlier, 76 years later, and on the Julian Day system 27,729 days later. A few are delayed to 27,730 and three listed as 27,728. Twice a 19-year cycle is added and in 1889 a synodic month is subtracted. The purpose of this tabulation is to show the need of lunar-solar calendar men to keep continual watch on the irregularities of the moon and also the value of extended periods of observation.

July 9	-37	1707 733
	76	27 730
June 10	39	1735 463
	76	27 729
May 11	115	1763 192
	76	27 729
April 11	191	1790 921
	76	27 730
March 13	267	1818 651
	76	27 729
Feb. 11	343	1846 380
	76	27 729
Jan. 12	419	1874 109
	76	27 729
Dec. 13	494	1901 838
	76	27 729
Nov. 13	570	1929 567
	19	6 940
Nov. 13	589	1936 507
	76	27 729
Oct. 14	665	1964 236
	76	27 729
Sept. 14	741	1991 965
	76	27 730
Aug. 16	817	2019 695
	76	27 729
July 17	893	2047 424
	76	27 729
June 17	969	2075 153
	76	27 730
May 19	1045	2102 883
May 19	1045	2102 833
	76	27 728
April 18	1121	2130 611
	76	27 730
Mar. 20	1197	2158 341
	76	27 730
Feb. 19	1273	2186 071
	76	27 728
Jan. 19	1349	2213 799
	75	27 730
Dec. 21	1424	2241 529
	76	27 729
Nov. 21	1500	2269 258
	76	27 728
Oct. 21	1576	2296 986
	19	6 940
Nov. 1	1595	2303 926
	76	27 729
Oct. 2	1671	2331 655
	76	27 730
Sept. 4	1747	2359 385
	76	27 729
Aug. 6	1823	2387 114
	76	27 729
*July 8	1899	2414 843
		- 29
June 8	1899	2414 814
	76	27 730
May 11	1975	2442 544
		27 729
April 11	2051	2470 273

*no eclipse

Metonic Cycle Eclipses in Sequence-- 38 B.C. through 2051 A.D.

The following series of solar eclipses demonstrated the effectiveness of and also the irregularities encountered in using the Metonic cycle to predict eclipses. Note the grouping of four cycles (6940, 6940, 6940 and 6939) to produce the longer 76-year Callippic cycle, which when shortened by one synodic month (29 or 30 days) allows the sequence to continue another 76 years. The total eclipse of June 8, 1937 has been used as a starting point. Oppolzer's <u>Canon der Finsternisse</u> has been used to verify the fact of an eclipse on the <u>Julian Day calculated.</u> The Gregorian calendar dates are used back to 1595, Julian calendar dates for the earlier years. The designations -37 and -18 are the astronomer's term for 38 B.C. and 19 B.C. The 29-day adjustment between the first two eclipses produces a 6911-day interval. One should be able to calculate an earlier eclipse for Julian day 1700 793 in the year 57 B.C. (-56) and be almost certain of its occurance on or within a day of July 9.

Julian Calendar		Julian Day	
July 9	-37	1707 733	
		- 29	
*June	-37	1707 704	
		6 940	(1)
June 10	-18	1714 644	
		6 940	(2)
June 10	1 A.D.	1721 584	
		6 940	(3)
June 10	20	1728 524	
		6 939	(4)
June 10	39	1735 463	
		- 30	
*May	39	1735 433	
		6 940	(1)
May 11	58	1742 373	
		6 939	(2)
May 10	77	1749 312	
		6 940	(3)
May 10	96	1756 252	
		6 940	(4)
May 11	115	1763 192	
		- 29	
*April	115	1763 163	
		6 940	(1)
April 12	134	1770 103	
		6 939	(2)
April 11	153	1777 042	
		6 939	(3)
April 10	172	1783 981	
		6 940	(4)
April 11	191	1790 921	
		- 30	
* March	191	1790 891	

The Julian Day system is a perpetual calendar which eleminates the problem of dealings with years "B.C." and with leap years. It is a count of days beginning arbitrarily with January 1, 4713 B.C. at Greenwich mean noon. Our civil day begins 12 hours earlier at midnight, the Sacred Calendar begins days at sunset or 6 P.M. an additional 6 hours earlier. A time zone 12 hours west of Greenwich would be .5 day earlier on the J.D. system. Fractional days are expressed as decimals. The day of the week can be determined by noting the remainder after dividing by 7, a remainder of 1 indicating Tuesday. The June 8, 1937 total eclipse on J.D. 2428 693 divided by 7 gives a remainder of 1, thus a Tuesday eclipse.

*No eclipse listed.

Julian Calendar		Julian Day	
*March	191	1790 891	
		6 940	(1)
March 12	210	1797 831	
		6 939	(2)
March 13	229	1804 772	
		6 939	(3)
March 12	248	1811 711	
		6 940	(4)
March 13	267	1818 651	
		- 30	
*Feb.	267	1818 621	
		6 940	(1)
Feb. 11	286	1825 561	
		6 939	(2)
Feb. 10	305	1832 500	
		6 940	(3)
Feb. 11	324	1839 440	
		6 940	(4)
Feb. 11	343	1846 380	
		- 30	
*Jan.	343	1846 350	
		6 940	(1)
Jan. 12	362	1853 290	
		6 940	(2)
Jan. 12	381	1860 230	
		6 939	(3)
Jan. 12	400	1867 169	
		6 940	(4)
Jan. 12	419	1874 109	
		- 30	
*Dec.	418	1874 079	
		6 940	(1)
Dec. 13	437	1881 019	
		6 940	(2)
Dec. 13	456	1887 959	
		6 940	(3)
Dec. 14	475	1894 899	
		6 939	(4)
Dec. 13	494	1901 838	
		- 30	
*Nov.	494	1901 808	
		6 940	(1)
Nov. 13	513	1908 748	
		6 940	(2)
Nov. 13	532	1915 688	
		6 939	(3)
Nov. 13	551	1922 627	
		6 940	(4)
Nov. 13	570	1929 567	
		6 940	(5)
Nov. 13	589	1936 507	
		- 29	
Oct. 15	589	1936 478	

Solar eclipses were chosen for this sequence in that there must be a solar eclipse at every eclipse season, while when dealing with lunar eclipses the season is shorter and thus not infrequently a season will pass without a lunar eclipse. Usually however a lunar eclipse will be found occurring at the full moon previous to or following each of these solar eclipses.

Julian Calendar		Julian Day	
Oct. 15	589	1936 478	
		6 939	(1)
Oct. 14	608	1943 417	
		6 940	(2)
Oct. 15	627	1950 357	
		6 939	(3)
Oct. 14	646	1957 296	
		6 940	(4)
Oct. 14	665	1964 236	
		- 30	
Sept. 14	665	1964 206	
		6 940	(1)
Sept. 14	684	1971 146	
		6 940	(2)
Sept. 15	703	1978 086	
		6 940	(3)
Sept. 15	722	1985 026	
		6 939	(4)
Sept. 14	741	1991 965	
		- 30	
*Aug.	741	1991 935	
		6 940	(1)
Aug. 15	760	1998 875	
		6 940	(2)
Aug. 16	779	2005 815	
		6 940	(3)
Aug. 16	798	2012 755	
		6 940	(4)
Aug. 16	817	2019 695	
		- 29	
July 18	817	2019 666	
		6 939	(1)
July 17	836	2026 605	
		6 939	(2)
July 17	855	2033 544	
		6 940	(3)
July 17	874	2040 484	
		6 940	(4)
July 17	893	2047 424	
		- 30	
June 17	893	2047 394	
		6 940	(1)
June 17	912	2054 334	
		6 940	(2)
June 18	931	2061 274	
		6 940	(3)
June 18	950	2068 214	
		6 939	(4)
June 17	969	2075 153	
		- 29	
May 19	969	2075 124	

Julian Calendar		Julian Day	
May 19	969	2075 124	
		6 939	(1)
May 18	988	2082 063	
		6 940	(2)
May 19	1007	2089 003	
		6 940	(3)
May 19	1026	2095 943	
		6 940	(4)
May 19	1045	2102 883	
		- 30	
April 19	1045	2102 853	
		6 940	(1)
April 19	1064	2109 793	
		6 939	(2)
April 19	1083	2116 732	
		6 940	(3)
April 19	1102	2123 672	
		6 939	(4)
April 18	1121	2130 611	
		- 29	
March 20	1121	2130 582	
		6 940	(1)
March 20	1140	2137 522	
		6 940	(2)
March 21	1159	2144 462	
		6 940	(3)
March 21	1178	2151 402	
		6 939	(4)
March 20	1197	2158 341	
		- 30	
Feb. 18	1197	2158 311	
		6 940	(1)
Feb. 19	1216	2165 251	
		6 940	(2)
Feb. 19	1235	2172 192	
		6 940	(3)
Feb. 19	1254	2179 131	
		6 940	(4)
Feb. 19	1273	2186 071	
		- 30	
Jan.	1273	2186 041	
		6 940	(1)
Jan. 21	1292	2192 981	
		6 940	(2)
Jan. 20	1311	2199 920	
		6 939	(3)
Jan. 19	1330	2206 859	
		6 940	(4)
Jan. 19	1349	2213 799	
		- 29	
Dec.	1348	2213 770	

	Julian Calendar		Julian Day	
	Dec.	1348	2213 770	
			6 940	(1)
	Dec. 22	1367	2220 710	
			6 940	(2)
	Dec. 22	1386	2227 650	
			6 939	(3)
	Dec. 21	1405	2234 589	
			6 940	(4)
	Dec. 21	1424	2241 529	
			- 30	
	*Nov.	1424	2241 499	
			6 939	(1)
	Nov. 21	1443	2248 438	
			6 940	(2)
	Nov. 21	1462	2255 378	
			6 940	(3)
	Nov. 21	1481	2262 318	
			6 940	(4)
	Nov. 21	1500	2269 258	
			- 29	
	*Oct.	1500	2269 229	
			6 939	(1)
	Oct. 23	1519	2276 168	
			6 939	(2)
	Oct. 22	1538	2283 107	
			6 940	(3)
	Oct. 22	1557	2290 047	
			6 939	(4)
	Oct. 21	1576	2296 986	
(Change to			6 940	(5)
Gregorian	Nov. 1	1595	2303 926	
Calendar)			- 29	
	Oct. 3	1595	2303 897	
			6 940	(1)
	Oct. 3	1614	2310 837	
			6 940	(2)
	Oct. 3	1633	2317 777	
			6 939	(3)
	Oct. 2	1652	2324 716	
			6 939	(4)
	Oct. 2	1671	2331 655	
			- 29	
	Sept. 3	1671	2331 626	
			6 940	(1)
	Sept. 3	1690	2338 566	
			6 940	(2)
	Sept. 4	1709	2345 506	
			6 940	(3)
	Sept. 4	1728	2352 446	
			6 939	(4)
	Sept. 4	1747	2359 385	
			- 29	
	Aug. 6	1747	2359 356	

The change to the Gregorian Calendar involved dropping 10 days from the month of October in 1582. October 4 was followed by October 15. Every fourth year was a leap year under the Julian Calendar, which caused the spring equinox to retreat in the calendar 1 day every 128 years. The Gregorian rule states that century years are not to have an additional day unless they are divisible by 400. Thus both 1596 and 1600 were leap years while 1700, 1800 and 1900 were not.

Gregorian Calendar		Julian Day		
Aug. 6	1747	2359 356		
		6 939	(1)	
Aug. 5	1766	2366 295		
		6 940	(2)	
Aug. 5	1785	2373 235		
		6 939	(3)	
Aug. 5	1804	2380 174		
		6 940	(4)	
Aug. 6	1823	2387 114		
		- 29		
July 8	1823	2387 085		
		6 940	(1)	
July 8	1842	2394 025		
		6 940	(2)	
July 8	1861	2400 965		
		6 939	(3)	
July 7	1880	2407 904		
		6 939	(4)	
*July	1899	2414 843		
		- 29		
June 8	1899	2414 814		
		6 939	(1)	
June 8	1918	2421 753		
		6 940	(2)	
June 8	1937	2428 693		2428 693
				1 388
Mar. 7	1941			2430 081
				1 389
Jan. 14	1945			2431 470
				1 387
Sept. 1	1948			2432 857
				1 388
Aug. 20	1952			2434 245
		6 940	(3)	1 388
June 8	1956	2435 633		
		6 940	(4)	
*June	1975	2442 573		
		- 29		
May 11	1975	2442 544		
		6 939	(1)	
May 10	1994	2449 483		
		6 940	(2)	
May 10	2013	2456 423		
		6 939	(3)	
May 9	2032	2463 362		
		6 940	(4)	
*May	2051	2470 302		
		- 29		
April 11	2051	2470 273		

The following inset series demonstrates the "short cycle" of 1/5 of a Metonic cycle. The table on page 40 demonstrates further the eclipses that occur in a single calendar year. Each calendar year will contain as many as five, the maximum per season is two. Some years will be without a lunar eclipse; some will have one, two and three, though never more than one per eclipse season.

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