"Salutation to thee, generous one of Allah, 'Aisa spirit of Allah, Sālih beloved of Allah, first creation of Allah and seal of the prophets of Allah." And they pray and recite the fātihah. Then they enter the makām and cover the tomb with a piece of green calico, and the people enter in small parties and take a blessing by kissing the piece of calico, which they call the *tōb* (robe), and they repeatedly wipe their faces with it. And many people make lamentation upon the graves of their relatives buried in the vicinity of the makām. Some of the crowd sing together, others swing themselves from the trees, others watch the women promenading, while yet others use the opportunity to buy and sell at small stalls scattered around. So they occupy the time till the evening, when they return to the town (Ramleh) in the same order as they came —often not less than 5,000 people—with the soldiers accompanying them. The dervishes walk in front with the banner of Nebi Sālih, showing great excitement and shouting out, until they reach the Great Mosque, where prayers are quietly said, and everybody goes home.

(To be continued.)

MEASURES OF DISTANCE IN PALESTINE.

By Colonel Sir Charles Watson, K.C.M.G., C.B.

There is a matter in connection with the study of the geography of the Holy Land, which sometimes causes difficulty to those who are interested in the subject, and who wish to follow on a map the accounts of the topography of the country and of the relative positions of places referred to in the Bible, the Books of the Jewish historian Josephus, and the descriptions of other ancient writers. To an Englishman the word "mile" conveys the idea of an English mile, and the word "furlong" of an English furlong, and it is overlooked that, eighteen centuries ago, the mile and furlong were not the same length as in England at the present day. Then again, while the maps published by the Palestine Exploration Fund are

drawn in accordance with English scales, maps issued in France and some other European countries are usually compiled on a scale based on the metric system of measures. For reading maps in connexion with history it is very necessary to be familiar with the different measures, and to remember their relative lengths without having constantly to refer to some treatise dealing with them. A few remarks on the subject may therefore be of help to those who are interested in the question, and who have not had the occasion to devote themselves to a study of it.

Measures of length may be conveniently divided into two classes; first, the longer measures, such as the mile, the furlong, and the kilometre, which may be called measures of distance; and, secondly, the shorter measures, such as the yard, the foot, the inch, and the metre, used for buildings, for manufactures, and for domestic purposes. It is with the former measures that I propose to deal in this paper.

At what period measures of distance were first reduced to a regular system is not known, but they certainly date back to the remotest antiquity with which we are acquainted, and were as carefully fixed in the days of the Babylonians and of the ancient Egyptians as in the time of the Greeks and Romans. It is evident that such measures were originally used by some people who had a high degree of scientific knowledge, and who were aware of the fact that the earth was a sphere and not a flat surface, as supposed by more ignorant people who succeeded them. They must have had an acquaintance with astronomy and mathematics, and have been able to make use of the heavenly bodies for getting measurements of the earth, just as this is done at the present day, but how they acquired that knowledge is an unsolved problem.

There is an interesting passage in the *Antiquities of the Jews*, in which Josephus gives his solution of the question. After describing the creation of Adam and Eve, the murder by Cain of his brother Abel, and the birth of Seth, Josephus goes on to say:—"Now this Seth, when he was brought up and came to those years in which he could discern what was good, became a virtuous man, and, as he was himself of an excellent character, so did he leave children behind him who imitated his virtues. All these proved to be of good disposition. They also inhabited the same country without dissensions, and in a happy condition, without any misfortunes falling upon them until they died. They also were the inventors

of that peculiar sort of wisdom which is concerned with the heavenly bodies, and their order." And, in another place, Josephus says of Noah and his predecessors:—"God afforded them a longer time of life on account of their virtue, and the good use they made of it in astronomical and geometrical discoveries, which would not have afforded the time of foretelling the periods of the stars unless they had lived six hundred years; for the Great Year is completed in that interval."

Whatever may be thought of this explanation by Josephus, there can be no doubt that measures of distance were based on measurements of the earth, and on the ancient division of the circle into degrees, minutes and seconds. This division was founded on the equilateral triangle, which was regarded by the old mathematicians as of special importance, and rightly placed by Euclid in the first proposition of his First Book. The angle of an equilateral triangle is the unit of angular measurement, and, when the measurement of angles was taken in hand by the ancients, they divided this angle into sixty parts, the best possible number that could have been selected, as $60 = 3 \times 4 \times 5$, and is divisible by 2, 3, 4, 5, 6, 10 and 12. Each of the 60 parts was called a degree, each degree was divided into 60 smaller parts called minutes and each minute into 60 seconds. As the angle of an equilateral triangle is contained six times in a complete circle, the number of degrees in a circle was 360. This, which may be called the natural division of the circle, has been in use from the remotest antiquity to the present time, and it is improbable that it will ever be superseded by any other system.

At the time of the French Revolution of 1792, certain French scientific men thought they could improve on the ideas of their predecessors by dividing the circle into 400 degrees, each degree into 100 minutes, and each minute into 100 seconds. But, notwithstanding strenuous efforts to introduce it, the decimal division of the circle has proved a failure, and the ancient system continues in general use.

The manner in which measures of distance are based on the form of the earth is as follows:—If a circle is described, with the centre of the earth as its centre, passing through the north and south poles, it will be cut in half by the equator, and an arc of 90 degrees will be intercepted between the pole and the equator. The length of one-sixtieth of a degree, or 1 minute of arc, measured

on the surface of the earth along this circle, is called a geographical mile, and is the unit of measures of distance. If the earth were a perfect sphere, the length of a geographical mile would always be the same, but, as the diameter from the north pole to the south pole is a little less than the diameter across the equator, the circle, passing through the two poles, is not perfect, and, in consequence of this, the geographical mile varies somewhat, and increases from a length of 6,046 English feet at the equator to 6,108 English feet at the pole. Its mean length may be taken as approximately 6,075 English feet. We do not know whether the ancient astronomers of the East were acquainted with the fact that the earth was not a perfect sphere, but there can be no doubt that this length of 6,075 English feet was very nearly what was adopted in early times as the length of the geographical mile.

With the Greeks, the principal unit of measures of distance appears to have been the stadion, of which ten were contained in the geographical mile. The stadion was divided into six plethra, each plethron having a length of 100 Olympic feet. There were therefore 6,000 Olympic feet in the geographical mile, the Olympic foot being equal to 12·15 English inches. The Greek system of measures of distance was an admirable one, and it is to be regretted that it was not adopted by the Romans. But the latter made their land mile equal to eight instead of ten stadia, and also divided the mile into 1,000 paces, each pace of five Roman feet, the Roman foot being equal to 11·66 English inches. The word "mile" is derived from the fact that the Roman land mile was 1,000 paces, "mille passuum."

For measurement of distances by sea, however, the Romans adhered to the geographical mile of 10 stadia, and, in the Antonine Itineraries, while distances by land are given in Roman miles of 8 stadia, distances by sea are given in multiples of 10 stadia. In the Itinerary of the Bordeaux Pilgrim, written in the fourth century, while the land distances are in Roman miles, the pilgrim says, with reference to his voyage across the Adriatic Gulf from Macedonia to Italy: "trans mare stadia mille, quod facit milia centum," thus showing that he knew the sea mile was composed of 10 stadia.

The English mile, though it has the same origin, differs from both the geographical and the Roman mile. Like the latter it is divided into 8 stadia or furlongs, each furlong containing 660 English feet. But the English sea mile is the geographical mile, divided into 10 stadia, or, as we call them, cable lengths.

The last of the four measures of distance under consideration is the kilometre, which differs altogether from the other three. When the French Revolution took place at the end of the eighteenth century, it was one of the objects of the revolutionary party to obliterate the history of the world, and, as far as possible, to do away with the records of the past. It was decided that the idea of God was obsolete; a new calendar was started, dating from the year of the Revolution; the week was made to consist of ten days, and the day of ten hours; while, as has already been mentioned, the ancient and scientific division of the circle into 360 degrees, was changed to a new division into 400 degrees, each degree being divided into 100 minutes. The arc of the earth's surface measured on a great circle from the equator to the pole was thus made equal to 10,000 minutes, and it was decreed that the new measure of distance, which was to take the place of the old geographical mile, was to be the length of one new minute. The new geographical mile was called the kilometre, because it contained 1,000 metres, the metre being the primary unit of measures of length, and equal to $\frac{1}{10000000}$th part of the quadrant of a great circle from the equator to the pole. The length of the kilometre, as fixed by the French scientists is equal to 3280·84 English feet.

The following is a comparison of the four measures of distance which have been described above. The lengths are given to the nearest foot:—

	Olympic Feet.	Roman Feet.	English Feet.	Metres.
Geographical mile of 10 stadia	6000	6250	6075	1851
Roman mile of 8 stadia ...	4800	5000	4860	1481
English mile of 8 furlongs ...	5215	5432	5280	1609
Kilometre	3240	3375	3281	1000

It is useful to remember, for purpose of calculation, that the following relation is very nearly correct:—

20 Geographical Miles = 25 Roman Miles = 23 English Miles
= 37 Kilometres.

Now to turn to the practical side of the question. In books by Roman authors, the Roman mile of 8 stadia is usually given in mentioning distances by land, and the mile of 10 stadia for distances by sea. This rule is followed in the Antonine Itineraries, which are supposed to date from the fourth century, and, in the Peutinger

Tables, also believed to be of the fourth century, the land distances are in Roman miles. In the Bordeaux Pilgrim, written about A.D. 330, Roman land miles are used, except in a few cases, where the distances are given in Gallic leagues, which were equal to $1\frac{1}{2}$ Roman miles, or 12 stadia.

In the *Books* of Josephus, on the other hand, the author, who gives a large number of distances, almost invariably takes a length of 10 stadia, *i.e.*, the geographical mile, as the unit, and not the Roman mile. The distances given by Josephus are generally pretty correct, but in some cases are in error, either in consequence of a mistake in copying the manuscript or because he only gives the distance approximately.

For example he gives the length of the Jordan Valley, including the Lake of Tiberias and the Dead Sea, as 230 stadia, whereas he must have written 1230 stadia, as the distance measured on the map from the north end of the Lake of Tiberias to the south end of the Dead Sea is 1220 stadia. He gives the length of the Lake of Tiberias as 140 stadia and the breadth as 40 stadia. The actual length at the present time is 115 stadia, and the extreme breadth 65 stadia, but it is possible that he may have referred to the breadth opposite the city of Tiberias, which is 45 stadia.

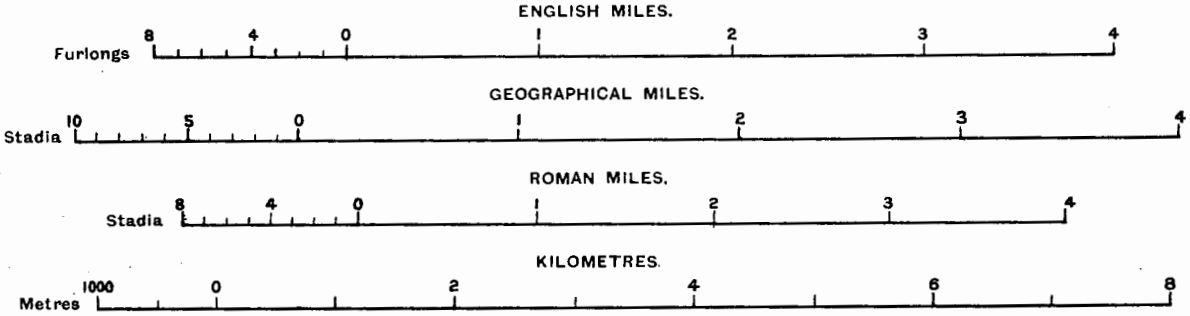
Josephus gives the distance from Jerusalem to Caesarea as 600 stadia. This may be compared with the distance of 73 Roman miles, or 584 stadia, as noted by the Bordeaux Pilgrim. As measured on the map the distance is 580 stadia, but it may have been a little more, as one cannot be sure of the exact line of road referred to. Again Josephus gives the distance from Jerusalem to Jericho as 150 stadia, while the Bordeaux Pilgrim makes it 18 Roman miles, or 144 stadia. The actual distance is 145 stadia.

Other instances might be given, but the above are sufficient to show that the distances given by Josephus, when compared with actual distances measured on the map, are very helpful in fixing the position of places mentioned in the *Antiquities* and the *Wars of the Jews*.

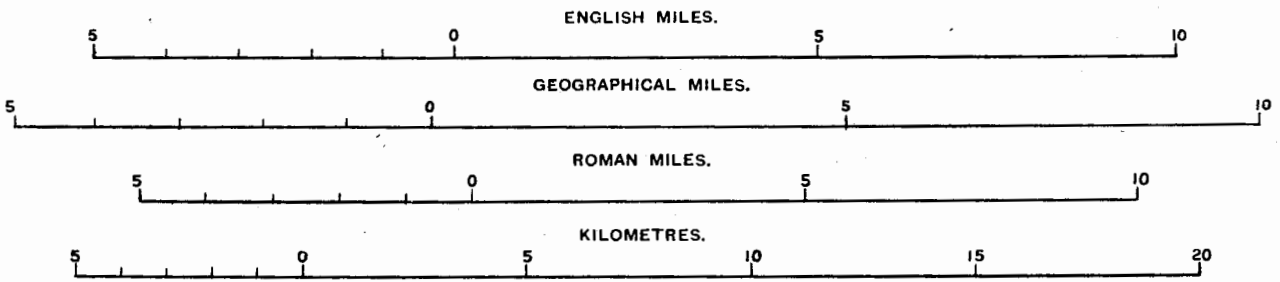
The distances given in the Bible are few, but, such as they are, they appear to be based on the same unit as those in Josephus. For example, it is stated in Luke xxiv, 13, that the village of Emmaus was 60 furlongs from Jerusalem. Josephus gives this distance as 60 stadia, and this is the actual distance to El-Kubeibeh, which is now generally accepted as the site of Emmaus.

COMPARATIVE MEASURES OF DISTANCE.

I.—Scale of 1 Inch to the English Mile.



II.—Scale of $\frac{3}{8}$ Inch to the English Mile.



In order to illustrate the relative lengths of the four measures of distance which have been described, a Table is given showing these in accordance with the scales of the two maps published by the Palestine Exploration Fund, the first being that of the large Map of Western Palestine, one inch to the English mile, and the second that of the reduced Map of Palestine, $\frac{3}{8}$ inch to the English mile. This diagram shows more clearly than a verbal description, the comparative length of those four measures of distance with which students of the geography of the Holy Land should be thoroughly acquainted.

THE SHEKEL OF THE SANCTUARY.

By E. J. Pilcher.

In May last the Rev. Prof. A. R. S. Kennedy delivered an important lecture before the Victoria Institute on "Hebrew Weights and Measures."[1] This lecture was intended to summarize our present knowledge of the subject, and to show the advance that has been made during the last few years. For example, until quite recently we could only infer the standards of the Hebrew measures of capacity from the corresponding Greek and Roman measures with which they were compared by various ancient writers. All this is now changed, for the Assumptionist Fathers at Jerusalem have unearthed a series of stone vessels, which enable us to ascertain the dimensions of the Hebrew measures at first hand.

In the department of linear measurement, there has been a prolonged controversy as to the standard of the cubit, some inclining to the "long measure" of 22 inches, others to the "short measure" of 17½ inches. Prof. Kennedy has shown that this question can be decided by reference to acknowledged Jewish remains, the most important being the temple at Jerusalem, several times rebuilt upon the old foundations. The careful measurements made by the investigators of the Palestine Exploration Fund clearly demonstrate that all stages of the work on the temple were

[1] *Transactions of the Victoria Institute*, Vol. XLVII.