

On Recent Surveys in Sinai and Palestine. By Major C. W.
WILSON, R.E., F.R.G.S.

[ABSTRACT.]

It is a remarkable fact that a country so replete with interest as Palestine to every branch of science, more especially to geography, both physical and historical, should have remained so long without any attempt at a systematic survey. It is only of late years that a thorough and organised system of examination has been entered upon.

The portion of country the investigation of which has been undertaken by the Palestine Exploration Fund and other kindred societies, under the superintendence of officers of the Royal Engineers, may be said to extend from Lat. $27^{\circ} 43' 20''$ N. to Lat. $33^{\circ} 26' 10''$ N., and, from the eastern shores of the Mediterranean, to Long. $36^{\circ} 18' 24''$ E., embracing an area of 40,000 square miles. Major Wilson's paper dealt more immediately with the part already explored, and which is included in what is usually known as Palestine Proper; but a general description of the entire district will give some notion of the nature of the work and the difficulties to be encountered. At Ras Muhammed, the most southern point of the peninsula of Mount Sinai, the Red Sea branches off to the right and left, one arm forming the Gulf of Suez, the other the Gulf of Akabah. At the southern extremity of the peninsula thus formed, rise the Sinaitic Mountains, a vast crystalline mass, similar in character to the adjoining mountains of Africa and Arabia; on the east they descend abruptly to the Gulf of Akabah, whilst on the west they are flanked partly by an arid plain, extending to the Mediterranean. Northward, a sandstone district separates the Sinaitic Mountains from the limestone plateau of the Tih, a dreary desert, which, falling gradually to the north, is drained by the great Wady el Arish, or River of Egypt of the Bible. To the north-east of the Tih are the limestone hills of Judæa, rising near Hebron to a height of 2840 feet; and which, continuing northward with slightly varying altitude and almost without interruption, are finally linked to the Mountains of Lebanon by the hills of Galilee, which attain their culminating point in Jebel Jermuk, 4000 feet. West of this range lie the maritime plains of Philistia and Phœnicia; whilst on the east is the valley of the Jordan, forming a natural separation between Palestine and the great eastern plateau which stretches away almost to the Euphrates.

Captain Palmer, of the Ordnance Survey, well described the

peninsula of Sinai as "a desert of rock, gravel, and boulder—of gaunt peaks, dreary ridges, and arid valleys." It is extremely wild and rugged, and has one of the most complicated systems of drainage in the world. The great crystalline mass, forming as it were the "core" of the peninsula, is split up into innumerable peaks, which attain a considerable altitude (the highest, Jebel Zebir, 8551 feet), and present views of a most grand and impressive character. The sandstone district, rich in antiquities and mineral wealth, is broken up into quaint forms, which, combined with the rich colouring, give a peculiar charm to the scenery; in the cretaceous and tertiary districts, on the other hand, the features are devoid of interest, and the scenery is monotonous. The wadis or valleys are deeply cut, and descend rapidly to the sea; they frequently take their rise in open plains, or *fershs*, which lie at the foot of the peaks, and form one of the most interesting topographical features of the interior. The valleys appear to have been formed by the action of water, and in many places along their sides are lofty banks of alluvium. The water supply is more abundant than has generally been supposed; in the mountain district there are several small perennial streams, and numerous springs of good water, especially in the vicinity of Jebel Musa. The sandstone and limestone districts are badly supplied, and the water found in the latter is brackish and purgative. There is one hot spring at the foot of Jebel Hammam Farún, the temperature of which is 157° . The vegetation is scanty, but there are evident indications that it has formerly been more plentiful; even now, at certain seasons of the year, there is a considerable amount of vegetation on the upland plains, and, in addition to the well-known oasis of Feirán, there are several others scattered over the peninsula.

The climate is variable: in the higher districts the cold in winter is severe, and the peaks are frequently covered with snow; in the lower districts the heat is intense, and when the Khamsín blows, almost unbearable. The air is dry, clear, and bracing, and there is a great difference between the night and day temperatures. The average rainfall is small, but the country is subject to storms of great violence, which produce the "seils" or floods so much dreaded by the Bedawin.

One of the most striking features of Palestine proper is its natural division into four parallel strips, viz. :—

1st. The Coast Plain, from 10 to 20 miles in width, extending without a break from the desert on the south to Mount Carmel on the north, northward again of which lie the plains of Acre and

Phœnicia. The greater portion of the plain is fertile and cultivated; but in the northern portion are large swamps.

2nd. The Hill Country, commencing about 50 miles south of the Mediterranean, and interrupted only by the plain of Esdraelon, traversing the country from south to north. The hills are broad-backed, with here and there rounded summits rising above the general level of the range, their altitude averaging from 2000 to 3000 feet; the highest—Jebel Jermuk—being 4000 feet.

3rd. The Jordan Valley, which runs nearly parallel to the coast from the base of Mount Hermon to the Dead Sea, which occupies its deepest portion. South of the Dead Sea, the valley rises gradually for about 68 miles to the water-parting, which, at an altitude of 7874 feet, separates the waters of the Dead Sea from those of the Gulf of Akabah.

4th. The Eastern Plateau, which attains its greatest altitude at Es Salt, 2771 feet; it is tolerably uniform in its characteristics, and maintains as far north as Baniyas a general altitude of about 2000 feet; at this point the grand peak of Hermon rises to a height of 8700 feet, and forms the commencement of the Lebanon. On the north the great plateau is covered by the basalts of the Jaulan, and east of this lie the volcanic hills of the Hauran and Ledja.

The one great river of the country is the Jordan. There is no other like it in existence—a purely inland river having no embouchure on the sea, and terminating its course at the very deepest part of the Old World, and far below the level of the ocean. Its principal tributaries are the Yarmuk and Zerka on the east, and the Wadis Jalud and Zeria on the west. There are also several streams discharging their waters into the Sea of Galilee and the Dead Sea, as well as some flowing westward to the coast. Springs of fresh water, as well as hot springs, are numerous, one of the latter near Tiberias having a temperature ranging from 132° to 142°. Almost all traces of its former dense forest-vegetation have now disappeared, except in a few places on the mountains, and along the coast; remains of the ancient terraces, marking the era of terrace-cultivation, may be seen on almost every hill.

Owing to the peculiar formation of the country, there is great variety of climate; that of the Lebanon may be compared with that of the Alps, that of the Hill Country with Italy, and that of the Jordan Valley with the tropics. The most unhealthy months are May and October, during the prevalence of the Khamsin wind. The rainy season commences about the end of November, and lasts till March. The country is still subject to those sudden

storms so frequently alluded to in the Bible; and in fact there does not appear to have been any great change of climate since the times of the Kings of Judah and Israel.

Having thus described the principal characteristics of the country in which the operations of the British and American Societies are being carried on, Major Wilson gave a short abstract of what had been done by individual efforts; commencing with the publication in 1835 of Berghaus's 'Karte von Syrien,' with its accompanying memoir, which was the first serious attempt to classify and portray in a systematic manner the knowledge acquired by the earlier travellers of the present century.

Passing on to more recent dates, he observed that the idea of a regular survey might be said to have been formed in 1864, when the sanitary state of Jerusalem excited considerable attention, and schemes were proposed for providing the inhabitants with an adequate supply of pure water. With that view a finished survey of the city was subsequently made by Major Wilson and five non-commissioned officers of the Royal Engineers, the results of which were published by Her Majesty's Government. A line of levels was also taken from the Mediterranean to the Dead Sea, and from Jerusalem to Solomon's Pools. The bench marks then made have been connected with the triangulation of the survey now in course of progress, and have enabled the surveyors to check the altitudes of many of their trigonometrical stations. The party suffered considerably from the intense heat and bad water. The success of this survey resulted in the formation, in June, 1865, of the Palestine Exploration Fund. As a preliminary step to the work of this association, a cursory examination of the country to be surveyed was undertaken by Major Wilson, Captain Anderson, and one sergeant of the Royal Engineers. The results of this expedition, which remained in the country about six months, were briefly as follows:—Observations for time and latitude at forty-nine different stations; a line of azimuths from Baniyas to Jerusalem, giving independent determinations of longitudes for the points used; a reconnaissance, on a scale of one inch to a mile, of a district extending from Baniyas to Hebron, as well as one of a large portion of the Maritime Plain; special surveys of the Sea of Galilee and vicinity, Samaria, Beisan, and Mounts Ebal and Gerizim; an examination of the French map of the Lebanon, in which many errors were found; more than fifty plans of synagogues, churches, temples, tombs, &c.; and a large number of tentative excavations at different points, which yielded good results. Numerous photographs were taken, and two questions of some importance to the geography of the country were settled—

one, the point at which the stream from Wády Zerka enters the Jordan, the other the correct course of Wády Surar.

Encouraged by the extraordinary success attending the preliminary work, and taking into consideration the extreme interest felt by every one in Jerusalem, the Committee determined to devote their attention for the time being to excavations in the Holy City. And, in accordance with this decision, an expedition was sent out in 1867 under Captain Warren, R.E. The difficulties which he had to encounter, and the remarkable results which he obtained by his excavations, are already well known. He was able, however, whilst in Palestine, to carry out some important reconnaissances which added much to our knowledge of the country.

In 1868 a fund was raised, by the exertions of the late Mr. Pierce Butler, for an examination of the peninsula of Sinai, and, by the 24th of October in the same year, a party, consisting of Captains Wilson and Palmer, R.E., the Rev. F. W. Holland, and five non-commissioned officers of the Royal Engineers, left Southampton; they were afterwards joined by Mr. E. H. Palmer and Mr. Wyatt. The expedition was employed in the desert for five months, during which period at thirty-six encampments there were eighty-three sets of observations made for determining the time and latitude. The direction of the true meridian was determined at six different stations, and miscellaneous observations for azimuth and magnetic variation were taken at twenty-four points of the survey. In addition special surveys were made of Jebel Musa, Jebel Serbal, and their vicinities, on a scale of six inches to the mile. The relative positions and altitudes of fifty-six mountain peaks were determined by triangulation. A series of barometrical and hypsometrical observations were taken at Suez and at the camps of the expedition. Seven hundred miles of route-survey were made, extending over many parts of a district which may be described as bounded at its four extreme points by Suez, Ain Hudherah, Jebel eth Thebt and Tur. Special plans and photographs were made of all ruins and inscriptions met with, and geological, botanical, and natural history specimens collected. The entire results of this work have since been published on various scales.

In November, 1869, Mr. Palmer was sent out by the Fund to explore the Desert of the Tih and part of Moab, and was accompanied on his journey by Mr. C. Tyrwhitt-Drake.

Leaving Suez, Mr. Palmer visited Jebel Musa, and thence travelled north-east to Beersheba, Hebron, and Jerusalem, by way of Ain Hudherah, Wády Byar, and Nakhl; from Jerusalem he passed southwards by an almost entirely new route through the Nejed

to Petra, finally returning northward by way of the Dead Sea and Moab to Jerusalem.

Mr. Palmer accomplished his journey on foot in native costume, and the geographical results obtained are most valuable, as also is the collection of correct nomenclature and native traditions.

The Committee now felt that the period had arrived for the completion of an accurate survey, and at the annual general meeting of the Fund in June, 1871, it was resolved that immediate steps should be taken for carrying out the survey of Palestine; it was also announced that a similar Fund had been formed in America to co-operate with the English one, and that an arrangement had been made by which the English party was to survey the country west of the Jordan, whilst the Americans took the east.

Captain Stewart, R.E., was appointed to the command of the English party, with two non-commissioned officers from the Ordnance Survey; and they were joined in Palestine by Mr. Tyrwhitt-Drake.

The scale selected for the general survey was one inch to a mile, with a larger scale for plans of localities having special interest. The sheets for the projection of the work were prepared in London by Captain Bailey, R.N., each sheet containing 20' of latitude, and 30' of longitude.

The vicinity of Ramleh on the plain east of Jaffa was deemed the most suitable locality for the measurement of a base-line, which has been connected by triangulation with the Admiralty Survey at Jaffa, and with the Jerusalem Survey; it was also thought advisable to fill in the detail as the triangulation proceeded. Arrangements were also made to carry out a series of meteorological observations, in conjunction with the observatories previously established by the Fund at Beyrout, Nazareth, Jaffa, and Gaza, as well as at Jerusalem.

Captain Stewart landed at Jaffa on the 8th November, 1871, but was shortly after attacked with severe illness, which compelled his return to England; and the duties connected with the survey devolved (until the arrival of Mr. Drake) upon the non-commissioned officers. Captain Stewart was succeeded by Lieutenant Conder, R.E., in July, 1872; since which date the progress of the survey has been rapid and steady, and the programme laid down by the Fund efficiently carried out. In September, 1872, a second base-line was measured on the great plain of Esdraelon, and connected by triangulation with the first, the measured and calculated lengths agreeing most satisfactorily.

From the second base the triangulation was extended to the north

and west, and by January of the present year had been carried to Haifa and Carmel, and 1250 square miles completed and drawn on the sheets.

The survey is now progressing between Carmel and Jaffa. In addition to the survey, a most searching and vigorous system of archaeological investigation is being carried out; geological specimens are being collected, and a geological map of the country prepared by Lieutenant Conder; and Mr. Drake is busily occupied in forming a collection of botanical and zoological specimens, in addition to his labours in ascertaining correct nomenclature, &c. The difficulties encountered, owing to the climate and the opposition of the people, have been by no means inconsiderable, and it reflects no slight credit on the party that the work should have been so efficiently performed.

Mr. F. GALTON asked Major Wilson if he could give any explanation of the tunnels near Jaffa.

Major WILSON said the water from the limestone hills appeared to have been kept back by the parallel ranges of tertiary sandstone. Marshes had thus been formed, and, at some unknown period, drifts were cut through the sandstone hills in order to drain the marshes behind. These drifts were, in many cases, now closed, and that was one reason why the neighbourhood of Jaffa was so unhealthy during certain seasons. Miasma was produced by the stopping up of the waters. There was a large tunnel, 10 feet or 12 feet high, cut right through the sandstone.

Mr. WOOD asked if any new light had been thrown upon the Sinaitic inscriptions. Mr. Palmer had promised an interpretation of them, but it had not yet been made public.

Major WILSON said it was greatly to be regretted that Mr. Palmer had not published his account of the inscriptions. No less than twenty-five bilingual inscriptions had been found, and from these Mr. Palmer had constructed an alphabet by means of which he was able to read every inscription found in Sinai. There could be no doubt that they only dated as far back as from the first to the third or fourth century A.D. They were merely short sentences, interesting in many respects, but having no bearing on the history of the Exodus. Mr. Palmer was probably so engaged at Cambridge, where he was Professor of Arabic, that he had not time to publish his interpretation of the inscriptions.

Mr. PHENÉ said he had been in communication with Mr. Palmer for some years, and had received from him drawings, made on the spot, of the buildings found in Palestine and in the desert of the Tih. These had been most kindly sent to him to illustrate papers read by him (Mr. Phené) before different societies. From these drawings it was evident that the buildings were identical with those found in the Hebrides and in the islands of Arran in Galway Bay and at Holyhead. In section, in elevation, in construction, and in every detail, they were alike.

Mr. SAUNDERS said the paper which had just been read marked an epoch in geographical research, when scientific methods of investigation were taking the place of limited, individual observations. Travellers in Palestine had done almost all that could be expected of them, and what was lacking was now being supplied by the organised Survey carried out by the Palestine Exploration Fund. He believed that that interesting country was quite as capable of

exciting enthusiasm in the present day as it ever was; but the subject required a series of lectures, instead of a single one, to do it justice, and to show the necessity of such a Survey as that which Captain Wilson was promoting, the completion of which would bring home to our very doors a knowledge of the sacred localities which even pilgrims could not be expected to ascertain by isolated personal observation. By such means Palestine would be made to attract as great an interest as in the time of the Crusades, and a far more intelligent. He believed the time was rapidly coming when the extraordinary position which Palestine occupied in the very centre of the three continents of the Eastern hemisphere, and surrounded by great navigable inland seas, would make the Map that the Exploration Fund was engaged in producing, one of the most interesting and most sought-after documents in the whole range of geography.

Sir CHARLES NICHOLSON said the paper was one of a most able and scientific character, and would form an important contribution to physical geography. It was impossible to listen to a paper on such a subject without associating with it historical reminiscences of a kind which, perhaps, had no parallel in any other country. He was glad to hear that the district to the east of the Dead Sea presented no greater difficulties in the matter of surveying than the country which had already been surveyed to the west of that sea. Discoveries of a most interesting character connected with the archæology of that region might, therefore, be expected. If another Moabite Stone were found, it would repay any amount of labour, expense, and exertion, that might be incurred in obtaining it. Any one at all familiar with the literature of the Semitic dialects must know what interesting light had been thrown on that subject by the discovery of the stone, on which were forms of inflection and locution precisely similar to those found in the early books of the Old Testament. This afforded a convincing proof of the antiquity of those books. It was, therefore, desirable that the gentlemen who were engaged in the Survey should be alive to the necessity of preserving every trace of inscriptions. The theory of Mr. Forster, which referred the inscriptions on Mount Sinai to a period coeval with the Exodus of the Jews, had been long abandoned, and it had been satisfactorily ascertained that they belonged to a period not later than from the first to the third century. The whole of the peninsula of Sinai contained important Egyptian remains. In the north-eastern parts there were ruins of a large Egyptian city—Sarbool el Khadem—which must have existed near the line followed by the Jews during their sojourn in Sinai. It contained records of the fourth Egyptian dynasty, and of very extensive copper-mines having been worked there. It was most desirable, therefore, that those remains, as well as other historical monuments, should be examined.

He must now remind them that this was the last ordinary meeting of the session, and it was his duty to call their attention to the great obligation the Society was under to the Chancellor and Senate of the University of London, who had so kindly granted the use of their magnificent hall. He, therefore, asked the meeting to unite with him in a vote of thanks to the Chancellor and Senate of the University, as an expression of grateful acknowledgment for their liberality and kindness. It had been suggested that another and supplementary meeting should be held on July 7th, to receive some information with regard to Sir Bartle Frere's late mission, and to hear an account of a boat-journey up the River Wami in Eastern Africa, by Mr. C. H. Hill. That meeting would, of course, be conditional upon the Society obtaining the permission of the Chancellor and Senate of the University to occupy the theatre. He was not aware that there was anything likely to prevent the concession; but, still, as the use of the room had been limited to the ordinary nights of the session, it would be necessary to ask permission to hold this Special Meeting.

The vote of thanks to the Chancellor and Senate was then unanimously agreed to.