The Censuses of the Book of Numbers

and Babylonian Astronomy

by M. Barnouin

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NOTE: The translation and distribution of this essay in no way constitutes an endorsement of its primary thesis, which is that later Jewish theologians in priestly circles rewrote the census records of the book of Numbers in order to make them correspond to astronomical cycles, for theological reasons. Rather, the position of Geneva Ministries is that the census figures reflect the true population of Israel at the times they were taken. The fact that these correspond to astronomical cycles, and to the arrangement of the tribes around the throne of God, provides us with evidence of the magnificent superintendence which God exercises over all His works, and adds incredible richness to our view of the universe, and to our understanding of the Abrahamic promise, that his seed would be as the stars of the heavens (especially in view of the fact that the lifespans of the antedeluvian patriarchs also correspond to astronomical cycles). Barnouin's essay is at some points difficult reading. (It is difficult in French also, which is why we had two translators work it over.) The reader is encouraged to think hard, and to work with an open Bible. We believe that, in spite of its deficiencies, Barnouin's work has opened a door of wonder and future research. It is with that in mind that we have translated this essay, and provided it to you.)

The priestly traditions have idealized the wilderness accounts. They have enriched them with a large amount of precise data belonging to liturgical ritual and to the calendar, in such a way as to present Israel as a people whose sacred religion unifies them and binds them to God for ever. The well ordered formal structures, such as the genealogies and the censuses, constitute the community in its consecrated being (Ex. 30:12-16). As for these accounts, we read them as embellished by a profusion of precise numerical data. We sense, as in the case of the Temple, the intent to demonstrate that God has directed and has ordered everything with exactitude. But why, in the censuses, are there so many numbers where the first three digits are of such significance and precision? Where do these numbers come from? A variety of hypotheses have been proposed, not so much to provide actual proof, but rather with the aim of giving an indication of the way research should be conducted concerning those clearly artificial numbers.

We intend to take up, once again, the numerical data of the censuses by comparing it with other similar data in the Pentateuch. After that, we shall try to see in what way these numbers are artificial by investigating their compilation from various sets of numbers that the writers might have known and used.

Taking as an hypothesis the use of a whole body of numbers concerning some astronomical periods, we shall find out if such an hypothesis correlates with the results that we read in the book of Numbers.

The book has also two censuses of Levites. They are 22,000, even 22,300 in Chapter 3, and again a second time 23,000 (Num. 26:62). The lay people comprise twelve tribes, due to the division of Joseph into Ephraim and Manasseh (in Chapter 26 Manasseh comes before Ephraim). This allows us to see the tribes cleverly arranged as four regiments, facing the four cardinal points, and paraded around the Presence which is certainly there when Israel is drawn up in orderly ranks around its Levites (Ezk. 48:35). The military force so deployed goes hand in hand with the notion of holiness. It has to do with a sacred frame, comparable with the Temple (Ps. 114:2), because God is sovereignly encamped (Judith 16:2). It has to do with the twelve tribes in active service for God, and this number twelve appears even more clearly in other more simple expressions of the number of the children of Israel.

First of all in Numbers 31:5 it is a question of an army of 12,000 men. Then the second part of the chapter delights in showing all the calculations for dividing the plunder spoil. 1/500 is taken for Yahweh, 1/50 for the Levites, as if it was

usual that the armies should be divided by 501 or by 500. When they speak of the community's share it is a question of "a man in 500." It is impossible to divide 500 by 12 for the twelve tribes. So, that's not a consideration. If rather we think in terms of 500 per tribe we come to 6,000. If above all we add all the numbers given for the spoil, we find 840,000, that is, 7 x 120,000. Taking this line we arrive quite straightforwardly back at the twelve tribes.

The same is true for the Levites, but in 1 Chronicles 23:4, 24,000 officiants are spoken of in conjunction with the 24 priestly classes, as if to substitute for the twelve tribes by doubling them. If we speak of Levi and the eleven other tribes, we can then compare them to the 22,000 of Numbers 3:39. We cannot, however, see why Numbers 26:62 speaks of 23,000. If we count Levi as a 13th tribe in addition to the twelve tribes we would have an explanation only for the total of the census of 2 Samuel 24:9, that is, 13,000 for Israel and Judah together.

In the same order of magnitude, there twice appears in the Pentateuch the estimate in round figures: 600,000 (Ex. 12:37; Num. 11:21). In the calculation of Exodus 38:24-29, the two last numbers 70 and 2400 are related to 7 and 12, as is usually the case. But questions remain concerning the 29 and 730, listed

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[1]According to Egyptian custom, there is no unit of 100 men but of 200. "Egyptian Military Organization," JEA (1953):32-47. See p. 42 and p. 45.

in v. 24, and concerning the 100 and 1775, in v. 25. These are clearly related to the total of the first census in v. 26. The 1775 shekels correspond to the 3550 people in excess of, in round figures, the 600,000 which in turn corresponds to the 100 talents with the coefficient 6000. This calculation, by giving a total of 603,550 distinguishes an additional part 3550 from a principal part, this latter coming from the product of 6000 by 100.

This also seems to be valid for the second census. Because the simple comparison of 603,550 and 601,730 leads us to think that there is a common base: 60...0 (thus 600,000), plus each time an addition: here 3550, there 1730 -- especially since we can go through the given numbers in both the censuses for all the tribes. For every twelve numbers, there are eleven that can be divided by 100, and the twelfth by 10. The multiplication by 100 is clearly a phenomenom that occurred after the composition of each tabulation of numbers. Anyway, both times the starting point of 6000 is plausible in accordance with what we have seen in Numbers 31, that is 12 times 500 in the calculation of the plunder spoil, which gives 6000, and there is (in Num. 31:5) a total of 12 times 1000 that is 12,000 for the twelve tribes.

There are not many numbers comparable in order of magnitude in the Pentateuch. There, numbers are formed from the usual

elements like 7 or 3 (or 4?) For example, in Numbers 16:49 (Heb. 17:14) we find 14,700 = 49 x 300 = 3 x 7 x 7 x 100. But it is in an altogether different direction, not a mystical one but an arithmetical one, that we have to look in order to see the artificiality of the numbers in the two censuses.

The limitations of our study dictate that we consider only the numbers in the Masoretic text of the censuses. We are not here considering the problems concerning the original graphology of the digits nor the possible errors in the copying of manuscripts.[2] It is clear that numbers are thought of in units, tens, hundreds, etc., whether they are written out longhand or set out as digits which, by their displacement from the right, denote units, then tens, then hundreds, etc. There is another question: How were the figures of large numbers set out for the purpose of adding them up? How did they add in a practical manner twelve numbers each having three digits other than zero? For the period prior to the inclusion of our numerical tables in the Pentateuch, the only possible hypothesis is that the calculation had to have been made according to a sexagesimal system of numbers. The same system has probably also been used to set out the numbers.[3] But it would be useless to examine this right now because we want to concentrate only on the numbers themselves.

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[2] cf. H. L. Albrik, "The lists of Zerubbabel (Nehemiah 7 and Ezra 2) and the Hebrew Numeral Notation," BASOR 136 (1954):21-27.

[3] M. Barnouin, "Remarques sur les tableaux numeriques du livre des Nombres," RB 76 (1969):351-364. Includes bibliographical notes.

Table 1

Numbers 1 & 2		(order for Chapter 2)	Numbers 26	
Reuben	46500	Judah	Reuben	43730
Simeon	59300	Issachar	Simeon	22200
Gad	45650	Zebulon	Gad	40500
	151450			
Judah	74600	Reuben	Judah	76500
Issachar	54400	Simeon	Issachar	64300
Zebulon	57400	Gad	Zebulon	60500
	186400			
Ephraim	40500		Manasseh	52700
Manasseh	32200		Ephraim	32500
Benjamin	35400		Benjamin	45600
	108100			
Dan	62700		Dan	64400
Asher	41500		Asher	53400
Naphtali	53400		Naphtali	45400
	157600			
	======			======
	603550			601730

It is important to observe that the numbers for the tribes are all in the same order of magnitude. The first digit is usually (nine times out of twelve) equal to 5 or close to 5, that is, having the value of 4 or 6; thus we have numbers that are all different but not too far away from the average. If the total is a little bit more than 600,000, the average is near 50,000. If it is 6000, the average is 500. The numbers that are the farthest from the average are either for Judah, whose number starts, both times, with a 7 and is the highest

of the twelve; or for the weak tribes, when in the first census two start with a 3, and in the second census one starts with a 3 and another with a 2. The other possibilities -- that is, 0, 1, 8, 9 -- are never used for the 24 numbers of the tribes.

If we now study the second and third digit of each number, we can expect a normal spread in the variable range 0-9, whether the numbers are due to chance or to a non-arithmetical cause, as, for example, in a true census with a multitude of demographical factors producing the numbers. But we observe an abnormally high proportion of the use of the digits 4 and 5, while the digits 0, 1, 8, and 9 seldom appear. Indeed out of 48 digits in second and third place, in the 24 numbers, the digits 4 and 5 should only appear 9 or 10 times. But they occur 22 times. The digits 0, 1, 8, 9, should be found 18-20 times, but they occur only 5 times. (For the digits 2, 3, 6, 7 the proportion is normal: 21 times.) On reflection we can only explain the phenomenon by reference to "proportions," that is, by arithmetic which favours 4 and 5 instead of 0, 1, 8, 9. For example, we can imagine the 24 numbers being obtained either by dividing numbers ending in 9 into two whole numbers, which favors endings in 4 or 5; or by dividing numbers that are multiples of 10, thus favoring numbers ending with two 5s or else with a 4 and a 6, in the units (and the same being true for the tens if the divided number was a multiple of 100).

It is best to take the above phenomenon as really a proof of the artificial origin, of an arithmetical nature, of the 24 numbers of the censuses, at least in terms of their composition. This was probably achieved by splitting the numbers whose ending was 9 or 0. This is true whatever mode of writing down the numbers was used. This is also true for the sexagesimal system.[4]

The statistical use of the digits presents only two secondary anomalies worth noting. Zero is present three times as a second digit, everytime followed by a 5. But zero is never a third digit. The text does not give any number for any tribe which is a multiple of a 1000. We can see that eleven out of twelve are multiples of 100. This is clearly artificial, as is the impression of "precision" conveyed by the first three digits since the third one is never zero. It is not here a question of round numbers but of many values found between 100 and 1000, not multiples of 10; and therefore they in fact can convey precise and scientific information. The other little anomaly concerns the digit 2 because it appears seven times. We note the number 222 given for Simeon in Numbers 26 where it is unique among the 24 numbers. [The number 222 is] the only one which is the difference between two pair of them, namely in Numbers 1, between Issachar (544) and Manasseh (322), and between Dan (627) and Ephraim (405). In fact 322 is half of Dan's in Numbers 26, that is, 644. Very probably these coincidences come from some

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[4] Ibid., pp. 353f. and 358.

sort of a detail of the calculation.

We have to note also that 405 is found for Ephraim in Numbers 1 and for Gad in Numbers 26, the same for Naphtali with 534 in Numbers 1 and for Asher in Numbers 26. We will have to see whether or not this is the result of a deliberately constructed calculation.

We will have to distinguish several stages in the writings. The last one apparently consisted of multiplying the numbers of the tribes by 100. For the two totals (603,550 and 601,730), the Pentateuch's context makes us observe an early common element, that is, 600,000, to which 3550 was added here and 1730 was added there. The quantity of 600,000 before dividing by 100, was 6000, and this value is not different from the ones given in Numbers 31 that we have already examined. It seems that 6000 appeared first, then 600,000, then the two actual totals. As we see that the number of Gad, in Numbers 1, has a final addition of 3550, and that of Reuben in Numbers 26 an addition of 1730, we can then note the three steps that follows.

6000 expressed as twelve, numbers which are each of three digits:		multiplication by 100	addition	results
in Numbers 1	Gad 421	42,100	3550	45,650
in Numbers 26	Reuben 420	42,000	1730	43,730

By reconstructing the three digit number of Gad in Ch. 1 and the one of Reuben in Ch. 26, we obtain for the twelve numbers of each group a slightly different statistical use of 1 to 9 from the one observed in the actual text, but still very abnormal and justifying the previous line of thought. It is very interesting to suppose that the addition was assigned in Numbers 26 to Reuben, because it was the first tribe and that its number 420 drew attention to this (either because of its value being 7 times 60, or because it was the only one to finish with a zero), and because, in Numbers 1, the addition 421 has been assigned to Gad whose number 421 was very close to 420 already altered in Numbers 26, rather than to any other number of a tribe. Nevertheless, we are required to study the numbers rigorously and with respect to their arithmetic without modifying them by approximating them and without looking for symbolism. The question even more strongly needs answering: Where do these precise sets of numbers come from which constitute two groups in our censuses, two groups each formed of twelve numbers of three digits with 6000 as the total? It could be any combination provided it was arithmetical and at least granted digits 4 and 5 a predominant frequency. But this combination might only represent a part of the whole structure, the latter in turn deriving from precise data with origins yet in obscurity.

Let us then look at the hypothesis according to which the numbers in the censuses might have originated from numerical

data belonging to the astronomical scholarship of the time, that is, Babylonian Astronomy.

Such an hypothesis appears true, -- even lying on the face of the text, if the numbers in Chapter 5 of Genesis are considered -- mainly because the number of years attributed to Enoch came from the exact knowledge of the complete number of days in a solar year: 365. There are other reasons deriving from the arithmetic of the numbers in this genealogy and from their indisputable Mesopotamian origin.[5] The Jewish tradition, more fully developed in the writings concerning the beginning of the Christian Era, credits not only Enoch but also Seth, as well as Abraham and Moses, with the knowledge of the Chaldeans' astronomical secrets.[6] Whatever symbolic or theological ideas developed on the subject, tradition considered that what it had was exact scientific knowledge coming from the observation of the "movement of the stars," from the "revolution (Greek: periodoi) of the sun, moon, and others, both the planets and the fixed bodies."[7] Although condemning astrology, the Bible could only but praise the science of Solomon, especially concerning the heavenly bodies and their cycles (Wisdom 7:17-19). This

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[5] M. Barnouin, "Recherches numeriques sur la genealogie de Gen. V," RB 77 (1970):347-365. Includes bibliographical notes.

[6] Philo, "Vita Moysis," 1; 5; 23; translation Colson, vol. 6 (Cambridge, Mass. 1950), p. 288.

[7] Philo, "De Abrahamo," 69; translation J. Corez, volume 20 (Paris, 1966) p. 53. Cf. "De Cherubim," 22; ibid. vol. 3 (1963), p. 29; "De migratione Abraham," 177; translation Cazeaux, vol. 14 (1965), p. 209.

science led to praising God (Barnabas 3:27-37). It is normal to think that Israel received it from the Babylonians (Dan. 1:4).

The comparison of the genealogical years with astronomical time scales is logical. It is particularly so for the data expressed in days, because of the maxim "a day is equivalent to a year" (Num. 14:34; Ezk. 4:6). It becomes very illogical, however, to use such data for constructing the numbers to be used in a census account. At the same the editors in the priestly tradition might also have liked to compare the orderly ranks of the people with the sanctuary, and the sanctuary with a replica of heaven. Ezekiel saw the union of the two Godly Houses. Maybe the aim was to concretize in numbers the ancient comparison of the innumerable multitude of the people with the start (Dt. 1:10; 1 Chron. 27:23; Jer. 33:22).

There is a link between the twelve tribes and the twelve months of the year (1 Chron. 27:1, 16-22). This was at least the theory of the priestly tradition.[8] The administrative practice itself took into consideration the disappearance of certain tribes (1 Kings 4:7-19; 5:2-7). But Israel seems only to have known lunar months. There were thirteen in some years. It was easy to arrive at thirteen by counting twelve + Levi as in the census; or Levi could have been left aside and Manasseh

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[8]It is the classical system of the amphictyony. Cf. W. W. Hallo, "A Sumerian Amphictyony," JCS 14 (1960):88-114.

could have been divided in two. Levi, with the temple, has a central place and forms a unity rather like the parallel between one (solar) year with twelve (lunar) months.

On the other hand there is a clear enough correspondance with the calendar concerning the offerings of the sanctuary in Exodus 38:24. We are told of 29 talents and 730 shekels, without any apparent link with the following verse, numerically tied to the first census (600,000 + 3550). If we consider the two basic astronomical times scales, that of the lunar months: 29 1/2 days, and that of the year 365 1/4 days, we observe that 730 is twice 365 as in Exodus 38:24. But can we make this comparison? We might be inclined to do so if we look, in Numbers 3:46-50, at the complete explanation of the multiplication: 273 (first born) times 5 (shekels) = 1365. Indeed the number 365 is not easy to handle and only divides by 5, with 73 as the result. We could also divide the year in four quarters three of 92 days (total 273) and one of 92 days. The so-called priestly calendar liked these periods of 91 days (= 7 x 13) and it had conceived a theoretical year of 364 days. But we do not see it here.

In the other hand, however, we are encouraged to examine certain data such as 730 (Ex. 38:24) and 273 (Num. 3:46) because the second census is 600,000 + 1730. The difference between them is 3550 - 1730 = 1820; that is, 20 quarters, each quarter

having 91 days...?

Also it is strange to have five or six independent and yet convergent signs. Note in Exodus 38:24, the lunar month indicated by 29, and the year by doubling itself 730. Note in Numbers 3:64, a connection with the quarter (273 = 3 quarters) and one with the year by 1365. Similarly with 1730 in Numbers 26 and the difference with Numbers 1 (1820 = 20 quarters). All this is enough to encourage us to look more towards astronomy for a solution.

The most interesting phenomenom of the Middle Eastern calendar is the lunar month. Because on average its length is 29 days and 530/1000 of a day, there need to be alternate months of 29 and 30 days. A series of twelve successive lunar months, commonly called a "lunar year" will be equivalent to 354 days and 36/100 of a day, so that in three consecutive years we have to have one year of 355 days and two of 354 days. The relation between the lunar calendar and the astronomical years is better shown by the coincidence between 19 of its years and 235 lunar months: 6939 days and 6/10. This "Meton cycle" seems to have been known and used by the Babylonian scholars as early as 450

BC.9 But the moon has irregularities in its average cycle. If we want to celebrate the new moon on the day of the first appearance of the moon we have simply to look for it. Otherwise we would require a system denoting the start of the lunar month based on the Meton cycle, with an addition (or subtraction) to allow for the separately calculated deviation. The latter has its own cycle of 173 days and 1/3.[10] In order that this cycle fall in with the lunar month and with some variation or other in the lunar cycle we have to wait 38 cycles or 6585 days and 8/10. This time span was known to the Babylonians Scholars and that is where it got its Greek name of Saros; but the Babylonians did not use it to forecase eclipses as we now do.[11] We are

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[9]We should make a correction of something said in the article mentioned in the above footnote #5. That is in RB (1970). p. 355, footnote 12 and p. 356. Cf. O. Neugebauer The Exact Sciences in Antiquity (reprinted in New York and Evanston, 1962), p. 102; p. 104 (n. 44) and p. 116. Cf. also B. Z. Wacholder and D. B. Weisberg, "Visibility of the New Moon in Cuneiform and Rabbinic Sources." HUCA 42 (1971):227-242.

[10]We cannot escape the difficulty arising from the fact that the astronomical observations give (more and more accurately) natural periods of time. These have their own causation, and do not correspond to a whole number of days. Yet for the calendar, we can only consider whole numbers of days. We find then a, so to speak, "exact" correspondence when we take the whole number which is the closest to the astronomical timescale. But, if we would multiply more than once we obtain whole numbers which do not exactly match astronomical realities. A single lunar year has "exactly" 354 days because that is the nearest whole number. For 3 years however the following is the case: 354 + 354 + 355 = 1063. A calculation based on multiplying the value (173 days) of the variations in the lunar cycles would shift away from reality. Hence the calculation proposed in the article described in the footnote 3 above, in RB (1969), footnote 12 (p. 363).

[11]Cf. B. L. Van der Waerden, Die Anfange der Astronomie (Groningen, 1966?) pp. 148-159. A. Aaboe (and others) "Two Lunar texts of the Achoemened period from Babylon," Centaurus 14 (1969):1-22, cf. p. 18 for the length of 223 lunations.

speaking of the coincidence of 223 lunations, or 6585 days and 2/10. The difference with the Meton cycle is twelve lunations: 354 days and 36/100.

There are at least three relations between these numbers and the ones of the censuses in Numbers.

These censuses highlight the two totals and over and above the common element of 600,000, the numbers 3550 and 1730. If 355 had been chosen on the basis of the lunar year, it would be surprising because 354 is its twice more frequent value. 354, in the first census, is for Benjamin. Maybe it was a choice that corresponded to the theme represented by the name; the youngest, beloved of his father (Gen. 25:16ff.; 42; 46) blessed by God "all the day long" (Dt. 33:12). Anyway 173 is the other important number for the lunar astronomy. By chance 355 - 173 = 182 = two quarters of 91 days; we had noted this earlier, maybe wrongly because it is an indirect relation, whereas that of 173 with the lunar periods, is a direct one.

On the other hand, there are two numbers for the tribes repeated in both the censuses, and that can hardly be attributed to chance. These two numbers are as we said before, 405 and 534. At least by taking the three significant figures -- those that corresponded to a total of 6000 for the twelve tribes: 6000 + 405 + 534 = 6939. Should we compare this number with

the Meton cycle? The latter corresponds to 6939 days and 6/10, that is about 6940 days. But this demands a very exact knowledge of the duration of the year and of the lunar cycles. On this subject, however, the Babylonians had only reached a relative level of precision such that we can express by 1/30000 for example. If we take 529/1000 of a day instead of 530 in addition to the 29 days, for the lunar period we will come to, in effect, 6939 and 315/1000 of a day instead of 6939 and 550/1000 for the Meton cycle. This goes to show that 6939 might well have been the most exact whole number for the Meton cycle during the first centuries after its discovery.[12]

These coincidences noted above concern the numbers used for the censuses and highlighted by the text itself: That is the two totals, and the tribe numbers common to the two censuses. That of Benjamin, in the first census, has not been emphasized by the body of numerical data but only by the thematic value

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[12] It is difficult to say from what time the Palestinian Jewish scientists knew the Meton cycle. We can follow the Talmudical tradition which states that Gamaliel knew it (Rosh-ha-Shana: Y, 58b; B, 25a). This knowledge could have coexisted with the custom of verifying each new moon by direct observations for the liturgical calendar and the public calendar. In this latter area, practical imperatives such as harvests and feasts made themselves felt, especially in the case of a sabbatical year, by demanding that the inter-calary month should be placed in such a year rather than in the next. Cf. S. Zeitlin "Notes relatives au calendrier juif," Rev. Et. juives 89 (1930):349-359, which refers to previous studies. Cf. also the article mentioned in footnote #9 above, and S. Talmon "Divergences in Calendar-Reckoning in Ephraim and Judah," VT 8 (1958):48-74.

of its name.[13] There are not only exact numerical coincidences, but also the use of elements taken from the lunar astronomy, and textually positioned so we might consider them as intentionally chosen for emphasis. From that the proposed hypothesis seems probable, and it would be quite normal to think that those making the calculations selected from the exact astronomical data the numerical quantities that we have seen clearly evident in the censuses.[14]

Now, we can look for the origin of each of the given numbers concerning the tribes in both censuses. We saw the solar year (365, whence 730) mentioned in connection with the sanctuary offerings (Ex. 38:24) or with the Levitical census in Numbers

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[13]We know that the LXX, in the second census, gives for seven of the twelve tribes numbers which are very different from those of the MT, while keeping the final total. It is strange that the new number attributed to Benjamin is 35500. It seems that the translators have recognized in the number 35400 of the first census the "weak" value of the lunar year and have believed that it would be all right to give the "strong" value in the second census.

[14]It is possible to extend the study. For example, for the addition of the two totals, somewhat tempting, arising from the idea that 2 times 6000 makes the number 12 reappear, so the two totals of the censuses would give: 355 + 173 = 528. If we remember that 355 - 173 = 182, we can make comparisons with Genesis 5:28, that is if we think that the people who did the calculations had their attention set on the length of a quarter (91 days) and its multiples, that is 182 and 910 (Genesis 5:14). The total of the nine given numbers for the antedeluvian patriarchs in Genesis is 1056, twice 528. On the other hand, the addition 603,550 + 601,730 = 1,205,280 = (3300 x 365) + 780 would be intentional if we could reasonably assume a sound knowledge of the exact length of the year, and the idea that in 330 years there must have 78 leap years; an excellent calculation because the actual answer (better known now) is 80 leap years. The early error would have been only 2 days in 120,528. Other similar hypotheses are possible, but they are difficult to prove.

3. We also have seen relations between the annual lunar cycles (355 and 173 days) and the totals given for the twelve tribes. But to compare each tribe to one of the months of the year would not give us a suitable number for each of them. It would also be hard to see a comparison with other stars, as in Genesis 37:9. But it could have been feasible to look for numbers coming from other astral movements all round the heavens. The most interesting are those which measure the duration of the separate planetary cycles relative to the sun. Travelling across the vault of heaven the planets find themselves from time to time in the same corner of the sky as the sun, in positions where they cannot be seen because they are drowned in light. The Babylonians took careful note of this synodic periodicity. It is easy by making observations each morning before sunrise to see which planets are still to be seen even though they are still very close to the sun. The beginning or the end of each "hidden," "out of sight" phase can be noted. After a long number of years of accumulated and recorded observations, the calculation can be made of the average time between two passages "behind the sun." It is this average time that is called the synodic period of the planet under consideration (see Table 2, below).

Even if their goal was astrological in the first place, the Chaldeans gathered wonderful scientific observations that

we find in their records in complex but intelligible forms.[15] Certainly their methods of calculation were far from the preoccupation with the calendar which was of principal concern to Israelite Scholars. If the Israelites were interested in the planetary periods, it is because they were evaluating them in terms of numbers of days in order to compare them not only to the years like the Babylonians but also to the months and to the weeks of seven days. Scholarly circles among the Jews, those specifically linked with a priestly environment, and to whom we can attribute the numbers of the Pentateuch, had probably as much scientific knowledge coming from Babylon as the Greeks had. We can almost talk of Greek speaking "international scientific clubs" in the last centuries before Christ, that is, from Alexander onwards. The name of Berosus, in the third century, remains

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[15] In addition to the explanation of the results and the bibliography given in the study indicated in footnote 5 above, we can consult: B. L. Van der Waerden, "The Date of Invention of Babylonian Planetary Theory," Archive for the History of the Exact Sciences 5 (1968):70-78; and O. Schmidt, "A Mean Value Principle in Babylonian Planetary Theory," Centaurus 14 (1969):267-286.

most representative.[16]

In particular concerning the synodic periods of planets, these are expressed in whole numbers of days in the work of Cleomede (4th, or perhaps 1st century AD). The numbers are exact except the one for Jupiter which is 398 days instead of 399. It is very possible that these numbers, expressed in such an easily handled form, came from Babylonian calculations. Cleomede himself mentions in his work that it was Berose who gave the Chaldean astronomy to the Greeks.[17]

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[16] P. Schnabel, Berossos... (Leipzig-Berlin, 1923) with chapter X written on the Babylonian astronomy (pp. 211-245). A Jew like Flavius Josephus knew the role of Berosus. Contra Apion, I:129; edit. Thackeray (London, 1926), pp. 214f. Even if a kind of legend surrounds the name of Berosus, we cannot deny that a notable part of Babylonian knowledge, specially in the calculation of numbers, reached the Greeks. Cf. O. Neugebauer, "Ancient Mathematics and Astronomy" in C. Singer (ed), An History of Technology (Oxford, 1954; repr. 1965). Cf. pp. 798-803, "Babylonian astronomy."

Also we must mention as an example of this diffusion of the numerology of the Babylonian astronomy, the book of Hypsicles (2 centuries B.C.). "One of the few surviving examples of a Greek astronomical text employing a Babylonian arithmetical technique" says G. J. Toomer in JAOS 90 (1970):298, in giving an account of a work concerning Hypsicles.

[17] Cleomedes, Kyklickes theorias Meteoron, ed. H. Ziegler (Bibliot. Script. Graec., 1891). Berosus is mentioned in book II, at the beginning of chapter 4; pp. 180-183. The planetary periods are in the same book, chapter 7, pp. 226-229. Concerning Cleomede we can read O. Neugebauer "Cleomedes and the meridian of Lysimachia," Am. J. of Philology 62 (1941):344-347.

O. Neugebauer or his successors ought to be asked what the current state of research is on the date of Cleomede. Concerning the policy of spreading scientific knowledge (internationally) by Darius (and his successors), cf., Van der Wearden in Archive for the History of Exact Science (Springer Verlag; New York), vol. 1 (1968):70-78.

For the lunar and solar year, we have seen values arising natural observations, and numbers equivalent to a whole number of days plus a sizeable fraction (1/3 or 1/2 of a day). By contrast, the numbers given for the astronomical synodic planetary periods, were all five by chance close to a whole number of days. Not one varies more than a 12/100 of a day. The error involved in taking whole numbers is not too serious then. Even by multiplying several times whole numbers are not easily obtained. When we add the five periods expressed as whole numbers, we get exactly the whole number closest to the total arrived at by including every detail (that is, by including the fractions of days). If we suppose that the Jewish scholars worked on these known periods only in terms of whole numbers, as we also found in Cleomede's work, we can be assured of the exactitude of their additions or multiplications (by 2 or 3, even 4).

It is difficult for us to reconstruct the ancient mind when on the one hand it exactly followed the precision of astronomical data but on the other hand could consider combinations adapted to circumstances. It was as if they resized precious stones in order to arrange them in an ornamental design, without losing their original overall effect, and all by cutting some and by regrouping others.

With numbers it might be all a question of divisibility, but with planetary periods it is not so easy as we see below.

Table 2

	Synodical periods of the planets:					
	Mercury	Venus	Mars	Jupiter	Saturn	Total
	116	584	780	399	378	2257
divisor:	4	8	12	7	7	37
quotient:	29	73	65	57	54	61
alternative divisor:			3	3	3	
quotient:			260	133	126	

	Solar Year		Lunar Year	
	true	theoretical	long	weak
	365	364	355	354
divisor:	5	7	5	6
quotient:	73	52	71	59
alternative divisor:		4		2
quotient:		91		177

By reading previously in Exodus 38:24 the numbers 29 and 730 as being, the first, the value of a lunar month and the second, twice the solar year, we did not expect to observe that by a happy coincidence the timescale of 29 days (close to the lunar month which is 29 and 1/2 days) is only a quarter of the smallest of the planetary periods, namely that of Mercury, while 73, on the other hand, is the common divisor of 365 and of 584, the length of the Venus period.

The above table does not mention another similar case where 13 is the divisor of the Mars period: 780, and also of the theoretical length of the year 364 days. The calendar does not take account of the fact that 364 = 13 x 28. We have already

talked about the quarter 91 (= 7 x 13) and its multiples of 2 and 10. It is the multiple of 20, that is, 20 x 19 = 5 x 364 = 1820 which is the difference between the totals of the two censuses. We can write 1820 = 4 x 7 x 65. It is parallel with the period for Mars: 780 = 4 x 3 x 65. Such considerations could have been made by those who, while composing the numerical table of Genesis 5, wrote twice the number 65 (Gen. 5:15, 21) and started their table by the double number, that is 130 (Gen. 5:3). The likeness between 65 and 365 is also noticed in Genesis 5 when speaking of Enoch. We could even ask ourselves if some numbers taken from the book of Daniel could be combinations of 365 and 65. But this would not furnish an adequate explanation.[18]

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[18]This is about the numbers given in Daniel 7:14 (2300 evenings and mornings) and 12:11f. (1290 and 1335). We have to understand that the first means 1150 days. Three times we have equations with the numbers of the tribe from the second census (Table 5):

1150 = 420 (Reuben) + 405 (Gad) + 325 (Ephraim) = 420 + (2 x 365)
1290 = 222 (Simeon) + (2 x 534 (Asher))
1335 = 405 (Gad) + 605 (Zebulon) + 325 (Ephraim) = 605 + (2 x 365).

It is strange that we can obtain these equations by using the first three tribes of the list of Numbers 26 and similarly twice in relation to the length of the year. The element 65 can be found also:

1290 = (3 x 365) + (3 x 65)
1150 + 1335 = 2485 = (2 x 365) + (27 x 65) = 7 x 355 (lunar year.)

Total of the three numbers: 3775 = (5 x 365) + (5 x 390 (half of Mars's period)). So the three enigmatic numbers of Daniel seem to belong to a harmonious numerical system having the same tonality as that of the censuses.

The example of Genesis 5 is important mainly because it speaks of the length of the nine patriarchs' lives. They are three by three, in close relationship with the total of the five planetary periods, 2257. Specially if we examine the ten numbers obtained by adding, two by two, the periods, we see that two of them have the rare property of being like the number 2257, multiples of 37. 962 = 584 (Venus) + 378 (Saturn) and 777 = 399 (Jupiter) + 378 (Saturn). 962 and 777 are among the nine lifetimes of the patriarchs (Gen. 5:20, 31). Except for this last one justified in Genesis 5:20 & 31, and 365, all the other lifetimes form an homogenous group in order of importance (between 890, 970). The result is that when composing a set of numbers such as the ones for the twelve tribes of the censuses, we have to use the combinations which are obtained by adding two or three of the quantities expressing the basic astronomical periodicities and collected in the Table 2 above.

It is of course possible that, among the numerous combinations one set permits us to construct, there are chance coincidental results from combinations deriving from other sets. For example, out of the twelve numbers of the census, 66 pair each grouping two different numbers, can be made. Then by examining these 66 totals of pairs, quite by chance, some are found to coincide with certain among the 21 totals of pair calculated from seven given numbers (the five planets, the sun, and the moon). Chance will multiply these coincidences if other possible combinations

are included. We have to say, however, that this phenomenom is rare. Take 365 for example, it being a given that there is an absence of a factor [or divisor] common to much of the astronomical data.19 We have then to look for links between this data and the censuses of the book of Numbers while keeping an open mind as to whether these links were accidental or intentional. Depending on our finding, it is one or the other of these two hypotheses that will appear reasonable to us.

Since it is a serious possibility that the inclusion of two censuses, each one with its strange total, might be the fruit of a certain calculation deriving from elements such as 355 and 173, it will first of all be wise to ask ourselves if a similarity could exist between the planetary periodicities and the two censuses taken together.

Can we find some clues among the tribe numbers? We saw that, in the first census, Benjamin's number is the lunar year

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19Even without any astrological objectives, the ancient scientists would without doubt have liked to find simples proportions between the length of the year (the whole number 365) and that of the planetary periods. But the relations between these natural numbers are only the result of chance, and are not very simple. We can note the following:

3 x 365 = 399 (Jupiter) + (6 x 116 (Mercury))
2 x 265 = 584 (Venus) + 378 (Saturn) + (2 x 116)
8 x 365 = 5 x 584 = (3 x 780 (Mars)) + (5 x 116)
13 x 365 = 73 x 65 (12th of Mars's period)
= 2257 (total of the five planets) + (2 x 780)
+ (8 x 116)

354. On the other hand, a similarity exists with the solar year of 365 for the first number of this census (Reuben 465) as well as for the biggest number fo the second census (Judah 765). If this element 65 attracted attention, as we thought because of Genesis 5, we should note as a pointer from the second census the existence for Manasseh of 325 = 5 x 65, and the sum of Benjamin and Naphtali who have two almost equal numbers: 456 + 454 = 910 = 14 x 65 = 10 x 91 (quarters). The element 65 can be considered a planetary one because it is the twelfth of the only period which is divisible by 12, that of Mars (780). And 21 x 65 = 1365 (Num. 3:50).

As we mentioned before, there are two tribe numbers that we find used in both of the two censuses, that is, 405 and 534. Even more, if we recall Ephraim's number in the second census (325) we can, right away, see that by adding 405 to it we have 730 as a result; a figure that we found in Exodus 38:24 and which is the same as twice 365. As for the other common number, 534, it forms an interesting combination with the smallest numbers of the censuses, that is: 222 (Num. 26:14), to give 534 + 222 = 756 which is twice Saturn's period (378). So the two common numbers of the two censuses take on a particular significance in the second where one can write:

$$6000 = \frac{(405 + 325)}{2 \times 365 \text{ (sun)}} + \frac{(534 + 222)}{2 \times 378 \text{ (Saturn)}} + \frac{4514}{2 \times 2257} \text{ (total of the 5 planets)}$$

It seems that the total: 365 + 378 + 2257 = 3000, taken from natural astronomical data, had drawn attention to itself. By multiplying it by 2 we had a pattern for dividing 6000 into elements harmoniously tied to astral periodicities. This value of 6000 (multipled by 100 to give the 600,000 found in our text) and considered as a traditional datum, poses the problem of dividing it into twelve numbers, each with a particular significance in terms of its quantity. It is this type of problem which was behind the technique, so averse to our mind set, used by these ancient mathematicians in their calculations. When we study their work, "we are under the impression that the different calculations were made from the total sum before assigning values among the various numbers."[20] It belongs to a certain kind of work which seeks a literary effect by using numbers, and which seeks above all to express the perfection of the forefathers in theological terms; that is, it has to do with the perspective of the Divine activity which created men united in blessings just like the stars were created "with measure, number, and weight" (Wisdom 11:20).

The time has come to look in detail at the numbers of the first census.

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[20] This was said in another context by Ed. Dhorme, "L'aurore de l'histoire babylonienne," RB 23 (1924):534-556: cf. p. 554; published again: Recueil Edouard Dhorme (Paris, 1951) pp. 3-79; cf. p. 25.

Obviously we have to take into consideration our previous study of the tribes' numbers: Before the general multiplication by 100, we had two sets of twelve numbers of three digits each, the total being 6000 with 421 for Gad in Numbers 1 and 420 for Reuben in Numbers 26. On the other hand, the study of the statistical use of the numbers (from 0 to 9) leads us to think that the numbers were formed from pairs, preferably ending by 9 or 0.

The research then starts with the twelve numbers of the first census by examining the 66 pair that can be formed by taking two different numbers. We have identities among these 66 pair. Among them three are equals. They are equivalent to 949 (see Table 3 below). Among the others, we have, on one hand, two equals, with the value of 1167 (same table), and on the other hand, two other equals with a value of 1161 = 415 + 746 = 534 + 627.

These equalities could be attributed to chance but we observe that 949 is the sum of two astronomical periods: then that these three pair concern six numbers, other than the four numbers forming the two pair having a value of 1167; finally that 1167 is also tied to the planetary periods. These three coincidences imply that ten among the twelve numbers are tied to astronomical periods. The two remaining numbers are 354 (Benjamin) which is the lunar year and 465, the first one of the whole series.

They form a pair: 354 + 465 = 819 = 9 x 91 (quarter). Such a complete system of the relations among the six pair cannot be easily attributed to chance.

Table 3 (Numbers 1 & 2)

465 + 421 + 574 (= 4 x 365)
(=20 x 73)

354 746 593
819 1167 =1167 = 399 (Jupiter) + 378 (Saturn) + 390 (1/2 Mars)
(9 x 91)

544 + 322 + 534 = (2 x 584) + (2 x 116 (Mercury))
405 + 627 + 415
949 = 949 = 949 = 365 + 584 (Venus) = 13 x 73

The astronomical periods are linked, as we can see, in a fairly simple way to pair of numbers in the first census, especially to 949; 1167, however, is a little bit more complex. But we can examine the six numbers forming the left side of the table by separating the three forming the top line and whose total is a multiple of 365. Among the three of the bottom line, the first one is 354 (lunar year). The two others have together a value of 746 + 593 = 1339 = 949 + 390 (half the period of Mars) = 390 + (13 x 73). So the table shows, because of the twelve numbers, a division of 6000 into various multiples of 73 to which we have to add 354 (lunar year) and 390 (half the period of Mars). The multiples of 73 are: 4 times 949 plus 4 times 365; which is, 4 times 584 (Venus) plus 8 times 365;

or if we like, 9 times 584 = 9 x 8 x 73 = 72 x 73. We can write:

6000 = 354 (moon) + 390 (1/2 Mars) + (5 x 584 (Venus)).

Of course, we do not have any proof that the ancient mathematicians knew of such an equation.[21]

We can say the same about the following and very interesting observations. Suppose that we look for an equivalence to two complete series of the five planetary periods in [adding] the numbers of the first census. We already find in the two pair having a value of 1167 the following: 2 x 399 (Jupiter) plus 2 x 378 (Saturn) plus one Mars (see Table 3). Among the six pair of numbers having a total 949, the three forming the top line are twice 584 (Venus) and twice 116 (Mercury). The three numbers of the bottom line have a value of 405 + 627 + 415 = 1447. By taking away Mars's period (780), which is not included yet, we will have a remainder of 667. Since the first number of the set (465) has not yet been taken into account we add

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[21] We have noticed that by adding to 6000 the two common numbers from the two censuses, that is 405 and 534, we obtained 6939, the length of the Meton cycle. If we take these two tribe numbers in the second census and the 6000 in the first, we can then, in the latter only take eleven numbers of tribes, by leaving out Benjamin (354). Since 354 has a value of twelve lunar months, we come to 6939 - 354 = 6585. Instead of 235 lunations (Meton) we have for a result, from the eleven numbers of tribes of Numbers 1 and from the two numbers 405 and 534 taken in Numbers 26, the value of 223 lunations = 6585 days which are the Saros. Of course it is only a possibility and we cannot yet see any other clue that proves its actual presence in any calculations by the Israelites.

it to 667 and easily find a relationship with the astronomical periods, because 465 + 657 = 355 (lunar year) + 777 (Jupiter + Saturn, cf. Gen. 5:31). We can then write that:

$$6000 = (2 \times 2257) + 777 + 355 + 354.$$

We recognize 2257 as the total of the 5 planetary periods. The coexistence of the two values of the lunar year 355 and 354 is not at all abnormal, because a 355 day year is normally preceded and followed by those of 354 days.

Thus we find in the first census, a relationship between 6000 and 2257, parallel to the one already seen in the second census. The two relationships are exact because quite by chance there are equations between the astronomical numbers. For example, in this last relationship we can consider separately 399 (Jupiter) in 777, and note that 399 + 355 + 354 = 378 (Saturn) + (2 x 365), which makes us think of the above relationship found in the second census. It is therefore probably that at least one of these equations concerning 6000 and 2257 had already been taken into consideration by those who long ago compiled our sets of numbers.

Was this compilation possible? We have now to try to present an hypothesis to see if it works. We will start from the six pair considered in Table 3. But how could it be that from the

pairs' totals, taken (we suppose) from the astronomical data, the twelve numbers used for the tribes were derived, while endeavoring to make one different from the others? In fact these differences are often of significance. Let us take 222: It is a number from the second census, but it is also, strangely enough, equal to the difference between two numbers from the first census, and this occurs twice. We are talking about 544 and 322, and 627 and 405. These four numbers form two pair among the three having the same total 949. It is logical to think of a common structure. In Table 4 below we started from the relationship 949 = 700 (Mercury + Venus) + 166 (Mercury) + 133 (1/3 of Jupiter's period) with the division of 700 into 300 + 400 as it is natural. This also explains the compilation of the third of the pair of tribes number having 949 as a total.

For the two pair having a value of 1167, the calculation may have started from the two whole planetary periods of Jupiter 399 and Saturn 378 adding to each one half of the remainder 390 (half of the Mars period.) For one of the two pair 173 might have been included, which is a lunar period and it figures in the total of the second census. As far as the pair totalling 819 = 9 x 91 (quarter) is concerned it could have been divided into 5 x 91 and 4 x 91, that is 455 and 364.

We can see that such a process can produce the twelve numbers almost in the order that we found them in the first census.

Table 4

819		1167			1167	
455	364	399	378		399	378
		390 = 195	+ 195	=	195 +	195
		594	573		594	573
-10	-10	-173	+173		-1	+1
456	354	421	746		593	574
Reuben	Benjamin	Gad	Judah		Simeon	Zebulon

949		949		949	
300	400	300	400	300	400
+133	+116	+133	+116	+116	+133
433	516	433	516	416	533
+111	-111	-111	+111	-1	+1
544	405	322	627	415	543
Issachar	Ephraim	Manasseh	Dan	Asher	Naphtali

The Biblical writer could have modified this order to select a particular number for a particular tribe, or to obtain certain particular results when partial additions, like those on Chapter 2, were made.[22]

It only remains to examine in detail the twelve numbers of the second census. That is the homogeneous set formed by the numbers of the three significant digits, having 6000 for a total of which the first (for Reuben) has a primary value of 420, according to what we saw earlier.

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[22] In the article already noted (see footnote 3) we looked for what reasons had led -- from an arithmetical standpoint -- to a preference for some particular arrangement of numbers, which corresponded to the number of tribes in the census.

The phenomenon observed in the first census, that is, equal pairs linked to astronomical periods, is not found in the second census, except for 405 + 765 = 643 + 527 = 1170 = 18 x 65. This quantity of 65 (the twelfth of Mars's period) was, it seems, familiar to the mathematicians. We find it again in another pair which has for a total one of the numbers of the antedeluvian genealogy 454 + 456 = 910. 910 (Gen. 5:11) has a value of 10 quarters of 91 days and 14 times 65. The element 65 is present as we have seen in its multiple by 5, that is 325. Thus are seven tribe numbers directly relating to the element 65.

But two other pair of numbers have a total identical to one of the lifetimes found in Genesis 5. That is 605 + 325 = 930 (Gen. 5:5) and 644 + 325 = 969 (Gen. 5:27). Now it seems that the calculations in Genesis are intentional. There are five planetary periods, and there are five totals that we can obtain by adding four different periods. We have then, for the first four planets (Mercury, Venus, Mars, Jupiter) the sum 116 + 584 + 780 + 399 = 1879 = 910 + 969 = 454 + 456 + 644 + 325: four of the second census numbers.

We also had noticed that 222 + 534 = 2 x 378 (Saturn). We have then left two numbers which we have not yet mentioned: 420 and 605. They form a pair whose total can be written: 325 + 700. The sum of the two first planetary periods is 116

+ 584 = 700. We also notice the following equation: If we add to the two tribe numbers (222 + 534) that of Dan (644) we obtain: 222 + 534 + 644 = (2 x 378) + 644 = 2 x 700. If to that we add 420 + 605 we have for five of the tribe numbers the following sum: 1400 + 325 + 700 = 2100 + (5 x 65). So, by adding the tribe numbers two by two three times, we obtain with ease the result 700, the remainder being in multiples of 65; in all 60 times 65, that is 3900. If we remember the relationship between 700 and the periods of Mercury + Venus, we can write, starting with the second census numbers: 6000 = (60 x 65) + (3 x 700) = (5 x 780 (Mars)) + (3 x 116 (Mercury)) + (3 x 584 (Venus)). Of course we do not have any proof that this relationship was taken into consideration, but this relationship shows clearly that the set of the twelve numbers could have been formed according to a consistent system of relationships with the astronomical periods, while following the basic "given": namely, "divide 6000 into twelve numbers".

As far as the twelve numbers of the second census are concerned we can supply as an example one table from a range of possibles. It is interesting to consider, at the same time, the relationships with the planetary periods. We show them in the following table simply by putting the name of each planet.

Table 5 (Numbers 26)

Multiples of 65:	325		1170		1170		910		325		700	
Mercury + Venus:		700								700		
	+35	-35	585	585	585	585	455	455		-56	+56	
	360	665									378	378
	+60		-180		+58		+1				-156	
		-60		-180		-58		-1				+156
	420	605	405	765	643	527	456	454	325	644	222	534
Numbers 26:	Reu.	Zeb.	Gad	Jud.	Iss.	Man.	Ben.	Naph.	Eph.	Dan	Sim.	Ash.
Genesis 5:			↘	↓	↓	↙	↘ ↙ 910		↘ ↙ 969		↘	↙
							↳ 1879 = ↙					
Planetary periods:			2340 = 3 x 780 Mars				116 + 584 + 780 + 399 Merc. Venus Jup.				756 = 2 x 278 Sat.	

In this second census as in the first, the difference between the two numbers of the same pair can be significant. For example, for the two last numbers above, we twice see the amount 156, that is a fifth of 780 (Mars period). 156 is then 12 times 13 since the whole (Mars) period has a value of 60 times 13. 13 is found in the Jewish calendar since the year has 52 (4 x 13) weeks, a quarter having 91 days: 13 weeks.

For the four first numbers of the above table, we see not only multiples of 60, but also other complementary elements, apparently without any significance. The calculation of the two first numbers could have been done differently. On the other hand, in the third pair the difference 643 - 527 = 116 (Mercury period) appears as a deviation of +58 and -58, from

the average.

We have to examine if such an hypothesis, concerning the pair of numbers, provides an explanation of the mathematical feature of an abundance figures 4 and 5 and an almost complete absence of figures 0, 1, 8, and 9. It is true that 4 and 5 are easily obtained in the first census (Table 4) by considering the pair having a value of 819 and two of the three pair having a value of 949. The same can be said of the second census (Table 5) for the pair having a value of 910 and the first of the two pair having a value of 1170. Other appearances of 4 and 5 are the results of other quite different causes. For example, the digit 5 in 65 and also in 315; or because the elements 756 and 700 lead to the appearance of 56 which in turn leads to the appearance of two 4s in the number 644. And so by chance, normal astronomical data numbers make up the phenomenom.

So our analysis of arithmetical relationships ends by revealing a possible way of explaining the origin of the census numbers as being derived from astronomical data. Such an hypothesis is probable only if we have proof that the writers knew of such facts and had the means and the desire to do the necessary arithmetical calculations. It is reasonable to assume that

we have proof that this was the case.[23]

Indeed we know of the attention paid to the calendar in traditional Jewish priestly circles. If in the Pentateuch, we found numbers relation to lunar and solar periodicities, then we can assume that other numbers also came from such a source. All the same we have to take into account that some complex sets, like those in the genealogy in Genesis 5 or in the censuses, also use more diverse and rich materials. Then the use of the planetary periods ought to have been most attractive as a means of compiling a numerology for all the tribes of Israel.

Although the above tables are only hypothetical, they allow us to imagine what could have occured in certain stages of development, our lack of knowledge preventing us from making an exact reconstruction.

We can only propose limited and provisional conclusions. It is a bit like being in an archeological excavation when the several remains of an ancient monument can be seen without anyone's being able to say how it was planned or built. Yet we are able to guess at its function because of its situation, its materials, and the peculiarities of its structure.

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[23]All the references we have mentioned on the nature and diffusion of this astronomical knowledge are found again in O. Neugebauer, History of Ancient Mathematical Astronomy (Heidelberg and New York, 1975), 3 volumes.

The aim of the early books of the Bible was to convey the sacred status of the people of Israel. It was interesting that it was a living portrait yet unchangeable like the astronomical periodicities (Gen. 8:22; Jer. 31:35). It was a representation that was at one and the same time diverse (since each tribe had its own number) and harmonious (in terms of the whole). A mysterious image. Whether we are aware or not of its links with astronomy, it makes it presence felt to the reader. The numbers give a sense of strength and movement. In the text numbers follow each other, like the progress of a religious procession. The numbers have an evocative quality and a certain magic. It is the fascination quality of a complex mural captivating even those who cannot interpret it. Numbers are an international language. They stay the same, with their arithmetical properties, no matter in which field they are applied. They communicate across space and time from an early time to a later, conveying the same harmonies and proportions because of their given properties.

To use numbers that measured celestial movements seemed admirably suited to the sacred accounts of the tribes of the "children of Israel" who had become "Yahweh's armies" (Ex. 12:37, 41) marching around His Presence in the wilderness.