

## Biblical chronology

I noted with great interest the two articles, in the Viewpoint section in issue 21(1) of the *Journal*, dealing with the Chronology of the 430 years of Exodus 12:40. The two authors, Mike Viccary and David Austin, together make a compelling case for the point of view that the 'Egyptian sojourn' lasted only 215 years.

I was curious in another direction, however. We read in Exodus:

'Now these are the names of the children of Israel who came to Egypt; each man and his household came with Jacob: Reuben, Simeon, Levi, and Judah; Issachar, Zebulun, and Benjamin; Dan, Naphtali, Gad, and Asher. All those who were descendants of Jacob were seventy persons (for Joseph was in Egypt already). And Joseph died, all his brothers, and all that generation. But the children of Israel were fruitful and increased abundantly, multiplied and grew exceedingly mighty; and the land was filled with them' (Exodus 1:1-71).

So the *LORD* blessed the descendents of Jacob and the population grew rapidly and filled the land. As we read further, it was this population growth that frightened the Egyptians and they afflicted the Israelites in an attempt to control them. Then we read:

'But the more they afflicted them, the more they multiplied and grew' (Exodus 1:12a).

Then Pharaoh tried to force the midwives to kill the male children, but this plan too, was thwarted:

'Therefore God dealt well with the midwives, and the people multiplied and grew very mighty' (Exodus 1:20).

This whole period of time saw the Israelites multiply so that on the actual day of the Exodus itself, we read:

'Then the children of Israel journeyed from Rameses to Succoth, about six hundred thousand men on foot, besides children' (Exodus 12:37).

It is estimated and widely accepted that, including wives and children, about *2 million people* began the Exodus journey out of Egypt. So my curiosity was piqued about the amount of time needed to produce such a population. What would be the rate of growth to do this and would it be a realistic value, i.e. in harmony with what we already know about population growth rates throughout history. I assumed that the 70 descendants of Jacob with their wives and children would number  $3 \times 70 = 210$ . This would be the starting population. The rate of population growth at any instant is given by the differential equation:

$$dN/dt = rN$$

where  $r$  is the rate of increase in population;  $t$  is some stated interval of time;  $N$  is the number of the population at a given point in time. The algebraic solution of this equation is:

$$N = N_0 e^{rt}$$

where  $N_0$  is the starting population (210);  $N$  is the final population ( $2 \times 10^6$ );  $r$  is the rate of growth (unknown variable);  $t$  is elapsed time in years (215);  $e$  is the base of natural logarithms: 2.71828 ... . So, putting in the numbers we get

$$2 \times 10^6 = 210e^{215r}$$

Solving this for a value for  $r$ :

$$e^{215r} = 2 \times 10^6 / 210 = 9523.81$$

(to 2 dp)

Therefore

$$215r = \ln(9523.81) = 9.16$$

(to 2 dp)

and so

$$r = 9.16 / 215 = 0.0426$$

Finally, as a percentage, we arrive at  $r = 4.26\%$ .

This is a trifle high on historically observed growth rates. Some natural growth rates in third world countries

have been measured over 3%. Here, however, God said they would be fruitful and increase abundantly, multiply and fill the land. Every effort to control the population growth was overruled by God, so we gather from the biblical text that this was a prolific growth rate, ordained and insisted upon by God. This is also in harmony with the natural world and within the capacity of the human race to reproduce that fast, especially if the death rate was kept low, as seems to be the case here.

The 'doubling time' of the population would therefore be about *16 years*.<sup>2</sup> This is not unreasonable under the circumstances. However, we must accept that all these figures are (reasonable) estimates and not exact figures.

So, in conclusion, the period of 215 years in Egypt with a growth rate of 4.26% is in harmony with the possible range of human reproduction rates (live births minus deaths) to achieve a population of approximately 2 million at the Exodus.

All of this, of course, proves exactly nothing. It is merely an exercise of curiosity. It is a matter of seeing that God's word can be trusted, even in the smallest, unobvious details. What the Bible says, properly exegeted and understood in context, can be trusted. No aspect of the natural world is out of harmony with the biblical text and if God says they reproduced mightily, then they did—and 215 years is long enough to do it!

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### References

1. All scriptural quotations are from the NKJV.
2. The doubling time of the population would be when  $N = 2 \times N_0$ . Putting this in our exponential growth equation,  $N = N_0 e^{rt}$  we get:  $2N_0 = N_0 e^{rt}$  and so  $e^{rt} = 2$ . Therefore  $rt = \ln[2]$  where  $\ln[2] = 0.69$  and we already know that  $r = 0.0426$ . Therefore the Doubling Time,  $t = 0.69 / 0.0426 \approx 16$  years.