

THE NUMBER OF PEOPLE IN THE EXODUS FROM EGYPT: DECODING MATHEMATICALLY THE VERY LARGE NUMBERS IN NUMBERS I AND XXVI¹

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A mathematical analysis is given of the very large numbers of people at the Exodus from Egypt recorded in the book of Numbers. It is shown that if there were "273 first born Israelites who exceed the number of Levites" (Num. iii 43), then the total number of Israelite men aged over 20 in the census following the Exodus was about 5000, not 603,550 as apparently recorded in Numbers. The apparent error in Numbers arises because the ancient Hebrew word *ʿp* can mean "thousand", "troop", or "leader", according to the context. On our interpretation, all the figures in Numbers are internally consistent including the numbers at both censuses, the encampment numbers, etc. In addition we deduce that the number of males in the average Israelite family at the time of the Exodus was 8 to 9, consistent with the concern of the Egyptians that the Israelites had "multiplied greatly" whilst in Egypt (Exod. i 7). The total number of men, women and children at the Exodus was about 20,000 rather than the figure of over 2 million apparently suggested by the book of Numbers.

1. Introduction

The Old Testament book of Numbers records that Moses conducted a detailed census of the Israelite community that had come out of Egypt at the Exodus. The total number of male Israelites over twenty years old who were able to serve in Israel's army was 603,550 (Num. i 46). This implies a total number of men, women and children of at least two million. As is well known, there are substantial problems with accepting these figures as they stand for the reasons outlined briefly below (see Davies² for a recent review).

First, the numbers in Numbers appear to be internally inconsistent. For example, Num. iii 43 states that the number of firstborn males a month or more old was 22,279. However, if the number of males over twenty years old was 603,550, this implies a total number of males a month or more old of about one million, hence a ratio of all males to firstborn males of about 50 to 1. The average mother must then have had about 100 children (50 sons and 50 daughters). This is unlikely. Second, even allowing for heaven-sent manna, quail and water, it is difficult to imagine a population of two million people surviving in the desert for about 40 years. Third, other parts of the old testament state that initially there were too few Israelites to occupy the promised land (Exod. xxiii 29, 30) and that they were "the fewest of all peoples" (Deut. vii 7). Yet two million Israelites would have easily filled the promised land, and until the relatively recent Jewish immigration into Israel the total population of Palestine was only about one million.

For the above reasons, and others, it is difficult to accept the very large numbers in Numbers as they stand. The purpose of this paper is to give a new mathematical argument based on internal evidence within the book of Numbers which shows that about 5,000 males over 20 and about 1,000 Levites were involved in the Exodus. We will show that the numbers in Numbers are internally

¹ I am indebted to Professor K.A. Kitchen (Liverpool), Professor A.R. Millard (Liverpool) and Dr. E.C. Lucas (Bristol) for their detailed comments on a draft of this paper and to Dr. G.A.D. Briggs (Oxford) for helpful comments.

² E.W. Davies, "A mathematical conundrum: the problem of the large numbers in Numbers I and XXVI", *VT* 45 (1995), pp. 449-69.

consistent when properly interpreted. Our new theory also enables various alternative theories proposed by others to be assessed.

2. Different interpretations of the large numbers of Numbers

Some of the main interpretations suggested by others are outlined briefly below:

- (i) The figures are accurate. This has been argued by various scholars (e.g. Gispén³), but for the reasons given in section 1 above this interpretation seems unlikely.
- (ii) The figures are accurate but represent the population many years later, for example at the time of David (Dillmann⁴ Albright⁵). However, the numbers are still very large, and the internal inconsistencies referred to in section 1 above remain.
- (iii) The Hebrew word translated "thousand" (*'lp*) has been mistranslated and should have been translated as "family", "group", or "troop". Thus Flinders Petrie⁶ suggested that when the number of the tribe of Reuben is translated as forty-six thousand five hundred (Num. i 21), the correct translation should be 46 families containing 500 men. Mendenhall⁷ agreed with Petrie, except that he argued that the lists refer to men of military age, not the whole population. Clark⁸ and Wenham⁹ have proposed variations of the Petrie theory. Israel's total population leaving at the Exodus was 5,550 according to Petrie, over 20,000 according to Mendenhall, about 72,000 (Wenham) and about 140,000 (Clark).
- (iv) The numbers are based on astronomy and calendars. Barnouin¹⁰ in a detailed theory has suggested that the census numbers refer to combinations of the lengths of lunar years, solar years, planetary periods, etc. Although astronomy plays a larger role in biblical writing than is often realised (e.g. Humphreys and Waddington)¹¹ there is no evidence at all to support the ingenious theory of Barnouin.
- (v) The numbers are symbolic and based on gematria, in which each letter of the Hebrew alphabet is given a numerical value. Thus Holzinger¹² showed that the numerical value of the Hebrew letters in "the Israelite community" is 603 and in "all the men . . . who are able to serve in the army" (Num. i 3) is 551. Putting these together yields 603,551, which is very close to the census total of 603,550 of Num. i 46. However, this theory only explains one of the numbers in Numbers and even then only approximately. This approach is clearly contrived and there is no evidence to support it.
- (vi) The numbers are purely fictitious and greatly exaggerated to serve a theological purpose (as concluded by Davies p. 467). However, a prime theological purpose of the Exodus account is to demonstrate the power of God in defeating the Egyptian army at the Re(e)d Sea. Greatly exaggerating the number of Israelites is hardly consistent with this purpose. Nor is it consistent with the general statements in the Pentateuch which represent the Israelites who fled from Egypt as too few in number to occupy effectively the land of Canaan. The prime purpose of a census is to produce accurate numbers, hence tentatively we take the numbers in Numbers seriously even though there are gross difficulties in accepting the numbers as they stand.

³ W.H. Gispén, *Het boek Numeri I* (Kampen, 1959), pp. 29-34.

⁴ A. Dillmann, *Die Bücher Numeri, Deuteronomium und Josua* (Kurzgefasstes exegetisches Handbuch zum Alten Testament, 1886), p. 7.

⁵ W.F. Albright, *From the Stone Age to Christianity*, (Doubleday Anchor, Garden City, 1957) p. 253.

⁶ W.M. Flinders Petrie, *Researches in Sinai* (John Murray, 1906), pp. 207ff.

⁷ G.E. Mendenhall, "The census of Numbers 1 and 26", *JBL* 77 (1958), pp. 52-66.

⁸ R.E.D. Clark, "The Large Numbers of the Old Testament", *Journal of the Transactions of the Victoria Institute* 87 (1955), pp. 82-92.

⁹ J.W. Wenham, "Large numbers in the old Testament", *TB* 18 (1967), pp. 19-53.

¹⁰ M. Barnouin, "Les recensements du Livre des Nombres et l'astronomie babylonienne", *VT* 27 (1977), pp. 280-303.

¹¹ C.J. Humphreys and W.G. Waddington, "Dating the Crucifixion", *Nature* 306 (1983), pp. 743-746

¹² H. Holzinger, *Numeri* (Tübingen and Leipzig, 1903), pp. 5-6, 134.

3. The meaning of 'lp

In many languages the same word can have different meanings, with the meaning being determined by the context. Thus in English the word crab can mean sea crustacean, zodiacal constellation, nebula, wild apple, something that can be caught when rowing. The context usually makes clear the particular meaning intended, but evidently there is the potential for misunderstanding. Similarly in Hebrew the same word can have more than one meaning, but the situation is further complicated by the fact that the original Hebrew Old Testament manuscripts contained no vowels but consisted only of consonants. The vocalisation of this consonantal Hebrew text was formally carried out over one thousand years later by Jewish scholars, the Masoretes, in the sixth to tenth centuries A.D., based on oral and written traditions.

The consonants 'lp have a number of different meanings in Hebrew including the following:

- (i) 'lp (later vocalised as 'elep) means "a thousand". It has this meaning in Gen. xx 16, Num. iii 50, etc.
- (ii) 'lp (later vocalised as 'allup) means "leader" (chief, etc.). It has this meaning in Gen. xxxvi 15, Ps. 1 v 13, etc.
- (iii) 'lp (later vocalised as 'elep as in (i)) means "group" (family, clan, etc). It has this meaning in Judg. vi 15, I Sam. x 19, etc. Brown, Driver and Briggs¹³ suggest that this third meaning of 'lp is in the sense of a company of men united under a leader, which shows an interconnection between the various meanings of 'lp. Following others (e.g. Noth)¹⁴, if the group of men involved is a military unit we will refer to it as a "troop".

Noth suggests that the original meaning of 'lp was troop and later it became known as "thousand". In fact 'lp means "one thousand" in the Siloam Tunnel Inscription (c. 700 B.C.), in the Moabite Stone (c. 840 B.C.) and in other ancient Hebrew and Aramaic inscriptions. It has the same meaning in Ugaritic c. 1400-1200 B.C. (Millard, private communication). It would seem that 'lp has had several different meanings from ancient times (see Millard¹⁵ for a similar range of meanings of the equivalent word in Assyrian). We do not know whether or not the ancient Hebrews had different vocalisations to distinguish between the three different meanings of 'lp given above.

The possibility of misinterpretations arising because of the different meanings of 'lp can be illustrated from different English translations of 'lp in the Old Testament. For example, the AV and RSV translate 1 Sam. xxiii 23 as "all the thousands ('lp meaning (i)) of Judah" whereas the NIV translation is "all the clans ('lp meaning (iii)) of Judah". Similarly in Josh. xxii 14 the AV translates 'lp as "thousand", whereas the RSV and NIV have "clans". In both cases the latter interpretation seems preferable.

If bible translators can misinterpret 'lp as "thousand" (meaning (i) above) when "clan" is intended (meaning (iii)), there is clearly scope for a scribe copying an early Hebrew text to interpret 'lp as "thousand" (meaning (i)) when "troop" (meaning (iii)) was intended. We explore below for the first time which of these interpretations of 'lp makes sense mathematically.

4. A new mathematical analysis

Amid all the very large numbers in the book of Numbers, one figure stands out as being entirely reasonable, that is "the 273 firstborn Israelites who exceed the number of the Levites" (Num. iii 46). This very precise figure is reasonable not only because it is small, but it is also likely to be correct because redemption was involved, which would be taken very seriously. Each Levite symbolically redeemed each firstborn Israelite, but since there were 273 more firstborn Israelites than there were Levites, Moses collected 5 shekels (about 55 gm) of silver from the Israelites to redeem each of the excess 273 firstborn Israelites (Num. iii 4), making a total collected of 1,365 shekels, about 15.5 kg

¹³ F. Brown, S.R. Driver and C.A. Briggs, *A Hebrew and English Lexicon of the Old Testament*, p. 49.

¹⁴ M. Noth, *Numbers*, tr. by J.D. Martin from *Das vierte Buch Mose, Numeri*, 1966 (SCM Press, 1968), pp. 20-23.

¹⁵ A.R. Millard, *The Eponyms of the Assyrian Empire 910-649 B.C.* The Neo-Assyrian Text Corpus Project, 1994, p. 9.

(Num. iii 50). All of these figures are consistent and the total weight of silver is not unreasonable. We therefore tentatively take the figure of 273 as historical and explore the implications of this figure on the total number of Israelites. First, we write down the key equation:

$$I_f - L = 273 \quad (1)$$

where I_f = number of firstborn Israelite men, L = number of Levite men.

It should be noted that Num. iii 39 and iii 43 make it clear that I_f and L refer to males older than 1 month. Presumably because of the relatively large numbers of deaths at birth and in the first month of life, it was convenient to count only those older than 1 month. Hence throughout this paper, numbers of people refer to those older than 1 month, unless otherwise stated.

A detailed mathematical analysis of the situation based on equation (1) is inappropriate since we do not have good enough data, but we can make some reasonable estimates which enable a figure for the numbers involved at the Exodus to be deduced which is consistent with equation (1). In order to solve equation (1) we need to estimate

$$\text{Number of Israelite men/Number of Levite men} = I/L$$

Ancient Israel had a twelve tribe system (traditionally descended from the twelve sons of Jacob) and one of these tribes was the Levites. The census in Numbers of "the number of Israelite men" excluded the Levites, who were counted separately (Num. i 47). It is reasonable to assume that the number of men in eleven tribes was approximately eleven times the number of men in the one Levite tribe. Hence

$$I = 11L \quad (2)$$

We also need to estimate the following quantity:

$$\text{Number of Israelite men over 20 years old/Number of Israelite men} = I_{20}/I$$

It is a well known statistic that for many countries in the world with a high birth rate about half the population is aged under 20. The Israelites in Egypt had a high birth rate (Exod. i 7) hence we assume, to a first approximation, that the same statistic applied to them, thus

$$I = 2 I_{20} \quad (3)$$

There is one final number we need to estimate in order to solve the problem:

$$\text{Number of Israelite men/Number of first born Israelite men} = I/I_f = n \quad (4)$$

Since we cannot easily estimate n we perform some analysis:

$$\text{From equations (1) and (2): } 11 I_f - I = 11 \times 273 = 3003$$

$$\text{From equation (4): } I(11 - n) = 3003n \quad (5)$$

$$\text{From equation (3): } I_{20}(11 - n) = 1501.5n \quad (6)$$

Also, from equations (2) and (5):

$$L(11 - n) = 273n \quad (7)$$

In Table 1 we have tabulated values of I_{20} (the number of Israelite men older than 20 years) and L (the number of Levite men) from equations (6) and (7) for values of n in the range 1 to 10 using equations (6) and (7). We note from these equations that since the number of men must be positive,

then n must be less than 11. Hence the problem noted in the Introduction, that the numbers in Numbers imply an average number of men per family of 50, which is biologically unlikely, is now ruled out by our mathematical analysis which shows that this number must be less than 11. The significance of Table 1 is that it gives figures for the number of men over 20 at the Exodus, the number of Levites and the number of men in the average Israelite family which are internally consistent with the key figure of 273 (Num. iii 46) mentioned above. For example, if the number of men over 20 at the Exodus was 150, then Table 1 shows that there were also 27 Levites and the number of men in the average Israel family was one. Conversely Table 1 shows that there cannot have been both 4004 men over 20 and 102 Levites at the Exodus, because 4004 men over 20 corresponds to 8 men in the average family and 102 Levites corresponds to 3 men in the average family, which is clearly inconsistent.

Table 1 (and the underlying equations 6 and 7) can therefore be used to test various possible interpretations of the numbers in the book of Numbers, and to eliminate interpretations which are internally inconsistent. In particular, if *'lp* is translated "thousand" then this yields the figures of 603,550 men over 20 (Num. i 46) and 22,000 Levites (Num. iii 39). We can eliminate this interpretation because the figures are totally inconsistent with Table 1. We now test the figures yielded by translating *'lp* as "troop".

5. Should *'lp* be translated "thousand" or "troop" in the census figures in Numbers?

5.1 Table 2 gives the numbers of men over 20 years old recorded at the first census (Num. i 46), interpreted in two ways: (i) if *'lp* is translated as "thousand" and (ii) if *'lp* is translated as "troop". If *'lp* is translated as "troop" then the total number of men aged over 20 is 5550. We note from Table 1 that this implies an average family size of between 8 and 9 men per family (men aged over 1 month), the actual number being 8.7 (from equation 6). This number is consistent with the small amount of available evidence. When Jacob was in Egypt his 12 sons had a total of 57 sons, i.e. an average of about 5 sons per family. Exod. i 17 emphasises that subsequently the Israelites "multiplied greatly" in Egypt, hence a figure of 8 to 9 men per family is not unreasonable at this period of time. It may be of interest to note that this figure is close to the average number of men aged over 20 per troop which from Table 2 is about 9. If about 50% of the population was under 20 this implies that each troop comprised the men of military service age (over 20) of about 2 families. The small size of about 9 men per troop is consistent with broadly contemporary information about troop sizes in ancient texts. For example, in the El-Amarna tablets¹⁶ king Rib-Addi of Byblos asked the king of Egypt for a contingent of troops of twenty men each (108.66f.) and on another occasion (133.16f.) he asked for a troop of ten men from Nubia. The overall average of 9 to 10 men per troop in Table 2 and the departures from this average in the men per troop for each individual tribe are what one might expect from the setting up of troops in the desert taking into account tribal relationships, particularly if one troop was composed of two families of men of military age, as suggested above. The interpretation of *'lp* as "troop" is therefore consistent with the numbers of military men in the first census.

5.2 Numbers of Levites

A major test of the interpretation of *'lp* as "troop" is whether the same average size of 8.7 men per family deduced above for the military census also predicts correctly the numbers of Levites, with *'lp* again interpreted as "troop". Substituting $n : 8.7$ into equation (7) gives for the number of Levites:

$$L = 273 \times 8.7 / (11 - 8.7) = 1041 \quad (8)$$

¹⁶ J.A. Knudtzon, *Die El-Amarna Tafeln* (Leipzig, 1915), pp. 480, 565.

From Table 3, the number of Levites, interpreting *'lp* as troop (or team, see below), is 1000. This agrees so well with equation (8) that the interpretation of *'lp* as troop is confirmed. None of the other theories mentioned in section 2 fits the mathematical analysis presented here, whereas the interpretation of *'lp* as troop fits extremely well. In particular there is high internal consistency of all the numbers, including 273.

We can now check the assumptions we made in performing the mathematical analysis in section 3. In equation (3) we assumed that about half the male population was under 20 years old. From Table 2, the total number of military men over 20 was 5550. Hence if our assumption is correct, the total number of males (excluding the Levites) older than one month should be:

$$I = 2 \times I_{20} = 2 \times 5550 = 11100$$

In equation (2) we assumed that the total number of males (excluding the Levites) was eleven times the number of Levite males. Hence the number of Levite males should be:

$$L = I/11 = 11100/11 = 1009$$

which fits remarkably well the figure of 1000 in Table 3. Hence the assumptions we made appear to be justified and our interpretation is highly self-consistent.

It is clear that the average number of men per "troop" of Levites (48 from Table 3) is very much higher than for the military men. This is not surprising. A military troop is very different from a priestly troop (and clearly "troop" is not the correct term in the latter case) and there is no reason why a "team" of priests should have the same number of men as a military troop. In addition, one would expect large variations in team sizes according to the job function. It is clear from the Book of Chronicles that at a later period of time there were rather large teams of priests (for example 93 gatekeepers, I Chron. xxvi 1-12), consistent with the larger teams in Table 3.

5.3 *The second census*

For completeness we consider the second census (Num. xxvi) taken about forty years after the first census. The numbers are given in Table 4. Interpreting *'lp* as troop again, the numbers give 596 troops of 5730 military men, with an average number of 9.6 men per troop. This compares with the first census numbers of 598 troops containing 5550 men, with an average 9.3 men per troop. These figures are consistent with a static population in the harsh desert conditions and the numbers are fully compatible with interpreting *'lp* as troop.

6. *An assessment of the theories of others*

The mathematical analysis presented here shows that the very large numbers in Numbers, obtained by translating *'lp* as 1000, cannot be correct because they are inconsistent with there being "273 first born Israelites who exceed the number of Levites". Petrie was the first to suggest that *'lp* should not be translated as "1000" but he effectively translated it as "family" instead of "troop". The numbers Petrie obtained are inconsistent with the analysis presented here, in particular with the key figure of 273. In addition, it is clear that the censuses in Numbers refer to men of military age (over 20) and hence the more appropriate name is "troop" and not "family". Our mathematical analysis shows that the size of a troop was about twice the number of males over twenty in a family. Our analysis supports the theory of Mendenhall, except that he believed the figures referred to the population many years later. (Mendenhall initially dated both censuses to the period of the Judges, but later he modified his position and dated them to the period of the early Israelite monarchy).¹⁷ We see no reason to doubt that the numbers refer to the figures in the wilderness period after the Exodus,

¹⁷ G.E. Mendenhall, "Social Organisation in Early Israel" in F.M. Cross *et al* (ed.) *Magnalia Dei: The Mighty Acts of God, Essays on the Bible and Archaeology in Memory of G. Ernest Wright* (Garden City, 1976) pp. 147-8.

which also maximises the time for the correct interpretation of *'lp* as "troop" to be forgotten (see section 8 for further discussion). The theories of Clark and Wenham are inconsistent with the key figure of 273 and hence are rejected.

The theory of Mendenhall is therefore the only theory with numbers compatible with the mathematical analysis presented here, and the agreement with our analysis is extremely good. We therefore take this to be the most probable interpretation, with the important caveat that the census figures refer to the numbers at the time of the Exodus and not at a much later period of time.

7. *The correct interpretation of the census and encampment numbers*

We have shown that in the census numbers *'lp* should be interpreted as "troop" rather than "thousand". In both cases *'lp* was later vocalised to *'elep*. Although in normal usage the context would usually distinguish which meaning of *'lp* was intended, we suggest that the original text in Numbers was particularly liable to misinterpretation because *'lp* was used with two different meanings as detailed below. We do not know whether or not the original vocalisation distinguished between *'lp* (troop) and *'lp* (thousand).

Num. i 21 gives the number from the tribe of Reuben as 46,500. From Table 2 we suggest this should be interpreted as 46 *'lp* (troops) and 500 men, hence there were 500 men in the tribe of Reuben over 20 years old. Adding the tribal figures, Num. i 46 gives the total number of Israelite men over 20 years old as 603,550. From Table 2 we suggest the total in the original text was of the form 598 *'lp* (troops) and 5 *'lp* (thousands) and 550 men, and the original readers understood that there were 598 troops containing 5550 men. At a later date, when the original meaning was lost, a scribe conflated the numbers and ran together the two *'lp* figures (598 + 5), to yield 603 thousand, not realising that two different *'lp* meanings were intended. Similarly, we suggest that "603,550 men" in Exod. xxxviii 26 was originally 598 *'lp* (troops) and 5 *'lp* (thousands) and 550 men. We suggest the rounded total of "about 600,000 men" (Exod. xii 37) was a rounded up version of 598 *'lp* (troops) misinterpreted as 598 *'lp* (thousands).

Chapter two of Numbers divides the troops into north, south, east and west camps. We suggest the original numbers can be deduced as follows. Num. ii 1-9 states there were 74,600 military men in the tribe of Judah, 54,400 in the tribe of Issachar and 57,400 for the tribe of Zebulun, making a total of 186,400 military men in the east camp. We suggest the correct interpretation is 74 *'lp* (troops) and 600 men for Judah, 54 *'lp* (troops) and 400 men for Issachar, 57 *'lp* (troops) and 400 men for Zebulun, yielding a total of 185 *'lp* (troops) and 1 *'lp* (thousand) and 400 men. This was later conflated to 186,400 men, although 1400 men was originally intended. Similarly, in the south camp these were 1450 men, in the west camp 1100 men and in the north camp 1600 men. These figures are plausible and reasonable, and we have explained how the misinterpretation has arisen. The total number in the camps is then 5550 men, in exact agreement with the numbers in the first census.

8. *Objections to the present approach*

The conclusions of this paper support and extend the interpretation of Mendenhall with the important difference that it is suggested that the census numbers refer to the figures in the wilderness period shortly after the Exodus and not to the population many years later, at the time of the Judges or early monarchy. Various scholars, for example Davies and Fouts,¹⁸ have strongly criticised Mendenhall's theory and it is instructive to analyse these criticisms.

Davies (p. 463) states "In the first place, while there is ample evidence that the term *'elep* can refer to a tribal sub-division, it is by no means clear that this term was used specifically to designate a fighting unit levied from a particular tribe". However, the use of *'elep* to designate a fighting unit levied from a particular tribe seems to be clearly indicated in Num. xxxi 5 "So there

¹⁸ D.M. Fouts, *The use of large numbers in the Old Testament, with particular emphasis on the use of 'elep*. (Th.D. thesis, Dallas Theological Seminary, 1992).

were selected out of the tribes of Israel a thousand men (or a troop, *'elep*) from each tribe, twelve thousand (or twelve troops, *'elep*) armed for war".

Davies (p. 463) also states "secondly, on Mendenhall's hypothesis, some of the fighting units in Num. i and xxvi would have been extremely small . . . for example, each unit in the tribe of Simeon would have consisted of just five men . . . the largest unit in the first census (Gad) would have consisted of only fourteen men... ." However, we have already noted the references in the El-Amarna tablets to troops of twenty men and of ten men. Hence, there is clear evidence that in early times troop sizes could be very small. We do not doubt that in later times troop sizes were larger. The variations in troop sizes (from five to fourteen in the first census) are what one might expect in selecting small coherent fighting groups, particularly if each troop comprised the men of fighting age of two families, as suggested in section 5.1. The average troop size (9.3 men in the first census and 9.6 in the second census) is remarkably close to the figure of ten men in the troop referred to in the El-Amarna tablets.

The third criticism of Davies (p. 464) is that "it is difficult to explain, on Mendenhall's hypothesis, why the relative size of the fighting units should diverge so widely between the census recorded in Num. i and that recorded in Num. xxvi. For example, in Num. i, Simeon would have had just five men per unit, but according to Num. xxvi, the same tribe would have had nine men per unit". Davies may be correct that this is difficult to explain on Mendenhall's theory, in which the censuses refer to the time of the monarchy, but it is not difficult to understand on the present theory where the censuses refer to the wilderness period and the two censuses are one generation apart. At the first census (see Table 2) Simeon had 59 troops containing 300 men, hence 5 men per troop. At the second census (see Table 4) Simeon had 22 troops containing 200 men, hence 9 men per troop. The reduction in the size of the tribe of Simeon may be consistent with the story of the plague which killed 24,000 men, that is on our interpretation 24 troops (Num. xxv 9), shortly before the second census. The plague was a result of the immorality of Israelite men, and since Zimri the Simeonite achieved particular notoriety in this (Num. xxv 14) the tribe of Simeon may have been particularly subject to the plague, and the census numbers may have indicated this. Whether or not this explanation for the reduced size of the tribe of Simeon is correct, the reduced population of Simeon regrouped into fewer troops each containing a larger number of men. This seems to be eminently reasonable.

Davies' fourth criticism (p. 464) is that the high numbers are equally problematic in the case of the Levitical census recorded in Num. iii 14-39, and that *'elep* can hardly be understood in the sense of a "fighting unit" here. We agree with Davies that *'elep* cannot be understood in the sense of "fighting unit" when applied to the Levites. However, as explained earlier, *'elep* is a generic term meaning group, clan, troop, team, etc. Clearly we should choose the appropriate term for a group of Levites, such as "team". The numbers of Levites per team is not problematic as explained in section 5.2.

Davies' (p. 465) final criticism of Mendenhall's theory is that if it were correct then it might be expected that the high numbers elsewhere in the Old Testament would be capable of a similar explanation and he cites I Chr. xii 23-40 as a situation where this is "patently not the case". However, we suggest that every example of very large numbers in the Old Testament, and indeed in other ancient literature, should be treated on its merits and considered in its context. It does not necessarily follow that our explanation of the very large numbers in the census in Numbers is applicable elsewhere, because as pointed out in section 7 the potential for confusion in Numbers is particularly high, with *'lp* used with two different meanings in the same sentence. The figures in I Chr. xii 23-40 do not have the intricate and interlocking structure of the census figures in Numbers, and they are from a later period of time (on our theory although not on Mendenhall's). In addition, the figures differ in the Hebrew text and in the Peshitta text¹⁹ so that the "original" figures are not clear. Whether or not *'lp* should be interpreted as troop in I Chr. ii 23-50 requires further investigation, independently of whether *'lp* means troop in the census figures in Numbers, for which we have given detailed arguments. However, it is worth noting that in the present paper we have

¹⁹ G.M. Lamsa, *Holy Bible from the Ancient Eastern Text* (Harper and Row, 1933), p. 460.

suggested that *'lp* should have been translated as troop instead of thousand on over 40 different instances in the Old Testament (in the numbers for each tribe in each census in Numbers, in the encampment numbers and in various isolated verses, e.g. Exod. xii 37 , xxxviii 26, Num. xxv 9, etc.). There are many other verses we could have referenced in which apparently very high numbers can be explained by interpreting *'lp* as troop or group. Finally, Davies (pp. 465 and 466) makes the general point "The basic weakness in the type of approach exemplified by scholars such as Petrie and Mendenhall is the implicit assumption that the numbers in the two census lists are to be interpreted in historical terms . . . such an approach is misconceived and, it represents a complete misunderstanding of the Priestly writer's aim . . . the numbers are purely fictitious and were simply invented, possibly by the Priestly writer himself". However, how credible is it that the Priestly writer would simply invent improbably large numbers and ascribe these not to a battle, where exaggeration may be understandable, but to a census, the whole purpose of which is to produce exact numbers? It is suggested that it may be a disservice to any writer to attribute to him an invented and fictitious text when there is a logical, coherent and historical interpretation of what he has written. In this paper we have provided an alternative theory to that of Davies which accounts in detail for the numbers in both censuses and the encampment numbers. We have also answered all the criticisms Davies makes of this approach. Our new mathematical analysis shows that the numbers in Numbers become remarkably consistent in considerable detail if *'lp* is interpreted as "troop", which we also demonstrate is a valid interpretation from a consideration of the Hebrew. A summary of our conclusions is given below.

9. Summary and Conclusions

- (i) A new mathematical analysis is presented of the large numbers of people at the Exodus recorded in the book of Numbers.
- (ii) This analysis is based on assuming to be correct the statement in Num. iii 46 that there were "273 firstborn Israelites who exceed the number of Levites". This statement, plus some reasonable assumptions, leads to mathematical equations for the number of men of military age (over 20 years) and for the number of Levite men which can be compared to the corresponding figures given in Numbers.
- (iii) The comparison demonstrates that the word *'lp*, which has a range of meanings, should have been interpreted as "troop" rather than "thousand". It then follows that the total number of military men aged over 20 years in the census following the Exodus was 5550 not the 603,550 recorded in Numbers.
- (iv) Another figure to emerge from this mathematical analysis is that there were 8 to 9 males (aged over one month) in the average Israelite family at the time of the Exodus, which is consistent with the Israelites multiplying greatly while they were in Egypt (Exod. i 7).
- (v) The average number of military men (aged over 20) per troop was about 10, which is consistent with the known sizes of military troops at that time from the El-Amarna tablets. It is suggested that a troop may have comprised the men of military age from about two families.
- (vi) The number of Levite men (over one month old) in the census was 1000 rather than the 22000 recorded in Numbers. The average size of a team of priests was about 50.
- (vii) The analysis supports and extends the theory of Mendenhall except that we suggest the figures refer to the time of the wilderness period following the Exodus rather than to a later period as in the Mendenhall theory.
- (viii) If there were 5550 men aged over 20 at the Exodus, this implies a total of about 10,000 men aged over one month and hence about 20,000 men and women. To this must be added the 1000 Levite men aged over one month and about 1000 Levite women. Therefore, as a round number, the total of men, women and children at the Exodus was about 20,000.

Table 1
*Relation between numbers at the Exodus and the average
number of men in an Israel family*

n	1	2	3	4	5	6	7	8	9	10
I ₂₀	150	334	563	858	1251	1802	2631	4004	6757	15015
L	27	61	102	156	228	328	478	728	1228	2730

Note on Table 1:

n = number of men in the average Israelite family at the census 13 months after the Exodus

I₂₀ = number of Israelite men over 20 years old at the census

L = number of Levite men at the census

I₂₀ and L are calculated from equations (6) and (7) respectively. These equations also show that n must be less than 11.

Table 2
*Numbers of military men at the first census
(thirteen months after the Exodus. Num. i 1-46)*

Tribe	Numbers if 'lp = 1000	Numbers if 'lp = troop		Men per troop
		Number of troops	Number of men	
Reuben	46,500	46	500	11
Simeon	59,300	59	300	5
Gad	45,650	46	650	14
Judah	74,600	74	400	8
Issachar	54,400	54	400	7
Zebulun	57,400	57	400	7
Ephraïm	40,500	40	500	12
Manesseh	32,200	32	200	6
Benjamin	35,400	35	400	11
Dan	62,700	62	700	11
Asher	41,500	41	500	12
Naphtali	53,400	53	400	8
Total	603,550	598	5550	9.3

Notes on Table 2:

The numbers above refer to the number of military men over 20 years old (I₂₀). Because the descendants of Levi were excluded from this military census, the descendants of Joseph are listed according to the families of his two sons, Ephraim and Manesseh (Num. i 32). In this way the traditional tribal number is maintained at twelve, and Joseph is given the "double-portion" of the ranking heir.

Table 3
Number of Levites at the first Census (Num. iii 21-39)
(The numbers below refer to the number of Levite men over 1 month old)

Tribe	Numbers if 'lp = 1000	Numbers if 'lp = "team"		Men per team
		Number of teams	Number of men	
Gershon	7,500	7	500	71
Kohath	8,300*	8	300	38
Merari	6,200	6	200	33
Total	22,000	21	1000	48

* Hebrew manuscripts give 8,600 and some Septuagint manuscripts 8,300. Most commentators accept that 8,600 is a corruption of 8,300 or else the numbers do not add up to 22,000 (Num. iii 39).

Table 4
Number of military men (over 20 years old) at the Second Census
(About 40 years after the Exodus. Num. xxvi)

Tribe	Numbers if 'lp = 1000	Numbers if 'lp = troop		Men per troop
		Number of troops	Number of men	
Reuben	43,730	43	730	16
Simeon	22,200	22	200	9
Gad	40,500	40	500	12
Judah	76,500	76	500	7
Issachar	64,300	64	300	5
Zebulun	60,500	60	500	8
Ephraïm	32,500	32	500	15
Manesseh	52,700	52	700	13
Benjamin	45,600	45	600	13
Dan	64,400	64	400	6
Asher	53,400	53	400	8
Naphtali	45,500	45	500	9
Total	607,730	596	5730	9,6