AN

OUTLINE OF MALARIA IN PERSIA

with NOTES on

ENTOMOLOGY and EPIDEMIOLOGY.

Being the Subject of a Thesis
for the Degree of M.D. (Glasgow).

submitted
by

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AN OUTLINE OF MALARIA IN PERSIA.

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FORWORD.

On innumerable occasions while carrying out malaria investigations in Persia, I wished that some record of malaria investigations were available for use both as a guide and as a reference. None exists, though in the literature some entomological findings are recorded, and here and there details of local malaria surveys are published.

During the late war, when large numbers of troops were in Mesopotamia, the Army found it necessary to employ Malaria Field Laboratories to investigate and to catalogue the various degrees of malaria risk in the different parts of the country, in order that the number of malaria cases among troops might be kept at a minimum. I was employed on such malaria duties, at first with one Malaria Field Laboratory which covered both Persia and Iraq, later with another, which worked in Persia alone, and finally, as Malariologist responsible for the malaria prevention scheme in the whole of the occupied area of Persia. Practically all parts of the country where there are roads, were surveyed, and I feel that it is well worth while to co-ordinate these records into one volume/

/volume, as a guide to anyone who may have to work in the face of the malaria of that country.

All the surveys detailed here were carried out while on military duty in Persia. Most of the work is based on personal investigations, but certain areas were surveyed by other officers engaged on similar duties at about the same time, and these have been included to make the picture as complete as possible. At various times, however, I had to travel through the different surveyed areas, and so had the opportunity of seeing for myself what economic as well as malaria conditions were prevailing. The Army Medical Directorate of the War Office very kindly made available to me such reports as were in their possession, and material from these reports has been made use of wherever necessary to fill in gaps. The source of all such material is shown in the bibliography.

Until the official history of the late war has been written, it will not be possible to include a complete incidence of military malaria cases, and further, since the 'place of infection' is to a large degree vague, such incomplete unofficial figures as are available are better omitted. In any case, it may be argued that such figures, taken from an imported population, can have little real bearing on the presentation of the epidemiology of a country.

The area which is covered in this work is roughly that which lies between the Iraq Frontier and a line drawn from the/

/the Persian Gulf to the Caspian Sea, i.e. between the longitude lines 45° East and 52° East, and the parallels 38° North and 29° North.

As has been already said, practically no previous malaria information was available for guidance, so that each survey really covered fresh unsurveyed territory. The areas covered were always dependent upon, and always directed towards possible movements of troops. It is pointed out that the surveys were carried out during 1943 and 1944, before Mepacrine was routinely administered to troops, and before the advent of D.D.T. as an insecticide. The basis of the surveys was the presumption that the whole of Persia was malarious, and that the least malarious areas, were, if tactically possible, to be used as camp-sites in the event of fighting occurring in these parts. Later, various areas and routes were surveyed, in order to find camp-sites which were relatively free of malaria, and which could used by truck drivers engaged in delivery of goods to Russia by way of the trans-Persian route. Further surveys were carried out of the railway line from Ahwaz to Teheran when it became necessary to employ troops in the protection of the railway and telegraph communications.

For similar reasons the regions of the South Persian Oil-fields was also surveyed. Apart from a few semi-permanent camp areas in which large numbers of troops were, for practical purposes, always located (such as, at Kermanshah and Durad), no/

/no anti-malaria work was carried out, but everywhere, wherever troops were stationed, rigid discipline in regard to personal protection against mosquito bites was enforced.

These surveys were carried out always working against a time factor. So many days were allotted to complete the survey of any particular route, so that except in areas which were frequently revisited, or in which long halts were made, it was not possible to work out detailed epidemiology.

The method of survey was by 15 cwt. truck, and the survey team consisted of one officer, an entomology laboratory assistant, a driver, and an interpreter. The vehicle carried food supplies for anything up to thirty-five days, and [redacted] equipment which consisted of a haematology box and an entomology box. The contents of these boxes is shown in Appendix .IV. In addition, a microscope with oil immersion lens for examination of blood slides and larvae, and a binocular low-power microscope for examination of insects were also carried.(1)

It was considered safer, both generally, and also as a protection against malaria, for the party to camp in the open, far from villages, and this was done except when there was a Gendarmerie Post conveniently available. Whenever possible, camp was struck by 8 o'clock in the morning, and work was continued until about 4.0 p.m. when a new camp site was found for the night. Between 4.0 p.m. and darkness, blood films were stained and examined, insects identified and mounted, and/

/and larvae identified and preserved. All blood examinations were carried out by "the thick drop method" and stained by a rapid stain. The stain used at first was Field's Stain, but later it was found that better results were obtained using a polychromed methylene-blue stain, prepared as shown in Appendix II. This stain kept better over longer periods, and also stained parasites more distinctly. Any doubtful specimens, or specimens which there was no time to examine during the tour, were brought back and examined at leisure in the laboratory.

Blood films in many regions were difficult to obtain sometimes because of the native timidity of the inhabitants, at other times, because the Persian authorities had recently been in the region carrying out mass vaccination, and in the "Russian-occupied areas" because shortly before the survey was carried out, the Russians had compulsorily vaccinated most of the inhabitants against typhus! In view of the very interesting ecological findings in A.maculipennis in Azerbaijan, a request was made to revisit the area in order to carry out dissections on large numbers of these mosquitoes, but permission for a second visit was refused by the Russian Authorities. The interesting find of A.sacharovi without intense malaria at Kinar-I-Gird could not be followed up owing to the unit being transferred to another area.

Maps used throughout the tours were $\frac{1}{4}$"-scale International Survey Maps to which all Grid References refer, except in/

/in regions of "permanent camps" where similar 1:100,000 scale International Maps were used. All these maps are collected and shown in ~~Volume II~~ PART III, and the malaria endemicity is marked throughout, green indicating moderate or slight endemicity, pink, high endemicity and red hyperendemicity.

The malaria endemicity in most areas was based on spleen-rate findings, and where possible this was combined with blood examination. Dissection of mosquitoes was not extensively carried out, first because of shortage of time, and second, because it was never possible to follow any particular species through any particular season, and so the epidemiology is of necessity, largely based on findings among the same species in similar areas in Iraq, Syria and Palestine.

The children were examined always with them standing,(2) as in strange villages it would never have been possible to persuade a sufficient number to assume the prone position for examination. The bare abdomen of the children was palpated by slipping a hand up under their shirt, though of course, in the summer time both the boys and girls would wear little more than a pair of trousers.

It was found that no reasonable answer could be obtained on enquiring the age of any particular child, so that ages were estimated by the size of the child, its gait, or teeth, etc. All spleen rates are based on children of estimated ages between/

/between 2 and 10 years old. Infants are excluded, but where a sufficient number was obtained they have been shown as separate infant spleen rate.

The population of the villages was also estimated roughly. The method used, was to inquire the number of houses in the village, and if this was apparently correct to the eye, that number was multiplied by five on the assumption that at least five people would occupy each house. In the towns the chief of police or local governor (parmandar) could usually give an estimate of the population.

When these surveys were first begun, it was usual to give the children some sweet-meat or a coin after examination. This however, was stopped later, as it was found that the parents much more readily encouraged the children to come forward if three or four tablets of quinine were given to each child after it was examined. It appeared that the elders knew only too well the value of quinine in stopping their fever. For a short time, mepacrine was used for this purpose instead of quinine, but as it was new to the villagers, they were suspicious of its efficacy while they did know the value of quinine, and so the latter drug was reverted to. The child was instructed to put it away in a safe place until such time as it might develop fever.

In many parts of the country, one was told that there were dispensaries which gave quinine free of charge to all who/

/who had fever. In practice, what happened was that the quinine was issued by the Central Government to the village dispensaries, but too often its use was confined to the wealthy classes in the area or else it reached the venders in the bazaars. During 1943 and 1944, it may be pointed out, that the cost of quinine purchased in the bazaar was about one shilling and sixpence per five grain tablet !

This paper is divided into ~~two~~ THREE parts. In Part I ~~of Volume I~~ is described the topography, water supplies, entomology etc., of the country, while Part II shows the actual survey details. In ~~Volume II~~ PART III is shown the coloured collected maps of the regions visited.

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PART I.

I. INTRODUCTION.

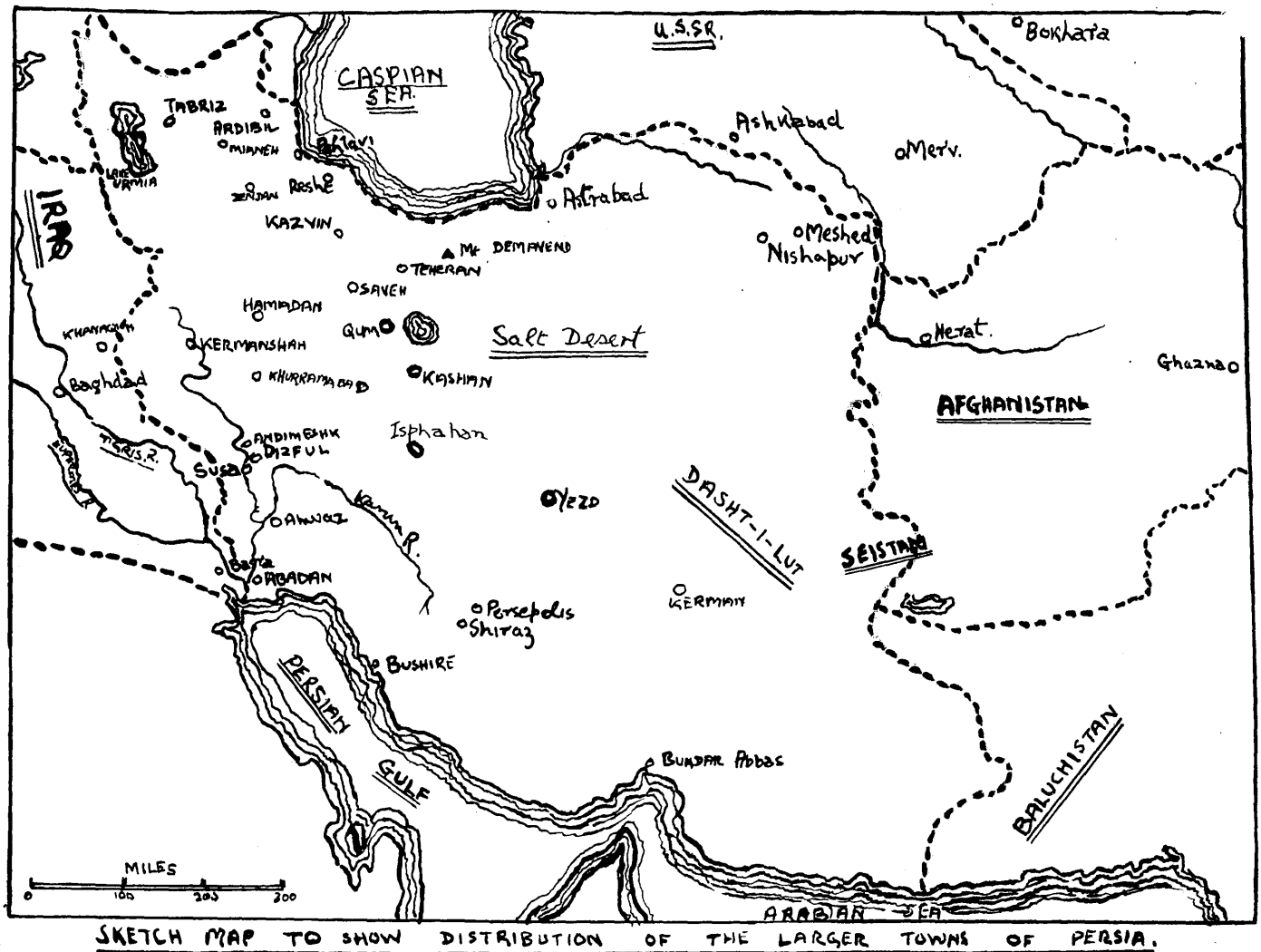
1. BRIEF DESCRIPTION OF COUNTRY.

a. Geography.

The Kingdom of Persia is bounded on the north by the Caspian Sea and the Transcaucasian and Transcaspian territories of Russia; on the east by Turkestan, Afghanistan and Baluchistan; on the south by the Persian Gulf and Arabian Sea, and on the west by Turkey in Asia, and Iraq.

The areas covered by the surveys all lie between the Iraq boundary and the line drawn from say, Bushire on the Persian Gulf, to the Caspian Sea. That is, they all are in the western half of Persia which is the only really populated part of the country. To the east of the line the only fertile country lies in the vicinity of Shiraz and Persepolis, (unfortunately an opportunity of visiting that area was never available), of Yezd, Meshed, and Kerman. Apart from these few cities, the remainder of the land is the sun-baked salt desert of Dasht-i-Lut. The distribution of the larger towns as shown in Map I. demonstrates this very clearly. The peoples of the waste desert region form only a trifling part of the population of Persia so that the surveyed areas constitute an index of the malaria which exists among Persians to-day.

MAP I.



SKETCH MAP TO SHOW DISTRIBUTION OF THE LARGER TOWNS OF PERSIA.

Persia, with the exception of the lowlands of Khuzistan and the Maritime plains bordering on the Caspian Sea and the Persian Gulf, forms the western and larger half of what is known as the Great Iranian Plateau, raised aloft between the valleys of the two great rivers, the Tigris and the Indus. This plateau has a saucer-like character, and is of very much greater altitude at the edge, rising to heights of between 4,000ft. and 8,000ft. Some of the most depressed portions in the centre/

/centre however, are barely 500ft. above sea level.

The drainage of the plateau divides into two main parts - one half flows into the Persian Gulf, and the other, into the Caspian Sea. The rivers which have no outlet to the sea, drain themselves into inland lakes (as Lake Urmia) or into swamps (known as Kavir). During the spring rains, which melt the snows on the mountains, thousands of streams flow from all directions into the innumerable depressions of inner Persia, or help to swell the few perennial rivers. Except for the Karun River which flows into the Shatt-al-Arab at the head of the Persian Gulf, and properly is a a tributary of the Tigris-Euphrates outflow, none of the rivers of Persia have an outlet to the sea. These rivers, then, which are in heavy spate after rains, barely suffice for domestic and agricultural purposes in the summer, and by autumn have dwindled to a mere trickle running through the middle of their wide courses.

"The great desert region of Persia", writes Le Strange (3) (Lands of the Eastern Caliphate, 1905) "stretches right across the high plateau of Iran going from north-west to south-east and dividing the fertile provinces into two groups; for the desert is continuous from the southern base of the Elburz Mountains, which to the north overlook the Caspian, to the arid ranges of Makran which border the Persian Gulf. Thus it measures nearly 800 miles long but in width varies considerably/

/considerably, for in shape, this enormous area of drought is somewhat like an hour-glass measuring in parts only 100 miles across."

b. Geology.

Persia lies within the great Alpine-Himalayan fold system,(4) forming the connecting link between the Taurus structures and those of Afghanistan and Baluchistan. It is divided into three major zones.

1. The Elburz Mountains. This is a group of folded mountains with a thick sedimentary series showing movement towards the north. Large volcanoes are situated in these ranges, though except in Gurgan, most are extinct, as for example, Mount Demarvend (about 17,000 ft.)

2. Central Persia. This is a high plateau region but with large depressions, formed of old crystalline rocks, early Palaeozoics and Mesozoics poorly developed. Active volcanos exist throughout the Tertiary.

3. The Zagros System. The mountain belt of south-west and south Persia consists of strongly folded and overthrust structures, the movement having been directed against the Arabian foreland. Some Palaeoziac rocks, thick Cretaceans and Tertiary series are to be found here.

2. CLIMATE.

During the winter, the prevailing winds are north-east, but in the north are interrupted three or four times a month by the eastward passage of depressions moving across from the Mediteranean, bringing westerly winds and some small rainfall. During the summer, a strong dust-laden northerly wind blows unceasingly for about four months. This wind is known as the "Shamal" and is reputed during June to carry dust far out into the Persia Gulf. In July, the S.W. monsoon sets in along the coast and the northerly winds are mostly limited to the interior.

The annual variation in temperature is very great, and in the north, as in Tabriz and Teheran, the mean in January and in July may show a variant of 50°F., but towards the Persian Gulf this variant will diminish to about 25°F. In the highlands, the winters are severe, as is seen in Teheran at an altitude of 3,800 ft., where the mean January temperature is 35°F.

By far the most pleasant season of the year is the spring. At that time the ground is still moist from the winter rains and snow, and the temperature is moderate. In late autumn, though the temperature is again moderate, the air is dry and dusty, and the soil, having been baked dry by the summer heat, is crumbling. Summer everywhere is very hot and dry, and the mean temperatures during July and August exceeds 80°F. over practically the whole of the country. The day temperature is/

/is very high but usually the nights feel cool, though between the 2nd and 11th June, 1942, at Andimeshk, the minimum temperature recorded was 107°F., and the maximum day temperature was between 125°F. and 131°F. (shade readings.) On the coast of the Persian Gulf and on the Caspian Sea, the nights are warm, sticky, and oppressive. At Abadan during the months of June and July, a Relative Humidity of over 85% is not rare. As a rule, however, owing to the rarified atmosphere, the daily range is large, and changes of temperature are apt to be sudden and great at all seasons.

3. RAINFALL.

Viewing the country as a whole, there is only scant rainfall except in the mountain areas. There, the rains melt the snows on the tops of the mountains and this water supplies irrigation water in the early part of the year. It is for this reason that a number of cities, which otherwise would be dry, have grown up in climatically favourable spots since millet can be cultivated in the spring months. The slopes of the hills around such places produce sufficient grass to maintain flocks of sheep and goats. Incidentally it is from the wool and hair of these animals, which in this part of the world are very hardy, that originates the one truly ancient industry of rug-making.

The rainfall is everywhere small except in the Elburz Mountains which receive heavy rains brought about by /

/by atmospheric depressions over the Caspian Sea. Over the plateau south of the Elburz the annual rainfall is about 9" in the north, but decreases to the south and south-east, being only 2" at Seistan. At the head of the Persian Gulf rainfall is greater, slightly over 10", but the Makran Coast again has only about 5" in the year. Rainfall is almost entirely limited to the months October to May and is greatest from December to March.

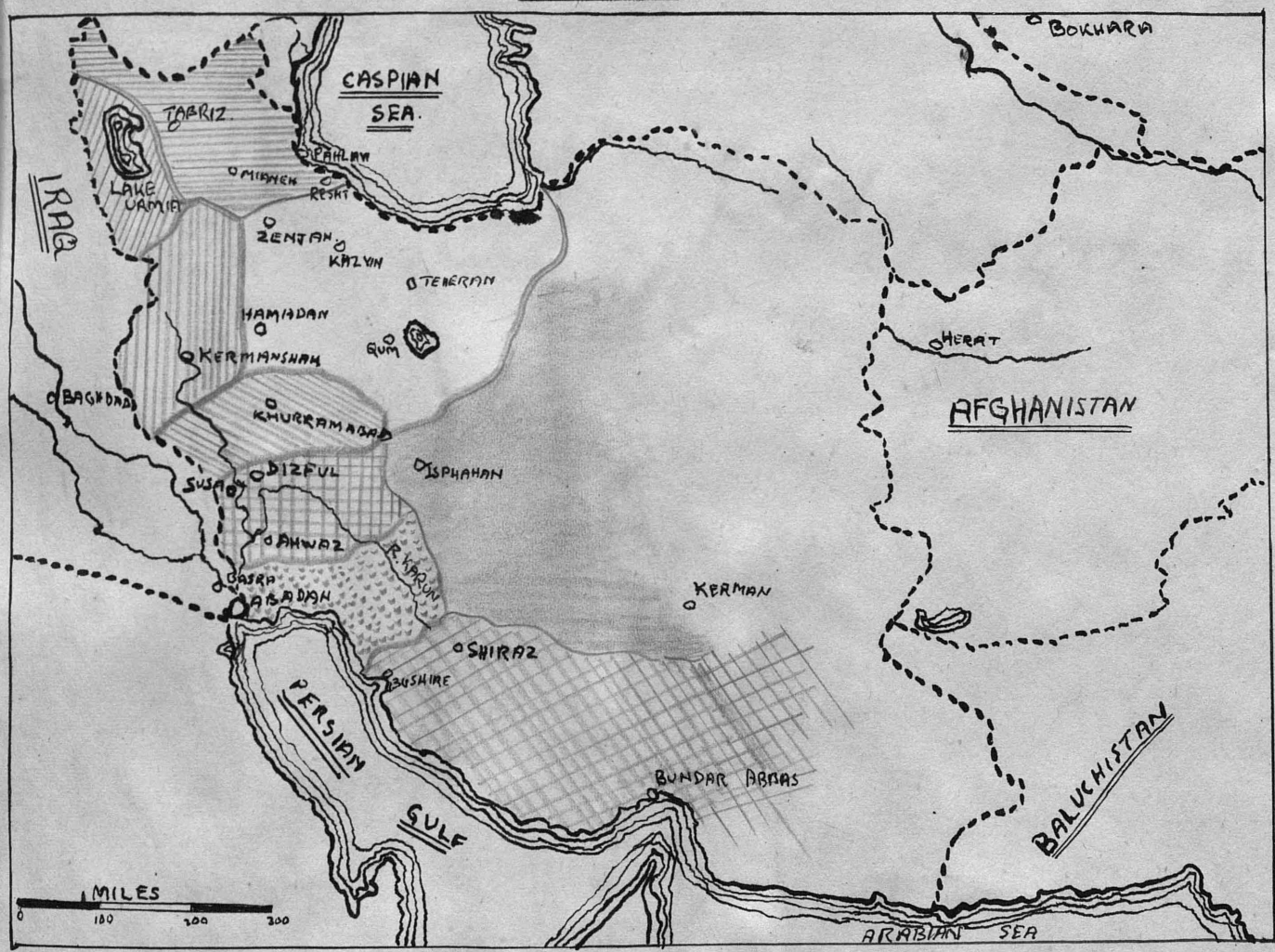
The rainfall is very spasmodic and more than half of the annual total may fall in one day. As a result of this variability, disastrous droughts sometimes occur. Thunderstorms and cloud-bursts occur in most parts of the country a few times in the year.

Again considering the country as a whole, it may be said that snowfall is variable and uncertain. In the maritime areas snow is rare. In the highlands, and in fact in all the country over 3,000' altitude, there is each year a definite possibility, between December and April, of being under snow for days and not infrequently for weeks together, (the writer was "snowed up" for two days in Khorramabad during February 1944). During such severe weather the passes leading from the plains to the plateau become closed to all except mule transport and during the thaw become probably even more dangerous and impassable.

4. POPULATIONS and TRIBES. (5)(6).

Despite its huge size, the population of Persia is, as far as can be estimated, only about 14 millions. To-day it is doubtful whether any true Persians survive in the towns. However, in the country, various peoples have remained as individual tribes, often unable to speak any language other than their own tribal tongue or else some dialect which is very far removed from the classical Persian of the Court or that used by the upper classes in India. The distribution of the main tribes is shown in Map II.

MAP II



SKETCH MAP TO ILLUSTRATE THE DISTRIBUTION OF THE VARIOUS TRIBES OF PERSIA

KEY

AZERBAIJANIS ASSYRIANS KURDS LORS BAKHTIARI QASHGAIS FARS QASHGOLI

The FARS with whom little contact was made, except these few scattered round Behberan, and in the Oilfields, occupy the south and south-eastern part of the country. They are desert dwellers and it is believed that they have been largely absorbed by Arab settlers. On the coast the language used is Arabic and not Farsi, or classical Persian. No personal observations of their habits were made, but it is presumed, from the barren lands they occupy, that they must be desert nomads and in character not unlike the Bedouins of Arabia.

The QASHGOLIS and the QASHGAIS who occupy the country around, and east of, Shiraz are renowned for their brigandry, and have never been truly brought under the sway of the Central Government. The latter tribe produces some of the most beautiful carpets of the tribal type in the world.

The BAKHTIARI who inhabit the alluvial plain areas of Persia are undoubtedly the most simple, backward, and inbred of all the tribes. In the villages of this simple people it was extremely difficult to obtain children to examine. They are an agricultural people and, in the main, live in small villages under a feudal chief, and as a community eke out sufficient food from the unwilling land to feed themselves. Sheep are rare, but goats manage to survive on the scant grass and camel-thorn. This primitive tribe is dying out as an entity, first, because of the difficulty of surviving in the barren/

/barren land which they inhabit, and second and more important, because with the improvement in communications and the growth of the south west Persian oil fields, they find it easy to be absorbed as labourers, either by the Anglo-Iranian oil Company or in road-building.

Until the coup which placed Shah Reza on the throne of Persia, the LORS were the wildest and most troublesome people in the land. Legislation was introduced forcing this people to give up their nomadic habits and to live in Khurramabad (the capital of Luristan) and in other towns. This was done not only to break up the tribe but also to facilitate the collection of taxes from them. To-day, they are drifting back to their hills and their old wandering habits and foraging customs.

The KURDS who occupy the mountain area west of Hamadan, through Iraq and into Turkey, are a true mountain tribe. They have retained their own language and dress and are one of the most inordinately proud, as well as colourful people that exist. They are said to be descendants of the Medes of ancient history. They are a hardy people who, in their village farms, work hard despite the fact that they inhabit one of the world's most malarious tracts. They consider themselves a vastly superior people to the Persians with whom thay are frequently at war, and resent the Persians overlording their country. They are/

/are nomadic within their own hills, and have huge flocks of sheep and goats. A very large part of the famous rice of Persia is grown in Kurdistan.

North of Kurdistan is entered the fertile regions around Lake Urmia which is inhabited by a large colony of ASSYRIANS. These people who still speak the language of Biblical days, are descendants of those who fled eastwards after the fall of Ninevah. They are a peaceful people and form the larger part of the Christian community in Persia. They are magnificent farmers, and their fruit gardens are extensive and incredibly lovely.

Beyond Urmia is the province of Azerbaijan. The AZERBAIJANIS are a conglomerate people who consist of intermingled Russian, Turks and Armenians. West from Kazvin, Persian is not spoken, but Turkish, Armenian and Russian, are the tongues used. It is an area of intense cultivation. Along the river-valleys rice is grown, but as soon as the rivers are left behind, one comes upon most extensive and intensive cultivation of wheat. Wheat was always grown here, but under the tutelage of the Russians, every corner of the land is now planted with wheat. As one goes across the hills of wheat in this region, one is reminded of the wheat growing areas in Canada.

There still prevails all over Persia, a feudal system, and the land is owned by a mere handful of usually absentee/

/absentee landlord chiefs. The duties levied on the workers are heavy, and one farmer described them briefly as follows: one fifth of the crop goes to the landowner, one fifth to the owner of the irrigation water, one fifth to the landowner, one fifth or more as seed for the following year, and the remainder for the farming community to live on.(8)

From the foregoing it will be seen that apart from the far north, and except where they have been herded into town, the tribes of Persia are nomadic. These nomadic pastoral populations are dependant for their livelihood on flocks and herds which are grazed on relatively sparce native vegetation, and moved frequently with the exhaustion of the pasturage. Thus the number and the type of animals may differ from place to place, and the number in any single area, from season to season, with the variation in water and food supply. Sheep and goats are more important where the pasturage is poor. Horses, mules, and asses are also common, since they furnish transport. For similar reasons, camels are found in the arid desert areas. Since pasturage is poor and soon exhausted, these nomadic herders are compelled to move their animals and communities frequently. Such moves take place with the change of the season. In winter time, the tribesmen migrate to the desert where there is some rain and scant feeding for their herds, but in the summer, as water becomes scarce, they return to the hills.

Though there is no individual or group ownership of land in the ordinary sense of the term, these migrations are within roughly fixed tribal limits established by custom through the years. Such nomadic herding therefore, is sometimes associated with limited agriculture. Where this is the practice, the migrations are timed to allow harvesting of the drought-resistant crops, as barley, millet, and occasionally wheat. In the migratory areas, this nomadic habit sometimes passes imperceptibly into primitive settlements, whenever the agriculture assumes greater importance than the herding, and then crop food is added to the diet of animal products such as meat, cheese and milk.

The places where the foregoing can take place are, in relation to the size of the country, not numerous. The poverty of the land has in many parts, and particularly after a poor crop year, given rise to professional brigandage, which on occasion has been carried on on a very large scale. The objects of attack have mainly been the settled agricultural people and the wealthier folks of the lowlands, in addition to traders who use the ancient caravan routes across the Dasht-i-Lut desert. The Central Government has tried to curb the marauding propensities of the tribesman by the establishment of gendarmerie posts throughout the country, but the low rates of pay tend to make the gendarme and the amniere organise his own levies on the villages, and since the protection/

/protection offered by this police force is not great, both their immediate value and their eventual reputation is doubtful.

5. OCCUPATIONS, TRADES and COMMUNICATIONS.

The occupation of the peoples of Persia is firstly agriculture. The fertile syncline valleys in the hill region appear to be able to produce any crop or fruit, and if intense and modern farming were to be introduced the poverty of the land would largely disappear. The farming methods used though, would seem to have changed little since Biblical days when one ox was used to draw a plough. At best there is a primitive form of agriculture which consists of an occasional sowing, alternating with long fallow periods when the soil is allowed to recover its fertility. It is certain that the intense malaria of these fertile valleys could be eradicated by proper drainage coupled with intense farming, and the peoples be held to the lands in a flourishing country. Here indeed malaria could be made to disappear before the plough and the peoples raised from poverty to prosperity. Under not dissimilar conditions such improvements have been brought about in the swamps of Palestine.

The only industry, as such, in Persia, is the workings of the Anglo-Iranian Oil Company. This organisation employs thousands of tribesmen and is slowly but surely attracting the wanderer to security of employ as a labourer.

The crafts with the exception of rug-making are dying arts. In Isphahan the miniature painting on ivory and the silver carving, is limited to a few families and sold only to very local markets. Many turquoise mines exist in the neighborhood of Meshed.

Communications are opening up the country a great deal, and the boost given to the railway line by the Allied Occupation will leave a permanent mark. There are now magnificent metalled and surfaced roads linking the main towns of Western Persia, and it is thought that these will help much towards the creation of static populations, provided that in the near future they are not allowed to fall into gross disrepair.

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II. HISTORY OF MALARIA IN PERSIA.[10]

An extensive search was made in the translations of Persian writings in medical histories to find references either on the history of malaria in Persia or the bearing of malaria on the history of Persia, but none could be found. In fact no reference to fever affecting communities or armies was noted. In view of the extensive distribution of the disease in the country it cannot be believed that it has had no bearing on its history, and one is therefore left with the presumption that malaria has always been accepted there and that the toll it takes each year among children, and adults too, has grown to be accepted as the normal, like such other endemic sicknesses as smallpox and cholera.

Christophers and Short[12] make mention of casualties due to malaria among the British force in Persia during the First World War. In the recent war, during 1941 and 1942, very severe malaria casualties occurred in both British and Indian troops stationed in Abadan, the Sennah Valley, Kermanshah, and many other places, but no records of these have yet been published. No doubt they will be included in the official history of the Second World War, but whether they have much real bearing (as an imported population) on the picture of the true malaria endemicity of the country, is doubtful.

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III. ANOPHELINE MOSQUITOES OF PERSIA.

A. General considerations in regard to Persian Anophelines and collection of information.

Until the recent War, Persia had not been investigated at all thoroughly by malariologists. Even during the War, much of the information, of necessity, was based on the assumption that conditions are similar to those prevailing in Palestine and Syria, and in Greece, Albania and Italy, about which countries a vast amount of information, in reference to malaria and mosquitoes, is available.

In all the entomological investigations, time was the limiting factor, and spleen rates, for the purpose of assessing military malarial risks, were considered more important than the accruing of detailed entomological scientific information. In addition too, it was often necessary to visit areas out of the mosquito season, as that was the only time available for the tour, and too frequently only one out-of-season visit was made to an area. Everywhere, when possible, both larvae and resting mosquitoes were caught, examined and studied. This was necessary to determine, in season, the malaria carrying species and various types of breeding places. Out of season, much information about hibernation habits, and resting places, could be gleaned, as well as, whether species over-wintered as/

/as adults or larvae, and if as adults, whether any feeding continued into the late autumn, and whether true gonadotropic dissocation was occurring in any particular species. Larval collections were always made, for "it is well known to workers in the tropics that a larval survey may give very different results as regards the prevalaent anophelines, from those obtained by a collection of adult mosquitoes in houses." (S.R. Christophers and M. Misseroli).(11)

In the wilder country, and especially in thieving Luristan and Kuzistan, and in the hill country of Kurdistan, the peoples were unaccustomed to, and sometimes had never even seen either a motor vehicle or British Military personnel. Also in these parts, early and strict Moslem customs prevailed, and access to dwelling houses was difficult to obtain. Collecting insects in stables was often resented in the belief that a survey of the villagers' cattle and horses was being carried out for purposes of taxation!

In some areas, as e.g. in Andimeshk and Kermanshah, the effect of fairly extensive military anti-malaria works would tend to vitiate the results of collections of mosquitoes. However, a journey of two miles to the nearest village would show the true local picture. In fact, throughout such areas adult mosquito catching stations were established within and out-with the limits of the "controlled" areas as a measure of the effectiveness of the anti-malarial work.

It will be noted that in working out the entomology throughout the country no "night catching" of mosquitoes was done. This was not carried out until 1944 in Burma where the method incriminated at least one previously unknown vector species, but at the time of these surveys its importance was not fully realised.

B. Species of Anopheles encountered.

Almost the only previous information about anophelines and malaria in this part of the world was obtained by Christopher and Shortt (15) during the 1914-1918 war, they found the following to be the common species:-

A. stephensi breeding in the date palm region of the Shatt-al-Arab and Karun rivers. This species has apparently greatly extended its range since then, for it is found in Persia up to the foot hills north of Andimeshk and in Iraq as far north as Baghdad.

A. pulcherrimus abundant throughout the plain region.

A. superpictus in the hill region.

A. stephensi and A. pulcherrimus were found to be associated with the transmission of malaria. These authors also recorded seven other species, most of which were only occasionally encountered. Since 1918, a few isolated collections in Persia have added six species to the list. It may be seen therefore that the previous knowledge of the anophelines of Persia was/

/was extremely scanty.

In the following remarks, it will be noted that the fauna includes Indian or Oriental elements near the westward limit of their distribution, and Palearctic elements near their southern limit of distribution, and all these species meet and mingle. The Palearctic species are further sub-divided into an European group, with a distribution extending far to the north, a Mediterranean group, with a more restricted distribution but at their probable eastern limit, and a Sahara-siddian group, in the line of their north-eastern spread.(13).(14).

Mosquitoes and larvae were identified from synoptic key tables which were prepared by Major T.T. Macan, R.A.M.C. Entomologist of No.1. Malaria Field Laboratory, R.A.M.C. These are shown in Appendix III & IV respectively.

These species are considered under the headings of:-

1. Geographical distribution.
2. Whether the species occurs in the plains or hill regions of Persia.
3. The usual type of breeding place.
4. Bionomics.
5. Relation to malaria. } where known.

A. PALEARCTIC.

a. Euro-Siberian species.

1. Anopheles Claviger. Meigen.

Found also in Palestine, Syria, Turkey, South Caucasus, Iraq, Turkestan and North Africa. Is a cold water breeder, occurring in cool mountain springs in Persia. In Palestine (27) and Syria it breeds in wells and cisterns inside of houses. In general, this mosquito breeds in permanent stationary water and smaller areas of water with little vegetation. Hibernates as a larva. When breeding in houses can become a dangerous vector of malaria. Normally zoophilic and rests in stables.

2. Anopheles Plumbeus. Stephens.

Found also in Europe and south-west Asia. In Cyprus, Asiatic Turkey, south Caucasus, and Turkestan. Is found in bush and forest country. Is a tree-hole breeder and was found breeding in tree-holes in the forest around Babulshah on the Caspian. Is a wild mosquito. It hibernates as an adult, resting in caves. Is zoophilic in habits.

3. Anopheles Maculipennis. race typicus. Meigen.

Found also throughout the Palearctic region. In Cyprus, Turkey, Caucasus, Iraq, and Turkestan, but has not penetrated to the North-West Frontier of India. Is found in Persia in the hill country and the plateau generally and at an altitude range of 3,000 - 5,000 ft. It breeds in the smaller areas of permanent stationary water, as ponds, ditches and swamps, but prefers that some freshening of the water should occur. The/

/the small clearer corners of rice fields are one of its favourite sites. It first appears towards the end of July and reaches its maximum numbers by September. Is a dangerous malaria carrier towards the autumn, and has been found infected in late September in Kurdistan with an infection rate of 3.5% (Macan)[18]. It over-winters as an adult, and during winter is to be found in hundreds in any warm (underground) stable. May feed occasionally during the winter months. Identification of this species should, where possible, be confirmed by obtaining its eggs. Is zoophilic of choice but is readily diverted to man. Rests in dwelling houses but most frequently in stables and out-houses.

b. Mediterranean species.

1. Anopheles Superpictus. Grassi.

Found also throughout the Mediterranean regions and south-west Asia as far as the North-West Frontier of India. In Italy, Macedonia, Egypt, Palestine, Syria, Cyprus, Turkey, Iraq and Baluchistan. The altitude range of this mosquito is 1,000 - 3,000 ft. Its favourite breeding place is at the edges, pools and backwaters, of fairly fast flowing mountain springs. Also beneath stones in rocky-bedded streams, and at the edges of slow flowing water. Outside of the plains, it is probably the most wide-spread Persian malaria vector. It appears early in in May and is prolific until October. It becomes infected/

/infected early in the season, and remains infected until the onset of the cold weather. Wherever this species has been found, infections of gut or gland have been recorded. It overwinters as an adult. Shows no particular preference in feeding, and will feed indiscriminately on man or on animal. It rests on the roofs of stables and houses, but also shows tendencies to be "wild" and can be found in large numbers resting in caves and under ledges in the open. In all the countries of its distribution, it is to be located in the sub-montane and mountainous tracks. It is possible that the "wild" type is a sub-species but no investigations of this were possible.

Christophers and Shortt note that A. superpictus was the only species present in some places and concluded that this was the responsible malaria carrier over most of northern Mesopotania.

2. Anopheles Saccharovi. Faure. (= Elutus. Edwards.)

This species is found in the Mediterranean and south-west Asia. In Italy, the Balkans, Macedonia, Palestine, Syria, Iraq, Turkey, Turkestan, and the Persian Gulf. The altitude range of this anopheline is from sea level to about 3,500 ft. It is a very adaptable mosquito, and wherever it is found is associated with intense malaria (vide p.82 under Kinar-i-Gird.) It disperses widely and undergoes a pre-hibernation flight of anything from eight to ten miles (G.G. Mer)(16). Its normal/

/normal flight range is said to be two to three miles. However, in the Persian Gulf area it is found with a very patchy distribution and a very localised flight, resulting in localised and patchy intense malaria. It breeds in swamps, ditches, and marshes, in the plains and in the hills, in seepages and rice-fields and occasionally was found in backwaters with a moderate degree of pollution. It over-winters as an adult, and undergoes complete gonadotropic dissociation. It appears early in the year at the end of the cold season, and continues right through until the late autumn. During the hottest months of June, July and August, however, its numbers fall, to reappear in full strength as soon as the greatest heat has passed. This species has been found infected (infection rate of 2.5%) as early as mid-May in Basra (Etherington)(17), and in the same area an infection rate of over 7% was recorded in late September (Macan)(18). This very dangerous anopheline will feed on animals but is essentially androphilic. Its resting places are in houses and stables, mainly in the two to three feet angle formed between the ceiling and wall.

3. <u>Anopheles Algeriensis.</u> Theobold.

This is a Mediterranean species. It is found in North Africa, Egypt, Palestine, Syria, Cyprus, South Caucasus, Iraq and Turkestan. The only specimens found in Persia were taken near the Iraq border. These were specimens of the larva, but the imago was never seen in nature. It is a wild anopheline/

/anopheline and has apparently no relation to man or malaria. It appears to over-winter as a larva. It breeds in permanent stationary water preferably with some vegetation. Also in overgrown drying river beds.

4. Anopheles Marteri. Senevet & Prunelle.

This species is found in the mountain regions of North Africa, Syria, and Iraq. The only part of Persia in which it was found was in the Karind region of West Persia, and there it was breeding in a very cold mountain spring. Nothing is known of the relation of this species to malaria, but it is considered to be a wild mosquito.

5. Anopheles Sergenti. Theobold.

This Mediterranean species has not been found in Persia. It has been included in the key and is mentioned here, for it has been located along the Arabian coast and it was expected in Persia. It has been reported from North Africa, Egypt, Palastine, Syria and Baluchistan where it breeds in ponds and ditches which have a moderate amount of vegetation. In the slow flowing backwaters and at the edges and pools of both slow flowing and mountain streams. It also breeds in swamps, as in the Hulah Marshes in Palastine where it breeds throughout the winter, though then becoming greatly reduced in numbers. This mosquito is mildly androphilic and is a vector, though of no great importance, in Palestine.

c. Sahara Siddian species.

1. Anopheles D'thali. Patton.

Found also in the Mediterranean region and North Africa. In Sudan, Abyssinia, Arabia, Egypt, Palestine, Iraq and Baluchistan. In Persia, this species was found throughout the plains and foot hills, and the lower coastal range of mountains in the South-West oil-bearing area. This species breeds in any available fresh water. Although in several areas (Egypt, South Arabia) this anopheline has been suspected of being a vector, on epidemiological grounds only, no report of infection could be found in the literature, and certainly its presence made no difference to the malaria picture in Persia. In the only series of dissections carried out (127 during November), no gut or gland infections were found (vide page 111 Andimeshk). Its main resting place is in tents and houses, well towards the shaded parts of the roof.

2. Anopheles Multicolor. Cambouliu.

Is found in North Africa and South West Asia. In Arabia, Egypt, Palestine, Syria, Iraq, Cyprus and Baluchistan. It is a desert species, and breeds in desert and oasis lakes, where the water often has a high degree of salinity. Is said to transit malaria in Sahara Oases. Persia it has been found in the vicinity of Ispahan as well as in the oil field area, where it was located in black Bedouin tents and stables. It probably feeds on both man and animals.

3. Anopheles Hyrcanus. Pallas.

Is found throughout Europe and Asia in its various varieties and sub-species. In Palestine, Syria, Cyprus, Iraq and India. This species has never been found infected except in China and the East Indies where probably a different sub-species from the one found in Persia was being dealt with. No dissections were carried out in Persia. This species is wild and zoophilic, and seldom enters houses. It makes its first appearance early in the year, and is the first anopheline to be taken after winter in the Persian Gulf area.

B. ORIENTAL.

1. Anopheles Stephensi. Liston.

An Asiatic species which is found in Arabia, Iraq, Baluchistan, and sporadically throughout India. The A. stephensi which is found in Bengal is probably a sub-species for its habits are completely different from the similar mosquito found in lower Persia. In Bengal, too, it has never been incriminated as a vector, While in the Persian Littoral it is probably the most important vector. In the date-growing region, it breeds mainly in the terminals of irrigation canals and in stagnant algal covered waters, while in Bengal it is invariably found in clear fresh water having little or no shadow. This species does not appear to hibernate, but continues to lay eggs throughout the winter, though at a much slower rate. It has, (for practical purposes), been found/

/found infected throughout the year in South Persia so that in Abadan it is the cause of almost perennial transmission. It breeds, in pools formed by leaking irrigation canals, in borrow-pits, and residual or sub-soil water in excavations without shade. It is confined to the alluvial plain areas in Persia. This species is very strongly androphilic in its habits, and rests in dwelling houses, mainly in the damp area near the floor, or near water storage places. It also shows a preference for resting on dark articles of clothing which may be hanging on the wall. Its range of flight is short, not more than 400 - 500 yards, and is therefore found localised in village areas, flying only from blood source to the nearest water supply. This species will lay its eggs in very small quantities of sullied water, as foot prints or cart tracks.

2. Anopheles Culicifacies. Giles.

This is an Indian species penetrating westwards. It is found also in Arabia, Turkestan and Baluchistan. The only recordings of this anopheline in Persia are from Bushire and occasional specimens taken by Marsh in the South West Persian oil fields. No records could be found of infections in this species in Persia. In all probability this main vector of the Punjab and Ceylon will carry malaria in the lower Persian Gulf. In India it is a very domestic mosquito with a very short flight range and resting almost entirely in houses. In India too, it has been found very heavily (e.g. 6.7% Sporozoite rate/

/rate in the Delhi area - Covell)[19]. It breeds in permanent stationary water, not necessarily extensive, but in which there is little or no vegetation. It also breeds in transitory collections of water, such as drying beds of rivers, flood water and seepage pools, ditches and drains, rice fields and sugar plantations, and even in hoof marks. It has been found also breeding in brackish water both maritime and inland. In India its range of flight probably never exceeds 400 - 600 yards. It appears soon after the end of winter and reaches its greatest numbers about the time that the rains stop. With the onset of the hot weather it disappears to reappear again in the late summer. In India this species over-winters as an adult.

3. Anopheles Fluviatilis. James.

This also is an Indian species nearing the western limit of its expansion. It is found also in Iraq, Turkestan and Baluchistan. This species in the Persian Gulf cannot satisfactorily be separated from A.arabica, (A.funestus. var., arabicus. Christophers and Chand), which has been recorded in Muskat only. This mosquito breeds in the backwaters and slowly moving side waters of rivers and streams, but is found also in small collections of static water in which there is a moderate amount of vegetation. It is a dangerous vector in India but nothing is known of its relation to malaria in Persia. It was found as the only species in the desert oasis of Shifatha, in Iraq. It rests in stables and houses, and has/

/has attacked the writer in shaded light during the day. It has been collected during the day-time, resting on the under-surface of large reeds close by its breeding place (personal observation). Nothing is known of its over-wintering habits.

4. Anopheles Pulcherrimus. Theobold.

This probably is the most common mosquito in Persia and is found throughout the whole countyr. It is an Indian species but is also to be found in Arabia, the South Caucasus, Iraq, Turkestan, and Baluchistan. It is a most voracious feeder by day as well as by night. It rests in obvious situations in tents and houses. It would appear to over-winter as a larva. It is zoophilic, but given the opportunity will feed on man. This anopheline has never been found infected in nature, and in the laboratory can only be infected with difficulty. It breeds in any collection of permanent stationary water, as seepages from irrigation canals, in rice fields, and swamps in which there is plenty of vegetation to provide shade cover.

5. Anopheles Turkhudi. Liston.

This also is an Indian species, and has been recorded also from Arabia, Egypt and Baluchistan. There are a few previous records of this mosquito from Persia, but on one occasion only was it found by the writer, and then only two larvae were found. That occurred in the foot hills of the first Persian mountain range near Melavi. It is said to breed/

/breed in slow running or stagnant water, and also in pools in sandy river beds. Nothing is known of its habits and it is believed to have no relation to malaria.

6. Anopheles Apoci. Marsh.

This species has been reported only from South West Persia where it breeds in inland brackish waters. No samples were taken during the various Persian tours. Its relation to malaria is not known, but in view of its rarity, can be of no great importance.

C. Description of various breeding places of Persian Anophelines.

The various types of anopheline breeding places are listed as follows:-

1. Rivers.
2. Streams and Springs.
3. Wells.
4. Ricefields.
5. Irrigation canals.
6. Karezes.
7. Natural water outcrops.
8. Sullage and Storm-water channels.
9. Rain-water collections.
10. Flood water.

and these are discussed under the various headings.

1. Rivers.

The rivers all flow in some part of their course through rocky mountain cuttings - sometimes for 100 - 150 miles of their course. In these deep gorges the only suitable breeding places occur behind rocks or under pebbles, or in the very small backwaters formed behind any out-jutting rock or fissure. There is little shade. In such waters the chief breeder is A. superpictus. Most of the waterways are, at least in some part of their course, non-perennial. The first waters come down with the spring rains and to this is added the flood waters from the mountains brought down by the warm spring rain melting the winter snows. This occurs about mid-March. Towards the end of June, these rivers, which a month or two before, were raging torrents, begin to dry and by mid-July are little more than trickles of water running along their pebbly beds. In such water channels these streams frequently disappear suddenly and the course runs dry for several miles down stream when the water reappears as a new spring outcrop in the same river bed. In the late summer, this type of water forms extremely dangerous breeding places.

In the mountain valleys and through the plateaus there are many slow-flowing meandering rivers, and all species are to be found breeding in the back-waters and seepages from them.

2. Springs and Streams.

Every village is, of-course, based on a water supply. This may take the form of one of the rivers mentioned above, or else the village may be set back on the tributary water-shed of the main river. Many villages in the hills depend merely on a stream or even a head-water spring for their domestic water supply. In the hills, too, there is little artificial irrigation, rain water being sufficient for the crop, so that unless water is scarce no great pains are taken to keep the water course of the spring, clear, or the banks, tidy. Where such springs are non-perennial, ponds are dug in the channel in order to conserve water against the dry period, and until the stream dries out it will flow through such a pond. Seepages under such conditions are few, and any water outcrop is carefully linked with the main stream. Anopheline breeding, under such conditions, usually is not great until the time when the stream begins to dry, but then, for a short period, intense breeding may occur. On the other hand, if the stream water is plentiful, and especially in the hills, where the crops are rain irrigated, there is often gross carelessness with the water. The banks of the stream are broken by numerous crossing places. Bridges are never built and both man and beast break the stream banks wherever their fancy pleases. Here too, leakages and seepages are common, and all such sites give rise to prolific breeding places, especially in country where A. superpictus and/

/and A. saccharovi occur.

Another very dangerous type of breeding place is to be found at the head-waters of springs and in the swamps formed by the local catchment area. No effort is made to drain such swamps and often, although no breeding is to be found in the village, a walk of half-a-mile upstream along the water supply, will show such seepages which, almost invariably, breed mosquitoes in thousands.

3. Wells.

In those villages that are dependent purely on a well-water supply, few, if any, mosquitoes are found. In none of these villages was mosquito breeding ever found in wells. The wells are permanent and deep, and in many places go down to 60 feet and more to reach the sub-soil water.

The shallow well, is in a different category. Villages which lie along the banks of the wide stony-bedded non-perennial rivers, frequently have to dig shallow wells during the late summer, in order to supply their ordinary water demands, when the rivers dry out. These shallow wells are dug in the middle of the river bed, and in country in which A. superpictus is found, form very suitable breeding places for that anopheles.

Another type of shallow well also can be mentioned, though it has never been found to have any connection with anopheline breeding, and that is the shallow well which is dug as an /

/an auxiliary water supply for cattle in the plains in the alluvial area.

4. Ricefields.

Rice is grown throughout the submontaine region of Persia, at the altitude of 500 - 4,000 feet. No effort on the part of such local doctors as are interested, can prevail upon the villagers to maintain an intermittent irrigation scheme for their ricefields. There is some legislation to the effect that no rice should be grown within 3 kilometres of villages. In practice, however, it appears that the only time that this is en-forced is when the farmer fails to pay the necessary tribute to the local official.

A ricefield is often about 200 yards in length and 100 yards in breadth, and this is divided up by small earth sectors into squares of about 100 sq. yds. These small walls or dams are built so that water is retained within the rice paddys. Since the fields are laid out on hillsides in tiers, water is allowed to flow from one field into the next field below, and the flow is stopped whenever a sufficient depth is reached. The extent of the ricefields is often many miles covering the whole of a hillside, and water is retained throughout the area. to a depth of 6 to 9 inches. This is the state of affairs throughout the rice bearing area from the time the rice is sown in early April, until the time when it is cut in late/

/late September. These ricefields, from the time the rice-shoots appear above the water until they reach a height of 12 inches, form, by their broken shade, almost ideal breeding grounds for all species. The water is slowly moving and is freshened every six to eight days by allowing inflow from the water supply to percolate progressively from tier to tier; this together with the shade protection offered by the young rice shoots, makes for perfect breeding conditions. Breeding in the ricefields, except at the corners and edges where the rice is not thick, seems to stop as soon as the rice fronds are thick enough to form dense shadow. However, at the edges and in the corners mentioned, larvae can be found almost throughout the season. A. saccharoví, in particular, favours such breeding places, and the presence of ricefields within the altitude range of that anopheline always resulted in intense malaria. After mid-August and until October, A. superpictus also could be found; and in higher ranges, from 3,000 to 5,000 feet, A. maculipennis race typicus could also be taken.

5. Irrigation canals.

In the date-bearing area at Abadan, and Khurramshah, the river water is let in to irrigate the palm trees. The canals which carry this water divide and sub-divide into numerous channels in order to water the thousands of palm trees. At this point, the river (Shatt-al-Arab) is tidal, and the larger canals nearer the river banks are flushed out effectively by/

/by tidal movement. The rise and fall of the river, especially during the floods when the sub-soil water is almost, if not actually, at river level, is insufficient however, to flush the canal terminals. These develop a growth of algae, often broken, and form ideal breeding places for A.stephensi. Unless the date growers are forced to, they do not keep their irrigation canals clear, and in a very short time, the canals become littered with palm leaves, banana fronds, and all kinds of rubbish which impedes a free flow of water in the canals, giving rise to further breeding places. A.saccharovi which occurs in the date bearing area at Basra, 30 miles upstream, has for some unknown reason failed to penetrate this area, nor has A.culicifacies which is found in Bushire, and also recorded in the South West Persian oilfields.

There is an extensive system of irrigation canals throughout the alluvial plains, and these are said to have originated in the days of the Babylonian Empire. The water is carried in large nullahs of ditches, sometimes 25 feet across and 10 feet deep, and they divide and redivide and eventually the water is carried in small channels round the circumference of fields of wheat and barley. The crop is irrigated by the simple method of breaking the wall of these mud canals at the desired point and flooding the fields. This causes a puddling of water in the fields which provides breeding grounds for A.stephensi. and A.pulcherrimus. In some/

/some parts of their course, these canals are "high-level", i.e. through the years they have become silted up and the walls reinforced and 'bunded' higher and higher with a result that the water is carried at a higher level than the surrounding country. Leakages occur frequenly, and form breeding places for A. stephensi.

A further system of canals is worthy of mention, and that is the one which runs from the springs near Kermanshah to waterless Qasr-i-Shirin, (the Princess' Palace), 140 miles away on the Iraq frontier. This canal system was built, (so legend has it), by a Persian chief as a task set him before he could win the hand of the Princess. Howsoever be it, this canal system, in contrast to all the mud walled canals of Persia, was the only one seen which has stone morticed walls and base. Leakages are few, but where they occur in this A. saccharovi country, produce further breeding places both for that anopheline and for A. superpictus. The canal though over fifteen hundred years old is in a remarkably sound state of preservation. (v. Survey No. 12..)

Further irrigation canals are found in the plateau between Mianeh and Tabriz. These though, are small and used for domestic rather than agricultural purposes. On account of their altitude (about 6,000 feet) they play little, if any, part in the malaria picture.

6. Karezes.

The karez occurs in Persia and in Baluchistan, and in some regions is of considerable importance. Since the system may be unfamiliar to many people, a description of this method of obtaining water is given.

A karez may be described as a series of vertical shafts sunk into the earth's surface, and linked together at their lower ends by a continuous unlined channel. By this means subsoil water is collected and brought to the surface to be used for domestic and irrigation purposes. The shafts, which were sunk in order to facilitate the excavating of the tunnel, may be very deep at the head of the karez - a cable 150 feet long was insufficient to plumb the depth of one near Andimeshk. Moving along the channel from the karez head, the length of the shafts progressively decreases until the tunnel emerges at the surface. It is the popular belief that water flowing in a karez is derived from underground springs, but according to Oldham (1892)[20] this is seldom the case, and it is from his paper that the following quotation is taken. (The karez system in Persia in no way differs from that at Quetta).

FIG. I.

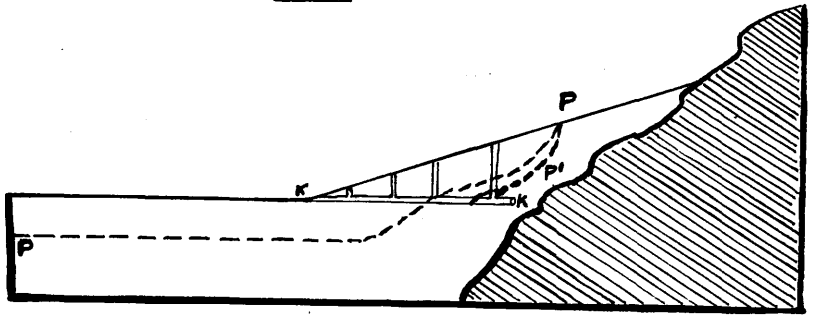


Diagram to illustrate the theory of the Karez (after Oldham).

"In Fig. 1 a diagramatic section of one of the gravel slopes is represented; the dotted line PP represents the limit of permanent saturation, that is the limit below which the gravels are charged with water even in the driest season. Such a limit exists everywhere, but the form and the contour depends on a variety of conditions such as the rainfall, discharge of streams at the head of the fan, permeability of the gravels etc. Now if the karez KK is driven into this slope that portion of it which lies below the line PP will drain the subsoil of its water and discharge this at the outlet."

"It will be seen from this that in its nature and mode of action the karez is only a subsoil drain; in both cases the object is to bring water which lies underground to the surface, the only difference being that in the one case it is desired to obtain the use, and in the other to get rid, of the water."

"From the nature of the case these karezes are affected by the rainfall in a marked manner - a single dry season, and still more in a succession of years of deficient rainfall, causes a diminution in the discharge of the karez....."

"When the Karez in Fig 1 is first made water will flow freely into it from the surrounding gravels, in all that portion which lies within the original limit of permanent saturation. But, after it is completed, a new outlet is provided for the/

/the subsoil water, the limit of permanent saturation will adapt itself to the new condition and ultimately will settle down with a profile which may be represented by the line PP'P. The subsequent history of the karez will new depend on the relative importance of the causes which led to the subsoil water originally maintaining its level along PP'P. If the gravels were tolerably permeable and a considerable quantity of water was constantly percolating through them, the karez will settle down to a fair and abundant discharge. If, on the other hand, the amount of water percolating was very small and the level of saturation kept up by the impermeability of the gravels, the ultimate condition of the karez will be one of very small discharge....."

"The amount of labour spent on some of these karezes, and the depth of their numerous shafts is astounding; They are frequently miles in length, and the shafts near their heads are said to be in some cases 150 feet deep."

In the Andimeshk area of Persia, one karez system in the foothills was, by means of following the shafts, traced back to its beginning, a distance of $11\frac{1}{2}$ miles. On another occasion near Kazvin, a series of karez shafts was followed for almost 5 miles with no indication as to where it would eventually end.

When a karez runs full of water, it presents little or no/

/no malaria danger. But as a karez becomes dry, or discharges only a little water, it usually is allowed to fall into a state of neglect. The villagers then either seek out a new water supply or else desert the village. It is these disused karezes which can form dangerous breeding places for anophelines.

7. Natural water outcrops.

These form an important site of anopheline breeding in the fertile syncline valleys of the mountain region. On the hillside of such valleys is formed part of the watershed of the rivers which flow through them. These areas are, of-course, intensely cultivated and numberless villages are scattered over the slopes of the hills. The villages are as a rule based on a spring or stream which is perennial, and are well canalised (either by man or by nature) to supply the domestic water demands before flowing on to irrigate the rice-fields. In the limestone hills such a spring is frequently only one of a line of spring water outcrops and since, usually one or two of these outcrops is sufficient to supply the demands of the village, the remainder are left to form seepages. It is in such seepages that A. saccharovi, A. superpictus and A. claviger will breed.

8. Sullage and Stormwater channels.

The foothills and plains of Persia are cut by numberless dry watercourses. These are deep stormwater channels which, when the floods come down, carry a torrent of water for a few days only, and then during the subsequent four to six weeks/

/weeks, proceed to dry out. While drying they form favourite breeding places for A.pulcherrimus, A.stephensi and A.superpictus. Such water must always be sought for during the late spring for it constitutes the earliest breeding place, and by the time that it has dried out, the rivers are running sufficiently slow to be used as breeding places by these anophelines.

Sullage water is also worthy of mention here, for as has been noted under the 'Species of Anopheline', A.stephensi will breed in the Gulf area in water with a high degree of pollution. In the date-bearing region, houses are frequently to be found situated near the irrigation canal terminals and these ditches form the handiest and natural site for the disposal of sullage water.

9. Rainwater Collections.

In the plains this is of little importance for the arid soil drinks in any rains that falls. In any case, rains only occur in December, January and February, when mosquitoes are few in number, and breeding and transmission are both at their lowest ebb.

In the hills however, the rains may form pools in the rocks, etc., and these can offer temporary breeding places, but the real importance of the rains in this terrain is that it raises the level of the subsoil water and this gives rise/

/rise to innumerable transient seepages which offer the ideal breeding place for the various vector mosquitoes and in particular for A. saccharovi.

10. Flood Water.

In the hills, the rivers, after the spates have passed, rapidly fall, and again run in their normal channels, but in falling, they leave behind them thousands of pools which before they dry out, provide very suitable breeding places in the early part of the year. This undoubtedly is the cause o f the early summer malaria epidemic to be found along the course of the Ab-i-Diz (vide Survey of Railway Line No.9....)

In the Gulf region the floods produce a very different picture. At no time of the year is the subsoil water very low, and when the mass of flood water comes down the Shatt-al-Arab the subsoil water rises even up to the surface level. To this high subsoil water is added another factor and that is, that the whole of the region, which is densely populated, is riddled with borrow-pits. From time immemorial in this part of the world, the peoples have taken mud from the lowest lying part of the country and made sun-baked mud bricks which are used for building their villages. No soil is used to fill these pits. In more recent years, earth has been moved to build up the embankments for the railway tracks and roads, and so similar borrow-pits are created. The result of this is, that when the subsoil water rises, innumerable breeding places are created as the borrow-pits fill with water, and in these both A. stephensi A. pulcherrimus breed.

P A R T II.

DETAILS OF SURVEYS .

MALARIA SURVEY No. 1.

ROUTE

TEHERAN - TAKISTAN - ZENJAN - MIANEH - TABRIZ.

This route was surveyed between 13th July, 1943, and 7th August, 1943, and is catalogued as follows:-

1. GENERAL - Description and topography.
2. SECTOR - Teheran to Qurveh.
3. SECTOR - Qurveh to Zenjan.
4. SECTOR - Zenjan to Mianeh.
5. SECTOR - Mianeh to Tabriz.
6. DISCUSSION
7. NOTES on CLIMATE.

The map references refer to the following ¼" International Ordnance maps which are available in ~~Vol. II~~ PART III with the malaria endemicity of the routes shown in colour.

			~~Vol. II.~~ PART III.
I.39.D.	(TEHERAN)	Aug. 1940.	map. 1.
I.39.C.	(SAVEH)	May. 1940.	map. 2.
J.39.U.	(SHAHSAWAR)	Nov. 1941.	map. 3.
J.39.T.	(KAZVIN)	Feb. 1943.	map. 4.
J.39.S.	(ZENJAN)	Feb. 1943.	map. 5.
J.39.M.	(HERAU)	Feb. 1943.	map. 6.
J.38.R.	(MIANEH)	May. 1943.	map. 7.
J.38.Q.	(MARAGHEH)	May. 1943.	map. 8.
J.38.K.	(TABRIZ)	May. 1943.	map. 9.

GENERAL.

For the purposes of description, this route divides itself conveniently into four parts.

1. Teheran - Qurveh.

This road runs along the foothills of the Telagahan range, through arid country. The villages are watered mainly by karezes, and have their own gardens, but apart from their own requirements, carry on little or no agriculture. Intensive cultivation takes place only in the region of the large perennial water courses, as the Keraj Rud and the Abhar Rud. Malaria risks are slight except in the vicinity of the large rivers.

2. Qurveh - Zenjan.

Beyond Qurveh there is more extensive cultivation. The road winds to an altitude of 6,000 feet following the courses first of the Abhar Rud and then of the Zenjan Chai. Here the villages are much larger and have additional water supply from one or more springs. Everywhere here, great care is taken of the water, and much of it is carried in canals for distances up to 18 kms. Malaria risks continue to be slight on this sector, except where the road runs alongside the river, and then the risk becomes moderate.

3. Zenjan - Mianeh.

From Zenjan onwards to Mianeh, the road descends to an altitude of about 4,000 feet, and passes through an area in which there is a super-abundance of water. This water is used largely for the cultivation of rice. The ricefields lie/

/lie immediately adjacent to the banks of the summer course of the rivers, and are irrigated by continuous flood systems. Many of the villages have an additional water supply from springs, and these offer yet further breeding grounds for mosquitoes. Malaria risks here are very great, spleen rates as high as 70% to 80% being recorded.

4. Mianeh - Tabriz.

Leaving Mianeh, the road again ascends until it reaches an upland plateau which is entirely given over to the growing of wheat, which grows here as a rain crop. This extends as far as the Shibli Pass. Water supplies are obtained mainly from wells or small local springs, although one or two perennial rivers do occur. Malaria risks in the vicinity of these rivers is moderate, but throughout the remainder of the road may be considered slight.

ENTOMOLOGY.

A. superpictus and A.maculipennis were taken throughout the route Teheran - Tabriz; eggs obtained from A.maculipennis adult caught at various points along the road identified the mosquitoes as A.maculipennis race typicus. The only other species found was A.saccharovi located in the region of the Keraj Rud.

Many of the breeding places examined were breeding both A.superpictus and A.maculipennis in stagnant water, and in moving water where any alga or weed was present. On this route it would appear that these two species of anopheline are capable/

/capable of utilising almost any type of surface water, except a clean-edged, fast-flowing canal, as breeding places. A total of 81 dissections of A.maculipennis was carried out; no infections of either gland or gut were found.

1. TEHERAN - QURVEH SECTOR.

Fifteen villages and towns were examined along this part of the road. Of these, eleven showed spleen rates from 0% to 20%. In the remaining four the spleen rate was from 27% to 39% and these places were situated either near, or on, the large rivers. At Hisark near the Keraj Rud the spleen rate was 30% and the parasite rate 20%. Positive blood films were obtained from four cases. Of these, two were infected with p.vivax, one with p.malariae, and one with p.falciparum showing also gametocytes. At Qurveh on the Abhar Rud the spleen rate was 37% and the parasite rate 27%. Positive blood films were obtained from four cases and these were all infected with p.vivax.

Malaria on this route is of low or moderate endemicity except in the region of Keraj Rud and the Abhar Rud where it becomes highly endemic.

ENTOMOLOGY. On this stretch of road relatively few mosquitoes were found. Single specimens of A.saccharovi were taken in stables at Hisarak and Yangi Iman, and a few A.maculipennis and A.superpictus were obtained at other villages visited in this region. Intensive breeding of A.superpictus was first encountered at Yamchi and at Qurveh, both on the Abhar Rud. Details of survey are shown in Table I.

ROUTE

TEHERAN - QURVEH.

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
WARDABAD	4000	I.39.D.	VG/5341	250	33	6	18	—	—	—	NOT FOUND		No breeding found	From Karez which is divided into three main streams
KERAJ	4000	I.39.D	VG/4448	10,000	59	25	39	—	—	—	No Search		—	Town lies alongside the Keraj Rud.
HISARAK	4000	I.39.C	VG/3552	500	39 Inf. 8	11 1	30 —	20	4	20	A. saccharoni found in stables.	NOT FOUND	None found	From Keraj Ruel by one main irrigation canal with four divisions
YANGI IMAM	4,216	I.39.C	VG/1761	150	29	6	20	—	—	—	A. saccharoni Only 5 taken	A. saccharoni	Backwaters of river with little algae	Water from Rudkhaneh Kurdan. One Karez for drinking. Irrigation canals taken off from River.
HASHT GIRD	4,250	I.39.G	VG/1262	400	33 Inf. 2	0 0	0 —	—	—	—	NOT	FOUND	NONE FOUND	EIGHT WATER STORES in village. Water from Rudkhaneh-i-Kurdan
ABIAK PAIN	4000	J.39.U	VG/5307	150	16 Inf. 4	2 0	12 —	—	—	—	NOT	FOUND	NONE FOUND	One Karez — now only very small. Coal mine nearby.
ABIAK R.S	4000	J.39.U	VG/5306	—	—	—	—	—	—	—		Few A. maculipennis typicus many. A. Subpictus	Slow flowing irrigation canal with much algae and some shade	One Karez with irrigation canal taken off.
KAYANDEH	4,250	J.39.U	VG/2821	250	26 Inf. 3	1 0	4 —	—	—	—	NOT	FOUND	None found	One Karez only as total supply.
SHARIFABAD	4000	J.39.U	VG/1823	1000	26 Inf 2	1 0	4 —	—	—	—	NOT	FOUND	None found	Only one good Karez Three or four irrigation canals from one well-kept Karez.
KAZVIN	4000	J.39.U	VG/0528	60,000	209 Inf. 13	4 0	2 0	—	—	—	NOT	FOUND	None found	From non-perennial local river. In summer from one Karez. Some wells and water-stores

SURVEY TABLE No. I

ROUTE

TEHERAN – QURVEH (Contd)

LOCALITY	Altitude feet	Sheet	Grid Ref.	Popu-lation	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
SULTANABAD	4000	J.39.T	VF/9724	1000	39 Inf. 3	2 0	5 -	–	–	–	a.maculipennis typicus 4-10 per table	Scattered a. maculipennis typicus	Backwater of karez channel, dirty water, and weed.	One Karez for all purposes.
TAKISTAN	4080	J. 39.T	VF/7905	5000	45 Inf. 2	8 0	15 -	–	–	–	Not found	No	Search	Drinking water from wells. One karez for irrigation purposes. Abhar Rud 3Km. away.
NEHAVEND	4000	I. 39.B	J2/0854	1500	45	9	20	–	–	–	Not found	a. Superpictus	one larva of A. Superpictus taken in pond with rotting Ray Culicinus	From Chai Khaneh by irrigation canals. No springs. One Karez (Salt). Few bitter wells.
YAMCHI	4000	J. 39. T.	J2/0369	400	30 Inf 9	8 2	27 -	–	–	–	a. maculipennis typicus 0–10 per room a. superpictus 5–20 per room	Few a. superpictus only found.	Pools and backwaters of main river. Silty water, Stony bottom, No weed or shade	well water for drinking. all other water from Abhar Rud.
QARABAGH	5,000	J. 39. T	VF/7304	120	20	2	10	–	–	–	None	found	—	From one Karez.
HUSAINABAD	4,750	J. 39. T	VF/3804	100	20 Inf 3	1 1	5 -	–	–	–	None found	Few A.maculipennis typicus.	Heavily shaded irrigation canal with weed.	From springs. Largely dependant on stored snow.
QURVEH	4,800	J. 39. T.	VF/5003	1500	43 Inf 6	16 0	37 -	15	4	27	Few a. maculipennis typicus. Many A. Superpictus	Only a. Superpictus found. In large numbers	Leakages from irrigation canal – little weed or shade	Springs for drinking. Abhar Rud for irrigation

SURVEY TABLE No. I

II. QURVEH - ZENJAN SECTOR.

Eleven villages and towns were examined along this sector of the road which lies at an altitude of between 4,750 and 5,750 feet. Of these, ten showed spleen rates from 0% to 16%. Only at Saiyan which lies on the banks of the of the Zenjan Chai was a higher spleen rate found viz., 33%. No blood examinations were carried out on this part of the road.

Malaria on this stretch of road is of low or moderate endemicity except immediately adjacent to the banks of the Zenjan Chai where it becomes highly endemic.

Note: The relationship between the summer course of the Zenjan Chai and the road is not accurately shown on map J.39/S. For example, Binab lies actually 18 km. from the present course of the river. In general, water is not over-abundant and although some of the villages have springs and wells, many bring their irrigation water by carefully kept canalways over distances up to 10 or 12 miles.

ENTOMOLOGY. A.maculipennis and A.superpictus were found along this part of the road, A.maculipennis larvae and adults always occurring more abundantly than those of A.superpictus. From Qurveh onwards no larvae or adults were taken before Qara Bulaq. Most of the villages examined had but little water, one notable exception being Kurramdarreh which has a river, a very large irrigation canal with side branches, and numerous springs, but with no evidence of mosquitoes. At Qara Bulaq/

/Bulaq large numbers of A.maculipennis were taken in one underground stable near an irrigated garden, but were scattered very sparsely through the remainder of the village. No breeding could be found in the garden or elsewhere. Nineteen of these mosquitoes were dissected, but none was infected. Eggs laid by one adult showed slight additional spots to the normal two black bands of A.maculipennis race typicus.

A similar distribution was seen at Yusufabad, where A.maculipennis were abundant in stables on the side of the village nearest to the Zenjan Chai, where breeding was taking place, but were few in number in other parts of the village.

From Saiyan, A.maculipennis were obtained which laid eggs with two fainter thin bands between the normal broad black bands. No opportunity arose to return and investigate this aberration. It is just possible that a differant race of A.maculipennis may be occurring here.

Full detail is shown in Table II. following:-

ROUTE

QURVEH - ZENJAN

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
SHARIFABAD	4,750	J.39.T.	VF/3912	1,000	32 Inf 2	5 0	16 —	—	—	—	NOT FOUND	NO SEARCH		Each house has its own well. Irrigation water from Abhar Rud.
KHURRAMDARREH	5,150	J.39.T.	VF/3318	3,000	42	5	12	—	—	—	NOT FOUND	NOT FOUND		Spring supply for drinking. Karez & Abhar Rud for irrigation.
NASIRABAD	5,500	J.39.T.	VF/2626	250	19	2	10	—	—	—	No Search	NOT FOUND		Karez for all purposes.
SAIN QALEH	5,500	J.39.T	VF/2128	2,000	31	6	16	—	—	—	NOT FOUND	NO SEARCH		WATER from twelve springs in village.
SANBALABAD	5,800	J.39.S	VF/0443	200	17	0	0	—	—	—	NOT FOUND			Well water only.
QARABULAQ	5,800	J.39.S	ZK/9648	250	31 Inf 4	1 0	3 —	—	—	—	A.maculipennis typicus in large numbers EGGS - showed extra bands.	NOT FOUND		One Karez for all purposes. Plentiful.
KHAIRABAD	5,800	J.39.S.	ZK/9451	400	21 Inf. 2	0 1	0 —	—	—	—	NOT FOUND			One Karez only.
YUSAFABAD	5,800	J.39.S	ZK/9054	250	38 Inf. 4	3 1	8 —	—	—	—	A.mac. typ. 5-20 per room A.superpictus 0-5 per room EGGS: showing extra bands	A.mac. typ. in fair numbers	At edges of Zenjan Chai, in pools with weeds	River dries out, all supply from shallow wells — one in each house.
BINAB	5,750	J.39.S	ZK/8587	200	32	2	16	—	—	—	A.mac. typ. 5-20 per room EGGS: showing extra banding.	A.mac. typ. A.superpictus both in fair numbers	Swamp between irrigation canal and river	Drinking water from springs. Irrigation water from Zenjan Chai 18 Km away
SAIYAN	5,500	J.39.S	ZK/7765	300	24	8	33	—	—	—	A.mac. typ. EGGS Two batches showing extra bands	A.superpictus 0-5 per dip A.mac. typ. 5-20 per dip	Back waters & edges of Zenjan Chai. Breeding where weed. No breeding in seepages	100 yds from Zenjan Chai. Many small springs. Karez with irrigation canals.
ZENJAN	5,400	J.39.S	ZK/6867	40,000 Upper Town Riverside TOTAL Inf.	68 106 174 7	5 15 20 0	7 14 11 —	—	—	—	No Search	A.mac. typ. 5-20 per dip	Disused irrigation canals; much weed and dirty water. Shaded brick-kiln with borrow pits having little alga.	Karez for drinking. Wells in houses Irrigation from Zenjan Chai.

SURVEY TABLE No. II.

III. ZENJAN - MIANEH SECTOR.

The altitude along this part of the road falls to about 3,000 feet. Thirteen villages and towns were examined and two of these were revisited after an interval of about ten days. All the places examined were situated either on the Zenjan Chai or on the Mianeh Chai, with one exception, Nauruzabad which is situated on a high mountain pass and has only a well water supply. Apart from Nauruzabad, where the spleen rate was 9%, the spleen rates on the road vary from 38% to 81%. Blood examinations were carried out on six occasions and a total of 81 slides was examined. One case from Kahab and another case from Sarcham showed p.falciparum with gametocytes. The remaining seventeen positive blood films obtained were all infected with p.vivax.

Malaria on this route is mainly endemic but in the lower reaches of the Zenjan Chai a region of hyperendemicity is encountered. Malaria of low endemicity was found only at Nauruzabad on the barren mountain pass from the valley of the Zenjan Chai to that of the Mianeh Chai.

ENTOMOLOGY. From Zenjan town to Kahab the anopheline population showed a steady increase, associated with the presence of ricefields on both banks of the Zenjan Chai; from Kahab to Mianeh, mosquitoes were very numerous in villages situated on or near the river. A.maculipennis was found in greater numbers than A.superpictus on the outward journey, but on the return journey, ten days later, the A.superpictus density/

/density had increased considerably at the two villages revisited. At Kahab the ratio A.maculipennis : A.superpictus had changed from about 10 : 1 to about 10 : 10. Both these species were found abundantly in stables, but were present only in very small numbers in living rooms.

Dissections were carried out on 62 A.maculipennis and on 13 A.superpictus taken at Kahab, Achachi and Yangija. No infections were found.

Full detail is shown in Table III following:-

ROUTE

ZENJAN – MIANEH

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
KASHKAND	5,000	J.39.S	ZK/5869	200	24	9	38	–	–	–	a. Mac. Typ. 0-10 p. room a. Superpictus 0-10 p. room	a. Superpictus 10-30 per dip.	Pool in pebbly bed of river, no weed or alga. Young instars only.	Well water for drinking. Zenjan Chai dries out.
CHIAR (not on map).	4,750	J.39.S	ZK/4873	250	25	9	36	10	3	30	a. mac. Typ. more than 100 per room	Not Found.		Well water for drinking Many canalways taken from Zenjan Chai for irrigation.
YANGIJA	4,900	J.39.S	ZK/4878	800	28 Inf 3	13 1	47 –	12	2	17	a. Superpictus 5-20 per room or shed a. Mac. typ. more than 100 per room or stable EGGS a. mac. typ. some with slight extra bands	a. Superpictus 0-10 per dip a. mac. Typ. 10-30 per dip	Pools arising from springs. Little alga; well-shaded; much animal life.	Seven springs for drinking. Karez irrigation.
NIKPEI	4,500	J.39.S.	ZK/3886	300	23	13	56	–	–	–	a. superpictus 10-30 per room or stable a. mac. typ. 20-50 per room or stable EGGS a. mac. typ. some with slight extra banding	a. Superpictus 0-5 per dip a. mac typ. 10-30 per dip a. mac. typ. slight extra	Diseased stagnant irrigation canal; weed and brown water.	Shallow wells (salt) for drinking. Irrigation water from Zenjan Chai Now a deserted city.
KAHAB	4,000	J.39.S	ZK/3199	300	27	22	81	22	7	32	a. superpictus more than 100 per room or stable a. mac. typ. more than 100 per room or stable,	a. Mac typ. 10-30 per dip.	Ponds with weeds and reeds. Ricefields.	Drinking and irrigation water from Karez. Occasional water from Zenjan Chai.
TAZARKAND	4,000	J.38.R.	ZE/1909	120	27	19	70	12	4	33	a. superpictus more than 100 per room or stable a. mac. typ. more than 100 per room or stable	a. mac. typ. 0-5 per dip.	Ricefields	Water from Zenjan Chai for all purposes. Lies alongside river.

SURVEY TABLE No. III

ROUTE

ZENJAN – MIANEH (continued).

LOCALITY	Altitude	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
SARCHAM	3,750	J.38.R.	ZE/1416	150	21	14	67	10	2	20	A. superpictus 5-20 per room or stable. A. mac. typ. 5-20 per room or stable	NOT FOUND		Water from Zenjan Chai for all purposes. Some wells in use in very dry periods.
NAURUZABAD	4,000	J.38.R.	ZE/0923	150	34 Inf. 6	3 0	9 -	–	–	–	NOT FOUND		Only wells examined. No breeding.	Well water only. There is one dried out Karez. Village is situated on barren mountain pass.
JAMALABAD	4,000	J.38.R.	ZE/0732	100	23	10	44				A. superpictus 0-5 per room or stable. A. mac. typ. 0-5 per room or stable	A. superpictus 0-5 per dilp. A. mac. typ. 10-30 per dilp.	Seepage from raised spring stream. Overgrown	Spring-water supply flows through village.
QARA JARBAT	4,000	J.38.R.	ZE/0838	8	4	0	–				A. mac. typ. 0-5 per room	NOT FOUND		Karez; tankle supply only.
AFSHAR	4,000	J.38.R	ZE/0737	60	22	8	36				A. mac. typ 5-20 per stable. A. superpictus 0-5 per room or stable	NOT FOUND		Water from Karez; Local river dries out.
ACHACHI	3,250	J.38.R.	ZE/0345	1,200	50	27	34	15	1	7	A. mac. typ. more than 100 per room. A. superpictus flies. EGGS with extra bands	A. mac typ 20-50 per dilp. A. mac. typ.	Ricefields	Lies in angle between Zenjan & Mianeh Chais. River water for drinking. Also wells for all domestic uses. Extensive ricefields.
MIANEH	3,100	J.38.R	ZE/9347	20,000	147 Inf. 18	30 3	20 16				A. mac. typ. 20-50 per stable.	NO SEARCH.		From Mianeh Chai. There is a system of occasional "dry days." Drinking water from three springs. Washing water from wells in houses.

IV. MIANEH - TABRIZ SECTOR.

Immediately after leaving Mianeh the incidence of malaria drops. Once more the altitude rises and at some points is over 6,000 feet.

Sixteen villages and towns were examined in this sector. Of these, fourteen showed spleen rates from 0% to 20%. In the remaining two, Sumeh Sufla and Siah Chaman, the spleen rates were 38% and 28% respectively and both these villages are situated on the banks of large perennial rivers. Blood examinations were carried out in both these villages and also in Qizilja Maidan where the spleen rate was 14%. From Sumeh Sufla, parasite rate 25%, two positive blood films were obtained. From Siah Chaman, parasite rate 18%, two positive blood films were obtained. From Qizilja Maidan, parasite rate 9%, one positive blood film was obtained. These all showed p.vivax only.

Malaria along this part of the road is of low or moderate endemicity, except in the regions of the large perennial rivers where risks increase somewhat.

ENTOMOLOGY. The numbers of mosquitoes taken in this area were much fewer than on the previous part of the road. Most of the crops here are rain irrigated, and only a few breeding places associated with irrigation were found. The streams and rivers, with many back waters and pools are still dangerous. A.maculipennis adults were numerous only at Charza Khun, though they were taken in small numbers at many points. A.superpictus adults were found only at Charza Khun, Imieh and Bustanabad. Full detail is shown in Table IV. following.

ROUTE

MIANEH – TABRIZ.

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
UNIQ	4,400	J.38.R.	ZD/8961	500	20	4	20	–	–	–	NOT FOUND			Good drinking water from spring. Irrigation canal from Sheb Chai.
SUMEH SUFLA	5,000	J.38.R.	ZD/7462	300	28 Inf. 5	9 1	32 –	8	2	–	A. mac. typ. 0-5 per room.	A. mac. typ. 0-5 per dip A. Superpict. 0-5 per dip.	under pebbles in river.	River water supply which dries out. Then spring at upper end of village is used.
KHOJAN GHIAS	5,300	J.38.R	ZD/7067	200	23	2	9	–	–	–	NOT FOUND	A. Superpictus few only.	In main stream of spring canal with no vegetation.	Spring drinking water. Local river perennial.
GHARIB DUST	5,500	J.38.R.	ZD/5968	400	28 Inf. 5	2 1	7 –	–	–	–	NOT FOUND			Local non-perennial river. Spring water for drinking. Irrigation canal taken off for grazing crops. Wheat as rain crop.
SIAH CHAMAN	5,500	J.38.R.	ZD/4568	1000	33	9	28	11	2	18	NOT FOUND	A. mac. typ. 0-5 per dip	Slow flowing irrigation canal. Broken shade	Siah Chaman Chai perennial. Three springs for drinking.
IMAMIEH	6,000	J.38.R	ZD/3975	40	10	0	0	–	–	–	A. Superpictus 0-5 per room A. mac. typ. 0-5 per room	NOT FOUND		Spring water for drinking. One irrigation canal.
TIMA DASHT	6,100	J.38.Q	ZD/2979	1000	29 Inf. 19	1 1	3 5	–	–	–	NOT FOUND			From springs which are collected into small ponds and released at intervals
END DIR	6,000	J.38.Q	ZD/2387	500	40 Inf. 4	2 0	5 –	–	–	–	A. mac. typ. 0-5 per room or stable.	NOT FOUND		Rain crops. Three springs for domestic purposes.

SURVEY TABLE No. IV.

ROUTE

MIANEH - TABRIZ (continued).

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
CHARZA KHUN	5,500	J.38.Q	2D/1888	500	34	5	14	—	—	—	a. Superpictus 10-20 per room or stable a. mac. typ. 30-50 per room or stable EGGS a. mac typ	a. mac. typ. few only. with eggs banding	Under rock in main stream	Local river for all purposes. Some wells.
BUSTANABAD. I.	5,500	J.38.Q	2D/1793	350	35	7	20	—	—	—	a. Superpictus 0-5 per room. a. mac. typ. 10-20 per room or stable	a. mac. typ. 0-5 per dip.	In canal with silty water and grassy edges.	All water from the Ujan Chai.
BUSTANABAD. II. (At Police Post)	5,500	J.38.Q	2D/1693	220	26	3	11	—	—	—	ditto	ditto	Irrigation canal with weed	All water Ujan Chai.
GURU GOL (Lake at Point)	6,000	J.38.Q	UY/0502	—	—	—	—	—	—	—	—	NOT FOUND.		Water highly salt.
YUSUFABAD	6,750	J.38.Q	UY/0302	400	40	1	3	—	—	—	a. mac. typ. occasional catch in Houses.	NOT FOUND		From two fresh springs one in village, other near Lake.
QISILJA MAIDAN	6,000	J.38.Q	UX/9108	200	34	5	14	11	1	9	a. mac. typ. occasional catch in houses	NOT FOUND		From one karez only
BASMEJ	5,500	J.38.Q	UX/8609	1,500	44 Inf 8	0 1	0 -	—	—	—	NOT FOUND	a. mac. typ. 5-10 per dip.	Spring-fed large pond, having patches of alga.	From Basmej Rud, from karez and from spring All used for both domestic and irrigation purposes.
SHAH GOLU	5,250	J.38.K.	UX/7504	250	18	1	6	—	—	—	NOT FOUND			From mountain stream which feeds Lake as part of Tabriz reservoir.
TABRIZ	4,500	J.38.K.	UX/6818	250,000	410 Inf. 18	10 0	2 0	—	—	—	NO SEARCH			Part pipe-water supply. Many karezes fed by five or six mountain streams into open gutters. Wells in better-class Houses.

SURVEY TABLE No. IV

DISCUSSION.

The only places at which A. saccharovi was taken during this tour were on or near the Keraj Rud. This species had previously been taken further south at other points on the same river. Nowhere was it very numerous, and nowhere was it associated with its accustomed high degree of malaria. Much more information is required, particularly on the seasonal distribution of the species. This region may represent the furthest point reached in migration from another centre, and it is possible that the species may not as yet have established itself fully. Perhaps the breeding places are unsuitable, or perhaps even, they may dry out. Only tentative suggestions can be put forward.

It might have been expected that A. saccharovi would have occurred in the ricefield area which lies between 3,000 and 4,000 feet and where higher spleen rates prevail. Careful search was made for it; many mosquitoes were caught in killing bottles and immediately examined; many also were kept for egg laying. No evidence of A. saccharovi was found.

Some of the eggs laid by A. maculipennis adults showed variations from the normal two-banded A. maculipennis race typicus egg. In some the second band was incomplete, in others additional spots were seen between the bands, while yet others, showed additional banding. One set of eggs laid by an adult taken at Mianeh, had well developed floats, but the columellae/

/columellae did not appear to be fully developed with the result that these eggs appeared uniformly dark. It is considered probable that these eggs had been prematurely laid.

A.maculipennis was taken alone at some villages and there, even when present in fair numbers, was associated only with low spleen rates. It must be remembered that most of these places were visited once only, and the possibility must be considered that later in the season, A.superpictus may be distributed throughout this route. There is some evidence, from the two revisits which were made, to suggest that A.superpictus was at the beginning of its season, and it may be that at a later period in the year it becomes more numerous and more widespread. The same argument applies when considering the apparent correlation of the presence of A.superpictus adults in villages with a higher spleen rate. Perhaps it is that higher spleen rates occur only where A.superpictus establishes itself early in the season.

The upland country, where A.maculipennis predominates, and where A.superpictus was only found occasionally and never in large numbers, has few breeding places produced by irrigation water. The crops are rain crops. In addition, too, the pasture lands are large and cattle abundant. It was noted here that even big mosquito populations were not associated with high spleen rates. However, in the ricefield country, A.superpictus was always present. Here there is much irrigation, corn is/

/is grown as a subsidiary crop, and cattle are few, and the presence of large numbers of mosquitoes was always associated with high spleen rates.

No reliable continuous record of rainfall in these parts could be discovered, but local information speaks of rains in spring and autumn and occasional heavy showers in the summer. During this tour, several showers were met with, and on 22nd July, a torrential thunderstorm lasting for four hours occurred. Such heavy summer rain, by destroying breeding places and killing young larvae, may have considerable effect in reducing the output of mosquitoes. Rainwater pools do not last for a sufficient length of time to form additional breeding places.

Winter in these parts is both long and severe, and very cold nights prevail from early autumn to late spring. These weather conditions must have an effect in curtailing the mosquito season, the life of the sporozoites, and incidence of malaria.

Malaria occurs along the whole of this route, but only in the ricefield area does it become hyperendemic. This coincidentally is where the altitude is lowest, and the climate might be expected to be most mild. Malaria of high endemicity was found in the immediate vicinity of the large rivers. The summer course of these rivers divides into many channels, each containing a mere trickle of water, and this offers the opportunity of much anopheline breeding. On the remainder of the road, malaria of moderate endemicity occurs in association with gardens irrigated from local springs or karezes.

CLIMATE.

The following notes on climatic conditions on the last part of this route were supplied by the engineers working on the road maintenance. They are appended here to give some idea of the severe winter which prevails in these parts and which may have a definite bearing on the low malaria endemicity encountered.

GENERAL.

These observations on climatic conditions were made during the months of January, February, March and April, 1943. The winter of 1942 - 43 in Tabriz was unusually mild, with very little snow, and it is possible that the conditions reported as far as Km. 27 are not representative of a normal winter. On the remainder of the road conditions were no more severe than average, but the snow came very late. The heavy falls commenced about the middle of February. All distances are given from Tabriz Bridge.

Km. 0 - 26. Temperature slightly lower than Tabriz. Minimum recorded by Sub-Contractor at Basmej -21° C.

Km. 26 - 31. This stretch of road is very exposed. Snow conditions were very bad and the road was closed on many occasions. No temperatures were recorded but probable minimum about -25° C.

Km. 31 - 35. Shibli Pass. Snow conditions very bad with very low temperatures -30°C. were recorded at Km. 35, the summit of the/

/the pass being three of four degrees colder. One-way traffic was maintained with great difficulty.

Km.35 - 44. This stretch of road alongside the Guru Gol is subject to very heavy snowstorms and high winds. It was blocked repeatedly during the period mentioned. It is the worst section, for snow conditions, between Mianeh and Tabriz. Temperatures were low, at least as low as Shibli Pass, and very possibly lower. Guru Gol was frozen until the end of April.

Km.44 - 57. This stretch included Bustanabad. There was heavy snow but not as much drifting, and temperatures were rather higher, the minimum being -28° C. The area around the bridge remained fairly clear of snow.

Km.57 - 90. Very heavy snow, with high winds and very low temperatures. This is the coldest part of the road. The lowest temperature recorded was at Km.60 of -28° C. on a night when the Bustanabad temperature was -17° C. The only parts of this stretch which were not closed by snow, were small areas which were too windswept for the snow to remain.

Km.90 - 120. Fairly heavy snow but drifts occurred only on short stretches mainly on bends on the shoulders of the hills. Minimum temperatures were 2°-23° C.

Km.120 - 125. Very heavy snow and high winds. Temperatures were sufficiently high to ensure that the snow did not lie very long. No temperatures are available, but it is possible that/

/that -20° C. was not reached.

Km.125 - 140. Occasional heavy falls of snow with bad drifts in exposed places where the road crosses the bridges. In the valleys the snow did not lie very long. At Sumeh Sufla the minimum temperature recorded was -16° C. The exposed ridges are much colder.

Km.140 - 178. Occasional falls of snow becoming less at Mianeh (Km.178) is approached. In Mianeh snow rarely lasts more than a day and temperatures are comparatively high, the minimum being about -5° C.

MALARIA SURVEY No. 2.

ROUTE

TEHERAN - TAKISTAN - HAMADAN .

This route was surveyed between 30th March, 1944 and 1st April, 1944. The basis of the records is from an earlier survey by No. 1. Malaria Field Laboratory, R.A.M.C., and the present survey was carried out as a check survey.

The map references refer to the following ¼" International Ordnance maps which are available in ~~Vol~~ PART III. with malaria endemicity of the routes shown in colour.

			~~Vol~~ PART III.
J.39.T.	(KAZVIN)	Feb. 1943.	map. 4.
I.39.B.	(NUBARAN)	Jan. 1943.	map. 10.
I.39.A.	(DAMAQ)	July. 1942.	Not available.
I.39.G.	(HAMADAN)	Aug. 1942.	map. 11.

GENERAL.

The first part of this route i.e. from Teheran to Takistan is shown in Malaria Survey No.1. on page 49. At Takistan the road forks right to Tabriz, and continues straight on to Hamadan. The road from Takistan to Hamadan crosses from one part of the Great Iranian Plateau to another, past the headwaters of the Khar Rud, and through the Aveh Pass.

Travelling south from Kazvin the country is a flat upland desert. Irrigation is by extensive kareze systems and all water is conserved and used with the greatest of care for irrigation of the fruit gardens which are present in every village. In this region, as far as Varseh, malaria is patchy/

/patchy in its distribution, and for the most part associated locally with disused karezes. At Hisar the road commences to climb, following the course of the Khar Rud as far as Mihrabad, where it is joined by a large tributary from the south east, and two miles south of this point, the Aveh Chai River joins the Qara Su to form the main stream of the Khar Rud flowing northwards. There are many sulphur springs in this region, and this focal point in the northern watershed is the most malarious part of this section of the road. It lies in a very sheltered mountain depression and it is thought that the temperature range here is smaller than in the neighbouring parts of this region.

The road now continues southwards following the course of the Aveh Rud and traverses the Aveh Pass at the town of that name. The higher parts of this valley are not malarious, presumably as they are out of the range of A.maculipennis. For the next twenty miles the road winds downwards and out of this most beautiful pass through an area of Upper Fars country.

At Razan the road runs into another of the fertile upland plains of Iran, where malaria of moderate intensity is found in local association with spring water. Then onwards to Hamadan it turns southwest across the extensive Kabutarahaig Plain where the malaria risks are localised and at no point very great. Much of this terrain has no free water and villages are situated wherever wells can be readily sunk.

Throughout this route malaria of slight or only moderate endemicity is encountered and is to be found localised to the immediate vicinity of springs or else nearby disused Karezes. Unless the streams flowing out from the springs, or the karezes, were overgrown with weeds, no mosquitoes were found in the villages. In the river valleys which form part of the watershed of the Khar Rud, the disease was found to be more widespread and of greater severity. All the adult anophelines taken on the tour were in a state of hibernation.

The map sheet I.39.A. has not been included in Part III. as it is available only for "official" purposes and the War Office do not allow its release.

Full survey details are shown in Table V.

ROUTE

TAKISTAN – HAMADAN

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
TAKISTAN	4000	J.39.T.	VF/7905	5000	45	8	15	—	—	—	NOT FOUND	NO SEARCH		Drinking water from wells. One Karez for irrigation purposes. Akhar Rud 3 Km. away
NEHAVEND	4000	I.39.B	JZ/0854	1500	45	9	20	—	—	—	NOT FOUND	A. Superpictus	One larva taken in a pond, with much rotting veg. Culicines.	from Chai Khaneh by irrigation canals. No springs. One Karez (salt). a few bitter wells.
SAIDABAD	4000	I.39.B	JZ/0859	200	17	3	18	—	—	—	A. Superpictus 0-5 per room or Stable	A. algiericus 5-20 per dip		a few irrigation canals from a Karez. well-water for drinking
VARSEH	4500	I.39.B	JZ/0244	250	34	0	0	—	—	—	NO SEARCH		NO SEARCH	Bakhtiari soil. Wells only for all purposes. No agricultural works anywhere.
NUHUM	4750	I.39.B.	JY/9745	100	22	4	18	—	—	—	A. Superpictus 0-5 per room 20-50 per Stable	NOT FOUND		Village lies alongside the pebbly-bedded Khar Rud which is used for all purposes
HUSSAINABAD	5250	I.39.B.	JY/8937	75	20	0	0	—	—	—	NOT FOUND			Village is placed on a barren upland desert. One small Karez for all purposes.
KHIRKH BULAQ	5000	I.39.B.	JY/8635	150	11	4	37	—	—	—	A. mac. typ. more than 100 per Stable (hibernating).	NOT FOUND	Edges of wide pebble bedded river.	River lies along the Khar Rud. A few sulphur springs in the region.
MIHRABAD	5000	I.39.B.	JY/8534	300	10	10	100	—	—	—	A. mac. typ. more than 100 per room or Stable (hibernating)	NOT FOUND		On ab-i-Garm. Edges of river earthy and very untidy.

SURVEY TABLE No. V.

ROUTE

TAKISTAN – HAMADAN (continued)

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
NAJAFABAD	6,500	I.39.B	JY/6430	150	30	9	30	–	–	–	A. mac. typ. more than 100 in every stable. Few A. Superpictus	NOT FOUND	Potential breeding in seepages which form tributaries for Ab-i-Garm.	Situated on tributary of Ab-i-Garm. High sulphur content in water. Deep wells for drinking
AVEH	7,250	I.39.B	JY/8215	1000	27	0	0	–	–	–	NOT FOUND	NO SEARCH		There is one spring with stream flowing out of it. Wells in most houses.
SULTAN BULAQ	6,750	I.39.B	JY/7709	350	40	0	0	–	–	–	NOT FOUND	A. maculipennis 0-5 per dip.	Larvae were found in headwater pool of the spring	One spring ⅓ mi from village, small output, trained into well-kept channel.
RAZAN	6,000	I.39.B	OD/6692	2500	30	3	10	–	–	–	A few A. Superpictus hibernating in Houses	NOT	FOUND	One non-perennial stream. Wells.
AMRIA	5750	I.39.A.	OD/6283	150	18	4	22	–	–	–	A. mac. typ. hibernating in Houses. A. Superpictus in stables	NOT	FOUND	Two karezes with good output but said to dry out in Summer. Wells in some houses
KAHARUD	5,250	I.39.A	OD/6482	400	34	11	32	–	–	–	A. mac. typ. 20-50 per room or stable. A Superpictus 100 per stall	NOT	FOUND	Karez – outlet 1 mi away. Good flow in stream. Pebbly bedded river adjacent to village but dries out in Summer.
MULLA BUDAQ	5,750	I.39.A.	OD/5819	250	32	1	3	–	–	–	NOT FOUND	NO	SEARCH	Three wells as total communal supply.
GOSWAR	5,500	I.39.A.	OD/4502	25	9	0	0	–	–	–	NO SEARCH			Village almost derelict. Dried out karez. One well

SURVEY TABLE No. VI.

ROUTE

TAKISTAN – HAMADAN (Concluded)

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
JAFARABAD	5,500	I.39.A	OD/4499	150	25	3	12	—	—	—	NOT FOUND	a. pulcherrimus 2 specimens only.	Seepage round spring head water	One spring only, small output, very untidy.
DAMAQ	5,750	I.39.A	OD/4697	1000	44	10	23	—	—	—	a superpicta hibernating in large numbers in stables		NOT FOUND	Good spring water supply. Divides into several channels Sulphides in water.
CHAYAN	5,750	I.39.A.	OD/4693	200	16	3	19	—	—	—	ditto		NOT FOUND	One spring outcrop with several seepages. Some wells. Water said to fail sometimes in a dry summer.
MARAN-I-MUHAJRAN	5,750	I.39.A.	OD/2956	500	26	3	12	—	—	—	ditto		NOT FOUND	Non perennial small river alongside village. When this dries out sulphur springs nearby are used.
HUSSAINABAD	5,750	I.39.A.	OD/2751	350	31	1	3	—	—	—	NOT FOUND			Banian country – Village supplied by a karez of fair output
IJLALIYA	5,750	I.39.G	OD/2645	500	39	6	15	—	—	—	a. superpicta more than 100 per room or stable		NOT FOUND	Karez water supply which divides into several channels in the village
LATJAH	5,750	I.39.G	OD/2347	2000	54	13	24	—	—	—	a. superpicta more than 100 per room or stable		NOT FOUND	Local springs (eight) with many seepages
HAMADAN	6,000	I.39.G	OD/2226	100,000	82	0	0	—	—	—	NO SEARCH			Mountain springs have been diverted & now flow into a reservoir which is opened twice daily & flows through open gutters in the streets. Larger houses have wells. also from Gyaour River.

SURVEY TABLE No. V

MALARIA SURVEY No. 3.

ROUTE

HAMADAN - BUROJIRD.

This route was surveyed between 2nd April, 1944 and 5th April, 1944. The map references refer to the following ¼" International Ordnance maps which are available in PART Vol. III. with the malaria endemicity of the routes shown in colour.

			PART Vol. III.
I.39.G.	(HAMADAN)	Aug. 1942.	map. 11.
I.39.M.	(KHURRAMABAD)	Aug. 1943.	map. 12.

GENERAL.

Due south of Hamadan lies the KUH-I-ALWAND range of mountains, and in order to by-pass these mountains which rise to 12,000 ft. peaks, the road turns sharply eastwards for about fifteen miles and then once more swings south round the shoulder of the range, at Murad Bulaq. Between this point and Malayer, the road continues through a fertile plain, the mean altitude of which is in the neighbourhood of 6,000 ft. Crops throughout this region are rain irrigated. No rice is cultivated until the upper waters of the Ab-i-Diz is reached in the Durud valley.

Malaria throughout this route is of slight or moderate endemicity, and is associated with springs and streams and in overgrown disused karezes. Water is not plentiful, and the climate along this part of the road is very pleasant in the summer, but in winter severe frosts and snows are experienced. What malaria that does occur, here, is believed to be associated with a short season of A. superpictus.

ROUTE

HAMADAN — BURUJIRD

LOCALITY	Altitude	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
HAMADAN	6000	I.39.G.	OD/2226	40,000	82	0	0	—	—	—	A. Superpictus few only in stables	No Search.		Town water supply from river which is allowed to flow through open gutters in streets. Many houses have own wells
ABSHINEH	6000	I.39.G.	OD/3124	500	50	6	12	—	—	—	Few A. Superpictus	A. Superpictus	Backwaters of hill stream	Streams from local springs.
MURAD BULAQ	5750	I.39.G	OD/3824	300	30	4	13	—	—	—	No Search		—	Headwaters of the Qara Chai.
EWAK	6250	I.39.G	OD/3622	250	27	3	11	—	—	—	No Search	Not Found		Two local springs.
ZAMANABAD	6500	I.39.G	OD/4205	500	42	2	5	—	—	—	No Search		—	Situated on a perennial stream
MALAYER	5500	I.39.G	OJ/5271	10,000	236	11	5	—	—	—	Few A. Superpictus	No Search		Many springs. Shallow wells in most gardens. Open troughs in streets as town supply.
SAMEN	5750	I.39.G	OJ/4262	350	28	2	7	—	—	—	Not Found		—	Local springs which form headwaters for Dumad Valley
USHTARINAN	6000	I.39.G.	OJ/3640	600	27	3	11	—	—	—	Not Found		—	ditto.
BURUJIRD	6500	I.39.M.	OJ/4727	8,000	90	6	15	—	—	—	No Search		—	Headwater springs of the Ab-i-Diz.

SURVEY TABLE No. XI

MALARIA SURVEY No.4.

ROUTE

TEHERAN - SAVEH - QUM.

This route was surveyed between 27th June, 1943 and 30th June, 1943. The map references refer to the following ¼" International Ordnance maps which are available in PART Vol. III. with malaria endemicity of the routes shown in colour.

			PART Vol. III.
I.39.D.	(TEHERAN)	Aug. 1940.	map. 1.
I.39.C.	(SAVEH)	May. 1940.	map. 2.
I.39.I.	(QUM)	Aug. 1942.	map. 13.

GENERAL.

The whole of this area is irrigated by a kareze water supply, except in the region of the Mazdarqan Chai, where ground level irrigation canals are taken off. At no point is the water supply over-abundant, and along the road from Saveh to Qum the isolated villages are dependant for their water on deep wells or on drying out karezes. It is noted that the Siah Ab, the Mazdarqan Chai and the Rud-i-Shur rivers are all to a very definite degree saline.

MALARIA.

The route divides itself into two parts. Firstly, the road from Teheran to Saveh, and here in general the malaria risks are slight, but a localised area in which there was malaria of moderate endemicity was found at Pik. Here it is probable that the breeding occurs in the disused karezes which lie to/

/to the east of the town and where some A. superpictus larvae were taken. Secondly, the road Saveh to Qum, here also the malaria risks are slight, except in those regions which lie within two miles of either bank of the Qara Chai, where malaria of moderate endemicity was found.

ROUTE.

Throughout this route the road is little more than a desert camel-track. The maps I.39.D. and I.39.C. are grossly inaccurate and are in no way to be relied upon, this, of-course, may be due to the tracks having been moved since the time of the map survey. Whatever the cause, it is doubtful whether the barren, frequently disappearing, desert track from Saveh to Qum could be followed without the aid of a guide.

DATA.

Anopheline mosquitoes and larvae were found at various points along the route. The larvae were identified as anophelines of the Maculipennis Group and as A. superpictus, and the adults as A. superpictus and A. maculipennis race typicus.

With the exception of two points where spleen rates of about 35% were found, no spleen rate higher than 8% was met with.

Full detail is shown in Table VII, following.

ROUTE

TEHERAN – SAVEH – QUM.

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
SHAHTREH	3,500	I.39.D.	KV/6925	300	19 Inf 4	0 1	0 –	1 (Sick Child)	1		NOT FOUND			From Spring – Plentiful low-level irigation-canal system
SANU	3,500	I.39.D	KV/6316	50	16	0	0	—	—	—	NOT FOUND			From four springs Plentiful. Led off into irrigation canals.
NASIRABAD	3,500	I.39.D	KV/5714	100	19	1	5	—	—	—	NOT FOUND			Karez water supply led off into irrigation canals which are dried one day a week
SHAHRYAR	3,500	I.39.D.	KV/5312	1000	38	3	8	—	—	—	NOT FOUND			Deep well drinking water. Irrigation water from Sick Ch. (Saline) Free quinine available from Doctor.
PIK	3,250	I.39.C	[illegible]/2314	1000	32 Inf 5	12 1	38 –	12	0	0	a. superpictus one only found in stable.	NOT FOUND		Wells and Karez. Karez is drying out Barely sufficient water.
PARANDAK VILLAGE	3,250	I.39.C.	PA/1797	–	–	–	–	–	–	–	NOT FOUND.			Village deserted. No breeding in seepage from karez stream.
RAVIJAN	3,750	I.39.C	PA/1396	50	11	0	0	–	–	–	NO SEARCH			Well water only. Was once a large town with good karez supply. Karez now dry.
ZARIYEH	4,000	I.39.C.	PA/0596	4000	35	1	3	–	–	–	No SEARCH		NOT FOUND	Karez stream flows through town, trifle saline. No breeding in seepages from stream.
ASIABEG	3,750	I.39.C.	OE/9990	2000	33	1	3	–	–	–				Water from karez stream. Clean and well kept. No seepages.
PINAGIRD	3,750	I.39.C.	OE/9686	80	15	1	7	–	–	–	NO SEARCH			Derelict town – was decimated by typhus in 1920 and never repopulated. Karez water, sufficient

SURVEY TABLE No. VII.

ROUTE

TEHERAN – SAVEH – QUM (concluded).

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
GARDAN-I-PANDREH	3,750	I.39.C	OE/3978	50	15	3	20	—	—	—	NOT FOUND		Culicines in seepages	Two small springs with seepages. Garden irrigation taken off.
FATHABAD	5000	I.39.C	OE/8968	40	20	3	15	—	—	—	NOT FOUND			Poor village – desolate and derelict. Small spring water supply.
SAVEH	4250	I.39.C	OE/8557	5000	61	1	2	—	—	—	NO SEARCH			Wells in houses. There is a town supply from two springs. Irrigation water from Maglagan Chai (Salt). Many gardens.
YALABAD	3,500	I.39.I	OE/8450	2000	40	2	5	—	—	—	A. Superpictus one specimen only.	NOT FOUND		Water led in from Qasa Chai. Intermittant irrigation of fields every 15 days.
SURKHADEH (not on map)	3,250	I.39.I	OE/8246	500	18	6	33	17	2	12	A. Superpictus 0-20 per room or stable	A. Superpictus 0-5 per cliff. A. mac. Fyp 2 larvae only.	seepages from raised irrigation canal.	The town lies along the banks of the Qasa chai.
SEHELABAD	3,250	I.39.I	OE/9157	120	15	0	0	—	—	—	NO SEARCH			Deep wells only. Two karezes long since dried out.
AVEH	3,250	I.39.I	OE/9636	200	20	0	0	—	—	—	A. Superpictus Occasional specimen only.			Karez opening in village. Output poor. Stored in pool.
QUM.	3250	I.39.I	PA/3818	100,000	50 (OLD RECORD)	3	6% 6%	—	—	—	NO SEARCH			Qum Rud. Wells. Pipe lines.

SURVEY TABLE No. VII.

MALARIA SURVEY No.5.

ROUTE.

TEHERAN - QUM - SULTANABAD (ARAK).

This route was surveyed between 1st July, 1943 and 7th July, 1943. The map references refer to the following ¼" International Ordnance maps which are available in Part.III. with the malaria endemicity of the routes shown in colour.

			Part. III.
I.39.D.	(TEHERAN)	Aug. 1940.	map. 1.
I.39.C.	(SAVEH)	May. 1940.	map 2.
I.39.I.	(QUM)	Aug. 1942.	map. 13.
I.39.H.	(ARAK)	June.1942.	map. 14.

GENERAL.

For purposes of description this route divides itself conveniently into two parts, first, from Teheran to Qum, and then from Qum to Sultanabad.

TEHERAN to QUM. This road passes through an upland desert in which cultivation is only extensive in the vicinity of the large rivers, Keraj and Qara Chai, where irrigation is maintained by series of ground level canal systems. Along the mountain passes water is obtained from deep wells, and in some tested was found to be saline. The foothill regions have karezes, but most of these produce water sufficient only for gardens and very local cultivation. Towards the end of the summer, a large number of the karezes dry out, and so in many villages is found large underground water storage tanks. In general, malaria risks are slight although in the late summer there is a danger from localised breeding places formed by the drying Karezes. Malaria/

Malaria risks increase somewhat along the banks of the two rivers where irrigation canals give rise to a certain amount of anopheline breeding, and at Rahmatabad over one mile from the Qara Chai, a spleen rate of 22% was obtained.

QUM to SULTANABAD. In its first part, this road runs through the low watershed of the Qum Rud. Several canalways are taken off and locally, malaria of moderate endemicity is found at Jarvarjin, where a spleen rate of 44% was obtained. This local malaria continues until the Kuh-i-Ali Nazar range is passed, when the road runs into another upland desert, bordering on the great salt lakes. Here water is scarse, coming either from small karezes or from wells, and malaria risks are minimal until the heavily karezed area at Shabeh and Malkabad is reached. At this point an area of locally endemic malaria, is found in association with gardens which are irrigated from karezes systems.

ROUTE.

There is a metalled road the whole way from Teheran to Sultanabad. Large portions of this road however, are very rough, and travelling is easier along the desert track running parallel to the road.

MOSQUITOES.

Anopheline mosquitoes were found at various points along the route, and these were identified as A. superpictus and A. maculipennis race typicus. A very interesting find was made/

/made at Kinar-i-Gird. In a tea tavern in the village large numbers of A. sacchoravi were caught. After considerable search their breeding place was located on a small seepage about 150 yards from the tavern. Forty-two of the mosquitoes were dissected but no infections were found. The spleen rate of the village was only 12% and the parasite index Nil. This was the only occasion in the whole of the Middle East that A. sacchorovi was found not to be associated with intense malaria. This particular colony of anophelines may have been imported by a vehicle and was attempting to establish itself, but no further opportunity arose in which the position might have been investigated further.

In two areas malaria of high endemicity was encountered and spleen rates up to 44% were encountered. With these exceptions malaria risks throughout the route are slight.

Full detail is shown in Table VIII. following.

ROUTE

TEHERAN – QUM – SULTANABAD

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
KARIZAK	3,250	I.39.D.	KV/7818	150	21	0	0	–	–	–	NOT FOUND	NO SEARCH		Pipe line water supply from springs 3 miles away.
MEHADABAD (Abdullahabad)	3,300	I.39D	KV/7514	100	20	3	15	–	–	–	A. mac. typ. one only.	NO SEARCH		From one fairly large Kareg. Plentiful.
GARDANEH HASSAINABAD	4000	I.39.D	KV/7207	–	–	–	–	–	–	–	A. Superpictus in deserted houses.			one dried out kareze in a deserted village.
KINAR-I-GIRD	3,250	I.39.D.	KV/7399	120	17	2	12	17	0	0	A. superpictus 0-5 per room — A. sacharovi 5-20 per room. EGGS A. sacharovi	A. sacharovi 0-5 per dip.	Seepage from overflowing stream at head of spring.	From Kenj river by canals. This is used for all purposes.
HASSANABAD	3,000	I.39.D.	PA/6699	250	21	3	14	16	1	6	NOT FOUND			All water by canalways from Kenj Rud.
QALEH M'HED ALI KHAN	3,500	I.39.D	PA/4785	150	26	1	4	–	–	–	NO SEARCH.			Two kareges; One sweet & the other salt water collected overnight by blocking kareg channel & released daily.
ALIABAD	4,000	I.39.C.	PA/4472	80	12	0	0	–	–	–	A. Superpictus One only in stable.	NO SEARCH		Water supply from small perennial stream which flows past village.
KUSHT-I-NUSRAT	4,250	I.39.C.	PA/4069	10	5	0	-0	–	–	–	NO SEARCH			Spring water supply which is used for all purposes — 220 yds from village.

SURVEY TABLE No. VIII

ROUTE

TEHERAN – QUM – SULTANABAD ((continued)

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
ASCHARABAD	2750	I.39I	PA/3538	–	–	–	–	–	–	–	A. Superspicies more than 100 in deserted houses	A. Superspicies 5-20 per dip.	Backwaters of river. Vertical weed. Broken shade	Deserted village on Qara Chai.
RAHMATABAD	2,750	I.39.I.	PA/3337	200	18	3	17	15	1	7	A. Superspicies 0-5 per stable	NO SEARCH		Storage from water tanks for drinking. Uncooperative village.
QUM	3,250	I.39.I	PA/3018	100,000	50	3	6	–	–	–	NO SEARCH			Qum Rud. Wells. Pipe line supply.
ANTABAD	3,250	I.39.I	PF/0198	250	24	5	20	–	–	–	A. Superspicies in large numbers.	A. Superspicies 10-30 per dip.	In pools around spring and sp. tall grass.	Spring behind village. Two wells within the village walls.
TALAB	3,750	I.39I.	PA/1507	200	18	4	22	–	–	–	A. Superspicies 5-20 per room or stable.	NOT	FOUND	Karez stream flows round village. Fast with horizontal weed. Water a trifle salt.
JAVARJIN	3,750	I.39.I	OK/9998	250	27	12	44	18	3	16	A. Superspicies 5-20 per room or stable.	A. Superspicies 20-50 per dip.	Seepages from spring trickle out of side of rock.	Stream with many backwaters & pools flows on the North side of the village.
BANABAR	4,250	I. 39I.	OK/9589	50	11	3	27	11	2	18	A. Superspicies 0-5 per room. A. mac. typ. 5-20 per room. A. Sacharovi one specimen FOUND	A. Superspicies 5-20 per dip. A. mac. typ. 5-20 per dip. A. mcd. typ.	Seepages and hoof prints by small swamp ½ mile from village.	Good supply from Karez – adequate for all purposes.
IZUN	4,500	I.39.I	OK/9490	25	10	4	40	9	2	–	A. Superspicies 0-5 per room	NOT	FOUND	One small Karez with little more than a trickle flow.

SURVEY TABLE No. VIII

ROUTE

TEHERAN – QUM – SULTANABAD (concluded).

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
RAGHIRD	5,500	I.39.I.	OK/9289	500	32	0	0	—	—	—	NOT FOUND	No	SEARCH	Karez water. Saline. Drinking water from hill-spring. No algæ - fast flowing.
SALHABAD	5,500	I.39.I	OK/7885	100	12	0	0	—	—	—	No	SEARCH		Karez stream flows round village. Much pollution. Well for drinking purposes.
CHASMEH KHANWARDI	5,500	I.39.I	OK/6776	350	22	1	5	—	—	—	NOT FOUND	No	SEARCH	Karez stream flows right through middle of village. Clean banks. Much fish and life.
MASHKABAD	5,500	I.39.I	OK/6567	1000	56	1	2	—	—	—	A. superpictus two only found in house under bed	NOT	FOUND	Three springs flow into streams. Very well kept – banks of stream cut straight.
SHABEH	5,500	I.39.H	OK/5352	150	28	6	21	20	2	10	A. superpictus 5-20 per room or stable	A. superpictus 5-20		Seepages in Karez stream Hoofprints. Karez stream 5 feet wide flows through village.
MALKABAD	5,500	I.39.H	OK/4052	300	21	4	19	—	—	—	NOT FOUND	No	SEARCH	Extensive Karez water system but no head of water. Flood gates are used to dam back the water each night for release each morning
SULTANABAD (ARAK	6,000	I.39.H.	OK/3252	50,000	189	5	3	—	—	—	No	SEARCH		Wells in houses. Snow stored under houses. Some pipe water.

SURVEY TABLE No. VIII.

MALARIA SURVEY No. 6.

ROUTE

SULTANABAD - SARUQ.

This route was surveyed on 4th July 1943. The map references refer to the following 1/4" International Ordnance map which is available in ~~Vol.~~ PART III. with the malaria endemicity of the route shown in colour.

I.39.H. (ARAK) June 1942. ~~Vol.~~ PART III. map. 14.

GENERAL.

The route Sultanabad to Saruq runs first across open desert to the eastern foothills of the Kuh-i-Hindis range of mountains, then round the foothills to the northern end of the range where Saruq is situated. The range of mountains separates the villages on the route from the Qara Chai, and there is no permanent water on the eastern side of the range.

ROUTE. There is a good desert road all the way from Sultanabad to Saruq, but the road east from Saruq to rejoin the Qum - Sultanabad road at Mashkabad is not passable to more than light motor vehicles.

MALARIA. The whole route is one in which malaria risks are slight. Everywhere water is scarce and none is wasted. No mosquitoes or larvae were found at any point, but it is possible that a very short season of A. superpictus may occur late in the summer in these foothills. Full detail is shown in Table IX. following.

ROUTE

SULTANABAD – SARUQ.

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
SOSANABAD	5,250	I.39.H	OK/2964	130	19	0	0	–	–	–	NO SEARCH			Karez supply. Water scarce. Is dammed back during the day and is allowed to flow into and fill nullahs at night.
NUAZIN	5,500	I.39.H	OK/2274	100	23	3	13	12	1	8	NOT FOUND			Karez supply. The karez dries out in September when underground stored water is used.
SARUQ	6,000	I.39.H	OK/3486	2,500	37	4	11	–	–	–	NOT FOUND			Karez water supply. Adequate. Drinking water from hill springs.

SURVEY TABLE No. IX

MALARIA SURVEY No. 7.

ROUTE

SULTANABAD - MALAYER.

This route was surveyed on the 31st May and the 1st. June, 1944. The map references refer to the following ¼" International Ordance maps which are available in ~~Vol~~ PART III. within the malaria endemicity of the routes shown in colour.

			~~Vol~~ PART III.
I.39.H.	(ARAK)	June, 1942.	p. 14.
I.39.G.	(HAMADAN)	August, 1942.	p. 11.

GENERAL.

The road from Sultanabad (Arak), continues westwards across a low mountain range, enters the fertile Tureh Valley, and then crosses the valley at Tureh to turn northwards, along the barren face of the hills until it reaches Malayer.

Through the Tureh Valley, flowing from east to west, is one of the headwater streams of the Qara Chai. The river here flows through a well-defined channel, but backwaters almost certainly occur in the summer-time, when the water level will be at its lowest. There are no perennial tributaries of this river in this part of its course, but many storm channels exist. In the main, water is scarce. The valley nevertheless is very fertile and wheat, barley and all kinds of fruit are grown as rain crops. The mean altitude of this region is 6,250 feet.

The remainder of the road runs through desert country, except in the regions of Zangheh and Jurab where there are local springs which are utilised for garden farming, until Malayer is reached.

At no point along this road is malaria of more than moderate endemicity encountered. The reason for this is undoubtedly the altitude of the road being nowhere below 5,500 feet, coupled with the fact that the winter is both long and severe. At the time of this survey, no larvae, and only eight adult mosquitoes, were found, but such little malaria as does occur here is probably caused by a short season of A.maculipennis race typicus or else, though less likely, by a short season of A.superpictus.

This sector of the road is in one of the least malarious parts of Persia. The summer climate is delightful, with a day temperature that only rarely rises above 80°F, but in the winter time, the cold is very severe.

Details of findings are shown in Table X. following.

ROUTE

SULTANABAD — MALAYER

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Popu-lation	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
NAMAKHO	6,250	I.39.H	OK/1748	400	18	0	0	–	–	–	NO SEARCH			Small stream from nearby spring sufficient for all domestic purposes.
RIZ	6,800	I.39.H	OK/1150	150	24	3	12	–	–	–	NO SEARCH			Karez water supply with small stream outflow.
MARO	6,000	I.39.H	OK/0743	200	18	4	22	–	–	–	A. superpicta. Three specimens		NOT FOUND	The Qara Chai flows past village. Clear and fast flowing.
MATIABAD	6,250	I.39.H	OK/0247	100	21	5	24	25	1	4	A. mac. typ. 5 specimens are in state of hibernation		NOT FOUND	Small spring head-water with stream flowing through village.
TUREH	6,000	I.39.H	OJ/9645	1500	31	6	20	–	–	–	NOT FOUND			Qara Chai ½ mi. away. A tributary of which flows through village & gives it adequate supply.
QASIMABAD	7,000	I.39.H	OJ/8047	300	28	0	0	–	–	–	NO SEARCH			There are a series of small springs on hill behind village
ZANGANEH	6,250	I.39.H	OJ/6956	500	18	2	11	–	–	–	NOT FOUND			Stream from karez supplies all domestic needs.
JURAB	5,750	I.39.G	OJ/5664	200	20	1	5	–	–	–	NO SEARCH			Springs, slightly salt. Irrigate gardens. Wells for drinking.
MALAYER	5,500	I.39.G	OJ/5271	10,000	236	11	5	–	–	–	NO SEARCH			Town supplied by wells in most houses.

SURVEY TABLE No. X

(90)

MALARIA SURVEY No. 8.

ROUTE

BUROGIRD - ANDIMESHK.

This route was surveyed between 24th and 26th May, 1944. The map references refer to the following ¼" International Ordnance maps which are available in ~~Vol~~ PART III with malaria endemicity of the routes shown in colour.

			PART ~~Vol~~ III.
I.39.M.	(KHURRAMADAD)	Aug. 1943.	map. 12.
I.38.R.	(SIAMARREH)	July,1942.	map. 15.
I.38.X.	(CHAGHA SAFIT)	April,1942.	map. 16.
I.39.S.	(DIZFUL)	April,1942.	map. 17.

GENERAL.

Continuing south from Burogird the road runs along the eastern wall of the upper and higher end of the Durud valley. The first ten miles of the road, although within a mile or two of the head waters of the Ab-i-Diz, is still at an altitude of over 5,500 feet, so the malaria risk is not great, being produced only by a very short season of A.maculipennis and possibly A.superpictus also. From Qaleh Nau to the place where the road forks (Point 00/6495) a distance of another ten miles, the altitude drops a thousand feet, at the same time, spring waters become more numerous and rice fields now appear. With this, an area of A.saccharovi is entered into, and malaria becomes hyperendemic. The left (eastern) fork of the road runs to Durud Town, and that region is surveyed in Survey No. 10. (q.v.), while the right (southern) fork commences to climb/

/climb the last or most southerly fringe of the great Iranian Plateau. It is interesting to note the spleen rate at Khagah is 53% as compared with that of Abotabad, which is 21%, only six miles away but a thousand feet higher.

The road now climbs to 6,750 feet, to the head of the Zagheh Pass and the malaria risk diminishes with the altitude. Leaving the Pass, the altitude drops again to 5,000 feet, the road following the course of the Ab-i-Khurramabad. At Abistan, A. superpictus was found and its presence was associated with an immediate increase in the malaria endemicity. This continued along the road until the large town of Khurramabad, capital of Loristan, is reached.

At Khurramabad a visit to the town dispensary was made, and it was found there that during the previous year, 62% of all dispensary attendances were noted either as "malaria" or as "fever". (No blood examinations are carried out). The spleen and blood examinations carried out on this tour, however, confirm this (S.R.62%, P.I. 35%). The parasites in the twelve positive blood films obtained showed p.vivax only, and it would appear that at the time of the visit an epidemic (probably relapse) of benign tertian malaria was occurring.

Leaving Khurramabad, the road runs north along the northern anticline face of the shoulder of the mountain range to Chambagh, remaining at a mean altitude of 4,000 feet, but by reason of the scarcity of water the malaria risk diminishes.

At Chambagh the road turns south once more and descends out of the mountains, following the course of the Kashgan Rud. Two or three low hill ranges are crossed and at various points along the route the road leaves the river (now re-named the Kharkeh Rud) to rejoin it at points lower down in its meanderings

At Qaleh Husainyeh, the road runs through the foot hills, which beyond Andimeshk become a lowland desert, and at Ahwaz joins the alluvial plains of the Tigris-Euphrates outflow. Between Khurramabad and Andimeshk the area is one of malaria hyperendemicity throughout. The Andimeshk area is dealt with in a separate survey, Survey No. 11. (q.v.).

Until the foothills are reached there is little evidence of agricultural work, though shepherds and their flocks are to be seen dotted about the hills. The land is rocky and barren in the upper part of the route, but lower down beyond the Kashgan Rud, it is believed that, wheat oats or rice could be grown by means of artificial irrigation. The area however, is one across which roams the Baktiari who are far too nomadic by nature, to be interested in static farming.

South of Khurramabad the climate is extreme and shade temperatures exceeding 115 F. are the rule from June until Sept. In the southern part of the route there was at the time of the survey an epidemic of relapse p.vivax infections. Only one of the twenty-nine positive blood films obtained showed p.falciparum with gametocyte forms. From Khurramabad north, it would seem that by May the spring relapse epidemic had not yet appeared. Full survey detail is shown in Table XI. following.

ROUTE

BUROGIRD – ANDIMESHK

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
QALEH NAU	6000	I.39.M	OJ/5714	200	29	3	10	–	–	–	A. Superpictus Three only found in a cowshed.	NOT FOUND.		One mile from Ab-i-Diz. Local non perennial stream
KHAGAH	5000	I.39.M	00/6695	350	32	17	53	14	2	14	A. Saccharoni 0-5 per room	A. Superpictus Seven specimens were taken from edge of ricefield	Ricefield with young rice fronds. Ab-i-Diz small stream tributaries	Village lies alongside the flood course of the Ab-i-Diz. Spring-stream gives domestic water.
ABOTABAD	6000	I.39.M	00/6589	200	19	4	21	–	–	–	NOT FOUND			Well water supply only. Limestone outcrop of "bitter" water.
JAFAR (not on map)	6250	I.39.M	00/6288	80	15	3	20	–	–	–	NO SEARCH	NOT FOUND		Ab-i-Diz River ½ mile below – No local water
ABISTAN	5000	I.39.M	00/3789	150	21	8	38	–	–	–	A. Superpictus 0-5 per room or stable	A. Superpictus occasional specimen	Back water of stream ¼ mile from village	River course dry. Stream ½ mile away – trickle only.
TEL SHE	4750	I.39.M	00/2479	100	15	6	40	–	–	–	A. Superpictus in large numbers in animal houses	NOT FOUND		River alongside village. Wells in the Fort.
KHURRAMABAD	4500	I.39.M	00/1479	25,000	76	46	62	35	12	35	NO SEARCH	A. Superpictus Larvae in large numbers under pebbles in river	Ab-i-Khurramabad.	Ab-i-Khurramabad. Water storage tanks in town. Some pipeline supply. Few springs scattered about town
VAISIYAN	4750	I.39.M	ON/8674	250	16	7	44	–	–	–	A. Superpictus Few only found in houses.	A. Superpictus in large breeding	In back-water and swampy areas by Kashgan Road	Kashgan Road ½ mile away but 300 feet below.

SURVEY TABLE No. XI

BUROGIRD – ANDIMESHK (Concluded)

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate No.	Spleen Rate Enlarged	Spleen Rate %	Parasite Index No.	Parasite Index Pos.	Parasite Index %	Anophelines Adults	Anophelines Larvæ	BREEDING PLACE	WATER SUPPLY
CHAMBAGH.	4500	I.39.M	ON/8288	150	24	13	53	–	–	–	A. superpictus 0-5 per room or stable	NOT FOUND		Alongside Kashgan Rud. Many seepages by jagged banks. Main stream pebbly.
MAMOULAN	3500	I.38.R.	ON/7567	200	27	18	67	24	4	18	A. superpictus 0-5 per room or stable A. fluviatilis 20-50 per stable	A. fluviatilis 10-30 per dip.	Clear water overflow from river into grassy banks.	Alongside Kashgan Rud. Sulphur spring in village.
NATIJ BAKSH	3250	I.38.R.	ON/6765	100	18	12	67	–	–	–	A. Sacharovi Occasional specimen in rooms	NOT FOUND		Village 200 yds from Kashgan Rud.
MELAVI	3000	I.38.R	ON/5753	1000	46	20	43	31	2	6	NOT FOUND	A. turkhudi Bug larvæ A. fluviatilis 10-30 per dip A. superpictus 0-5 per dip.	Backwaters of river. Under pebbles in midstream. In overflows with grass. Hoof prints. Fast flowing	On Kasgan Rud. Fast flowing and perennial. Few shallow wells in houses.
CHAM-I-GARDAB	2000	I.38.X.	ON/7219	50	10	4	40	–	–	–	NO	SEARCH.		On Kharrah Rud. Wide – fast flowing pebbly.
HAZDAH KUZEH	1500	I.39.S	ON/9204	60	11	5	45	11	2	18	A. fluviatilis 20-50 per room A. Stephensi 5-10 per room	A. fluviatilis 5-10 per dip A. Stephensi occasional specimen	In river backwaters In seepage in limestone spring outcrop.	Ab-i-Zal tributary (Perennial stream) of Kharkeh Rud.
QALEH HUSSAINIYAH	800	I.39.S.	OT/0492	150	32	27	87	27	9	33	A. fluviatilis 50-100 per room or stable A. Stephensi 10-20 per room A. superpictus two specimens	A. fluviatilis A. Stephensi Intense breeding	On edges of ricefield. In backwaters of Karez.	From Bala rud. There is also a fast flowing Karez which gives summer water supply.

SURVEY TABLE No. XI

MALARIA SURVEY No. 9.

RAILWAY LINE

DURUD - ANDIMESHK.

The Railway Line in its lower part Durud to Andimeshk was surveyed between 16th and 20th April, 1944. The map references refer to the following ¼" International Ordnance maps which are available in ~~Vol.~~ PART III. with the malaria endemicity of the routes shown in colour.

			PART ~~Vol.~~ III.
I.39.N.	(ALI GUDAR)	June, 1942.	map. 18.
I.39.M	(KHURRAMABAD)	Aug. 1943.	map. 12.
I.39.S.	(DIZFUL)	April,1942.	map. 17.

GENERAL.

The purpose of this tour was not so much to carry out a detailed malaria survey of the Railway Route, as to assess the malaria risk to troops stationed at protective guard posts placed every few miles along the Line. In the Table of Survey Findings then, certain villages are mentioned but in addition a series of posts serially numbered are noted. All the posts were visited. The method of transport was a motor driven rail-car which was lent by the Officer Commanding No. 791 Railway Operating Battalion, U.S. Forces.

The general direction of the route is from north east to southwest, following the course of the Ab-i-Diz River. The upper watershed of this river collects in the Durud Valley above the town of that name, where it turns south to cut through the/

/the south Persian mountain range. For the next 100 miles of its course it passes through barren country lying in a deep gorge, and only occasionally spreads out, but throughout this length there is at least one bank of the river which has a pebbly edge. Large tributaries are few, but many small mountain springs and streams feed the main channel and provide frequent backwaters. At the time of the tour the river was in spate, but there is little doubt that despite the rapid flow in the main stream there is much pooling along its banks, with the formation of many backwaters.

At Shahbazan the railway leaves the Ab-i-Diz and turns westwards along the foothills until it comes to the Bala Rud where it turns south along the course of this river until it reaches the Andimeshk plain. The Bala Rud in this part of its course has a wide sandy bed and flows in many channels with many backwaters. The railway line at Durud is at an approximate altitude of 4,500 feet and in the next 80 miles to Teleh Zang descends slowly to 2,500 feet. At Shahbazan, ten miles further along the line it emerges on to the foothills at 1,500 feet and thereafter continues the rapid descent to 500 feet at Andimeshk.

Between the townships of Durud and Andimeshk, the country is only very sparsely populated. The mountain ranges are barren and water is scarce, but it is among these hills that roam the nomadic tribes of the Lurs and the Bakhtiari seeking grazing land for their cattle. The railway line, however, with its/

/its opportunities of employment and (?) spoil, has attracted a certain number of workers. The railway stations all have mixed and transient populations, while at various points along the line, there are camps for coolie gangs. All such people must be considered heavily infected with malaria. No permanent populations were discovered at any of the railway stations, and no villages are accessible from the railway line. Examinations were carried out at various points among these populations in the belief that, although they are migratory they are indicative of the constant malaria risk which is present in this region.

All the waterways along this route breed anophelines late in the year. Between Durud and Sefid-Dasht, no mosquitoes were found, but would scarcely have been expected as early in the year and after the extremely heavy rain which fell during the tour. At Chamsangar A. superpictus was found and thereafter this species was found wherever search was made as far down as Mazu railway station. At Bala Rud railway station A. pulcherrimus and A. stephensi were both found. In the northern part of the line, later in the year, it is considered that A. sacchorovi, so common in the Durud Valley, will almost certainly appear.

The populations examined all showed malaria of high endemicity or of hyperendemicity. All the positive blood films examined showed only p. vivax, and the absence of p. falcifarum would indicate that new transmission had not yet commenced.

Full survey detail is shown in Table XII. following.

ROUTE
RAILWAY LINE
DURUD – ANDIMESHK.

LOCALITY	DISTANCE FROM PREVIOUS POST	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate No.	Spleen Rate Enlarged	Spleen Rate %	Parasite Index No.	Parasite Index Pos.	Parasite Index %	Anophelines Adults	Anophelines Larvæ	BREEDING PLACE *	WATER SUPPLY & appearance of AB-I-DIG
DURUD	–	4800	I.39.N	00/7783	5000	42	18	43	31	7	23	NOT FOUND A. sacharovi later in year.		Rice fields. Many springs in the hills with consequent seepages. Many irrigation canals	Ab-i-Dig adjacent. Water towers. Springs. Irrigation canals.
Post † No. 80	5 miles	–	I.39.N.	–	–	–	–	–	–	–	–	NO SEARCH		River backwater much vegetation.	Beside Ab-i-Dig. River wide & mud banked, seepages
Post No. 79	2 miles	–	I.39.N	–	–	–	–	–	–	–	–	NOT FOUND		River edge pebbly but some grassy seepages.	Beside wide river – mud banks
Post No. 78	1 mile	–	I.39.N	–	–	–	–	–	–	–	–	NO SEARCH		River edges & backwaters (culex comp)	River becoming pebbly edged & still broad and spread out
Post No. 77	1 mile	–	I.39.N	–	–	–	–	–	–	–	–	NO SEARCH		mountain stream runs past camp River ½ mile away.	River ½ mile away runs through soft earth fields.
KARUN R.S.	2 miles	4250	I.39.M.	00/7174	–	VILLAGE 3Km. away –			NOT VISITED			NOT FOUND		Pebbly edge of river adjacent to camp	River stony-bedded. Pebbles & boulders.
Post No. 75	2 miles	–	I.39.M.	–	–	–	–	–	–	–	–	NO SEARCH		Under pebbles at river's edge.	River enters 1st short deep gorge cutting.
Post No. 74	1 mile	–	I.39.M.	–	–	–	–	–	–	–	–	NO SEARCH		NONE SEEN	Still in gorge with vertical banks of volcanic rock.
Post No. 73	½ mile	–	I.39.M.	–	–	–	–	–	–	–	–	NO SEARCH		Pebbly edges of river, Backwaters & drains.	Still in deep cutting.
Post No. 72	3 miles	–	I.39.M.	–	–	–	–	–	–	–	–	NOT FOUND		All local water	River now emerging from gorge – widening pebbly bedded.
Post No. 71-70	3 miles	–	I.39.M.	–	–	–	–	–	–	–	–	NOT FOUND		mountain spring Swamp just beside camp	Wide pebbly edged large boulders.

* UNLESS WHERE ACTUAL BREEDING IS STATED, THE BREEDING PLACES NOTED HERE ARE "POTENTIAL".

SURVEY TABLE No. XII

ROUTE
RAILWAY LINE
DURUD - ANDIMESHK (contd. 1).

LOCALITY	DISTANCE FROM PREV. POST	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE *	WATER SUPPLY
						No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
POST No° 69	1½ miles	4250	I.39.M	-	-	-	-	-	-	-	-	NO SEARCH		Rock pools No shade.	River flowing in cutting - fast and deep
POST No° 68+67	2 miles	-	I.39M	-	-	-	-	-	-	-	-	NO SEARCH		Many pools. Some puddling of banks	Along side Ab-i-Diz. Now wider + pebbly not so fast flowing.
BISHEN R.S	3 miles	4000	I.39.M	00/6065	60	15	9	60	14	4	29	NOT FOUND		many seepages and depressions. all local water.	alongside river Small springs out of hillside.
POST No° 65	2 miles	-	I.39.M	-	-	-	-	-	-	-	-	NO SEARCH		Pools. No shade	River in gorge some pools
POST No° 64	2 miles	-	I.39.M	-	-	-	-	-	-	-	-	NO SEARCH		Pebbly backwater Village ½ mile from post.	River pebbly and wide
POST No° 63	1 mile	-	I.39.M	-	-	-	-	-	-	-	-	NOT FOUND		Some seepages from tributary stream Weeds+++	River below camp. Tributary stream south of the camp. Coolie camp nearby.
POST No° 62	1 mile	-	I.39.M	-	-	-	-	-	-	-	-	NO SEARCH		under pebbles at river edge Pooling.	River in cutting Some pebbly edge.
POST No° 61	1½ miles	-	I.39.M	-	-	-	-	-	-	-	-	NO SEARCH		River edge pebbly with some grass cover.	100 yds from River. Coolie camp adjacent.
POST No° 60	2 miles	-	I.39.M.	-	-	-	-	-	-	-	-	NO SEARCH		Pebbly edges of river.	River pebbly edges - 20 yds from Post.
SEFID DASHT R.S	1½ miles	3750	I.39.M	00/6253	80	19	14	73	17	4	23	NOT FOUND		Backwater of river. Irrigation canals.	Post 100 yds above river. Village ½ mile away Some irrigation canals led off from river

* UNLESS WHERE ACTUAL BREEDING IS STATED, THE BREEDING PLACES NOTED HERE ARE "POTENTIAL".

SURVEY TABLE No. XII

ROUTE
RAILWAY LINE
DURUD – ANDIMESHK (contd. 2.)

LOCALITY	Distance from previous post	Altitude Feet.	Sheet	Grid Ref.	Population	Spleen Rate No.	Spleen Rate Enlarged	Spleen Rate %	Parasite Index No.	Parasite Index Pos.	Parasite Index %	Anophelines Adults	Anophelines Larvæ	BREEDING PLACE *	WATER SUPPLY (appearance of Rl-i-Dij.)
Post No 58	1 mi	3750	I.39.M	—	—	—	—	—	—	—	—	No Search		Pebbly edges of river Some grass verge	River wide and pebbly
Post No 57	½ mile	—	I.39.M	—	—	—	—	—	—	—	—	No Search		Pebbly edges of river. Some grass verge.	River wide and pebbly.
Post No 56	1 mile	—	I.39.M	—	—	—	—	—	—	—	—	—	—	Post Vacated	
Post No 55	1 mile	—	I.39.M	—	—	—	—	—	—	—	—	No Search		Under pebbles at river edge	River wide and pebbly
Post No 54	2 miles	—	I.39.M	—	—	—	—	—	—	—	—	No Search		Stream with much vegetation. Foot prints.	River ½ mile from Rly Line Weedy stream alongside Post.
Post No 53	1½ miles	—	I.39.M	—	—	—	—	—	—	—	—	No Search		River bed and edges	River wide and pebbly and in many channels
Post No 52	3 miles	—	I.39.M	—	—	—	—	—	—	—	—	Not Found in cookie quarters	Not found at river edges	ditto with cookie camps on banks	ditto.
Post No 51	2 miles	—	I.39.M	—	—	—	—	—	—	—	—	—	—	Post Vacated	
CHAM-SANGAR R.S	1 mile	3250	I.39.M	00/5046	80	21	13	62	18	4	22	Five c. Superficies in at hour in village	Not Found	Under pebbles and in poolings	River broadens out into many channels
Post No 49	½ mile.	—	I.39.M	—	—	—	—	—	—	—	—	Not	Found	Backwaters of stream.	River ¼ mile away. Mountain stream adjacent to Post.

* UNLESS WHERE ACTUAL BREEDING IS STATED, BREEDING PLACES NOTED HERE ARE "POTENTIAL"

SURVEY TABLE No. XII

ROUTE
RAILWAY LINE
DURUD - ANDIMESHK (Contd. 3.)

LOCALITY	Distance From Previous Post	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING* PLACE	WATER SUPPLY & appearance of Ab-i-Diz.
						No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
POST N°48	2½ miles	3250	I.39.M	—	—	—	—	—	—	—	—	NOT FOUND	a superficies larvae under pebbles	Under pebbles in mainstream & in grassy verge of Fib utaries	River wide and pebbly broadest. Small Fib utaries.
POST N°47	2 miles	—	I.39.M	—	—	—	—	—	—	—	—	NO SEARCH	NOT FOUND	Edges of river.	River in deep gorge but pebbly edged
POST N°46	2 miles	—	I.39.M	—	—	—	—	—	—	—	—	NO SEARCH	NOT FOUND	Edges of river and rock pools	River ¼ mile from post and Rly, flowing in deep gorge
POST N°45	1½ miles	—	I.39.M	—	—	—	—	—	—	—	—	No SEARCH		Under grassy verge of stream. Edges of river	River wide and pebbly. Four tributary streams enter here.
POST N°44	½ mile	—	I.39.M	—	—	—	—	—	—	—	—	No SEARCH		Rock pools	River in deep well-defined channel
POST N°43	1½ miles	—	I.39.M.	—	—	—	—	—	—	—	—	No SEARCH		River in gorge. Pebbly edge	River in gorge but out of cutting.
KESHWAR R.S	1 mile	2750	I.39.M	00/4042	40	12	5	42	11	2	18	a. superficies few found in station buildings	NOT FOUND	River ¼ mile away, with Pebbly edge Tributary stream grassy with weed.	River ¼ mile below station, mountain stream Tributary flows beside station. Railway workers
POST N°41	½ mile	—	I.39M	—	—	—	—	—	—	—	—	No SEARCH		Backwaters	River below post in cutting but rock split and many backwaters exist.
POST N°40	½ mile	—	I.39.M.	—	—	—	—	—	—	—	—	NO SEARCH	NOT FOUND	Pebbly edges of various channels.	River alongside Post. many channels
POST N°39	2 miles	—	I.39.M	—	—	—	—	—	—	—	—	No SEARCH		Pebbly bed of river.	River open & wide pebbly. many islands.

* UNLESS WHERE ACTUAL BREEDING IS STATED, THE BREEDING PLACES NOTED HERE ARE "POTENTIAL"

SURVEY TABLE No. XII

ROUTE
RAILWAY LINE
DURUD — ANDIMESHK (contd. 4.)

LOCALITY	Distance From Previous Post	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE *	WATER SUPPLY (appearance of Adv. dirs)
						No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
POST N°38	1½ miles	—	I.39.M	—	—	—	—	—	—	—	—	—	—	River edges	River fast flowing Rocky bedded, pebbly edges
POST N°37	ABANDONED	—	I.39.M.	—	—	—	—	—	—	—	—	—	—	ditto	ditto
POST N°36	½ mile	—	I.39.M	—	—	—	—	—	—	—	—	—	—	Edges of river some pebbles	River entering gorge cutting.
TANG-I-HAFT R.S	3 miles	2250	I.39.M	00/4332	40	8	5	—	8	1	—	A.Superpictus 0-10 in every building	A.Superpictus 0-1 larva per dip	Edges of riverlet tributaries where there was vetted weeds	Anticline valley. River in deep gorge. Rivulet- tributaries
POST N°34	1 mile	—	I.39.M.	—	—	—	—	—	—	—	—	—	—	western bank of river — mud pools.	River runs in sweeping loops through upland stony valley
POST N°33	2 miles	—	I.39.M	—	—	—	—	—	—	—	—	—	—	doubtful	River in another deep cutting.
POST N°32	½ mile	—	I.39.M	—	—	—	—	—	—	—	—	—	—	ditto.	ditto.
POST N° 31	1½ miles	—	I.39.M	—	—	—	—	—	—	—	—	—	—	ditto.	River still in cutting but some rock pools.
POST N°30	1 mile	—	I.39.M	—	—	—	—	—	—	—	—	—	NOT FOUND	Pools and backwaters	River in gorge many pools and bean waters.
POST N° 29	1 mile	—	I.39.M	—	—	—	—	—	—	—	—	—	—	many pools, and overhang-ing wooded banks	ditto.
POST N°28	1 mile	—	I.39.M.	—	—	—	—	—	—	—	—	—	—	ditto.	ditto.

* UNLESS WHERE ACTUAL BREEDING IS STATED, THE BREEDING PLACES NOTED HERE ARE "POTENTIAL"

SURVEY TABLE No. XII

ROUTE
RAILWAY LINE
DURUD – ANDIMESHK (contd 5)

LOCALITY	Distance from previous post	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE *	WATER SUPPLY (appearance of Rs-i-Dij)
						No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
Post No 27	½ mile	–	I.39.M	–	–	–	–	–	–	–	–	–	–	2 pools and crevices	River in gorge, many pools on rocky edges
Post No 26	½ mile	–	I.39.M	–	–	–	–	–	–	–	–	–	–	ditto	ditto
Post No 25	¼ mile	–	I.39.M	–	–	–	–	–	–	–	–	–	–	POST VACATED	
Post No 24	½ mile	–	I.39.M	–	–	–	–	–	–	–	–	–	–	POST VACATED	
TANG-I-PANJ R.S	¼ mile	2000	I.39.S	00/4823	25	9	2	–	9	0	–	A. superpictus in living rooms 0-2 per room	A. superpictus very occasional larvæ in backwaters	Larvæ found in shaded cracks & crevices at river edge.	River in deep gorge but leaving many backwaters.
Post No 22	2 miles	–	I.39.S.	–	–	–	–	–	–	–	–	–	NOT FOUND	Under pebbles	River in gorge and having pebbly backwaters
Post No 21	2 miles	–	I.39.S	–	–	–	–	–	–	–	–	–	Larvæ unidentified	In stream beside canal, much vegetation – Diptera larvæ also	River emerged from gorge – widening. Joined here by a pebbly tributary.
Post No 20	2 miles	–	I.39.S	–	–	–	–	–	–	–	–	–	Larvæ not identified	Actually free in pebbly edges of river.	River wide and pebbly many pebble islands
Post No 19	1 mile	–	I.39.S	–	–	–	–	–	–	–	–	–	–	crevices and backwaters	River in short cutting many crevices and backwaters
Post No 18	3 miles	–	I.39.S	–	–	–	–	–	–	–	–	–	–	Weeds and pebbly edges	River, broadening out pebbly. Weeds
Post No 17	3 miles.	–	I.39.S	–	–	–	–	–	–	–	–	–	–	Edges of tributary. Vertical grasses	River broad and many channelled Island glooming weedy tributary enters here.

* UNLESS WHERE ACTUAL BREEDING IS STATED, THE BREEDING PLACES NOTED HERE ARE "POTENTIAL"

SURVEY TABLE No. XII

ROUTE

RAILWAY LINE

DURUD — ANDIMESHK (Contd 6).

LOCALITY / Distance From Previous Post	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE *	WATER SUPPLY (& appearance of Ab-i-Diz)
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
POST Nº16 — 3/4 mile	—	I.39.S	—	—	—	—	—	—	—	—	—	—	Pools.	River sandy - pools Some railway workers houses
TELEH ZANG R.S. — 1/2 mile	—	I.39.S	—	40	13	4	31	9	2	—	A. Superpictus 0-5 per room. In station buildings and houses	NOT FOUND	In vegetation at river edge much puddling along edges	River wide with many channels and backwaters
POST Nº14 — 2 miles	—	I.39.S	—	—	—	—	—	—	—	—	NO SEARCH	A. Superpictus occasional specimen	Edge of river under stones	River now in one channel but pebbly edged
POST Nº13 — 3 miles	—	I.39.S	—	—	—	—	—	—	—	—	NO SEARCH	A. Superpictus two only — A. pulcherrimus in large numbers	In seepage at head water of spring stream much grass & weed. animal life.	River 1/2 mile from railway. Seepage with spring outflow, flows under railway line.
POST Nº12. — 1 1/2 miles	—	I.39.S	—	—	—	—	—	—	—	—	—	—	Doubtful	River in deep ravine. Flowing very fast.
SHAH-BAZAN R.S. — 2 miles	1500	I.39.S	00/4204	40	14	10	71	12	5	42	A. Superpictus A. pulcherrimus in equal numbers in village living rooms	A. Superpictus A. pulcherrimus in backwater residual pool.	Pools & edges of river.	River 1/3 miles from station. houses backing on river. Flowing slower. Fringe vegetation
POST Nº11 — 2 miles	—	I.39.S	—	—	—	—	—	—	—	—	—	—	Doubtful	River in gorge cutting.
POST Nº10 — ABANDONED	—	I.39S	—	—	—	—	—	—	—	—	—	—	ditto	ditto.
POST Nº9 — 2 miles	—	I.39.S	—	—	—	—	—	—	—	—	—	A. pulcherrimus 7 caught	Pond in middle of stream under grass.	River running east. 1/2 mile from Rly. mountain rivulet stream adjacent to post & Rly.
POST Nº8 — 2 1/2 miles	—	I.39.S	—	—	—	—	—	—	—	—	—	—	Pools.	River 1/2 mile away few like pools

* UNLESS WHERE ACTUAL BREEDING IS STATED, THE BREEDING PLACES NOTED HERE ARE "POTENTIAL".

SURVEY TABLE No. XII

ROUTE
RAILWAY LINE
DURUD – ANDIMESHK (Concluded)

LOCALITY	Distance From Previous Post	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE *	WATER SUPPLY
						No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
POST No 7	5 miles	—	I.39.S	—	—	—	—	—	—	—	—	—	NOT FOUND	Trickling stream	Railway line now leaves Ab-i-Diz Small slow flowing hill stream adjacent to Post.
POST No 6	2½ miles	—	I.39.S	—	—	—	—	—	—	—	—	A stephensi A fulicheno Scarce & in equal numbers in stable	A stephensi 0-1 per dip.	stream overgrown with tall reeds flows alongside camp.	Small overgrown hill stream. cattle now plentiful. Local habitation
MAZU R.S.	1½ miles	1250	I.39.S	00/2803	60	19	13	68	16	6	36	NOT FOUND	A fulicheno 0-5 per dip.	Spring swamp	Springs mostly "bitter," flows behind station
POST No 4	½ mile	—	I.39.S	—	—	—	—	—	—	—	—	—	—	Under pebbles shaded by weed.	On Bala Rud. Very wide - many channels pebbly. Some weed.
POST No 3	8 miles	—	I.39.S	—	—	—	—	—	—	—	—	—	—	River edges under pebbles	Bala Rud flows slowly below Post. many channelled pebbles
POST No 2	ABANDONED	—	I.39.S	—	—	—	—	—	—	—	—	—	—	ditto	ditto
BALA RUD R.S.	6 miles	750	I.39.S	OT/1696	40	14	10	71	14	6	42.	A. fulicheno 5-20 per 20m A. stephensi 10-30 per 20m	NOT FOUND	River edges - pebbles and grass verge.	Bala Rud ¼ mile away, wide with pebbly and grass edge
POST No 1	5 miles	—	I.39.S	—	—	—	—	—	—	—	—	—	—	Hill stream with back-waters	Bala Rud ½ mile away. Hill stream adjacent.
DOHUK R.S.	10 miles	600	I.39.S	OT/0878	—	—	—	—	—	—	—	—	—	—	River 1 mile away
ANDI-MESHK 1943 recording	9 miles	500	I.39.S	OT/1566	2500	67	32	48	24	6	25	No Search		—	from Ab-i-Diz and Bala Rud.

* UNLESS WHERE ACTUAL BREEDING IS STATED, THE BREEDING PLACES NOTED HERE ARE "POTENTIAL"

SURVEY TABLE No. XII

MALARIA SURVEY No. 10.

LOCAL SURVEY

DURUD AREA.

This area was surveyed on 21st and 22nd March, 1944. The map references refer to the ¼" International Ordnance map I.39.N. (ALI GUDAR) June, 1942, shown on ~~page~~ map 18, in ~~Vol.~~ PART III. with the malaria endemicity marked in colour.

GENERAL.

The town of Durud lies at the south eastern end of a long syncline valley which at this point is at its lowest altitude of between 4,500 to 5,000 feet. In this region the valley is about five miles wide, and flowing through its length towards its southern side is the Tirah Rud. About one mile south of Durud this river is joined by the Marbora Rud, and together they continue south as the Ab-i-Diz. The main water-shed of the valley comes from a northern hillside, where in addition to the streams there are many swamps from spring outcrops, but the southern face also has ~~many~~ numerous springs, which either remain as small seepages, or join to form rivulets that flow into the Tirah Rud.

The whole region is very densely populated for two reasons. First that the valley is extremely fertile, and secondly that at Durud, there are large railway sidings and workings, with consequent employment, as it is situated at the point where the railway emerges from its 180 miles climb through the mountains/

ROUTE

† DURUD AREA

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE *	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
HUSSAINABAD	5000	I.39.N	00/7682	100	25	16	72	22	4	18	NOT FOUND		Stream from spring head flows through village. Dries out in the summer-time → ←	Many small spring seepages in the hill side. Rice fields
ANGUSHTEH	5000	I.39.N.	00/7583	400	31	16	51	23	8	33	NOT FOUND		Two small hill side springs with streams flowing round the village. → ←	300 yards above the village on the hill side there are many seepages from a line of small springs
NASIRDIN	5000	I.39.N.	00/7785	100	29	26	90	20	4	20	NOT FOUND		Backwaters of Karez stream Edges of the Tirah Rud many rice fields.	Ce small stream from a Karez flows round the village.
DURUD	4800	I.39.N.	00/7781	2000	42	18	43	31	7	23	NOT FOUND		Edges of the Tirah Rud Many small tributaries. Mill pond and feed stream	Tirah Rud and irrigation canals crossed. Overhead tanks for railway also have pipe leads at various points.

* This survey was carried out out of the malaria season, and breeding places noted are "potential."

† Antimalaria works had been carried out in all four villages for 18 years

SURVEY TABLE No. XIII

/mountains from Andimeshk. Within a radius of five miles of Durud there are roughly 25 villages. This lower part of the valley is heavily cultivated, and water is obtained from the hillside springs, in addition to that which is led out of the Tirah Rud by canals. For a distance of 1½ miles on either side of the river, as it flows through this valley, there is one continuous line of ricefields. On the hillside wheat and barley are also grown.

Four villages were examined in this area, and all showed spleen rates between 43% and 90%. It is to be noted that these recordings were taken in the pre-epidemic period. A total of 96 blood examinations was carried out; of these 23 were found to contain parasites. The distribution of the parasite species was p.vivax 17, p.falciparum 1, p.malariae 2, unidentified 'rings', 3, and one case with a double infection of p.vivax and p.falciparum. Both cases of p.malariae infection were found at Angushteh, while the case of double infection occurred in Hussinabad. The severe degree of malaria occurring in this valley can be judged by the fact that these findings are made after one and half years anti-malaria work.

No adult mosquitoes of larvae were found on the occasion of this visit. On previous occasions the following species have been taken in this area:- A.superpictus, A.saccharovi (elutus), and on one occasion only, A.maculipennis race typicus.

Malaria here is hyperendemic. The epidemic peak occurs in September, with transmission from May until October.
Survey detail is shown in Table XIII. following.

MALARIA SURVEY No.11.

LOCAL SURVEY

ANDIMESHK AREA.

This area was surveyed on 26th and 27th March, 1944. The map references refer to the ¼" International Ordnance map I.39.S. (DIZFUL) April, 1942, shown on map 17 in Part. III, with the malaria endemicity marked in colour.

GENERAL.

Andimeshk lies at the head of the Persian plain, immediately to the south of the first great mountain range. The town and its surroundings, including Dizful, lie in a Bakhtiari desert which is cut by two large, fast-flowing rivers - the Ab-i-Diz and the Bala Rud. The former is perennial in the whole of its course, while the latter is perennial only in parts. For most of its relevant course, the Ab-i-Diz flows through a deep broad cutting, but the east bank has a pebbly ledge. The Bala Rud emerging from a cutting five miles upstream from the Town Area, spreads itself out into a flat, wide, many-channelled stream and has many backwaters.

The villages lying between these two rivers and to the south west of Andimeshk, carry on extensive agricultural work; wheat, barley, rice and melons are all cultivated there. To the north and east of Andimeshk for a distance of 3 - 4 miles, spring and summer crops are grown, and these are irrigated by the many canal-ways which are led across from the Bala Rud, but nowhere in this sector is cultivation intense. And so, by reason/

/reason of the nature of the soil there is no general extensive agriculture to the north of the town. The noteworthy exception to this being Qaleh Ali. Extensive grazing ground exists in the northern foothills and there are some karezes there, but these only produce sufficient water for the herds of sheep and goats.

Six villages were examined in this area and all showed spleen rates of between 36% and 52%. A total of 128 blood examinations was carried out; of these, 28 were found to contain parasites; the parasite species distribution was - p.vivax 21, p.falciparum 3, p.malariae 1, unidentified "rings" 4 and one of these showed double infection with p.vivax and p.falciparum.

It is to be noted that these recordings are made in the pre-epidemic period when the indices are at their lowest.

No larvae were taken at any point in the area during this visit. Only one adult mosquito was taken and that was identified as A.superpictus. At other periods of the year in this region A.d'thali in October, A.stephensi in May, and A.pulcherrimus from July to September have been recorded.

Malaria here varies from high endemicity to hyperendemicity and from previous recordings it would appear that there is a double epidemic in the region, the first occurs between May and July and the second higher peak between September and November.

Extensive anti-malaria works are undertaken here. These were commenced in 1942 and were still being continued at the time of the survey, so that an indication of the severity of the 'natural' malaria can be gleaned from the high indices obtained in 1944.

It is of interest to note that from analysis of the indices obtained, Qaleh Ali presents the source of greatest danger to this area. The presence of p.malariae there indicates that optimum conditions for mosquito propagation exist at some period in the year.

This area was also visited on 8th November, 1943, when dissections of A.d'thali were carried out. 127 specimens were examined but no gland or gut infections were found.

Full survey detail is shown in Table XIV. following.

ROUTE

ANDIMESHK AREA

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE *	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
SINJAR	400	I.39.S	OT/1658	200	31	11	36	21	7	33	NOT FOUND		Backwaters of irrigation canals. Ricefields less than 1 mile away.	Irrigation canal from Ab-i-Diz which is 300 yards from village.
BUNWAR BUZURG	350	I.39.S.	OT/0958	250	28	13	46	19	3	16	NOT FOUND		Ricefields immediate to village. Irrigation canal leakage	Irrigation canal from Ab-i-Diz runs along boundary of village.
CHAMGOLA	500	I.39.S	OT/2466	80	27	13	48	21	3	14	1. Suspicion One specimen only.	NOT FOUND	Under pebbles in main stream of Ab-i-Diz	Ab-i-Diz 200 yards away, in a deep cutting in "cement" desert.
ANDIMESHK (east)	450	I.39.S	OT/1566	1500	18	7	40	18	3	17	NOT FOUND		Backwaters and leakages from High level irrigation canals.	many canalways from the Bala Rud.
ANDIMESHK (west)	450	I.39.S	OT/1467	1000	36	16	41	25	6	24	NOT FOUND		ditto.	ditto.
QALEH ALI	500	I.39.S	OT/1370	250	31	16	52	24	6	25	NOT FOUND		ditto.	ditto.

* This survey was carried out, out of the malaria season, and breeding places noted are "potential."

SURVEY TABLE No. XIV

MALARIA SURVEY No.12.

ROUTE

IRAQ FRONTIER - KERMANSHAH - HAMADAN.

The various parts of this route were surveyed on different dates, and the whole has now been pieced together to make this very important route a single entity. From Khanaquin to Kermanashah the road follows the oil pipe-line and the whole course between Khanaquin and Hamadan divides itself naturally into four parts.

1. SECTOR - Iraq Frontier to Pay-i-Tak.
2. SECTOR - Pay-i-Tak to Kermanshah.
3. SECTOR - Kermanshah to Kangavar.
4. SECTOR - Kangavar to Hamadan.

The map references refer to the following ¼" International Ordnance maps which are evailable in ~~Vol~~ Part III. with the malaria endemicity of the routes shown in colour.

			~~Vol~~ Part III.
I.38.J.	(KHANAQUIN)	1941.	map. 19.
I.38.K.	(SHAHABAD)	June,1942.	map. 20.
I.38.L.	(KERMANSHAH)	July,1942.	map. 21.
I.39.G.	(HAMADAN)	Aug.1942.	map. 11.

Iraq Frontier to top of Pay-i-Tak Pass.

This Sector was surveyed on 20th and 21st Novemebr, 1943.

The road from Khanaquin in Iraq commences at an altitude of about 1,000 feet. It turns sorth east and at once commences to climb, and at Khusrovi on the frontier is at about 1,250 ft.

This small town has only a local water supply drawn from a karez, in addition to two very small springs. The road continues through a barren upland desert until it reaches Qasr-i-Shirin. That ancient town lies on the banks of the Cham-i-Hulwan River, (a tributary of the Diyala River), which is non-perennial, and apart from a few puddles was practically dried out at the time of the visit. It was at Qasr-i-Shirin that the very old canal system from Tak-i-Bustan was directed. In many parts of the routes surviving walls of this canal are still to be seen and still carry water. At Qasr-i-Shirin, the road turns due east and passes between two ridges in the hills as it rises to cross the western mountain wall of Persia.

From Qasr-i-Shirin onwards, a relatively fertile area is entered and this continues until the road rises into the Pay-i-Tak Pass. Throughout the valley which lies to the south of the road, A. saccharovi is abundant, and is associated with rice cultivation. Malaria here is intense. In addition to rice, wheat and barley are grown by means of artificial irrigation. The main occupation of the region is however, sheep farming.

The only larvae taken during the tour were found at Diligan in swamps 400 yards from the village. Twenty-five were examined and all were identified as A. algierensis. Dissections were carried out on adult species of A. saccharovi and of /

/of A. superpictus found at Anzil and Diligan. Twenty-four specimens of A. saccharovi and of A. superpictus were examined; no infections were found; in all, the ovaries were at Stage II, and in the stomachs of five, fresh blood was noted. It would appear then that feeding was continuing even as late in the year as November. Sixty-seven blood films were examined and of these thirty-two contained parasites, all but five of which were p. vivax.

It is pointed out that this survey was carried out in November, but the autumn had been extremely mild and at the time of the tour there had not yet been any ground frost and it is possible that that particular season was unduly prolonged.

Survey detail of this Sector is shown in Table XV.

ROUTE

IRAQ FRONTIER – PAY-I-TAK

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
KHUSROVI	1250	I.38.J	OF/4475	600	32	8	25	—	—	—	A. fluviatilis 5-20 per stable A. pulcherrimus 5-10 per room or stable	A. algiericus 5-20 per dip.	In pooling back-water of karez stream.	Karez stream with fair output. Several sulphur springs. Some wells.
QALEH SALZI	1250	I.38.J.	OF/4778	100	18	3	16	—	—	—	NOT FOUND			Water supply is from one karez with small output. Village is being deserted.
QASR-I-SHIRIN	1500	I.38.J	OF/5389	2500	49	24	49	30	10	30	NOT FOUND	A. algiericus in patches when up to 20 per dips were taken. Few A. pulcherrimus also found.	Cut edges and under pebbles in backwater of the river.	Water from the Chaur-i-Hulwan There is a large stone mortared canal with only very few leakages This comes from miles away and is probably karez fed. Ponds in houses.
SHER QUSH	2500	I.38.J.	OF/7772	50	9	9	100	—	—	—	NOT FOUND.			Small stream flows nearby outskirts of village

SURVEY TABLE No. XV

ROUTE

IRAQ FRONTIER — PAY-I-TAK (concluded)

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
SAR-I-PUL SAHAB	1750	I.38.J.	OF/7984	4000	42	39	92	—	—	—	A. Sacchorovi 20-50 per room or stable. — A. superpictus 5-10 per room or stable	NOT	FOUND	River flows through Town - wide, fast flowing - pebbly bedded.
ANZIL	2000	I.38.J.	OF/8580	60	16	16	100	15	23	65	A. Sacchorovi 50-100 per v stable 0-20 per room. — A. superpictus 5-10 per room or stable	NOT FOUND (Adults with fat body — hibernation commenced)		Large spring 300 yds from village. Network of irrigation canals Extensive rice cultivation throughout whole valley.
DILIGAN	2000	I.38.J.	OF/8478	200	12	12	100	7	14	50	A. Sacchorovi 5-10 per room or stable. — A. Superpictus 10-30 per room or stable.	A. Algeriensis 10-20 per dip.	In seepages by spring clear water - moving - vertical grass.	Three large springs flow together to become stream which flows past the village many seepages and overflows Rice fields on every side of the village.
AMRA	2000	I.38.J.	OF/8878	40	4	8	-	—	—	—	NOT FOUND.			Desolate mountain village. Stream flows through the village from limestone spring outcrop. Some backwaters.
PAY-I-TAK	3250	I.38.K	OF/9378	500	39	25	64	—	—	—	A. Superpictus in tea House - hibernating	NOT	FOUND.	many small mountain trickle streams feed a small river which runs alongside main road. Irrigation canals feed poplar groves.

SURVEY TABLE No. XV

Pay-i-Tak to Kermanshah.

This sector was surveyed in the company of Major J. Yofe R.A.M.C. between 21st and 23rd June, 1943.

After crossing the Pay-i-Tak Pass the road descends to run along the length of the Karind Valley following the course of the Ab-i-Karind river. Malaria is moderately endemic in this valley and the general altitude of the region is sufficiently high to be out of the range of A.saccharovi. The climate too, is sufficiently cool on this northern aspect not to allow of more than a three months transmission season. Rain crops of wheat are grown abundantly here and fruit gardens are numerous.

This upland valley ends at Firuzabad where the road winds through a barren waterless region until Shahabad is reached. The villages here are small and cattle are few in number. Such villages as have remained in this part earn their livlihood by working at the oil pumping station at Aliabad on the Anglo-Iranian Oil Company's pipe line. The course of the Abi-i-Karind runs alongside the road at this point but at the time of the visit was dry. Shahabad is out of this barren region and is a very busy town where both wheat and barley are extensively grown, in addition to the cultivation of the many fruit gardens which exist, but it is here that appears the first rice growing region of Persian Khurdistan. Of the 45 blood slides examined from this part of the road, 15 contained parasites, and 11 of these showed p.falciparum with ring forms. This very high proportion/

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/proportion of p.falciparum shows that malaria transmission had already commenced in this region.

Between Shahabad and Mashidasht the road crosses first a low range of hills at Zabari and then over a pass through the Khurkhur Mountains into a fertile valley through which flows the Ab-i-Marik River. Water is plentiful, rice is grown extensively, and hyperendemic malaria appears. From Shahabad to Kermanshah the higher parts of the road are the more malarious, though the really intense malaria is associated always with springs, poplar plantations, and rice fields.

In Kermanshah spleen surveys were taken from among school children and from children in the streets. The difference in the spleen rates may be explained in the fact that quinine is distributed in the schools to such children as have 'fever'. No registers of quinine distribution were kept in any of the three schools visited. This difference in spleen rate among the different classes of children may further be accounted for by the better home conditions of the school children and also that many of them admit to using mosquito nets at night.

Survey detail of this Sector is shown in Table VXI. following.

ROUTE

PAY-I-TAK — KERMANSHAH

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
SURKHA DIZA	3750	I.38.K	0f/9676	300	38	12	30	—	—	—	a. Superpictus 5-20 per stable	a. Superpictus 0-5 per dip.	In pooling of spring, much rannunculus on the water.	many springs with small streams in all parts of village. All streams flows to water poplar spaces.
HALATEH	4000	I.38.K.	OG/0770	120	15	5	33	—	—	—	a superpictus 8 in one stable only.	NO SEARCH		Small springs, water very unlikely and each of village has muddy backwaters from small springs.
HARIR	5000	I.38.K.	OG/1268	80	14	5	35	—	—	—	Few scattered a. Superpictus	many larvae of a. Superpictus	In foot prints & backwaters of stream - muddy water	One local stream, banks trodden down by cattle.
KARIND	5500	I.38.K.	OG/1564	3000	122	24	19	73	5	7%	a. Superpictus few only, found in uninhabited houses.	a. Superpictus one or two in random dips in backwaters of main town supply. a. maculipennis in mountain pool - very cold water - no shade.	Backwater of main stream ½ mile above town is headwater of ab-i-Karind. a. maculipennis found there - no vegetation.	many springs feed very large mountain pool out of which flows the Ab-i-Karind. Part of this is diverted into pipes as the town's supply.
KHUSRUABAD	5500	I.38.K.	OG/2553	120	23	3	13	—	—	—	NOT FOUND			One small spring now drying out. Villagers deserting Barren country.
FIROZABAD	5500	I.38.K.	OG/3051	DESERTED VILLAGE				—	—	—	NOT FOUND	a. Superpictus under pebbles in stream	Karez stream much vegetation and algae.	One drying out stream from Karez head
ALIABAD	5500	I.38.K.	OG/3448	150	21	2	10	—	—	—	NOT FOUND	NO SEARCH.		Three deep wells only

SURVEY TABLE No. XVI

ROUTE

PAY-I-TAK — KERMANSHAH (concluded)

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
SHARAB KHARAM	5000	I.38.K	06/3648	150	21	14	67	21	6	28	a. superpictus 5-20 per room or stable — a. sacharovi 0-5 per room	a. superpictus 3-10 per dip. — a. maculipennis group — 5-10 per dip.	Sides of lake have much reed, + algae. ditto and also at edges of stream.	One large spring stream which feeds into a small lake. Boggy covering round lake.
SHAHABAD	4500	I.38.K	06/4145	750	32	30	94	24	9	33	a. sacharovi 5-20 per stable	a. maculipennis larvae found. 2 identified	maculipennis group in all pools and in backwaters	Cham-Rawand Rivers Canals last off. Few local springs. much garden irrigation many poplar groves Pobpies.
ZABIRI	4500	I.38.K	06/5352	100	20	14	70	—	—	—	a. superpictus 1 body found in 20 mins.	a. superpictus 0-5 per dip. a. maculipennis group 10-20 per dip!	In weedy parts of stream. Very much shade from weeds.	Line of spring outcrops near and around village.
CHEHAR-ZABAR	5500	I.38.K	06/5557	200	16	4	25	—	—	—	Few a. superpictus only.	NO SEARCH		The main stream through village
MAHIDASHT	4500	I.38.K	06/6654	600	20	17	85	—	—	—	a. sacharovi 50-100 per room or stable.	Few a. superpictus larvae.	In backwaters and seepages. Much weed and shadows.	Ab-i-Mahik flows through village.
KERMANSHAH	4500	I.38.L	06/9068.	50,000							NO SEARCH			
				School Children	235	101	43	—	—	—				
				Town Children	126	77	61	48	18	37				
				Infants	21	3	14	—	—	—				

SURVEY TABLE No. XVI

Kermanshah to Kangavar.

This sector was surveyed in the company of Majors J. Yofe and D. Etherington, R.A.M.C., between the 7th and 10th September, 1943.

Kermanshah, the capital of Persian Kurdistan, lies at the western end of one of the most beautiful valleys in all Persia. On the north of the valley is the Kuh-i-Parau range of mountains, and the anticline face rises sheer to about 11,000 feet. On the south side of the valley is the long gentle slope of the Kuh-i-Safid range, covered with wheat on its upper slopes. On its lower parts are the bright green patterns of the ricefields, and interspersing this colour is seen groups of tall poplar trees growing from out of the scattered head-water springs, surrounded by fields of poppies. The valley is heavily watered, and the spring-water outcrops from the limestone ranges are many. The area is extremely fertile and rice is grown extensively. A. saccharovi has perfect breeding conditions in the ricefields, and that anopholine is reinforced by A. superpictus breeding in the springs, creating between them extremely intense malaria.

It is of interest to note in the analysis of the spleen rates how in a period of only 18 months anti-malaria work, villages within the military "malaria control area" show spleen rate reduction of as much as 40% as compared with adjacent similar villages outside the anti-malaria scheme. The same improvement is shown by comparing the various parasite indices.

At Bisitun the road passes through a narrow defile and enters another similar valley, the Chamchamal Valley, which it crosses following the course of the Gamsiab Rud. At Sahneh the road passes over a group of low hills on to Kangavar. This portion of the road is of slightly greater altitude being at about 5,000 feet, and A.saccharovi became less common and A.maculipennis race typicus was encountered in fair numbers. Malaria in the Chamchamal region though hyperendemic, would appear to be less intense in the Kermanshah valley.

During this tour, 125 blood slides were examined and 27 were found to contain parasites. Of these positive films, 17 showed p.falciparum, either alone or in conjunction with p.vivax, and this high proportion of malignant tertian parasites points to still current epidemic conditions at that time. This was confirmed also by mosquito examinations in the Kermanshah valley where 53 A.saccharovi were dissected, and one specimen with sporozoites and another with oocysts were found. 35 A.superpictus were examined and one specimen was found infected with sporozoites.

Survey detail of this Sector is shown in Table XVII following.

ROUTE

KERMANSHAH — KANGAVAR

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
GAWANA	4500	I.38.L	OG/8978	250	21	21	100	14	4	28	A. Saccharovi 20-50 per room or stable A. superpictus occasionally	A. saccharovi 5-20 per dip	Swamps from overflowing ricefield, & grass	From the Qara Su. Irrigation canals for ricefields
QALEH KUHNEH	4750	I.38.L.	OG/9076	150	16	16	100	16	4	25	A. Saccharovi 20-50 per room or stable.. a superpictus 10-30 per stable	A. saccharovi 5-10 per dip at edge of ricefield a. superpictus at edge of river	Edges of ricefields and under banks of river,	From Qara Su. Small local tributaries.
SHATERABAD	4750	I.38.L.	OG/9372	200	15	15	100	15	5	33	ditto.	A. Saccharovi in swarms in stony headwaters	Edges of ricefields Headwaters of springs. Swamps by riverside	From Qara Su, several small spring tributaries
TAK-I-BUSTAN *	4500	I.38.L	OG/9677	400	27	18	67	-	-	-	A. Saccharovi occasional specimen in animal houses	NOT FOUND	Local springs out of rocks flow into weed covered pool. Irrigation canals for ricefields	Large springs feed pools which flow on to Qara Su. Fresh water pools at Rock Carvings.
NAUKAN *	4500	I.38.L.	OG/9974	100	20	11	55	19	2	11	NOT FOUND	NOT FOUND	Local spring seepage. Swamp ¼ mile away. Poplar groves ½ mile away.	Well in village. Qara Su ½ mile away.
BIJANEH *	4500	I.38.L	OG/9770	60	9	7	-	-	-	-	NOT FOUND	NOT FOUND	Line of seepages fed by spring out crops. Adjacent to poplar groves. Ricefields. Poppy fields.	Three springs with well trained channels flow to feed the Qara Su.
CHALAWEH *	4500	I.38.L	OG/9974	200	16	8	50	12	1	8	NOT FOUND	A. superpictus in unlined pool in poplar grove	ditto	One large spring in village. Water taken off to ricefields and poplar groves

* VILLAGES IN WHICH ANTI-MALARIA WORKS WERE BEING CARRIED OUT.

SURVEY TABLE No. XVII

ROUTE

KERMANSHAH – KANGAVAR (concluded)

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
BALWARDI	4500	I.38.L	OH/2264	80	15	9	60	—	—	—	A. Saccharovi 5-20 per stable	A. Superpictus in stream. 0-3 per dip.	Backwaters of stream. Many swampy areas. Ricefields.	Two wells (deep). One stream with many backwaters Spring head nearby.
BISITUN	4500	I.38.L.	OH/2477	1000	21	15	71	16	5	31	A. Saccharovi 0-5 per room or stable A. Superpictus 20-50 per stable.	A. Saccharovi 5-10 per dip → In seepages at spring head algae & rammenbs A superpictus a few only. → In seepage swamps where there was much grass.		Fresh water springs out of the rocks many seepage springs form into streams which feed the Qara Su.
SAMANGAN	4500	I.38.L	OH/3485	300	14	13	92	—	—	—	ditto	A Saccharovi 5-20 per dip.	Edge of flood area in poplar grove	Multiple springs are led off to feed rice fields, poppy-fields and poplar groves
SAHNEH	4250	I.38.L	OH/4789	250	34	18	53	21	1	5	A. Superpictus 5-20 per room	A. maculipennis group larvae found at edges of stream	edges of stream	A river supplies the town and then flows on to join the Gamasiab Rud Many gardens
SARAB BIDSURKH	5000	I.38.L.	OH/5685	250	20	14	70	12	5	42.	A. mac. typ. one or two per room A. Saccharovi 5-20 per room or stable	A. mac. group 5-20 per dip. (Not Hatched) → In rice fields inside village A. Superpictus 0-4 per dip. → In swamp out of which flows river		Many springs and streams flow in all parts of village.
KARIZ	5000	I.38.L.	OH/6385	200	18	16	89	—	—	—	No SEARCH	No SEARCH	No SEARCH	Large stream with many canals led off to rice fields Said to come from karez 5 km to north.
KANGAVAR	5000	I.38.L	OH/7192	5000	61	39	64	—	—	—	A Saccharovi 10-30 per room or stable. A. mac. typ. in outhouses	A. mac typ groups 5-20 per dip in ricefields → (not hatched out) Ricefields with young fronds. A superpictus 0.5 per dip at edges of grassy stream → Stream, slow flowing, grassy edges – weed, some pollution.		Numerous streams from springs which lie above the town Ricefields on every side. Poplar groves. Poppy fields. Wheat on hillside.

SURVEY TABLE No. XVII

Kangavar to Hamadan.

This sector was surveyed on 20th and 21st July, 1944.

Leaving Kangavar the road turns due north to run along a wide open valley which is at a mean altitude of 5,000 feet. This valley is heavily watered by local springs, but no large watercourse flows through it. Malaria here is patchy and of no great intensity, except where it occurs in association with ricefields or poplar groves. At Deh-i-Buzan although at 5,000 feet, A. saccharovi was found in large numbers in a tea shop and larvae of the Maculipennis Group were found in an adjoining seepage behind the house.

At Asadabad the road climbs across the Kuh-i-Alwand range by way of the Shah Pass, and at the top it is at an altitude of almost 7,5000 feet. No mosquitoes or malaria exist in these limestone hills. Across the Shah Pass the road passes into the Hamadan plain, which again, by reason of its altitude and severe climate, is malaria free.

Survey detail of this sector is shown in Table XVIII. following.

ROUTE

KANGAVAR – HAMADAN

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
ALI DANA	5000	I.39.G	OH/7896	100	15	8	53	—	—	—	NOT FOUND	a culicifacies 0-1 per dip.	at head water of spring. much grass in water.	Village supplied by one spring with extensive seepage at head waters.
KHUSRUABAD	4500	I.39.G	OC/7906	120	22	10	52	—	—	—	No SEARCH			Non perennial stream flows thro' village. One karez with small output
DEH-I-BUZAN	5000	I.39.G	OC/8415	150	18	8	44	18	2	11	R. fluviatilis 20-50 per room.	culicifacies group. 0-5 per dip.	Jui seepage behind tea house	many small springs poplar groves. Limited rice cultivation
ASADABAD	5250	I.39.G.	OC/8623	500	28	4	14	—	—	—	NOT FOUND	NO SEARCH		Well water only. One non-perennial stream
AB-I-BARAK	5500	I.39.G	OC/9935	100	16	2	12	11	0	0	No SEARCH			Scattered springs not sufficient for garden irrigation.
ZAGHA	6000	I.39.G	OD/0534	250	24	0	0	—	—	—	No SEARCH			Wells for drinking Rain crops.
HAMADAN	6000	I.39.G	OD/2226	40,000	82	0	0	—	—	—	No SEARCH			mountain springs have been diverted and now flow into a reservoir which is opened twice daily and flows through open gutters in the streets. Larger houses have wells. Some water from Elvand River.

SURVEY TABLE No. XVIII

MALARIA SURVEY No.13.

ROUTE

KERMANSHAH - LAKE URMIA REGION.

This route as fas as Saqqiz was rapidly surveyed by the writer in June, 1944, in order to fill in various small gaps in the malaria surveys which had been previously carried out in 1942, but there was insufficient available time to proceed beyond Saqqiz. The whole route has now been pieced together, for it offers an interesting picture of malaria, after the outer lip of the Great Iranian Plateau has been crossed. For convenience of description the route has been divided into sectors and these have been chosen to conform with the geographical changes, which incidentally have coincided with the changes in the fauna. The route then is catalogued as follows:-

1. SECTOR - Kermanshah to Senna.
2. SECTOR - Senna to Diwan Darreh.
3. SECTOR - Diwan Darreh to Saqqiz.
4. SECTOR - Saqqiz to Mahabad and on to Miyandaub and areas.

The map references refer to the following ¼" International Ordnance maps which are available in ~~Vol.~~ PART III with the malaria of the routes shown in colour.

			~~Part II.~~ PART III
I.38.L.	KERMANSHAH	July, 1942.	map. 21.
I.38.K.	SHAHABAD	June, 1942.	map. 20.
I.38.E.	MARIVAN	1941.	map. 22.
I.38.F.	BIJAR	June, 1942.	map. 23.
J.38.W.	SAQQIZ	1940.	map. 24.
J.38.V.	MAHABAD	June, 1942.	map. 25.

continued.....

SECTOR I.

Kermanshah to Senna.

The road from Kermanshah to Senna begins by following the anticline face of the Kuh-i-Parau Mountains round the western shoulder of that range. It then turns north across a wide open valley following the course of the Qara Su river, which it soon leaves by crossing a high pass, and picks up the course of the Gaveh Rud, and later that of the Qishlaq river, the valley of which it follows to Senna.

Throughout the whole length of this road some of the most malarious valleys in Persia are crossed. The area although apparently very fertile, is not at any point subjected to intense cultivation. Water is very plentiful, but for the most part it is left in its native state, so that every one of the numberless spring-waters and seepages is associated with a natural swamp. There are a certain number of artificial irrigation areas in relation to rice fields, and in such places malaria of extreme severity occurs. Poplar trees and poppies are grown along the whole length of the road and again, with the natural flood irrigation of such areas, (which invariably are immediate to villages), intense anopheline breeding is to be found. In addition abundant breeding occurs along the courses of the main rivers as well as in their backwaters and tributaries. A. superpictus is to be found throughout the route, breeding/

/breeding in the rivers and springs. A. saccharovi is to be found wherever spring-water swamps occur, in poplar groves, in addition to its typical intense breeding in every rice field.

This tour was carried out very rapidly indeed, and there was insufficient time available to record anything more than spleen rates and to carry out a rapid search for mosquitoes. It is obvious however, from the findings, that the whole of this Sector is one in which there is most intense malaria.

Survey detail of this Sector is shown in Table. XIX. following.

ROUTE

KERMANSHAH — SENNA

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
KERMANSHAH	4,500	I.38.L.	OG/9068	50,000							A. Superpictus Occasional specimen. A. Saccharovi In houses only. Taken in single specimens	NO SEARCH.		Town Supply. Springs flow through town. Qara Su nearby is used for extensive garden irrigation.
				School children	235	101	43							
				Town children	126	77	61	48	18	37				
TAK-I-BUSTAN	4,500	I.38.L.	OG/9677	400	27	18	67	—	—	—	A. Saccharovi 0-5 per room A. Superpictus Occasional specimen	A. Superpictus 0-5 per dip.	In backwaters of stream tributary beyond storage pool.	Springs directly out of rocks, flow into deep pools and released as needed.
GAWANA	4,500	I.38.L	OG/8979	250	21	21	100	14	4	28	A. Saccharovi 20-100 per room or stable. A. Superpictus Occasional specimen.	A. Saccharovi Intense breeding at edge of ricefield	Edges of ricefield. Poppy field irrigation. Vertical grass shade.	Qara Su adjacent used for domestic purposes and for rice irrigation. Poppy fields.
AHMEDABAD	4,250	I.38.L.	OG/8886	250	30	23	77	—	—	—	A. Saccharovi 5-20 per room or stable A. Superpictus 5-20 per stable.	A. Saccharovi 5-20 per dip in ricefield water A. Superpictus 0-5 per dip in poppy irrigation.	Slow moving water - fresh. Shadow from tall grass and poppy plants.	Three local springs which flow on as tributaries of the Qara Su. Poplar groves & poppies
SARABALA	4,500	I.38.L	OG/8594	80	10	10	100	—	—	—	NO SEARCH.			Springs in village with much seepage formation.
SURKHAL	4,750	I.38.K.	OG/8396	40	8	5	—	—	—	—	A. Saccharovi few adult in houses more than 100 per stable	A. Saccharovi 10-20 per dip	Larvae were found only in the rice fields nearest to the river but not in those beside the village.	Ab-i-Razavar which is 2 miles away. Irrigation canals led off to feed intervening ricefields then on to village for domestic purposes.
VARMINJEH (WARMINIYEH)	4,500	I.38.K.	OB/7902	150	17	17	100	—	—	—	A. Saccharovi 0-5 per room or stable	A. Saccharovi Areas of ricefield 0-5 per dip A. Claviger 0-2 per dip	Edges of ricefield with shade from young rice. A. claviger was found under rocks in shadow at cool water margins of springs.	Large number of small spring outcrops with consequent seepages. Extensive rice cultivation.

SURVEY TABLE No. XIX

ROUTE

KERMANSHAH – SENNA (concluded)

LOCALITY	Altitude Feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
KULCHAN	4500	I.38.K	08/7214	80	15	11	73	—	—	—	No Search	A. saccharovi 0-5 per dip. A. superpictus 0-5 per dip.	At edges of rice fields & in seepages with much shade A superpictus in backwaters of River	Alongside the Karbalan Rud. many seepages Extensive rice fields covering the whole area.
BIA	5000	I.38.K.	08/7724	120	19	14	74	—	—	—	A. saccharovi in large numbers in all buildings A. superpictus few in stables	Many larvae taken from river but not identified as containers were frozen in transit	Slow flowing backwater of river – broken duckweed. also behind rocks in mid-stream.	From Karbalan River alongside.
HALTUSHAN	5800	I.38.K.	08/7637	200	16	12	75	—	—	—	NO SEARCH	ditto	In backwaters of rivers in seepages and overflow pools.	Karbalan River runs through village.
GAUSHAN	5500	I.38.K.	08/8144	150	14	10	71	—	—	—	A. saccharovi 3 specimens. A. maculip. Discovery A. superpictus in large numbers in stables.	A saccharovi and A. maculip. in equal numbers but scarce	Under ledges of river banks & in seepages arising from spring outcrops	On Gaveh Rud. River deep & clear flowing, cuts through soft earth. Banks 2 feet above water level. many springs
ASKARAN	4800	I.38.E.	08/7457	200	19	16	84	—	—	—	NO SEARCH (villagers very		unfriendly)	On Ab-i-Sirwan. Poplar grove near village and ricefields on all sides of village.
SENNA	4500	I.38.F.	08/8280	8000	65	46	71	—	—	—	NO SEARCH	A superpictus found in pool in "Hotel" garden.	NO SEARCH	Town lies along the banks of the pebbly-bedded Qizilagaj Rud many springs in the area but most houses have their own shallow well.

SURVEY TABLE No. XIX.

SECTOR II.

Senna to Diwan Darreh.

Leaving Senna the road continues almost due north to Diwan Darreh and runs alongside the valley of the Qishlaq Rudkhaneh as far as Hussainabad. There is another road as far as Hussainabad which crosses over the mountains directly, but that road was not surveyed.

Five miles north of Senna the road begins to ascend and from that point onwards A. saccharovi was no longer found, and an area in which A. maculipennis race typicus prevailed was entered into. With the disappearance of A. saccharovi the intensity of the malaria diminished. The whole valley of the Qishlaq river is intensely cultivated, and alongside its summer course rice is grown. Back from this area there is a large amount of wheat and maize as well as extensive fruit and vegetable gardens. A. superpictus was found breeding in the pebbly bed of the Qishlaq river and its backwaters, and A. maculipennis race typicus was found in the numerous swamp waters associated with seepages. The altitude of this part of the road rises to just over 6,000 feet and at no point is it below 5,000 feet.

Beyond Hussainabad the road passes through a barren upland desert. Villages are few and cultivation is small and is only carried out as gardens in the immediate vicinity of the villages. From Hussainabad as far as Diwan Darreh there is, for practical/

/practical purposes, no free water, and most of the villages are dependant on a well-water supply. Collections of mosquitoes revealed only A. superpictus and in very small numbers. No breeding was found anywhere along this sector.

The general altitude here is between 5,500 and 6,500 feet and frequently in the winter the whole countryside is covered with snow. Spring comes late here, and planting is not commenced until lat April. The summer is pleasant and equable.

Malaria in this sector is of moderate endemicity only, being localised to the vicinity of perennial water.

Survey detail of this Sector is shown in Table XX.

ROUTE

SENNA — DIWAN DARREH

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
NANNALLAH	4500	I.38.F	QB/8585	200	15	9	60	—	—	—	A. sacharovi occasional specimen in houses	NO SEARCH		From Qishlaq Rud Irrigation canals taken off for rice fields.
QULIYAN	5250	I.38.F	QB/8585	300	31	6	20	—	—	—	A. superpictus in rooms only. 0-5 per room	A. superpictus 0-5 per dip	In backwaters of main river. None in spring streams.	Irrigation canal system from Qishlaq Rud. Some local springs
TAZEHABAD	5750	I.38.F.	QB/8585	150	18	3	17	—	—	—	A. mac. typ 5-20 per stable A superpictus occasionally only	A. mac. typ 0-2 per dip. A. superpictus 0-5 per dip.	→ In seepages by the springs. → Under pebbles in main stream of river	Several small springs near village. Irrigation canal from Qishlaq R. fills a reservoir which is released to drive a water mill.
HUSSAINABAD	6000	I.38.F.	JW/9406	1000	21	5	24	—	—	—	A. mac. typ 5-20 per stable A. superpictus 5-20 per room or stable.	NOT	FOUND	There are four large tributaries of Qishlaq Road which unite at the town. Water is very plentiful and many seepages exist.
BAQLABAD	6000	I.38.F	JW/9412	100	19	2	11	—	—	—	A superpictus 5 in 20 min search.	NOT	FOUND	Small stream from a karreze flows through the village. Wells in houses
ZAGHEH	6250	I.38.F	JW/9128	350	14	2	14	—	—	—	A. superpictus two only.	NOT	FOUND	Two karez outlets supply water for all purposes Also near perennial stream. Wells.
NAZAREH BUZURG	5750	I.38.F	JW/8941	120	17	2	11	—	—	—	NOT FOUND	NOT	FOUND	At the Qizil Uzun River side - pebbly and fast flowing.
DIWAN DARREH	6000	I.38.F	JW/8495	3000	30	10	33	—	—	—	Few A. superpictus in stables by river.	NO	SEARCH	Large river flows through town, wide and pebbly. Many fruit and vegetable gardens. Few wells in houses.

SURVEY TABLE No. XX.

SECTOR III.

Diwan Darreh to Saqqiz.

Passing north from Diwan Darreh the road immediately begins to climb once more, and from that town onwards to Saqqiz it runs along the saucer-like adge of the Great Iranian Plateau, and the altitude rises to 7,500 feet; the mean being about 6,000 feet.

About 15 miles north of Diwan Darreh the route turns due west to Saqqiz, and along the whole of this sector there is no free water, and the villages are dependant on deep wells for their water supply. Malaria risk in this sector is slight until Sahib is reached. At that point the altitude begins to fall and the plateau edge has been crossed, and here the great inland watershed of Lake Urmia begins. At Sahib intense malaria is found and at that village, the only village on this sector where mosquitoes were taken, both A. superpictus and A.maculipennis race typicus were found and larvae of both these species were taken from the Zarineh Rud less than two miles away. A.marteri larvae were found in small numbers at a very cold water spring head.

From point where the road crosses the Zarineh river on to Saqqiz, the altitude falls rapidly, and at Saqqiz, once again one enters an area of upland valley cultivation. Saqqiz and the whole area around is heavily watered and some artificial irrigation is employed. In the vicinity of Saqqiz, wheat, barley and oats are grown, and there is some rice cultivation. Poplar groves abound and water is plentiful. In Saqqiz town, A.maculipennis race typicus was taken wherever search was made.

Survey detail of this sector is shown in Table XXI.

ROUTE

DIWAN DARREH — SAQQIZ.

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
ZARINEH	7500	I.38.W.	J.W/7263	120	20	1	5	—	—	—	NOT FOUND			Two wells only. Both deep. No other water in vicinity apart from impermeable shallow wells.
KALEH JUQ	7000	I.38.W	ZJ/0505	100	16	0	0	—	—	—	NOT FOUND			Several deep wells No surface water. There is one wadi which was dry but is said to hold water after the rains.
JIVIAN	6500	I.38.W	ZH/9806	200	24	1	4	—	—	—	NOT FOUND			One non perennial stream. About six wells. Water "bitter"
SAHIB	6000	I.38.W	ZH/8512	150	17	10	59	—	—	—	A. mac. typ. 5-20 per stable — A. superpictus 5-20 per room or stable.	A. mac. typ. 0-2 per dip. — A. superpictus 0-2 per dip A. martini specs. present	→ In seepages beside the springs. — → At the sides of the main river. Little shade. at spring head water much grass, cold water.	many springs and seepages in the vicinity. These join together & flow into the Zarineh Rud 2 miles away. Streams very unlikely
KARIZE	5,500	I.38.W	ZH/7513	300	35	2	6	—	—	—	One anopheles was found ?A. fluviatilis	NOT	FOUND	Large karize now disused — overgrown zone with trickle of water. Canal from the Ab-i-Saqqiz.
SAQQIZ	5000	I.38.W	ZH/6914	5000	90	25	28	—	—	—	A. mac. typ. 5-20 per stable and 0-5 per room, in vicinity of the rivers.	NO SEARCH		Two large perennial rivers flow on either side of the Town. Rice cultivation Poplar groves Many gardens Water plentiful.

SURVEY TABLE No. XXI

SECTOR IV.

Saqqiz to Mahabad and on to Miyandaub and area.

The writer was never fortunate enough to travel over this last part of the road to Lake Urmia. However, to complete the picture of the malaria which exists in this great drainage area of west central Persia, a series of spleen rates have been included in the table following, and the relevant ¼": 1 mile scale maps have been coloured from that information. The figures detailed were obtained from the Army Medical Directory (5) of the War Office from records held there of surveys carried out by No. 1. Malaria Field Laboratory, R.A.M.C.

No detail of populations of villages, of parasite indices or of entomology was available for this region apart from a note that A. superpictus was found throughout the area and that A. maculipennis race typicus abounds in the vicinity of Lake Urmia.

Survey detail of this Sector is shown in Table XXII. & XXIII. following.

ROUTE

SAQQIZ — MAHABAD

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
SERA	5250	J. 38. W	ZH/6429		47	8	17							
KUCHAU JARU	5000	J. 38. W	ZH/6232		16	2	13							
TUBAT	5000	J. 38. W	ZH/6637		22	6	27							
KARIZE	4750	J. 38. W	ZH/6438		17	10	59							
HISAR	4500	J. 38. W	ZH/6241		16	6	35							
ANGIJA	4750	J. 38. W	ZH/6642		29	7	24							
KUL TEPE	4500	J. 38. W	ZH/6443		16	7	40							
BUKAN	4500	J. 38. W	ZH/6446		35	16	46							

SURVEY TABLE No. XXII

ROUTE

SAQQIZ – MAHABAD (concluded)

LOCALITY	Altitude feet.	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
SHAIKH LAR	5000	J. 38.W	2H/5948		19	10	53							
BURHAN	5000	J. 38.V.	2H/4364		21	5	24							
QARA KAND	5000	J. 38.W	2H/5252		17	12	71							
QARA BULAGH	5000	J. 38.V	2H/3468		6	6	–							
ZIDIRSU	5500	J. 38.V	2H/2975		13	6	45							
MAHABAD	5000	J. 38.V.	2H/2173		86	43	50							

SURVEY TABLE No. XXII.

ROUTE

MAHABAD — MIYANDAUB & AREAS.

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
MAHABAD	5000	J.38.V.	ZH/2173		86	43	50							
JUSAF KANDI	5250	J/38.V	ZH/2278		17	8	47							
KUH QALEH	4500	J.38.V	ZH/2383		28	11	40							
KIZA KIAGRIZ	4250	J.38.V	ZH/1489		21	4	18							
GEK TAPPEH	4500	J.38.V	ZH/2784		17	10	59							
TALKHAB	4500	J.38.V	ZH/4093		21	7	33							

SURVEY TABLE No. XXIII.

ROUTE

MAHABAD – MIYANDAUB & AREAS (Concluded

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
MIYANDAUB	4000	J.38.W	ZH/5294		60	9	15							
IBRAHIMABAD	4000	J.38.W	ZH/6387		14	8	57							
GANG ALI	4000	J.38.W	ZH/6984		12	10	80							
UZUN QISHLAQ	4250	J.38.W	ZH/6881		16	4	25							
ALIABAD (not on map)	4250	J.38.W	ZH/6878		11	11	100							
RAHIM KHAN	4500	J.38.W	ZH/6676		22	5	23							

SURVEY TABLE No. XXIII.

MALARIA SURVEY No.14.

LOCAL SURVEY OF

ABADAN ISLAND.

This area was surveyed during the last week of June, 1943. The survey recordings shown in the following Table were made by personnel of No.1. Malaria Field Laboratory, R.A.M.C., and the details obtained by the writer from the Army Medical Directory at the War Office. The maps used were:-

50.TD.02
50.TD.04 Scale 1.27 inch = 1 mile.

These maps, however, are available only for official use, and so it was not possible to include them in Part III.

As Malariologist to the Occupied Area of Persia, the writer repeatedly visited Abadan Island in supervising the anti-malaria works which were being done there, and the following description is being written from the very vivid picture which he still has of that region.

Through the centuries the flood waters of the Shatt-al-Arab and Karun rivers have, during their spate, carried down mud and silt, and at the point of their junction formed a bar. As the silt and mud increases, a time comes when in some subsequent year the flood is not great, and is insufficient to wash over the silt bank, with the result that the course of the river is diverted into another channel, and in this way a silt island is formed. Such mud islands are found in the deltas of all the great fast-flowing, flood-carrying, rivers of the world, as the Nile, the/

/the Ganges, the Brahmaputra, and again here in the Shatt-al-Arab. Abadan is just such an island.

Many islands of this type exist in the mouth of the Shatt-al-Arab, and Abadan is the largest of these, being about 15 miles long and 6 miles wide. This silt soil is ideal for the growing of date palms, and the whole circumference of the island to a depth of half a mile from the river, is planted with palm trees. Along the sides of the island where the Shatt-al-Arab flows, and also where its smaller branch, the Bahmanshire Creek flows, there is a tidal rise and fall of water level, and ebb and flow irrigation of the palm groves is possible, with the result that date cultivation is extensive. In the Karun river proper, however, there is little, if any, tidal wash, and as the effect of the Shatt-al-Arab tide diminishes, so the date palms become fewer. Beyond the reach of the tide's effect, the middle of of Abadan Island is a desert, and practically the whole population of the island is employed at the Refineries of the Anglo-Iranian Oil Company.

Very extensive breeding of A.stephensi and A.pulcherrimus occurs in the palm irrigation canals. Wherever the effects of the tidal wash are felt, this produces a sufficient flushing of the canals to control breeding, and none occurs. But wherever anything, as a palm frond, tin can, a sunken boat, obstructs the tidal wash, breeding is prolific. The main breeding places are in the small pools alongside the irrigation canals, and in/

/in particular, in the irrigation canal terminals where water movement is minimal.

Withthe annual floods of the Shatt-al-Arab, the sub-soil water rises up to ground level on the Island, and fills every depression, ditch, or borrow-pit with water. During the flood, no breeding occurs in such water, but as the river level falls residual water remains in these depressions, which by that time have grown some weed and algae, and intense anopholine breeding may occur. A further site of anopholine breeding is to be found in the town areas. The Anglo-Iranian Oil Company have built a large residential area with houses of the bungalow type, and each of their gardens is irrigated by water stand-pipes. Breeding was repeatedly found in the small pools below the pipes, and in fact, in any water leakage in the area.

Malaria on Abadan Island is hyperendemic, and the spleen rates shown in Table XXIV were all taken after two years of intense anti-malarial work. The vector here is A. stephensi which, from investigations carried out by the anti-malaria units stationed on the island, would appear to transmit malaria throughout the year. At no time was A. saccharovi found on the Island although it was numerous and also a potent carrier, a short distance upstream towards Basra.

Survey detail is shown in Table XXIV. following.

ROUTE

ABADAN ISLAND

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate			Parasite Index			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
KHUMBA	SEA LEVEL	50. TD. 02	TD/076427	120	?		41	—	—	—			The Breeding places of A. Stephensi are always immediate to its blood supply and there is invariably to be found within 200 - 300 yards of human habitation. Twin species Bare is almost completely anopheline.	Directly from the great rivers. There are a few stellens wells which are used mainly after the floods when the salinity water is high, in the town area there are overhead water tanks and pipe line supplies.
MAHARZI	SEA LEVEL	50. TD. 02	TD/077404	100	?		58	—	—	—				
SUWAINA	SEA LEVEL	50. TD. 04	TD/1234	200	?		79	—	—	—				
SULAIKH	SEA LEVEL	50. TD. 04	TD/1436	200	?		90	—	—	—				
BAHMAN-SHIRE	SEA LEVEL	50. TD. 04	TD/1535	80	?		56	—	—	—				
HAJI SALBUQ	SEA LEVEL	50. TD. 04	TD/1131	150	?		86	—	—	—				
JURUF	SEA LEVEL	50. TD. 04	TD/0834	100	?		70	—	—	—				

A. stephensi is found throughout the area breeding in irrigation canals terminals, sumps, shoot pits etc; even in water with much algae and having a high degree of pollution.

The Image ill is the female in clean rooms resting on black clothes or on walls near water-tanks where there is some draught.

A. pulcherrimus is found throughout the area breeding mainly in clear water with vertical grass and floating some floating, either from a local stream or rain.

The Image of is to be found in rooms or stables having a particular preference

SURVEY TABLE No. XXIV.

MALARIA SURVEY No.15.

SURVEY OF

SOUTH PERSIAN OIL FIELDS.

A rapid malaria survey of the south Persian Oil Fields was carried out between 23rd and 26th of April, 1944, not with a view to producing a detailed malaria picture of the area, but in order to assess the malaria risk to troops who were carrying out guard duties at the oil wells. The map references refer to the following ¼" International Ordnance maps which are available in Part III. with the malaria endemicity of the routes shown in colour.

			Part. III.
H.39.B.	(RAM HORMUZ)	November,1942.	Map. 26.
H.39.N.	(HINDIJAN)	November,1942.	Map. 27.
H.39.I.	(BEHBERAN)	November,1941.	Map. 28.

GENERAL.—

The oil fields are situated among the foothills of the south western mountain range. They extend a distance of about 160 miles, from Masjid-i-Sulaiman in the north, to Gach Saran in the south. The wells are all situated on the south west face of the range and lie at an altitude varying between 800 feet and 2,500 feet. Although there are large rivers as the Ramus, Marun, and Zureh rivers, water is not over abundant in these foothills. Most of the water is collected in the higher parts of the range, and in many places the villages survive only by the use of deep wells which produce very 'bitter' water. Around the oil wells, many small 'wadies' exist, but these are either non-perennial, or flow only as a trickle. Many of such/

such streams are brackish.

Below the oil bearing area, there is barren desert extending to the Persian Gulf. Among the hills, the villages are few, and there is little evidence of permanent population. Cattle and sheep are rare and cultivation is only local and spasmodic. The oil wells have however, attracted large populations from among the nomadic tribes of the Qashgolis and Qashgais, as well as large numbers of Indians, all of whom have found settled employment. It is the examination of these imported, but now permanent, populations which becomes the index of the malaria in this area.

In so rapid a survey of so large an area, no more than an indication of the malaria situation can be obtained, but records have been made by Marsh, picturing the whole of the malaria of this part of the world. On this tour, only six points were examined, and with one exception all showed hyperendemic malaria. The notable exception is Masjid-i-Salaiman where the spleen rate found was 18%, but this is the result of many years of anti-malaria work. The blood examinations show current epidemic conditions; all but five of the twenty-five positive blood films obtained showed infections with p.falciparum, either above or together with p.vivax.

Various anopheline species were taken; three miles from Masjid-i-Sulaiman, A.superpictus was found in large numbers near "Numero Hasht" Well. At Haft Kel A.superpictus, A.d'thali, and

/and A. culicifacies were recorded. Throughout the central area A. stephensi and A. pulcherrimus were found together everywhere, with an occasional patch of A. superpictus. Only one or two searches for breeding places were made but no larvae were found.

Except in the region of Masjid-i-Sulaiman where the Anglo-Iranian Oil Company carry out widespread oiling of all waters, anti-malaria work is not extensive, and the malaria risk is extreme. It is of interest to note that in certain areas figures obtained from the Anglo-Iranian Oil Company, show that among their employees, annual total malaria cases (fresh infections and relapses) of over 60% occur,

So rapid a survey of so wide an area is of little value beyond locating the anopheline species and from this to assess the general malaria risk. From this point of view, the whole oil field area must be considered one of hyperendemic malaria. Further, the widespread presence of A. stephensi leads one to view that malaria transmission continues throughout most of the year, although of-course, less vigourously during the three winter months.

Survey detail is shown on Table XXV. following.

ROUTE

SOUTH PERSIAN OIL-FIELDS

LOCALITY	Altitude feet	Sheet	Grid Ref.	Population	Spleen Rate *			Parasite Index *			Anophelines		BREEDING PLACE	WATER SUPPLY
					No.	Enlarged	%	No.	Pos.	%	Adults	Larvæ		
MASJID-I-SULAIMAN	1500	H.39.B.	QU/0516	7,500	28	5	18	—	—	—	C. Superpictus 0-5 per native house,	No	SEARCH	Pipe line supply from Ahwaz. Some local "bitter" springs. There are also shallow wells in many of the native settlements.
HAFT KEL	1250	H.39.B	02/3258	1250	16	9	56	15	5	33	A. Superpictus 0-5 per room. A. d'thali 5-20 per stable. A. culicifacies occasional specimen in houses.	Not	FOUND	Well-water supply. many dried out or drying out storm channels exist.
AGA JARI	1000	H.39.H.	TE/6277	1000	26	16	62	—	—	—	A. stephensi 0-10 per room. A. pulcherrimus 20-50 per animal house	Not	FOUND.	Pipe line supply from storage in the hills. Local spring streams.
PAZANUN	800	H.39.H	TE/7764	500	18	13	72	18	8	44	A. Stephensi 20-50 per room. A. Superpictus occasional specimen in stables.	No	SEARCH	Well water for drinking. Few small spring streams into local Selpheron river.
GACH SARAN	2500	H.39.I.	UA/5627	1500	27	14	67	—	—	—	C. Stephensi and A. culicifacies 5-20 per room	No	SEARCH	Water stores in hills with stand pipe supplies. Some wells.
DUGUNDARBAN	2500	H.39.J	UA/5743	100	20	17	85	20	12	60	A. Stephensi and A. culicifacies 5-20 per room. A. Superpictus occasional	Not	FOUND	Deep wells only.

* SPLEEN RATES AND PARASITE INDICES WERE TAKEN FROM AMONG CHILDREN OF APPARENTLY TRUE "LOCALS" LIVING IN NATIVE HOUSES.

SURVEY TABLE No. XXV.

APPENDIX I

A RAPID STAINING METHOD FOR MALARIAL PARASITES.

METHELENE BLUE POLYCHROMED BY HEAT AND SILVER OXIDE.

(Method used in No. 10. Malaria Field Laboratory, RAMC.)

This stain is double polychromed, namely by pure heat and by silver oxide. In polychroming by exposure to light, the combination of these two dispenses with the time that other stains require.

METHOD.

1.6 gms., Silver Nitrate ($Ag\ NO_3$) is dissolved in 100 ccs., of distilled water. This solution is completely reduced by the addition of a concentrated solution of Caustic Soda (NaOH). This is now filtered and the residue is thoroughly washed to ensure that all traces of the alkali are removed. All residue is collected on a hard filter paper and dried.

1.7 gms., of Pure Methylene Blue is ground up with the Silver Oxide residue in a porcelain dish, and while this is being carried out 50 ccs of distilled water is added. The porcelain dish with its contents is now heated over a Bunsen flame to 85°C and thereafter is placed in a water bath at 100°C, and evaporated to one quarter of its total volume. A buffer solution consisting of 6.3 gms., Potassium Dihydrogen Phosphate (KH_2PO_4) and 5.0 gms., anhydrous Disodium Hydrogen Phosphate, (Na_2HPO_4) dissolved in 500 ccs., of distilled water is now added to the evaporated solution ensuring that thorough/

/thorough mixing takes place.

NOTE. If the hydrated salt of Disodium Hydrogen Phosphate (Na_2HPO_4) is used, the quantity required will be 12.6 gms., instead of 5.0 gms., Do not filter. This stain is ready for use immediately after it is made up. It does not deteriorate.

COUNTERSTAIN - with 0.25% solution of Eosin made up with the same proportions of buffer solution viz: 1.25 gms., Eosin dissolved in 50 ccs. of distilled water to which is added 450 ccs. of buffer solution which has been made up as above.

TECHNIQUE. Thick films should not be made too thick, a thickness of about 10-12 R.B.C's is sufficient. If possible the blood drop should be carefully passed through a flame to dry it. This destroys all fibrin that might tend to obliterate the stained drop. Thin films should be of usual depth. Both thin and thick films should be made on the same slide.

STAINING TIMES AND METHOD.

The thin smear portion, only, of the slide is fixed by dipping into a jar of Methyl Alcohol and then allowed to dry. The whole slide is then stained as follows:-

1. Methylene Blue Solution 8secs
2. Wash in Tap Water 3secs
3. Eosin Solution 2secs
4. Wash in Tap Water 3secs
5. Restain in Methylene Blue Solution.....8secs
6. Wash in Tap Water 3secs

If thick drops only are being stained, the staining process can be stopped at stage 4.

N.B. These staining times have been found satisfactory but may vary slightly with different batches of stain.

BLOOD PICTURE.

(a) Thick Films: Leucocytes stain darkly but well and without distortion or osmotic bursting of the cell. Complete haemolysis of the red cells takes place. The chromatin stains very well indeed and the cytoplasm of the parasite takes up a deep blue stain. No distortion of the parasite occurs. The background of the film is provided by the free haemoglobin.

(b) Thin Films: Both the red and the white cells take the stain up well. The parasites show clearly but the chromatin may tend to stain very dark. The cytoplasm of the parasite takes up a clear blue colour.

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APPENDIX II

SYNOPTIC TABLE FOR THE IDENTIFICATION OF THE ANOPHELINE MOSQUITOES RECORDED FROM PERSIA.

(after T.T. Macan.)

1. Fore margin of the wing with a conspicuous pattern of at least four dark and four light bands alternating 9

\- Fore margin of the wing uniformly dark, or with less than four light and dark bands alternating 2

2. Light and dark scale on the wing, fore margin of the wing dark with a light spot in the middle (only three white spots) . . . . Hyrcanus

\- Dark scales only on wings. 3

3. Dark scales congregated in places to form dark spots visible to the naked eye 4

\- Dark scales uniformly distributed. 5

4. At the tip of the wing the fringing hairs are light in colour and form a distinct spot, dark spots on wings conspicuous. . . Maculipennis

\- All fringing hairs of wing dark in colour, spots on wing less conspicuous . . . Sacharovi

5. Upper surface of thorax unicolorous, white frontal tuft absent 6

\- Upper surface of thorax dark at the sides with a lighter stripe down the middle, white frontal tuft present. 7

6. Hairs on thorax and wing scale very pale, branching of 4th wing vein nearer wing base than branching of second vein . . . . . Apoci

\- Hairs on thorax red-brown or dark-brown branching of 4th wing vein further from wing base than branching of 2nd vein . . . Algeriensis

7. Mesonotum with long dark hairs and no scale, fringing scales at tip of wing light, female proboscis brown with the tip distinctly lighter brown . . . . Marteri

- Mesonotum with golden hairs or hair-like scales on median area, and a tuft of pale scales on anterior border, fringing scales of wing uniformly dark, female proboscis uniformly brown. 8

8. Larger brownish species (wings 5.5 - 6mm. long) scales of frontal and mesonotal tufts dirty white, last joint of female palp less than half as long as the penultimate . . . Claviger

- Smaller blackish species (wings 5mm. long) scales of frontal and mesonotal tufts pure white, last joint of female palp more than half as long as the penultimate . . . . Plumbeus.

9. Tip of hind leg white, abdominal segments with a tuft of erect scales at the distal corners . . Pulcherrimus

- Tip of hind leg dark, abdominal segments without a tuft of erect scales at the distal corners 10

10. Femora and tibiae speckled . . . Stephensi

- Femora and tibiae not speckled 11

11. Light scales on wings confined to costal region, female palp with a light tip and 2 pale bands which may be so obscure that the palp appears unbanded . . . . D'thali

- Light scales on all wing veins; female palp with at least 3 conspicuous white bands 12

12. Tip of female palp dark 13

- Tip of female palp light 14

13. Thorax with distinct scales; base of costa light . . . . . Multicolor

\- Thorax without scales; base of costa dark . . . . . Turkhudi

14. Fringe spots of wing opposite about 2 veins only (frontal tuft not well developed; base of costa with a pale spot; 3rd vein dark; thorax without scales; legs dark except for occasional small bands at the tips of the tibiae; length of wing 2.5 - 3.5 mm.) . . . . Culicifacies

\- Fringe spots of wing opposite most of the veins 15

15. Third vein dark . . . . . Sergenti

\- Third vein light 16

16. Larger lighter species; fork of vein 5 light; light bands on branches of veins 2 and 4 . . . . . Superpictus

\- Smaller darker coloured species, fork of vein 5 dark, branches of veins 2 and 4 uniformly dark . . . . . Fluviatilis

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APPENDIX III

SYNOPTIC TABLE FOR THE IDENTIFICATION OF FULL-GROWN OR THE 4th INSTAR LARVAE OF THE ANOPHELINES OF PERSIA.
(after T.T. Macan.)

1. Long feathered lateral hairs on abdominal segments 1 - 6 frontal hairs small and simple. . . . **Plumbeus**

\- Long feathered lateral hairs on abdominal segments 1 - 3 only, a tuft of simple hairs on abdominal segments 4 - 6; frontal hairs large and feathered 2

2. Inner clypeal hairs close together; antennal shaft hair branched 3

\- Inner clypeal hairs apart; antennal shaft hair unbranched 7

3. Outer clypeal hairs unbranched, occasionally bifid or lightly feathered 4

\- Outer clypeal hairs densely branched 6

4. Leaflets of abdominal palmate hairs with a distinct shoulder, dividing the leaflets into blade and filament; posterior clypeal hairs long and simple . . . . . **Marteri**

\- Leaves of abdominal plamate hairs tapering evenly to a point, posterior clypeal hairs short and branched 5

5. Saddle hair inserted well within margin of saddle, pecten with long spines separated by 2 or more short ones; tergal plates wider than gut; inner clypeal hairs lightly feathered; head markings usually a black transverse band behind bases of the frontal hairs . . . **Algeriensis**

- Saddle hair inserted on or just outside margin of saddle; pecten with long and short spines alternating; tergal plates as wide as gut; inner clypeal hairs usually simple; head markings usually dark spots behind the bases of the frontal hairs . . . . . Claviger

6. Antennal shaft hair relatively long; with about 8 - 12 branches, set near the middle of the antenna; inner clypeal hairs simple . . . . Hyrcanus

- Antennal shaft hair relatively short, with about 5 branches, set about $\frac{1}{4}$ of the way from the base of the antenna; inner clypeal hairs feathered at the tip . . Saccharovi and Maculipennis

7. Outer clypeal hair branched . . . . Pulcherrimus

- Outer clypeal hair simple, occasionally bifid or lightly feathered 8

8. Anterior tergal plates on segments 3 -8 very large, exceeding in width the distance between the palmate hairs, posterior margin strongly convex and embracing the median accessory plate . . . . Fluviatilis

- Anterior tergal plates usually small, posterior margin never strongly convex and never embracing the median accessory plate. 9

9. Both long mesothoracic pleural hairs feathered; palmate hairs on abdominal segments 4 - 7 only . . . . . Turkhudi

- At least one long mesothoracic pleural hair simple; palmate hair on abdominal segments 2 - 7 at least 10

10. Both long mesothoracic pleural hairs simple 11

- One long mesothoracic pleural hair simple 12

11. Branches of inner subcaudal hair with straight ends; a wide gap separating second tooth of mentum from third . . . . .Culicifacies

\- Branches of inner subcaudal hair ends hooked like those of outer subcaudal, first three teeth of mentum evenly spaced. . . . .D'thali

12. Palmate hair on abdominal segment 1, clearly developed though smaller than palmate hair on other segments, one of the long metathoracic pleural hairs simple 13

\- No palmate hair on abdominal segment; both long metathoracic pleural hairs feathered 14

13. Anterior tergal plates wide, extending beyond the gut on either side; No., of branches on frontal hairs, inner 11 - 13; middle 11 - 15; outer 11 - 18, tips of inner submedian caudal hairs curved . . . . . Sergenti

\- Anterior tergal plates narrow, not extending beyond the gut on either side; No., of branches on frontal hairs, inner 4 -8, middle 3 - 4, outer 5 - 18, tips of inner submedian caudal hairs straight. . . . . Apoci

14. A pair of black spots around the bases of the frontal hairs . . . .Multicolor

\- No black spots around the bases of the frontal hairs . . . .Stephensi or Superpictus

APPENDIX IV.

EQUIPMENT.

The equipment boxes carried were designed specially for the purpose of these surveys. In their design many points were kept in mind and earlier models discarded; they had to be of reasonable size so as not to take up too much room in the vehicle and each article had to be securely fixed to obviate the possibility of being broken while travelling over very rough roads. In addition, certain of the articles had always to be readily available or else an opportunity of gaining entry into a house or stable might be lost through the delay in finding, say, torches or test tubes, or children might run away while one was looking for slides on which to take blood films.

The eventual design of the boxes was as follows. Each was three feet long, two feet wide, and two feet nine inches deep, and was divided into a lower compartment in which was placed the less immediately necessary articles and an upper shelf which fitted on top of this and in which was placed articles which may be required at any time while a village was being visited. The lid of the haematomology box was fitted with slots which would hold fresh blood slides facing downwards and thereby prevent flies eating the blood, until such time that one was ready to pack the blood slides away.

Before the commencement of a survey, several hundred blood slides were cleaned in the laboratory and in groups of five were wrapped in clean tissue paper, so that clean slides were always available during the tour.

CONTENTS OF ENTOMOLOGY BOX.

Lower Section:-

Dissecting Microscope, in case.
Two Mosquito Cages.
One Barraud's Box.
Two insect specimen boxes, with prepared mounts.
Four dissecting needles.
Two sets of specimen tubes in wooden blocks.
Larval preserving tubes.
Solutions:-
Normal saline,
90% alcohol,
5% formalin,
chloroform.
Menthol crystals.

Upper Shelf:-

Four torches - spare batteries and bulbs.
Test tubes - two dozen.
Dipping dishes.
Larval nets.
Well net.
Tubes for larvae.
One insect specimen box.
Insect killing bottle.
Chloroform.
Cotton wool.
Gum labels.

Haematology box - Over.

CONTENTS OF HAEMATOLOGY BOX.

Lower Section:-

High power microscope, with oil immersion.
Three slide boxes (to hold 100 slides each).
Spare microscope slides (250).
Methylated spirit.
Wax pencils.
Blood stains.
Quinine tablets (reserve).
Staining jars.
Drying racks.

Upper Shelf:-

Hagedorn needle in Spirit.
Cotton wool.
Wax pencils.
Microscope slides. (100)
Slide box.
Soft silk duster.
Notebook.
Quinine tablets.

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P A R T III.

COLLECTED MAPS SHOWING DEGREE OF MALARIA IN COLOUR.

The colours shown on the maps which appear on the following pages are to be interpreted as follows :-

Green	-	Low Endemicity.
Pink	-	Moderate Endemicity.
Red	-	High Endemicity and Hyperendemicity.

These maps which were obtained through the courtesy of the Directorate of Military Survey, Survey 3(B), War Office, have been arranged in the following order :-

I.39.D	Teheran	-	Map No 1.
J.39.C	Saveh	-	Map No 2.
J.39.U	Shahsawar	-	Map No 3.
J.39.T	Kazvin	-	Map No 4.
J.39.S	Zenjan	-	Map No 5.
J.39.N	Herau	-	Map No 6.
J.38.R	Mianeh	-	Map No 7.
J.38.Q	Maragheh	-	Map No 8.
J.38.K	Tabriz	-	Map No 9.
I.39.B	Nubaran	-	Map No10.
I.39.G	Hamadan	-	Map No11.
I.39.M	Khurramabad	-	Map No12.
I.39.I	Qum	-	Map No13.
I.39.H	Arak	-	Map No14.
I.38.R	Siamarreh	-	Map No15.
I.38.X	Chagha Safit	-	Map No16.
I.39.S	Dizful	-	Map No17.
I.39.N	Ali Gudar	-	Map No18.
I.38.J	Khandqin	-	Map No19.
I.38.K	Shahabad	-	Map No20.
I.38.L	Kermanshah	-	Map No21.
I.38.D	Mariwan	-	Map No22.
I.38.P	Bijar	-	Map No23.
J.38.W	Saqqiz	-	Map No24.
J.38.V	Mahabad	-	Map No25.
H.39.B	Ram Hormus	-	Map No26.
H.39.N.	Hindijan	-	Map No27.
H.39.I	Behbehan	-	Map No28.

MAP N°1

I. 39. D

TEHERAN

ĀSTĀN Nos. 1 & 2.

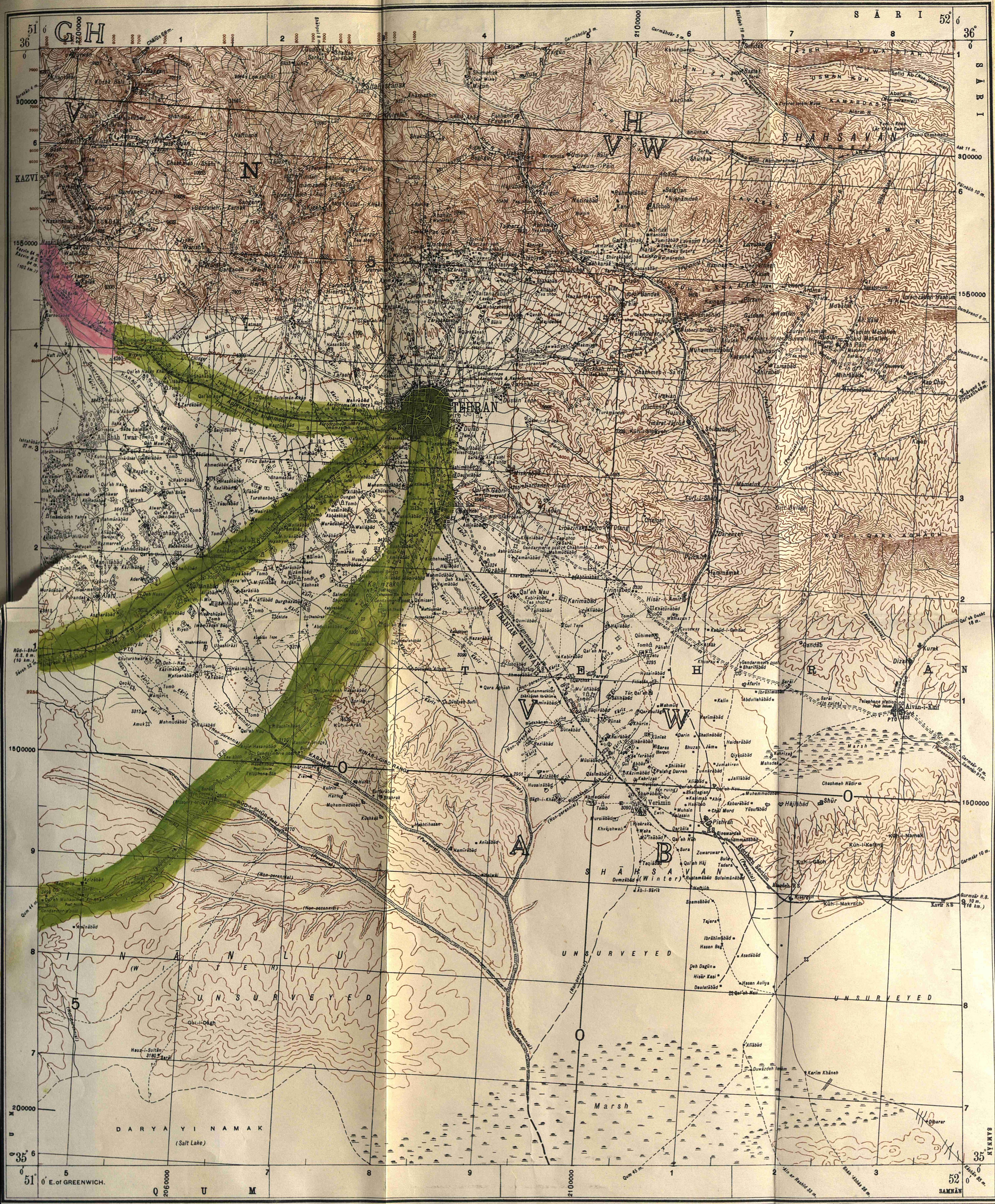
ĪRĀN

Mean Grid North, in this sheet is, for Grid B 3° 30′ / Grid C 4° 8′ East of True North.
Magnetic Declination about 4° 0′ East in 1936. (No annual change).

International No. I-39 D

No. 9 M

TEHRĀN


G H
V H W
N
A
T E H R A N
I N A N L U
D A R Y A Y I N A M A K
(Salt Lake)
U N S U R V E Y E D
Marsh
S Ā R I
S H Ā H S A V A N
K A V Ā S I A
K A N A R D A S H T
U S M Ā N K Ū H
K A R A J R O
K I N Ā R - I - G I R D R A N G E
R Ū D - I - S H Ū R (Salt)
TEHRAN
KAZVĪN
Karaj
Shahriyar
Ali Shāh 'Iwaz
Qadjishāh
Manjilabad
Alard
Sultānābād
Kand
Tarashk
Dushān Tepe
Dulāb
Shahr Rai
Firūzābād
Kahrizak
Karīmābād
Hisār-i-Amīr
Firiniābād
Veramīn
Pishvah
Shāhsavan
Qum 45 m.
Kāshān 85 m.
Garmsār 10 m.
Demāvend 6 m.
Demāvend 3 m.
Pāīnāb 10 m.
Ask 11 m.
Qal'ai Dasht 18 m.
Rūd-i-Shūr R.S. 6 m. (10 km.)
Qum 44 m.
Garmsār R.S. 10 m. (16 km.)
Kavīr R.S.
Sāveh 52 m.
Shāhrūd 3 m.
Garmābdār 3 m.
Garmābdār 5 m.
Bārsābān 4 m.
Chālūs 68 m.
Bāīsādeh 19 m.
Shāhrūd 8 m.
Lavāsān Kūchik
Lavāsān
Tehran Mahallen
Aivān-i-Kaif
Kūh-i-Kalang
Kūh-i-Namak
Kūh-i-Gāch
Kūh-i-Makrach
Kūh-i-Qara Aghāch
Kūh-i-Arāt
Kūh-i-Gul-i-Dāgh
Hauz-i-Sultān
Oibarar
Karīm Khāneh
Duwāzdeh Imām
Alīābād
Hasan Auliya
Deh Dagūn
Daulatābād
Hasan Beg
Asadābād
Ibrāhīmābād
Tajara
Samsābād
Rustamābād
Sulaimānābād
Dumzrābād (Winter)
Āb-i-Bārik
Hājjiūh
Taqiābād
Qal'eh Hāj
Sura
Zowarowar
Qal'eh Nūh
Darbāla
Khvājehwali
Mūrsiābād
Ahmadābād
Bāgh-i-Khās
Hāshtihasan
Hamirābād
Aniābād
Kūshkak
Muhammadābād
Hantug
Kulrin
Ziān
Hoāt
Sūrtarābād
Shahrak
Anjir Hasanābād
Bijin
Qal'eh Nau
Bachinābād
Amuk
Mahmūdābād
Hājiābād
Dūtaābād
Rūdkhāneh-i-Jārūd
Khairābād
Rihānābād
Kūnīak
Darīn
Shallināb
Haidarābād
Qiyāsābād
Jumakiran
Jallilābād
Zunnārābād
Shuzan
Jām
Saras (Sargul)
Shiābād
Palang Darreh
Kāzimābād
Kahrizak
Kolgar
Shaltagian
Kāsimab
Ahin
Hamlab
Chāh Murd
Akbarābād
Yūsufābād
Muhammadābād
Sinewandak
Qal'eh Gabri
Qal'eh Nau
Qal'eh Sabri
Qal'eh Mau
Qal'eh Muhammad Ali Khān
Āzizābād
Amīnābād
Ishtahābād 37 m.
Ibrāhīmābād
Rūdbār
Yaftābād
Firūz Bahrām
Shamsābād
Hasanābād
Nasirābād
Deh Shāh
Iskamān
Wirah
Ahmadābād
Husainak
Qal'eh Nau
Qal'eh Pain (Deh-i-Shāh)
Alwand
Rahmānābād
Imāmzādeh Yahya
Anābād
Hilārūd
Razmarreh
Mahmūdābād
Qal'eh Urrin
Khairābād
Kāzimābād
Kigabūr
Murādābād
Hisārmehtar
Purandak
Asgharābād
Deh Hasan
Sarāsiāb
Mu'āfābād
Durghazābād
Hisārchūpān
Imāmzādeh Baqir
Riyeh
Shahrisānak
Ughashirāzi
Shuturkhwār
Deh-i-Nau
Kāzimābād
Wahsanābād
Qeqāl
Mamūrin
Hākimābād
Ahrābād
Tomb
Karīz
Caravanserai
Telegraph & Telephone line
Motorable
Non-perennial
Perennial
Approximate alignment TRANS IRANIAN RAILWAY
Southern Section
Northern Section
Telephone Stn
Gendarmerie post
Post house
Tea shop
Sarai (in ruins)
Masonry bridge
Ford
Spring
Aerodrome (Military)
Aerodrome (Mamzadeh-i-Hasan)
Aerodrome (Mihrabad)
Approximate alignment
Telephone line
Telegraph & Telephone line
Qal'eh Sulaimān Khān
Qal'eh Murād Beg
Qal'eh Aqa
Qal'eh Hasan Khān
Imāmiyeh
Qoshantepe
Hippodrome & Racecourse
Farahābād
Imāmzādeh Hasan
Qasr-i-Firūz
Turkmanden
Tirakian (Dachenak)
Hujut
Imārat Jārūd
Shikarbegli
Kūh-i-Sipayeh
Tamisian
Kaleh
Sarāsar
Mamaluk
Yurt-i-Shāh
Yurt-i-Bālāeh
Chāh-i-Gāch
Darwezeh
Parchin
Tamrnamak
Qal'eh Nau
Karīmābād
Firiniābād
Hisār-i-Amīr
Khātūnābād
Mamazan 7
Causeway
Kabūd-i-Gumbad
Qūhimeh
Tomb
Pāīshi
Fayetu
3295
Gandab
Kurak
Dizak
Gendarmerie post
Sharifābād
Afarin
Sarāi
Ibrāhīmābād
Abdullahābād
Sarāi (in ruins)
Telephone station
Post house
Ford
PTO
3428
Aivān-i-Kaif
Tehran Mahallen
Sard Mahallen
Ab Pain
Gilak
Causeway
Mihrābād
Kabūd-i-Gumbad
Kāsp Chār
Chonei
Tirakian
Hujut
Imārat Jārūd
Shikarbegli
Kūh-i-Sipayeh
Tamisian
Kaleh
Sarāsar
Mamaluk
Yurt-i-Shāh
Yurt-i-Bālāeh
Darwezeh
Parchin
Tamrnamak
Chāh-i-Gāch
Kūh-i-Qara Aghāch
Chashmeh Nādir
Marsh
Kahrizak
Mahadas
Jamān 9 m.
Garmsār 10 m.
Kūh-i-Kalang
Kūh-i-Namak
Kūh-i-Gāch
Kūh-i-Makrach
Kavīr R.S.
Garmsār R.S. 10 m. (16 km.)
Hājiābād
Shūr
Shūr
Khūrin
Qarabulāg
Runak
Kūnak
Darīn
Shallināb
Haidarābād
Qiyāsābād
Jumakiran
Jallilābād
Zunnārābād
Shuzan
Jām
Saras (Sargul)
Shiābād
Palang Darreh
Kāzimābād
Kahrizak
Kolgar
Shaltagian
Kāsimab
Ahin
Hamlab
Chāh Murd
Akbarābād
Yūsufābād
Muhammadābād
Sinewandak
Qal'eh Gabri
Qal'eh Nau
Qal'eh Sabri
Qal'eh Mau
Āzizābād
Amīnābād
Ishtahābād 37 m.
Ibrāhīmābād
Rūdbār
Yaftābād
Firūz Bahrām
Shamsābād
Hasanābād
Nasirābād
Deh Shāh
Iskamān
Wirah
Ahmadābād
Husainak
Qal'eh Nau
Qal'eh Pain (Deh-i-Shāh)
Alwand
Rahmānābād
Imāmzādeh Yahya
Anābād
Hilārūd
Razmarreh
Mahmūdābād
Qal'eh Urrin
Khairābād
Kāzimābād
Kigabūr
Murādābād
Hisārmehtar
Purandak
Asgharābād
Deh Hasan
Sarāsiāb
Mu'āfābād
Durghazābād
Hisārchūpān
Imāmzādeh Baqir
Riyeh
Shahrisānak
Ughashirāzi
Shuturkhwār
Deh-i-Nau
Kāzimābād
Wahsanābād
Qeqāl
Mamūrin
Hākimābād
Ahrābād
Tomb
Karīz
Caravanserai
Telegraph & Telephone line
Motorable
Non-perennial
Perennial
Approximate alignment TRANS IRANIAN RAILWAY
Southern Section
Northern Section
Telephone Stn
Gendarmerie post
Post house
Tea shop
Sarai (in ruins)
Masonry bridge
Ford
Spring
Aerodrome (Military)
Aerodrome (Mamzadeh-i-Hasan)
Aerodrome (Mihrabad)
Approximate alignment
Telephone line
Telegraph & Telephone line
Qal'eh Sulaimān Khān
Qal'eh Murād Beg
Qal'eh Aqa
Qal'eh Hasan Khān
Imāmiyeh
Qoshantepe
Hippodrome & Racecourse
Farahābād
Imāmzādeh Hasan
Qasr-i-Firūz
Turkmanden
Tirakian (Dachenak)

MAP N° 2

J. 39. C.

SAVEH.

KAZVĪN, QŪM & TEHRĀN PROVINCES.

PERSIA

FIRST EDITION

Approximate Magnetic Declination 3° 45′ East (in 1921).

No. 9. I

SĀVEH

MAP N°3.
J.39.U.
SHAHSAWAR.

ĀSTĀN No. 1.

ĪRĀN

Mean Grid North, in this sheet, is 3° 30′ East of True North.
Magnetic Declination about 4° 30′ East in 1938.
(No annual change).

No.J-39.U
(I. & A. C. No. 8 L)
SHAHSAWĀR

R E S H T

C A S P I A N S E A
85 FEET BELOW BLACK SEA LEVEL

SHAHSAWĀR
P.T.O. & Telephone

Khurramābād
PTO

Dam-i-Jām (Gulijān)

Rāmsar
PO Hospital Hotel
Sulphur springs

Markush

Khashkau

Kashkhan

Ghaldarre

Gāvbar

Khaniyan

Siyalān P.T.

Kuchinān Kūh

Kūh-i-Kardshāl

Shutur Khān

Dodeksar

Haraneh

Kooshgedar

Zavarek

Salambar

Garmedar

Kajargardan

Pichiban

Lazur

Narghiz 13000

Kwisaar Shāh

Dinen Rūd

Ashtar

Hazarchal P.

Tanūr Khān 11700

Zivarchāl 13300

Akanek 13298

Andakan

Kharnak

Kharān

Amirnāh

Ushān

Pole bridge

Mir

Kāsnak

Alisar

Takiya

Nasa

Shanglābād

Safidābād

Kalyanak

Zwidasht

Pishandak

Manābād

Verkesh

Kuni Kibend

Durazān

Kasra?

Bālāghan

Dukhtar Qal'eh

Gyazan

Byazhta

Gūran

Gumar

Barigan

Shahrak

Talaghān Rūd (Perennial)

Ayānak

Mariam

Jordan

Nisa

Choikhāna 2 m.

Khotvend

Qeliand

Fa Shandek

Ashandak

Ibrāhimābād

Samaqābād

Qazi Mahalleh

Nawas Kūh 15000

Qatran 14

Gala Narvan

Sepn

Shahrestān

Miyānrud

Mineral spring

Kalāu P. 14500

Kandichāl P. 7 m.

Takht-i-Sulaimān 15500

Siāh Kamān

Sārir Kūh

Moka 16 m.

Hashr

Mehran

Dizan

Parachen

Khnikan

Alamsar

Lashkarek 13000

Imāmzādeh

Tāsh 13225

Sefrud

Sarfdarān

Sāri

Māmakūh

Sarfān Dasht

Dezambar

Ushgin

Siwazān

Fashand

Coal Mines

Aghbāb

Khir

Arsbābād

Ghārpūzābād 3 m.

Qishlāq

Dabrīābād 3760

Zarqar

Bāqirābād

Gharqābād

Aleh Baghlu

Mahmūdābād

Shahrābād

Muhammadābād Khāra

Khān Pushteh

Khākshān

Rizaābād

Nauduz 8808

Husainābād 3897

Muhrābād

Hasanābād

Khāk Ali 8906

Hazar Julfa

Kachāl

Kamālābād

Yusufian

Nasralābād

Shāshadār

Alvand

Kavandeh
Post House

Sharifābād

Khariyān

Hisār

Hindābād 4371

Mihdiābād

Walāmdar

Abbāsābād

Qarib Marza Khān

Kūh-i-Shāh Sata 8472

Jinsak

Zarin Buetān

Shutrak

Bavrin

Kurmian

Najafbāk

Changir

Namkur

Vers

Kūh-i-Barin 9361

Pargya

Kajarud

Kūh-i-Maljakhāni

Gargan-i-Ab Ambārkash

Tomb

Hira

Mīlak

Darband

Pasraz

Yawid

Sehdab

Abasak

Garmāb

Yarud

Kalayah

Durohan

Shutarak

Kalamin

Hilālābād

Pain Azgarin

Bāla Azgarin

Zoverdasht

Kuhak

Bāla Garmarud

Ahar

Qilid

Allahdar

Tuvan

Haudegan

Shamaklaya

Gasir Khān

Alin

Jilan

Shutur Khān

Alamūt R.

Badasht

Dunbali

Ayah

Yarak P.

Mali Khān P.

Amurdab

Kajarud

Ushān

Pole bridge

Mir

Kharān

Amirnāh

Kharnak

Kāsnak

Andakan

Hashr

Talaghān Rūd

Ayānak

Mariam

Jordan

Nisa

Choikhāna 2 m.

Khotvend

Qeliand

Fa Shandek

Ashandak

Ibrāhimābād

Samaqābād

Qazi Mahalleh

Nawas Kūh 15000

Qatran

Gala Narvan

Sepn

Shahrestān

Miyānrud

MAP N°4
J.39. T.
KAZVIN.

ASTĀN Nos. 1 & 3.

ĪRĀN

Mean Grid North, in this sheet, is for Grid B 2° 25′ East of True North.
Grid O 2° 52′
Magnetic Declination about 4° 30′ East in 1936.
(No annual change).

(I. & A. C. No. 8 H)

KAZVĪN

ARDEBĪL

RESHT

QIZIL UZUN R.

SEFID-RUD

SHAH RUD

ABHAR RUD (Perennial)

TRANS-IRANIAN R.

Customs barrier Iron suspension bridge

Gendarmerie Post

P.T.O. Telephone

Telegraph & telephone lines

Telegraph & telephone line (Perennial)

Road Guard Post

Tomb of Honorable Qurveh

Tomb of Sarsakhi

Tomb of Ramchi

Approximate alignment

Tehrān 203 m.

Tabrīz 295 m. (475 km.)

Qizilja 1 m.

Zanjān 5 m.

Zanjān 38 m.

Gulfepe 1 m.

Alīlar 3 m.

Kumani 6 m.

Arad Saman 8 m.

Sardarūd 3 m.

Khusrūd 3 m.

Tiandasht 3 m.

Natrsiābād 7 m.

Wachiābād 3/4 m.

Railway: Broad Gauge: Double, with Milestone; Single.
" Other Gauges. Double; Single.
Mineral Line or Tramway. Telegraph Line.
Road: Metalled, with Milestone; Unmetalled.
Cart-track. Camel-track or Trade route.
Mule-path, with Pass symbol. Foot-path.
Unsurveyed Stream. Doubtful information.
Well. Oil-well. Deserted Village.
Mine. Spring. Graves.
Mosque. Fort. Watch-tower.

Geographical Section General Staff No. 3919
Published by War Office 1941
2nd. Edition 1942.

Index to Sheets.

8 C	8 G	8 K
8 D	8 H	8 L
9 A	9 E	9 I

International Numbering.

J-39 M	J-39 N	J-39 O
J-39 S	J-39 T	J-39 U
I-39 A	I-39 B	I-39 C

Scale 1 Inch to 4 Miles QUARTER INCH or 1 : 253,440.

Miles 5 4 3 2 1 0 5 10 Miles

Yards 5000 0 5000 10000 15000 20000 Yards

Contour Intervals 250 feet.

Contours are approximate.
Form-lines are at approximate vertical intervals of 250 feet.
Heights refer to the level of the Persian Gulf.
A relative height, .25r represents the approximate height, in feet, between the top and bottom of a steep slope.
The word "Perennial" against water features indicates that they generally contain water, but the accuracy of the information regarding perennial water on this map is not guaranteed and must not be accepted without further investigation.
The numbers along the Resht-Kazvīn road denote distance in versts from Bandar Pahlevi.

PERSIAN GLOSSARY

Āb Water

Administrative Index.

1 ĀSTĀN No. 1
1 ĀSTĀN No. 3

Grid Index.

GRID C

Boundary: International: Demarcated Undemarcated.
" Province or State: do do
" District; Sub Division.
Boundary pillar: Surveyed; Unsurveyed
Heights in feet above mean sea level.
Bench-mark: Geodetic Survey; Canal.
Trigonometrical Station. Intersected Point
Approximate Height.
Post Office. Telegraph Office. Combined P.O. & T.O.
Caravansarai. Halting Place. Camping Ground.

.BM 1417 .1417
.1417 1417
.1417
PO TO PTO
Sarāi Halt CG

Compiled and Published originally under the direction of the Surveyor-General of India 1916 and revised to 1940
Heliographed by O.S.O. 1942.

1,036/7/42F

MAP Nº 5
J.39.S
ZENJAN

ĀSTĀNS Nos. 1, 3 & 4.

Compiled from various sources
(See compilation index).

ĪRĀN

Mean Grid North of Grid C 2° 14′ / Grid B 1° 53′ East of True North.
Magnetic Declination about 4° 40′ East in 1942.
(Increasing by about 1′ annually)

No. J-39 S
ZENJĀN

UNSURVEYED

Zenjān

Nikpei R.S.

Kanuan R.S.

Sāram Sākhli R.S.

Khairābād R.S.

Binab R.S.

IRANIAN STATE RY. (5' 6" gauge) Tehrān 157 m. (258 Km.)

Cultivation

Southern Limit of Grid C
Northern Limit of Grid B

Index to Sheets.

J-38 R	J-39 M	J-39 N
J-38 X	J-39 S	J-39 T
I-38 F	I-39 A	I-39 B

Indian Numbering.

QUARTER INCH or 1 : 253,440.

Scale 1 Inch to 4 Miles

Miles 5 4 3 2 1 0 5 10 Miles

Metres 5000 0 5 8 10 15 Kilometres
Yards 5000 0 5000 10000 15000 Yards

Contour Interval 250 feet. Contours are approximate.

Hill features shown by form lines are at approximate vertical intervals of 250 feet.

A relative height . 25r represents the approximate height in feet between the top and bottom of a steep slope.

The word "Perennial" against water features indicates that they generally contain water, but the accuracy of the

Administrative Index.

ĀSTĀN No. 1

1 ĀSTĀN No. 3.
2 ĀSTĀN No. 4.

Railways, Standard and broader gauges, double; single.
„ other gauges: double; single.
Mineral line or tramway. Telegraph line.
Roads, metalled, with milestone; unmetalled.
Cart-track.
Pack-track and pass. Foot-path.
Unsurveyed stream. Doubtful information.
Well. Oil-well. Deserted village.
Mine. Spring. Graves.
Mosque. Fort. Watch-tower.

Boundary, international: demarcated; undemarcated.
„ province or state: do do
„ district; sub-division.
Boundary pillar: surveyed; unsurveyed.
Heights in feet above mean sea level:
Bench-mark: geodetic; canal. BM 1417 .1417
Trigonometrical station. Intersected point. △1417 .1417
Approximate height. .1417
Post office. Telegraph office. Combined P.O. & T.O. PO TO PTO
Caravansarai. Halting place. Camping ground Sarai Halt CG

Geographical Section General Staff No. 3919

No. J.39.M



MAP N°6
J.39.M
HERAT.

ĪRĀN

No.J-39.M (I. & A. C. No. 8 C)

Mean Grid North, in this sheet, is 2° 14 East of True North.
Magnetic Declination about 4° 30′ East in 1936.
(No annual change).

HERAU

Aqchāi Ulia
Aqchāi Sufla
Kurturmish
Kaibadarreh
Mirza Khān Qishlāqi
Soin
Kiffabad
Beikeri
Dashkeri
Bazhkeri
Buzli
Dalmadaghli
Harem
Kachālabād
Qara Chenār
Meshkinjik
Surbai
Qaraga
Ajla Kandi
Sakhanli
Dovahanli
Sakschi
Narli Qishlāqi
Kuraim (Korochim)
Āq Karaba
Ali Kuli Qishlāqi
Ajim Qishlāqi
Hājī Gim
Qishlāq Gharib
Sihabad
Milish
Mizhder
Khalaf Ali
Qal'eh Jik
Kirkhbulāq
Qishlāq Qasim
Bābā Ali Qishlāqi
Dashbulāq
Jerjer
Taba Ali
Khadim Ali
Tutunsus
Konak Kiran
Tutunsus P.
Hasan Ali Kand
Push
Qizil Khush P.
Qara Qishlāq
Muchankal ?
Kazwar
Mara Khaneh
Nuqi
Portovo
Sanava
Pāqi
Dushmanli
Tardizak
Qara Qishlāq
Dushmanli
Armudakh
Qaraga
Enerja
Kuin
Zakir
Tabaganni
Surbakh
Endjavad
Tazehabad
Hājī Yusuf
Kajalukh Kand
Qizil Yatāgh
Mulk
Tadmara
Kialgish
Karandagh
Tarumdāgh
Marbagh
Shasiwarri
Hafta Chashmeh
Arsadiga
Pasirova
Aghanirri
Laila
Jandchai
Qivi Yukari
Qivi Ashaghi
Surabara
Iqbulāqi
Saghavar
Ilkizi
Saghavar Chai
Riz
Zalanjua
Qortevlar
Valigan
Shahrajua
Foal
Ahmadabād
Rustamabād
Zand
Ziarat
Qabagh
Bagliawa
Magiava
Sukhbulāq
Bina Khalkhal
Qishlāq
Zarenja Chai
Kegnan (Aqlar)
QIZIL UZUN R. (Perennial)
Māmān Ford
Abvāz 5300
Hagamun
Kenov ?
Kajal
Qizilja
Tazeh
Mazra'eh Ferry
Mindajin Ferry
Tai 5090
Hishain
Shigilyat ?
Manārum
Qalian
Kalat
Gil Gulāb
Rashidābād
Kunjun
Yanbulāq
Behmanabād
Tazeh Kand
Qal'eh Qarabulāq
Ahmadabād
Qarabulāq
Lalahlu
Qāzi Kandi
Okhtamush
Hāji Mik
Shirinbulāq
Āq Kand
Bashbulāq
Sulaimān Qishlāq
Bashbulāqi
Sulaimānbulāqi
Gulteqe
Hāji Mahmudlu
Qaraghanlu
Rudāghlu
Khairābād
Qara Qaiya
Birundeh
Toghar
Baridarreh
Qara Aghach
Chomalu
Hamamlu
Qishlāq
Aqcha Qal'eh
Ahmadabād
Qiblahbulāq
Dashbulāq
Kalachi
Qaitul
Filah Khasah
Qarya Guli
Qamchiqal
Dulak
Arāk Zangir
Sardehat
Lahargin
Qandirqalt
Dāgh Zangi
Kiah Dagh
Chili Khaneh Kuh
Qarul
Qarul
Tukmandash
Telamābād
Qchulāq
Dashtepe
Qandilah
Taqkandi
Mashkin
Zarenja 55 m.
Tehrān 253 m. (375 km.)
Bulak 2 m.
Jalālābād 2 m.
Karmahāhana 2 m.
Dizeh
Rashkasri
Khwāneh
Lissār Bāzār
Altar
Harandeh
Qal'eh Chin Qadim
Kharandan
Newan
Qal'eh Bin
Qal'eh bin Watkeh
Folghalleqanarch
Bakhtiar Mahalleh
Khwājeh Kiri
Shaikh Mahalleh
Chalanbar
Kurhalan Pushteh
Jam'aku
Tangehdeh
Kargānrūd PTO.
Kuwohkri
Sikandar Mahalleh
Nalband
Tazehābād
Kulārud
Minareh Bin
Otāq Sara
Fida Ali Beg
Ambarpusht
Hindi Kerān
Dehrezhlu
Meshaweshah
Bandar Pahlavi 34 m.
Tarandeh
Asalem
Nauzhah Mahalleh
Nūr Mahalleh
Qal'eh Sara
Warudansar
Kalandeh
Pirtahlāt
Mahalleh Shaikh ul Islam
Nov ?
Rovra P.
HERAU (HIRĀBĀD)
Qal'eh Sara
Ilija
Ilkizi
Ziarat
Qal'eh Jik
Qishlāq Sari Khān
Qaiyahlu
Qal'eh Sara
Qal'eh Sara
Qal'eh Sara

MAP N° 7

J. 38. R.

MIANEH.

ĀSTĀN Nos. 1, 3 & 4.

ĪRĀN

Mean Grid North, in this sheet, is 1° 35′ East of True North.
Magnetic Declination about 4° 10′ East (in 1939).
(Decreasing by about 15″ annually).

No. J-38 R
(I. & A.C. No. 1 O.)
MIĀNEH

TABRĪZ — ARDEBĪL — ZENJĀN — MARĀGHEH — SARASKAND — MIĀNEH — TARK — QIZIL UZUN — QIZILJAH

Unsurveyed — Approximate alignment — Fit for occasional M.T. — Perennial — Telegraph & telephone lines — Telephone Office — PTO — CG — RS — Tabriz 38 m. — Tabriz 42 m. — Marāgheh 48 m. — Yamni 10 m. — Tolqja 4 m. — Khojalar 5 m. — Ahvar 18 m. — Qābāgh Fort 18 m. — Zenjān 39 m.

Railway:—Broad Gauge: Double with Mile-stone. Single
„ Other Gauges: Double. Single
Mineral Line and Tramway. Telegraph Line
Main Road:—Metalled with Mile-stone. Unmetalled
Cart-track. Camel-track or Trade route
Mule-path, with Pass symbol. Foot-path
Unsurveyed or doubtful routes
Well-(1) Water, (2) Oil. Mine. Spring. Graves
Mosque or Imāmzāden. Fort. Watch-tower. Deserted Village

Index to Sheets.

1	J N B	8
K	O C	
L	P D	
1		8

International Numbering.

J-38 K	J-38 L	J-39 G
J-38 Q	J-38 R	J-39 M
J-38 W	J-38 X	J-39 S

Scale 1 Inch to 4 Miles, or 1:253,440.

Miles 5 4 3 2 1 0 5 10 Miles

Metres 5000 0 5000 10000 15000 20000 Metres

Contours and clinometric heights are approximate.

The word 'Perennial' against water features indicates that they generally contain water, but the accuracy of the information regarding perennial water on this map is not guaranteed and must not be accepted without further investigation.

Administrative Index.

ĀSTĀN No. 3
ĀSTĀN No. 4
1 ĀSTĀN No. 1.

Boundary of different countries
„ „ Province
„ „ District
Great Trigonometrical Survey Bench-mark . . . B M 1417
Trigonometrical Station . . . △ Khari
Intersected Point (with height) 1520
Heights-Trigonometrical Approximate. Relative . . . 2500 970 156 r
Post Office. Telegraph Office. P. O. & T. O. combined . . . P O T O PTO
Caravanserai. Halting Place. Camping Ground . . . Car: H P C G

Compiled and Published originally under the direction of the Surveyor-General of India 1922 and revised to 1940
Heliographed . . . . . by O.S.O. 1942.

Geographical Section, General Staff No. 3919
Published by War Office, 1931.
2nd Edition, 1942.
4000/4/42. No.2 RGR SEC. R.K.

TO GIVE A REFERENCE ON THIS MAP

LETTER	See LETTERS ON MAP
FIGURES	DISREGARD THE SMALLER FIGURES IN THE BORDERS, which give full co-ordinates from origin, viz. 2400000
	USE THE LARGER BORDER FIGURES or those printed on the face of the map.
POINT	△ KŪH-I-BAZQŪSH — LETTER D

47° 0′ E. of GREENWICH — 48° 0′ 0″

MAP N° 8

J. 38. Q

MARAGHEH.

ĪRĀN

ĀSTĀNS Nos. 3 & 4.

Compiled from various sources.

Mean Grid North, in this sheet, is 0° 57′ East of True North.
Magnetic Declination about 4° 0′ East in 1939.
(Annual change negligible).

No. J-38 Q
MARĀGHEH

T A B R Ī Z

Z C Z D

Z H Z J

T A B Ā D

M A H Ā B Ā D

K U H S T A N I

S H A H A R I S T Ā N I

M A R Ā G H E H

Sa'idabad

Khusraushāh

Sultan Dagh 11148

Hasan Sultan 11610

Chām Dāgh 12138

Ahram Dagh 10990

Kandevan 10259

Kuh-i-Sufiān 10288

Kuh-i-Sabalān 14785

Kuh-i-Sahand 11906

Kuh-i-Misho 11811

Kuh-i-Kaftar 11811

Kuh-i-Kalān 11811

Kuh-i-Kabūd 11811

Kuh-i-Kabūd 11811

Kuh-i-Kabūd

MAP N°9.

J.38.K.

TABRIZ.

ASTAN No. 3.
ARMENIAN S. S. R.
AND AZERBĀIJĀN S. S. R.

ĪRĀN, U. S. S. R.

Mean Grid North, in this sheet, is 0° 57′ East of True North.
Magnetic Declination about 4° 10′ East (in 1939).
(Decreasing by about 15″ annually).

No. J-38 K
(I. & A. C. No. 1 J)


AZERBĀIJĀN
ARMENIA
AZERBĀIJĀN
NAKHICHEVAN
Ordubad
ARAS OR ARAXES R.
TRANS CAUCASIAN
QARADAGH RANGE
SAVALAN RANGE
SOFU DAGH RANGE
SURMALU DAGH RANGE
QARAMALIK
TABRIZ
Aerodrome
British Consulate
Wireless station
Pir Aimal (Shrine)
Caravanserai
Telegraph & telephone lines
CAUCASIAN RAILWAY
Military Post
Police Post
Frontier Post
Ordubad Frontier Post
Julfa R.R.S.
Julfa 23 m.
Aras 19 m.
Marzikit 1 m.
Dūman 6 m.
Gand 5 m.
Khuda Afarin 22m.
Marahu 12 m.
Dalreh Darreh 2 m.
Nugadi 2 m.
Yukomar 4 m.
Kukomar 1 m.
Binab 7 m.
Nadar Ali 6 m.
Dizeh 17 m.
Marand 20 m.
Sufian 1 m.
Andabil 1 m.
Gugan 20
Aisigan 4 m.
Kurija 1 m.
Pireh Shahar 1 m.
Basmiraj 2 m.
Aniabad 2 m.
Turkan Bur 3 m.
Saqin Sarai 1 m.
Khalash 3 m.
Musa Ali 4 m.
Qari 4 m.
Sumadi 8 m.
Mezre
Khuramor
Qasimabad
Ibrahim-kandi
Nam Avaran
Mina
Kilvana
Old Ushtulin
Bakhshaish
Sehrajab
Arbatan
Jangur
Mehfari
Bejushan
Bildir
Ahmadabad (Ligli)
Karaja
Param
Sarai
Tazeh Kand
Mills
Kanmja
New Ushtulin
Kur
Alana
Iskandar
Nimatabad
Payagol
Kunduri
Tughun
Giavar
Maliakian
Turka-darreh
Istiar
Kuluk-darreh
Tea house
Telegraph & telephone lines
Russian Consulate
Barush Chai
Pir Chai
Aji Chai
Shor Ispiran Post
Shor Ispiran
Dash Ispiran
Angir Ispiran (Isbiran)
Caravanserai
Mill
Chasin
Dejja Sultan
Dizach
Suma-dil
Besheshai
Shaitan-kandi
Sikindi
Alavi
Misrov
Mekhtari
Lazeh Bulagh (Aliabad)
Tilgilan
Ashaghi
Gulan
Hasan Ali Kandi
Qizilja
Gulinja
Tabanabad
Nasrabad
Sar-i-Argan
Akhdorak
Zangiabad
Alba-Vandi
Ziganal
Mirzari-kandi
Shaikh Amli
Ziarat
Khinst
Ishikhli
Chaqaglu
Kheibashbai
Kuliambar
Khanvalasar
Buran-darreh
Chaqmaq Bulagh Ashaghi
Chaqmaq Bulagh Yukari
Kan-darreh
Chichanar
Chaikandi
Tibagli
Qishlaq Yukari
Qishlaq Ashaghi
Sirfageh
Sulidarreh
Hajibash
Tazeh Kand
Caravansarai
Aqal
Mill
Tarq
Aspikhan
Qara-gunei
Qara-darreh
Kizganab
Shahsuvar
Angija
Monastery
Jigir
Husainabad
Kiri
Abshari
Mushurabad
Letiaran
Ilya
Sarand
Abbasabad
Tokhtugan
Chimanzamin
Aghajagli
Agdash
Aqdash
Kukendi
Fit for vehicles in dry season (difficult)
Fit for vehicles in dry season
Gulzar Yukari
Gulzar Ashaghi
Gumanab Ashaghi
Tajeh
Tazeh Kand
Caravanserai
Tea house
Sahalan Military Post
Sultan Military Post
Savalan
Alvar
Yukari Mayan (Kichik Mayan)
Ashaghi Mayan (Büyük Mayan)
Khwaja Dizeh
Talkheh Rud
Qaramalik
Gujavar
Bal Marit
Nuvabi
Lavasan
Ahmaqieh
Sardarud
Shaikh Hasan
Akhulu
Yangi Kand
Lainchi
Kalacha
Isbala
Fit for M.T.
Fit for M.T. in dry season
Chilakhana Yukari
Chilakhana Ashaghi
Ammend
Haji Mijan
Kum-tapa
Tarzan
Dugijan
Zaberli
Mahmudabad
Pardul
Naurūzābād
Caravansarai
Arzaneh
Marau
Tea house
Shurdeh
Shirinja (Shir Panjeh)
Ovli
Ana Khatun
Qurgacha
Baba-bagh
Komur Chai
Banyar
Gumant
Caravanserai
Arpa Darreh
Caravansarai
Maranu
Sharifabad
Kailikh Bulagh
Chavarchin
Suluja
Guvarchin
Telegraph & telephone lines
Khwaja
Imicha
Amandi
Kujukh
Mill
Sehrajab
Markit
Jafarabad
Talkheh Rud
Sakhseli
Ziganal
Alpa'uta
Turka-darreh
Tazeh Kand
Mills
Kanmja
New Ushtulin
Old Ushtulin
Kur
Alana
Istiar
Kuluk-darreh
Tea house
Tazeh Kand
Dulgha Dagh
Kalalar
New Shabrak
Old Shabrak
Karaja
Ahmadabad (Ligli)
Param
Sarai
Bildir
Bilberdi
Mills
Tea house
Tazeh Kand
Caravansarai
Wali Mill
Tarq
Aspikhan
Qara-gunei
Qara-darreh
Kizganab
Shahsuvar
Angija
Monastery
Nam Avaran
Mina
Jigir
Aiklakhli (Ilkhachi)
Qujahar
Jiganab
Mills
Mill
Bilberdi
Bildir
Tea house
Param
Sarai
Ahmadabad (Ligli)
Karaja
Old Shabrak
New Shabrak
Sehrajab
Arbatan
Markit
Jangur
Mill
Bakhshaish
Mill
Kilvana
Tazeh Kand
Mills
Kanmja
New Ushtulin
Old Ushtulin
Kur
Alana
Iskandar
Nimatabad
Payagol
Kunduri
Tughun
Giavar
Maliakian
Turka-darreh
Istiar
Kuluk-darreh
Tea house
Tazeh Kand
Dulgha Dagh
Kalalar
Barush Chai
Pir Chai
Aji Chai
Shor Ispiran Post
Shor Ispiran
Dash Ispiran
Angir Ispiran (Isbiran)
Caravanserai
Mill
Chasin
Dejja Sultan
Dizach
Suma-dil
Besheshai
Shaitan-kandi
Sikindi
Alavi
Misrov
Mekhtari
Lazeh Bulagh (Aliabad)
Tilgilan
Ashaghi
Gulan
Hasan Ali Kandi
Qizilja
Gulinja
Tabanabad
Nasrabad
Sar-i-Argan
Akhdorak
Zangiabad
Alba-Vandi
Ziganal
Mirzari-kandi
Shaikh Amli
Ziarat
Khinst
Ishikhli
Chaqaglu
Kheibashbai
Kuliambar
Khanvalasar
Buran-darreh
Chaqmaq Bulagh Ashaghi
Chaqmaq Bulagh Yukari
Kan-darreh
Chichanar
Chaikandi
Tibagli
Qishlaq Yukari
Qishlaq Ashaghi
Sirfageh
Sulidarreh
Hajibash
Tazeh Kand
Caravansarai
Aqal
Mill
Tarq
Aspikhan
Qara-gunei
Qara-darreh
Kizganab
Shahsuvar
Angija
Monastery
Nam Avaran
Mina
Jigir
Aiklakhli (Ilkhachi)
Qujahar
Jiganab
Mills
Mill
Bilberdi
Bildir
Tea house
Param
Sarai
Ahmadabad (Ligli)
Karaja
Old Shabrak
New Shabrak
Sehrajab
Arbatan
Markit
Jangur
Mill
Bakhshaish
Mill
Kilvana
Tazeh Kand
Mills
Kanmja
New Ushtulin
Old Ushtulin
Kur
Alana

MAP Nº 10
I.39.B
NUBARAN

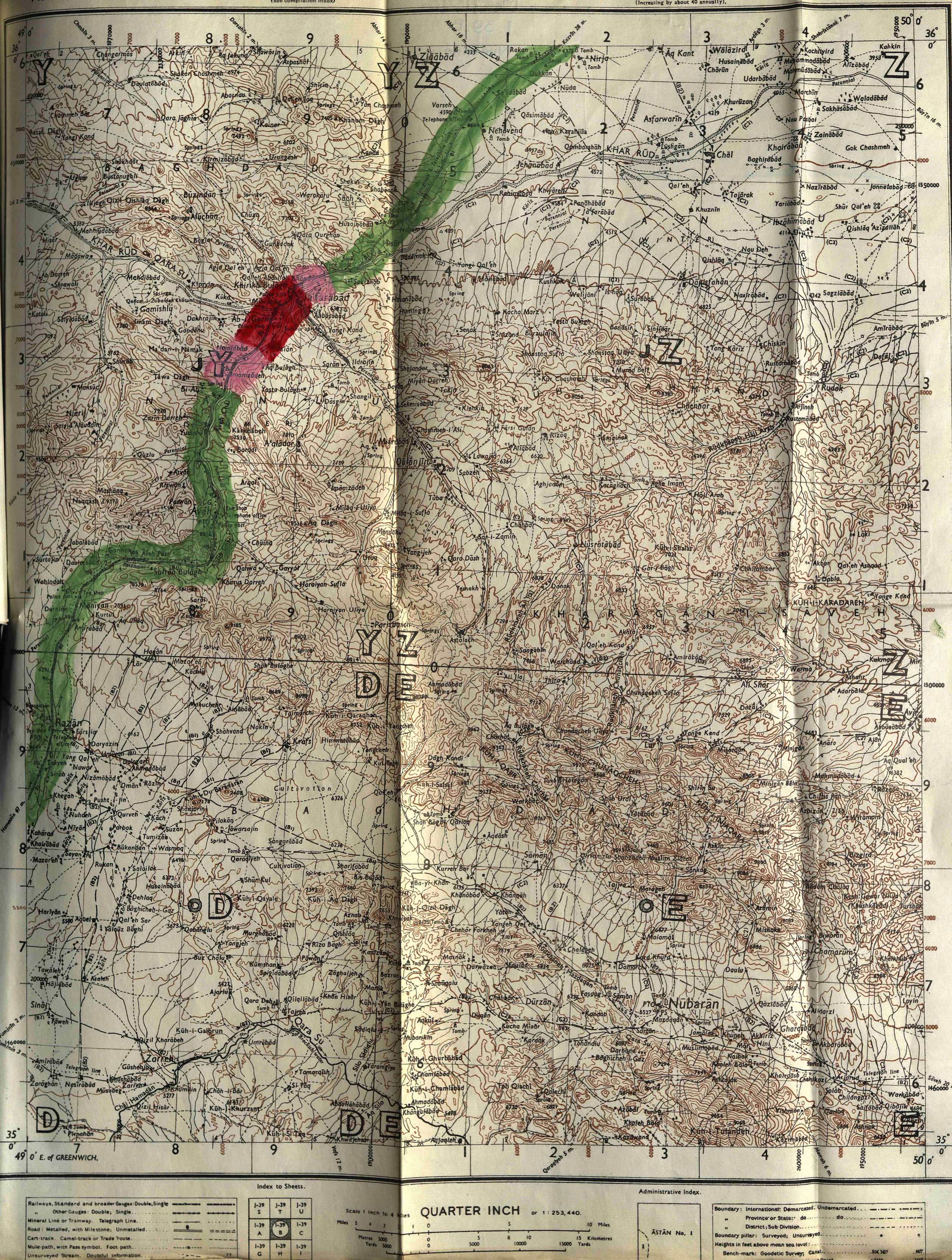
ĀSTĀNS Nos. 1 & 5.

Compiled from various sources.
(See compilation index)

ĪRĀN

Mean Grid North, in this sheet, is 2° 25′ East of True North,
Magnetic Declination about 4° 25′ East in 1942.
(Increasing by about 40 annually).

No. I-39 B
NŪBARĀN



Index to Sheets.

I-39 S	I-39 T	I-39 U
I-39 A	I-39 B	I-39 C
I-39 G	I-39 H	I-39 I

Railways, Standard and broader Gauges: Double, Single
„ Other Gauges: Double; Single
Mineral Line or Tramway. Telegraph Line.
Road: Metalled, with Milestone; Unmetalled.
Cart-track. Camel-track or Trade Route.
Mule-path, with Pass symbol. Foot-path.
Unsurveyed Stream. Doubtful information.

Scale 1 inch to 4 Miles

QUARTER INCH or 1 : 253,440.

Miles 5 4 3 2 1 0 5 10 Miles
Metres 5000 0 5 8 10 15 Kilometres
Yards 5000 0 5000 10000 15000 Yards

Administrative Index.

ĀSTĀN No. 1

Boundary: International: Demarcated. Undemarcated.
„ Province or State: do do
„ District; Sub Division.
Boundary pillar: Surveyed; Unsurveyed.
Heights in feet above mean sea level:
Bench-mark: Geodetic Survey; Canal. BM 1427 1417
Trigonometrical Station. Intersected Point. 1418 1417

49° 0′ E. of GREENWICH.

MAP N° 11

I.39.G.

HAMADAN

Compiled from various sources.
(See compilation index).

ĪRĀN

Mean Grid North, in this sheet, is 1° 53′ East of True North.
Magnetic Declination about 4° 10′ East in 1942.
(Increasing by about 1′ annually).

Scale 1 Inch to 4 Miles **QUARTER INCH** or 1 : 253.440.

Miles 5 4 3 2 1 0 5 10 Miles
Metres 5000 0 5 8 10 15 Kilometres
Yards 5000 0 5000 10000 15000 Yards

Index to Sheets.

I-38 F	I-39 A	I-39 B
I-38 L	I-39 G	I-39 H
I-38 R	I-39 M	I-39 N

Railways, Standard and broader Gauges: Double; Single
„ Other Gauges: Double; Single
Mineral Line or Tramway. Telegraph Line.
Road: Metalled, with Milestone; Unmetalled.
Cart-track. Camel-track or Trade route.
Mule-path, with Pass symbol. Foot-path.
Unsurveyed Stream. Doubtful information.

Administrative Index.

ĀSTĀN No. 5

Boundary: International: Demarcated. Undemarcated.
„ Province or State: do do
„ District; Sub-Division.
Boundary pillar: Surveyed; Unsurveyed.
Heights in feet above mean sea level:
Bench-mark: Geodetic Survey: Canal. BM 1417 .1417
Trigonometrical Station. Intersected Point △1417 1417

0° E. of GREENWICH.

MAP N° 12
I.39.M.

KHURRAMABAD.

IRĀN

ĀSTĀN No. 6.

Compiled from various sources
(See compilation index)

Mean Grid North, in this sheet, is 1° 53′ East of True North.
Magnetic Declination about 3° 50′ East in 1942.
(Increasing by about 0° 45′ annually).

No. I-39 M
KHURRAMĀBĀD

48° 0′ E. of GREENWICH

49° 0′ 34° 0′

Geographical Section General Staff No. 3919
Published by War Office 1942
2nd. Edition 1942.

PERSIAN GLOSSARY

Āb	Water.	Sudār	Pass.
Bandar	Port.	Hauz	Tank or lake.
Burj	Watch tower.	Kavir	Salt waste
Chāh	Well.	Kūh	Mountain.
Chashmeh		Pul	Bridge

I.&A.C. Numbering

2N	9B	9F
2O	9C	9G
2P	9D	9H

International Numbering.

I-38 L	I-39 G	I-39 H
I-38 R	I-39 M	I-39 N
I-38 X	I-39 S	I-39 T

Scale 1 inch to 4 Miles **QUARTER INCH** or 1: 253,440.

Miles 5 4 3 2 1 0 5 10 Miles

Metres 5000 0 5000 10000 15000 20000 Metres

Hill features are shown by form lines.

A relative height, .25r represents the approximate height, in feet, between the top and bottom of a steep slope.

The word "Perennial" against water features indicates that they generally contain water but the accuracy of the information regarding perennial water on this map is not guaranteed and must not be accepted without further investigation.

Road distance stones throughout this sheet give distances in kilometres, NOT in miles.

COMPILATION INDEX.

A Rapid recce. Survey on scale 1 inch

Administrative Index.

ĀSTĀN No. 6

Boundary of different countries, with pillars. (i) Surveyed (ii) Unsurveyed
" " Undemarcated
" " Province (i) Demarcated, (ii) Undemarcated
" " District
Great Trigonometrical Survey Bench-mark ... B M 1617
Trigonometrical Station. Intersected Point ... △ Khan 1617 · 1617
Heights - (i) Approximate, (ii) Relative ... · 1617 · 15r
Post Office. Telegraph Office. P. O. & T. O. combined ... PO TO PTO
Caravanserai. Halting Place. Camping Ground ... Car HP CG

Copied from a map by Survey Directorate H. Q. 10th. Army from original by Surveyor-General of India. Revised to 1942, Heliographed by O. S. 1942.

TO GIVE A REFERENCE ON THIS MAP

LETTERS See LETTERS ON MAP

FIGURES DISREGARD THE SMALLER FIGURES IN THE BORDERS, which give full co-ordinates from origin, viz 12 40000

MAP N°13
I. 39. I.
Qum

ĀSTĀN Nos. 1, 2 & 6.

ĪRĀN

Mean Grid North, in this sheet, is 2° 57′ East of True North.
Magnetic Declination about 3° 30′ East in 1936.
(No annual change)

International No. I-39 J

No. 9 J
QUM

S Ā V E

TAFRASH

K Ū H - I -

H I N D I S

K Ū H - I - Ā Z Ā N

Kūh-i-Mismār

Kūh-i-Sasuneh

Kūh-i-Ālūdarreh

Kūh-i-Fardu

Kūh-i-Sarzeh

Kūh-i-Hāfil

Kūh-i-Salalet

Kumin Kūh 12007

DARYA YI NAMAK (Salt)

Salt plain

Salt stream

Ā Z Ā N K Ū H

Q U M

Taraznain
Anjilavand
Imāmzādeh Maryam
Husainābād
Shalābād
Naudeg
Hājiābād
Shahsgird
Gul Tepe
'Aliābād
Sharifābād
Sinek
Kūrāb
Bilāban
Majidābād
Rizaābād
Fathābād
Ghorābād
Tujm
Sālihābād
Hraver
Riza Chāi
Kubi-i-Sasuneh
Remdār
Sulughan
Ali Khān Begi
Ranegān
Tājrūd
Ushterish
Dāulatābād
Jabrād
Ismā'ilābād
Tāj-i-Khātūn
Naichan
Pālānduz
Gandab
Ghazi
Garrakān
Emeran
Kanzan
Jijirūd
Amāreh
Guda
Gīr
Dalaghaj
Hamadān 104 m.
Dīsum
Nūnehgird
Sa'idābād
Rahgird
Dūdeh
Kardakaran
Maja
Sarāi Surkhāb (Deh Surkh)
Mūdshān
Orseo
Nau-i-Gird RS
Mushkābād
Amrābād
Shahsavārān
Khairabād
Kragrak
Iraq (Sultānābād) R.S. 21 m. (34 km.)
Iraq (Sultānābād) 21 m.
Mahallāt Bāla 27 m.
Mahallāt Bāla 13 m.
Mahallāt Bāla 14 m.
Isfahān 116 m.
Kāshān 48 m.
Kāshān 28 m.
Kāshān 17 m.
Qum Rūd (Perennial)
Pul-i-Dallāk 9 m.
Kusmābād 9 m.
Imāmzādeh Ja'afar
Tepe Salam Sarāi (In ruins)
Pahmanābād
Pul RB
Husainābād
Hājiābād
Sarāi-i-Pul Sarāi (In ruins)
Tehran 61 m.
Kūh Pah R.S. 9 m. (15 km.)
Sāveh 14 m.
Sāveh 2 m.
Mardin
Mazdaqān Rūd (Perennial)
Karāhat
'Amarābād
'Asrabād
Iralain
Band-i-Sāveh
Zanganeh
Deh
Arasu
Kardin
Husainābād
Mālikābād
Fathābād
Zoroastrian Mounds
Gardens
Hindis
Telephone line
Ā T E Ā
TRANS-ĪRĀNIAN RAILWAY
Approximate alignment
Southern Section
Zāgheh RS
Shāhābād
Rūdkhāneh Sag
Bāghak RS
Bāghalud
Naudeg
Qal'eh-i-Cham
Sarāi (In ruins)
Chashmeh 'Ali
Tea shop
Mahmūdābād
Qal'eh Surkh
Pul-i-Kūchak
Naizar Sarāi
Hājiābād
Husainābād
Dūdahak
Sarāi
Kbura
Orchards
Chashmeh Khvājeh
Tea shop
Sarāi (In ruins)
Niya Shahābād
Telephone station
Gendarmerie post
PTO
Dalijān
CG
Rajān
Dāghān
Gendarmerie post
Zawāhān
Motorable (Gravelled)
Telegraph & Telephone lines
Āb-i-Amārbār
Abotbezān
Maryam
Abrjish
Bidhand
Tireh
Dastgird
Sirui
Imāmzādeh Shāh Ibrāhim
Mazreno
Kahak
Narāk
Tank
Harmajehgān
Qarreh Beg
Haveh
Fardu
Sumbulābād
Zargun
Hadimindi
Mazār Imām Jum'eh
Neskarūd
Langrūn Sarāi
Hūrābād
Salām
Bidhand R.
Varjan
Sirui
Ziaret
Brick & stone
Garden
Telegraph & Telephone line
Approximate alignment
QUM
& telephone
PTO
CG
Gendarmerie post
Tea shop
Sarāi (In ruins)
Caravansarai
Halting Place
Camping Ground
Post Office
Telegraph Office
Combined P.O. & T.O.
Spring
Well
Graves
Mosque
Fort
Watch-tower
Oil-well
Deserted Village
Telephone station
Gendarmerie post
Ford
Takht-i-Rustam
Muhsinābād
Qal'eh-i-Cham
Sarāi (In ruins)
Chashmeh 'Ali
Mahmūdābād
Qal'eh Surkh
Husainābād
Hāsil Beg
Daulatābād 4390
Goābād
Kūh-i-'Aliābād 10500?
Kūh-i-Fardu
Kūh-i-Salalet
Kūh-i-Sarzeh
Kūh-i-Hāfil
Kumin Kūh 12007
Narāk
Kūh-i-Ālūdarreh
Mashād
Kumār
Rakha 6820
Mehrut
Nariābs
Telephone station
Gendarmerie post
PTO
Dalijān
CG
Tea shop
Sarāi (In ruins)
Isfahān 116 m.
Mahallāt Bāla 14 m.
Mahallāt Bāla 13 m.
Mahallāt Bāla 27 m.
Kāshān 28 m.
Kāshān 17 m.
Pul-i-Dallāk 9 m.
Kusmābād 9 m.
Tehran 61 m.
Kūh Pah R.S. 9 m. (15 km.)
Sāveh 14 m.
Sāveh 2 m.
Iraq (Sultānābād) R.S. 21 m. (34 km.)
Iraq (Sultānābād) 21 m.
Hamadān 104 m.
Kāshān 48

MAP N°14.
I.39.H
ARAK.

ĀSTĀNS Nos. 1, 5 & 6.

ĪRĀN

Mean Grid North, in this sheet, is 2° 25′ East of True North.
Magnetic Declination about 4° 10′ East in 1942.
(Increasing by about 0° 4′ 0″ annually).

No. I-39 H
ARĀK (SULTĀNĀBĀD)


Qara Chāi
Tamāchi
Amrābād Kurd
Qal'eh Jukh
Ahmadābād
Hizzach
Raskohān
Qal'eh Shah Nazar
Ikta
Qhāwand
Arabābād
Burakhchi
Dashta
Tarlān Do
Charaghān
Āq Darreh
Dizach
Shirīnābād
Saijān
Kushna
Khānābād
Walīābād
Paresābād
Amāra
Istgāh
Walīzaigar
Bulāq
Takia
Khairābād
Mahmūdābād
Soran
Ingemulk
Khumajān
Fatehābād
Shum Qāwar
Khārābād
Shaqala
Khusrowi
Ja'farābād
Ākmīya
Āghjakariz
Famārin
Sabzābād
Akbarābād
Nahrpushteh
Daulatābād
Bārkish
Kuzra
Khumājin
Qishlāq
Firūzābād
Āsimābād
Abdul Rahīm
Rājird
Ab Ambar
Kōl Tepe
Nasīrābād
Muhammadābād
Mīlājird
Khānābād
Chalābi
Kūtābād
Sūlākhāli
Imāmzādeh 'Abbās
Husainābād
Qishlāq
Āb Bulāq
Darreh Gurg
Khalīlān
Chizān
Dūtāl
Chakmak Tepe
Sirōn
Fārān
Dizābād
Karkanak
Deh Chāl
Sais Paighambar
Kalāchā
Saba
Tomb
Qal'eh Gulka
Deh Nau
Qushirwan
Qishlāq
Ahmadābād
Asdābād
Garma
Abbāsābād
Khabdāb
Qal'eh Gurtakī
Samardest
Qishlāq Dinar
Qishlāq Marza
Qishlāq Ajlanjir
Qanishli
Hisār
Gāzlān
Arjahawand
Muhammadābād
Qazilqia
Qalībāf
Hājiābād
Shahrd
Qal'eh Turgi
Qal'eh Kustam Khān
Husain Kurk
Kalāpād
Khairābād
Charlāb
Manizān
Qal'eh Bākhān
Babulghonl
Kulkul
Kumāshāh
Kizarāān
Sutton Khān
Kalāpād
Karkān
Enāl
Jawar Siān
Khānqān
Sanawarā
Qal'eh Samīwad
Dehsad
Miwakh
Shurshora
Nabīdar
Sankar
Gusheh-i Pāin
Gusheh-i Bāla
Mānizān
Amad Roganī
Demiyona
Sarchāl
Sbarābād
Mianrūd
Bādāmak
Qal'eh Izrāīl
Mast-i Bāla
Zangan-i Sufla
Khalīfarābād
Lanjir
Gurjāl
Gurāzār
Khushbījān
Qal'eh Nau
Dehchāneh
Shīrāār
Basrī
Khir Khop
Qāsimābād
Qūsh Tepe
Zāhirābād
Matīābād
Qara Bulāgh
Sang-i-Surkh
Jalgyīr
Bahmān (B)
Qolachi
Turen
Izzatābād
Tehtmahā
Hisār
Lamjān
Majra
Namakho
Gunjarukh Bala
Senjān
Gunjarukh Pain
Karārūd
Takiyeh Āgha Nūr
Baghdādī
Jamunjan
Marano Seta
Maran
Semangan R.S.
Injilāk
Amanābād
Nizāmābād
Hojiābād
Mūtābād
Ahmadābād
Malkābād
Shāhen
Kārchon
Qal'eh Nau
Mutabād R.S.
Tomb
Chagha
Telephone line
Police post
Hosp.
Shahr-i-Jird
IRĀNIAN STATE RY.
(48½ gauge)
Khairābād
Qum R.S. 65 m.
Qum 65 m.
Shāhzand R.S. 7 m.
Khumain 30 m.
Burūjird 34 m.
Hamadān 70 m.
Hamadān 34 m.
Ashtiyan 3 m.
Jaukai 20 m.
Mālayer 10 m.
Nuboran 16 m.
Firmahin 1 m.
Boroujird 12 m.
Brackish water
Perennial
Karez
Spring
Police post
Telephone line
Telephone & telegraph lines
Telephone office
Tomb
Annual fair (June)
Salt pans
Camel thorn
Kōra
Kūh-i Amiak
Kūh-i Namak
Kūh-i Panjeh Rustam
Kūh-i Dubrādaran
Ahmadābād
Bābuk
Tashnān
Qaraqiyeh
Rāshān
Vashmak
Qushq Khāneh
Khola Dāgh
Khūshās
Chaloghān
Farkū
Amra
Chālmīān
Maidānak
Gusthan
Pharadgan
Gustegird
Haftān-i-Sufla
Haftān-i-Ulya
Malik Paweh
Ajumān
Khānajin
Raikhta
Kūh-i Raikhta
Udoghach
Imām-i-Darvishān
Ziādābād
Safīmābād
Haft Khāneh
Ganjarān
Vanak
Amīrābād
Abbāsābād
Shīrinabād
Āq Ziārat
Zainkarak
Dostkand
Segherjo
Chahwār
Shāturgd
Kamrak
Gazrān
Barband
Khumān
Khuzar
Irāqīyeh
Jalīlābād
Tabartēh
Askal
Shāhābād
Mesheu
Farmahīn
Mukhtīsābād
Burzābād
Zulfābād
Mujdābād Kuhneh
Mujdābād Nau
Mazīdābād
Jonush
Azizābād
Buzqān
Ghiāsābād
Hasanābād
Daulatābād
Sādiqābād
Qal'eh Nau
Āliābād
Mezābād
Hurābād
Khushtun
Sharīfābād
Khamālābād Bāla
Khamālābād Pāin
Khalījābād
Shamsābād
Farhābād
Musalābād
Hathmābād
Nazmābād
Ja'farābād
Chashmeh
Deskūdeh
Zāgābād
Hithābād
Husainābād
Ahangarān
Bilīsksht
Sarīja
Karkān
Qasimābād
Michān
Futehābād
Asarwān
Vismeh
Nuāzin
Wazīrābād
Masnābād
Mashad Garma
Derman
Nudeh
Hashdeh
Buzān
Khārpashtu
Dehleh
Aibakābād
Muhammadī
Saidābād
Meharābād
Sosanābād
Hizāwdī
Kishta
Kurrādar
Tamīrābād
Marzgirān
Kajulja
Darbana
Thardāna
Kela
Sāgī
Gaukhāneh
Mubārikābād
Chaukhās
Teramis
Rāhizān
Āzād Murādābād
Qal'eh Azīzullāh Khān
Maighān
Meshed
Murādābād
Daudābād
Zorābād
Deh Nūmak
Sālihābād
Nādirābād
Muhsinābād
Isbiyābād
Zangijeh
Sughar Jokh
Mussiābād
Grekan
Bunchanān
Shahwarūn
Kingcan
Chol
Kasfshān
Shehrāb
Sarbāhand
Safīdāb
Dīzmānik
Hasanābād
Nadeh
Duristān
Kesne
Sarcheshmeh
Faizābād
Sheoshān
Sabzevār
Dimgeh
Tharalān
Gabarān
Minawa
Izar
Dīzījān
Fishnjān
Bazrijān
Mashad
Āb-i-Takesh
Dehghān
Khārlān
Naubahār
PO Hashān
Police post
Joftān
Āb Garm
Khurdābād
Naqushān
TAFRISH
Urtagar
Talkhāb
Chashmeh Garam
Washghān
Tomb
Khusrūān
Moassar
Güneh
Kāzimābād
Shāhzarūn
Annual fair (June)
Qara Chāi
Perennial
Khārak
Rhulosjird
Āzādjin
Darbar
Zarjān
Wemānd
Parsmān
Marzān
Maikān
Shutuk
Strom Buraq
Kahoiu
Lourkan
Spring
Kūh-i Amiak
Ahmadābād
Tashnān
Qaraqiyeh
Rāshān
Kōra

MAP N° 15.
I. 38. R.
SIAMMARREH.

ĀSTĀNS Nos. 5 & 6.

Compiled from various sources.
(See compilation index)

ĪRĀN

Mean Grid North, in this sheet, is 1° 21′ East of True North.
Magnetic Declination about 3° 25′ East in 1942.
(Annual change negligible).

No. I-38 R
SAIMARREH

47° 0′ E. of GREENWICH.

Railways, broad gauge: double, with milestone; single.
„ other gauges: double; single.
Mineral line or tramway. Telegraph line.
Roads, metalled, with milestone; unmetalled.
Cart-track.
Pack-track and pass. Foot-path.
Unsurveyed stream. Doubtful information.
Well. Oil-well. Deserted village.
Mine. Spring. Graves.
Mosque. Fort. Watch-tower.

I & A.C. Numbering.

2J	2N	9B
2K	20	9C
2L	2P	9D

International Numbering.

I-38 K	I-38 L	I-39 G
I-38 Q	I-38 R	I-39 M
I-38 W	I-38 X	I-39 S

Geographical Section General Staff No. 3919
Published by War Office 1941.
2nd. Edition 1942.

GLOSSARY

Āb	stream	Gardan	pass
Āb-i	spring	Haur	depression, marsh
Āshāghi	lower	Milleh	pass
Bulāq	spring	Qal'eh	fort
Chāh	well	Qislāq	winter pasture
Chāi	stream	Kani	spring
Cham	open valley	Kūh	peak, range
Chashmeh	spring	Rūd	river
Dāgh	peak, range	Tal	hillock, mound

Scale 1 Inch to 4 Miles **QUARTER INCH** or 1 : 253,440.

Miles 5 4 3 2 1 0 5 10 Miles

Metres 5000 0 5000 10000 15000 20000 Metres

Contour Intervals 250 feet. Contours are approximate.

The word 'Perennial' against water features indicates that they generally contain water, but the accuracy of the information regarding perennial water on this map is not guaranteed and must not be accepted without further investigation.

COMPILATION INDEX.

A Regular survey.
B Sketch survey.
C Sketch survey 1935-36.
D Unsurveyed.

Administrative Index.

ĀSTĀN No. 5
ĀSTĀN No. 6

Boundary, international: demarcated; undemarcated.
„ province or state: do do.
„ district; sub-division.
Boundary pillar: surveyed; unsurveyed.
Heights in feet above mean sea level:
Bench-mark: geodetic; canal. .BM 1417 .1417
Trigonometrical station. Intersected point. △1417 .1417
Approximate height. .1417
Post office, Telegraph office. Combined P.O.& T.O. PO TO PTO
Caravansarai. Halting place. Camping ground. Sarai Halt CG

Compiled and Published originally under the direction of the Surveyor-General of India 1923 and revised to 1941.
Heliographed by O.S.O. 1942.

TO GIVE A REFERENCE ON THIS MAP

LETTERS See LETTERS ON MAP
FIGURES DISREGARD THE SMALLER FIGURES IN THE BORDERS, which give full co-ordinates from origin, viz. 1230000
USE THE LARGER BORDER FIGURES or those printed on the face of the map.

POINT △ SHŪKA LETTERS O M

EAST. Take line west of POINT, and read figures printed against it in north and south borders, or on line

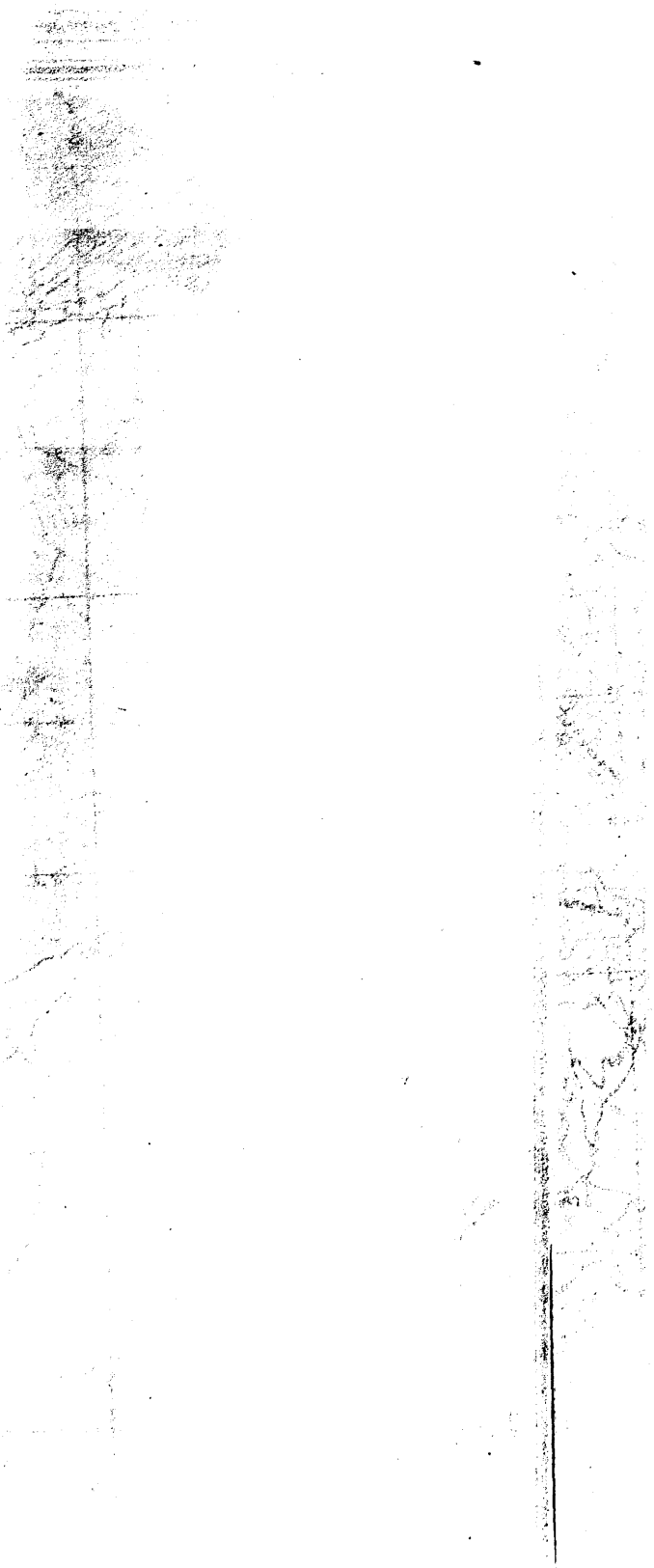
NORTH. Take line south of POINT, and read figures printed against it in east and west borders or on line itself

1000/12/42. W.O.

MAP N°16.

I. 38. X

CHAGA SAFIT.



ĀSTĀN No. 6.
'AMĀRA DIVISION.

ĪRĀN, 'IRĀQ

Mean Grid North, in this sheet, is 1° 21′ East of True North.
Magnetic Declination about 3° 15′ East (in 1939).
(Decreasing by about 15′ annually).

No. I-38.X
(I. & A. C. No. 2 P)
CHĀGHA SAFIT

47° 33′ 0 — 48° 0′ 33′ 0

1700000 — 1770000

1200000 — 1120000

Tās Gandāb 14 m. — Tās Gandāb 5 m. — Khurramābād 104 m. — Dizfūl 45 m. — Dizfūl 27 m. — Dizfūl 24 m. — Shūsh Fort 20 m. — Shūsh Fort 16 m. — Amārah 12 m. — Amārah 12 m. — Qal'a Husain 16 m. — Ghaslmah 13 m. — Marzāk 28 m. — Marzāk 25 m.

HUSHKAMĪR — KABĪR KŪH — ĀB-I-DANAN — SARĀB BĀGH — GAOKURRAH — KŪH-I-SHAHAT — KŪH-I-MARZU — PANJIREH — GADU — LARGHEH — MURMURAH — CHAHARRAH — DAHTRAH — DUWĀR DUMBAL — KŪH-I-PITĀK — GACHCHAN DAGH — KŪH-I-DALPARRE — CHUK SHAMMA — CHUKSARAHIN — DEH LORAN — Chagha Safit — MAZABDALI — ALUNI — BARTASH — BARZA — CATBA — TAMTAMAO — SHUSAMGAO — BONAKOHNA — KANARU — MERIJAN — TIBI — KŪH-I-GUTBA — CHAM-I-SHULAIL — BANO-I-BOZURGAN — KHAISAH — KHUZAINAH — SHUBAICHIYAT — IBRAH RUMAILAH — HARMALAH — ĪSAWI — KHAIT AS SULTĀN — AĪLAH — HAUR ĪSAWI — KHASH MIL — HAUR HALFĀWI — HAUR MATTASH — CA-AL-TELAT AMRA (Desert) — JABAL AIPATHSAN — SAGWAND — Unsurveyed — BALHAMRIN — SUKHAIRI — HADDĀM — BANI LAM — AMIBIAT — MURAIBI — 'AMĀRA — IRAN — IRAQ

Qalā Shāh Ali (Ancient fort) — Kūh-i-Kurra Kalūl — Kūh-i-Samand — Tomb of Mansūr Abūl Hasan — Kūh-i-Dal — Lak Chavir — Kūh-i-Sar Sāichanār — Kūh-i-Sharamin — Tetbalirak — Kūh-i-Shakar Ab — Kūh-i-Dinar — Kūh-i-Gulsiān — Kūh-i-Siāh — Kūh-i-Pitāk — Tang-i-Fitāk — Tang-i-Tezāb — Tappeh Chāgha Ali — Tappeh Tīskān — Tappeh Khaemān — Tappeh Gurga — Tappeh Baulah — Haft Chasa — Chasm Duzd — Tappeh Farrukhābād (Salt) — Tappeh Garrān — Tappeh Mīlān — Tappeh Khazīna — Tappeh Murādābād — Zumuīl — Hawīzah — Qatrah (Brackish) — Tel Shubaichiyat — Sukhairi (Brackish) — Gargariyah — Tel Shukhiyat — Tel Abūl 'Adhdham Kabīr — Tel Bishah — Tel-al-Barzīyāt — Manzilīyah (Brackish) — Umm Sail (Suhaini) 25 Wells (Brackish) — Jalīb Shūr (Brackish) — Umm ul Aujiyah (Brackish) — Umm ul Wawiyah (Brackish) — Shamrīyah 9 Wells (Brackish) — 7 Wells (Brackish) — Abu Hudaiyah — Chashmeh Khūl — Misian (Kurdish winter encampment) — Tappeh Palak — Qabr Umm-at Tuwaib — Figarah — Bir Salmanah — Antarīyah — Huwaitat — Abu Muarish — Abu Junairah — Remains of ancient canals — Rushaidah — Shaikhāb — Imāmzādeh 'Abbās (Gumbad-i-Abbās) — Tappeh-i-Ramaburdah? (Baghd-i-Timau Bugarai)? — Zanabe Tib Shuwai — Dasht Khait as Sultān — Abu-i-Maima — Abu-Sitāru — Karkheh R — Kharkhara R — Dawairij R — Ab-i-Mīsan — AKR — Ab-i-Shaur — Ab-i-Gaz — Ab-i-Kharkheh — Ab-i-Dinar — Ab-i-Siyāh — Ab-i-Gurga — Ab-i-Shurāba — Ab-i-Shakar Ab — Ab-i-Gharbi — Ab-i-Chamchamāl — Ab-i-Sharāfat — Ab-i-Kharāb — Ab-i-Kasaf — Ab-i-Kasaf — Ab-i-Kasaf

MAP N° 17.
I.39.S.
DIZFUL.

ĪRĀN FIRST EDITION

Mean Grid North, in this sheet, is 1° 53′ East of True North.
Magnetic Declination about 3° 30′ East in 1936. (No annual change)


48° 0′ E. of GREENWICH.
49° 0′
33° 0′
32° 0′
A H W Ā Z
L U R K Ū H
B A K H T Ī Ā R Ī
U N S U R V E Y E D
unsurveyed
Karkheh R
Hirreh R
Khurramābād 38 m.
Kūh-i-Sawārān
Kūh-i-Anāroh Rūd
Kūh-i-Bīāb
Kūh-i-Mungarreh?
Kūh-i-Dam Rīvāl
Tang-i-Ahwānd
Qirāb
SURAKŪN
Gypsum hills
Pāpi Mūsaei
Pashmīnazār
Dukūh RS
Kūh-i-Dumbalyān
Qal'eh Husainīyeh
Khirr-i-Chami-Chakai
Var-i-Zard
Ab-i-Gulai-Morī (Perennial)
MĀNDŪSĀN
Qal'eh 'Alī
Tang-i-Zardawar
Kūh-i-Chināra
Shāh Ahmad 1100
Qarīyeh Rāūzī
Aq Mūsa Rīza
Saifullah Khān
Ghulām Rīza Khān
Shūsh (Shush)
Qarīyeh Saiyid Timak
Haamūt
Tel Dab
Shaluniyeh
Abū Shimeh
Shaikh Chagh Amīr al Mubārik Tomb
Haddām Murāibi
Saben Haft Sheghal
Haft Tepe RS
Shāūr R.
Mahallāt 32 m.
Karkheh R.
(Perennial)
Pāyi-Pul Karkheh (In ruins)
Pīr Kahrūn
Tepe Kattareh
Tepe Bandabān
Tepe Jūwi
Ghaib Bin Ali
Maheūr Duz
Tepe Tulai
Tepe Saiyāh
Tepe Sarkar
Qal'eh Daiji
Sabzah RS
Husain Kūchak
Qal'eh Shuhad
Qal'eh Khanābāti
Qal'eh Zāwiyeh Kūchak
Ali Abdul Husain
Ali al Husain
Tomb
Kūhan Maryam
Shahrābād
Abbāsābād
Qal'eh Rūb'
Qal'eh Mirza Ali Khān
Qal'eh Jibar
Qal'eh Kuwaikh
Dachchāh
Qal'eh Khusrauābād
Sulaimān
Qal'eh Balangan
Qal'eh Hājiābād
Nejafābād
Kūtiyān
Qal'eh Jūbān
Qal'eh Qāzī
Shamsābād
Khaltak
Qāliwand
Saiyid Muhammad
Aziz Ailawan
Mūsaicheh
Shaikh Chagh Amīr al Mubārik Tomb
Mahallāt 32 m.
Motorable in dry weather
Approximate alignment
Shāūr R.
(Perennial)
Tang-i-Ahwānd
Qirāb
Kūh-i-Dumbalyān
Dukūh RS
Khirr-i-Chami-Chakai
Var-i-Zard
Ab-i-Gulai-Morī (Perennial)
Pashmīnazār
Qal'eh 'Alī
Tang-i-Zardawar
Kūh-i-Chināra
Qarīyeh Rāūzī
Aq Mūsa Rīza
Saifullah Khān
Ghulām Rīza Khān
Shūsh (Shush)
Qarīyeh Saiyid Timak
Haamūt
Tel Dab
Shaluniyeh
Abū Shimeh
Shaikh Chagh Amīr al Mubārik Tomb
Haddām Mura

MAP N° 18

I.39.N

ALI GWDAR

ĀSTĀNS Nos. 1 & 6.

Compiled from various sources.
(See compilation index).

ĪRĀN

Mean Grid North, in this sheet, is 2 25 East of True North.
Magnetic Declination about 3°55′ East in 1942.
(Increasing by about 0°40″ annually)

No. 1-39 N
ALI GUDĀR

Shāhzand
Dūrūd
Ali Gudar
Khurramābād
Khorramābād
Andarpa
Sarāband
Kangavar
Nahrmiyan
Mirza Khatun
Kulāh-i-Sih Uliya
Gal-i-Zard
Chigbaliy-i-Siah
Khetirān
Tāju-Daulat Shāh
Deh Safar Ali
Deh Qaid
Khatejab
Dujuft
Police post
Razābād
Bāqirābād
Gaidaraz
Chehār Chasrk
Hasan Darreh
Allābād
Bālān
Āq Bulāq
Hāji Yūsuf
Deh Zulfiqar
Deh Dāud
Deh Mehdi
Deh Askar
Hāji Bāgh
Deh Bāgh
Niāz Āgha
Qarqa'an
Gul-i-Zard
Deh Qara Dāsh
Deh Maula
Deh 'Abdullāh
Deh Ali Murād
Hashmān
Tepe
Tamatkhān
Sāgalo
Kulbadagh
Hindudar
Chhālma
Qāidān
Deh Hūsein
Deh Kalbi
Khena Darreh
Khenadareh
Deh Zamān
Qal'eh Nau
Kechalu
Raqarlu
Luzdar
Farziāna
Khalach
Deh Salmān
Bāgh Jamal
Dūāb
Qal'eh Jangi
Qal'eh Shūr Shūr
Aliābād
Qal'eh Gir Shāh
Deh Hāji
Chaqamishān
Bābki
Karīz
Khamām
Gulbar
Mālicheh
Deh Nasīr
Chubdār Bala
Chubdār Pāin
Dukhāmarin
Khushk
Murabok
Nizāmābād
Husainābād
Bāghtirān
Chenārstān
Bombur
Gusheh
Khiārsiāh
Tawān Dasht
Bahkunbād
Marwān
Wazdistān
Kul-i-Zard
Qal'eh Nau
Kechalu
Lazdar Wasat
Mishardi
Qaz-āb
Deh Salmān
Tang-i-Gandumat
Kamargap
Kūh-i-Behru
Takht Kalar
Gahr Mioneh
Kūh-i-Nahr
Kūh-i-Birinj
Kūh-i-Gallehgap
Kūh-i-Churagūn
Kūh-i-Kazinstān
Kūh-i-Kūl
Kūh-i-Gushtūn
Shahru
Chalisih
Ab-i-Rahmae
Sar Sabz
Gul-i-Chareh
Sar-i-Kūl 14 m.
Takht Shāh
Kūh-i-Lūna Qal'eh
Kūh-i-Darreh Duzdūn
Darreh Lūku
Kūh-i-Sīkasūn
Kūh-i-Gāhgul
Kūh-i-Batea
Kūh-i-Tamandar
Arjanak
Badrābād
Sih Kūneh
Tang-i-Zarrār
Qal'eh Kūh
Qal'eh Pocha
Takht Apan
Tang-i-Āb i Safīd
Kūh-i-Barz
Perennial
Ivoz Tangi
Chashmeh Duzd
Qal'eh Dukhtar
Qal'eh Makhadi
Ab-i-Garmak
Qal'eh Huma
Parg
Hoveh
Racheh
Sakun
Chashmeh Raisān
Qal'eh Alkhas
Bultak
Qal'eh Khvājeh
Khuwarzah
Farajābād
Nasrābād
Ashnakhur
Kūh-i-Sīl
Kamarbasteh
Darreh Sard
Gaekān
Kizna
Juz
Ismahūr
Dehzan
Sang-i-Safid
Gandmineh
Rukanābād
Jūshān
Gūran
Badbād
Askarān
Mughanaq
Chaman Sultān
Police post
Ab-i-Barik
Khalīleh
Darreh Sard
Darreh Sar
Mūrūk
Miyandasht 12 m.
Azna
Fairhān (Ruins)
Shāhpūrābād
Anūj (Ruins)
Lākhushk
Chārbās
Khūnsukh
Piādeh Rāh
Dumalkān
Mal-i-Shīr
Qashkāq
Bauki
Qal'eh Wardi
Urdūdar
Chigha Asfeh
Chām Zamān
Daulatābād
Sultānābād
Hundār
Aliābād
Ashrafābād
Sabor
Qishlāq
Deh Nasīr Sīnj
PTO Telephone office
Burnābād
Chaghatū
Qasimābād
Jalālābād
Qara Deh
Gurchāhin
Mushella
Mahmūdābād
Abbāsābād
Khumbe Pāin
Khumbe Bāla
Pinkābād
Jamālābād
Nishan
Changazin
Qāimābād
Arkawi
Nūrbin
Chashmeh Pahān
Gawar
Qishlāq
Kharzen
Sarābād
Kendāb
Kanāma
Jamālika
Rūdbārān
Sāq
Gilu
Hasanābād
Zālu
Ashiāneh
Ashāneh Auliya
Imāmzādeh Warcheh
Khistijān
Warcheh
Mirza
Dārāshur
Ribat
Astalak
Sukhegazgaon
Lakhaun
Deh Safid
Chenārtak
Khanābād
Khebābād
Aliābād
Khurchbasht
Shafiābād
Mirza Hūsein
Muhammadābād
Qamangkas
Kūh-i-Bishāl
Husainābād
Pushteh Kūh
Nasheb
Sukhanna
Asmesiyān
Khollabād
Gurjai
Khazmābād
Kundar
Mirūndeh
Tāziran
Ibāna
Dār-i-Bāgh
Farisiyān
Lazdar
Pīruwāri
Borfiyān
Qal'eh Bābu
Geligird
Salyidābād
Hamūdābād
Shātir
Gūbār Sufla
Gūbār-i-Uliya
Giyānjeh
Qishlāq
Dūmeh
Chehār Chashmeh
Dum-i-Siāh
Derah
Shurchāh
Imāmzādeh Qāsim
Chūgheh Safidān
Khurishān
Firbodāg
Parrān
Ashorābād
Tūlgūba
Hājiābād
Dāmād
Tameli
Zang-i-Dūn
Winaweh
Husainābād
Bidestān
Ahmeh Masjid
Āq Bulāq
Shah Waleh
Sizdar
Āgaxa
Qarsaqda
Kaneh
Zolgadarah
Bāgh-i-Mūri
Daliyān
Marziyān
Fin
Zarrinān
Gondab
Hashmatābād
Khanābād
Mianrudān
Rizbār
Kal Qaleh
Darband R S
Thiān
Kūh-i-Safid
Kirchiyan
Tunnel
Qal'eh Rustam
Dar Asbar
Dar Astaneh
Lasūr
Kūh-i-Pariz
Sarowand
Darreh Takht
Kenikuh
Galleh Chīr
Kūh-i-Ushtarān
Tang-i-Hujirwan
Amārat
Hoftkuh
Thi
Kholawar
Āqakandi
Khalach
Mājmir
Tang-i-Allāhu Akbar
Kūh-i-Dāsht
Kūh-i-Pāriz
Kūh-i-Sīāh
Kūh-i-Kūh
Kūh-i-Kūh Sīāh
Kūh-i-Kūh Sīāh Kūh
Kūh-i-Kūh Sīāh Kūh
Kūh-i-Kūh Sīāh Kū

MAP N° 19.

I.38.J.

KHANAQIN.

ĀSTĀN No. 5.
DIYĀLA, KIRKŪK AND
SULAIMĀNĪYA DIVISIONS.

ĪRĀN, ʿIRĀQ

Mean Grid North, in this sheet, is 0° 16′ East of True North.
Magnetic Declination about 3° 15′ East in 1939.
(Changing by about 15″ annually).

International No. I-38 J

No. 2 F
KHĀNAQĪN

DIYĀLA | SULAIMĀNĪYA

KIRKŪK | DIYĀLA

45° 00′ E. of GREENWICH. 46° 00′

Railway:—Broad Gauge: Double with Mile-stone. Single
" Other Gauges: Double. Single
Mineral Line and Tramway. Telegraph Line
Road:—Metalled with Mile-stone. Unmetalled
Cart-track. Camel-track or Trade route
Mule-path, with Pass symbol. Foot-path
Unsurveyed or doubtful routes
Well (1) Water. (2) Oil. Mine. Spring. Graves
Mosque or Imāmzādeh. Fort. Watch-tower. Deserted Village

Geographical Section, General Staff, No. 3919.
Published by War Office, 1941.
2nd Edition.

1,036/1/42F

Index to Sheets.

2 A	2 E	2 I
2 B	2 F	2 J
2 C	2 G	2 K

International Numbering.

I-38 C	I-38 D	I-38 E
I-38 I	I-38 J	I-38 K
I-38 O	I-38 P	I-38 Q

Scale 1 Inch to 4 Miles, or 1:253,440.

Miles 5 4 3 2 1 0 5 10 Miles

Metres 5000 0 5000 10000 15000 20000 Metres

Contour Intervals 250 feet.
Contours are approximate.

The word 'Perennial' against water features indicates that they generally contain water, but the accuracy of the information regarding perennial water on this map is not guaranteed and must not be accepted without further investigation.

Administrative Index



1 SULAIMĀNĪYA, ʿIRĀQ.

Boundary of different countries, with pillars. (i) Surveyed. (ii) Unsurveyed
" " " Undemarcated
" " Province. (i) Demarcated. (ii) Undemarcated
" " District
Great Trigonometrical Survey Bench-mark — B M 1417
Trigonometrical Station. Intersected Point — △ Khari 1417 · 1417
Heights (i) Approximate. (ii) Relative — 1417 · 1417
Post Office. Telegraph Office. P. O. & T. O. combined — P O T O P T O
Caravanserai. Halting Place. Camping Ground — Car: H P C G

Compiled and Published originally under the direction of the Surveyor-General of India 1924 and revised to 1941.
Heliographed — O.S.O. 1941.

TO GIVE A REFERENCE ON THIS MAP

LETTERS	See LETTERS ON MAP
FIGURES	DISREGARD THE SMALLER FIGURES IN THE BORDERS, which give full co-ordinates from origin, viz. 151000
	USE THE LARGER BORDER FIGURES or those printed on the face of the map.
	POINT QIZIL RIBAT (R S) LETTERS (O)F

MAP No 20

I.38.K.

SHAHABAD

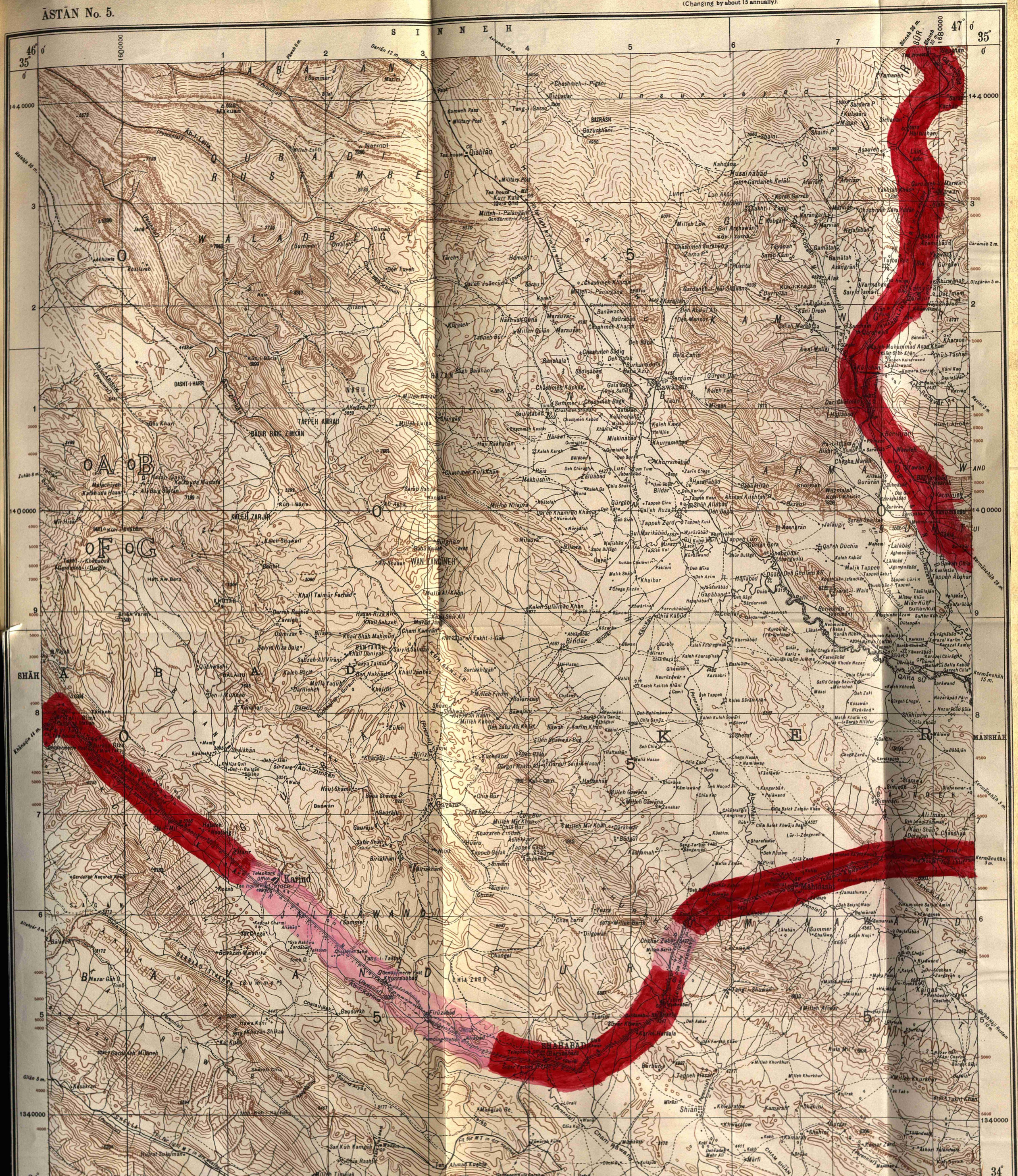
ĀSTĀN No. 5.

ĪRĀN

Mean Grid North, in this sheet, is 0° 48′ East of True North.
Magnetic Declination about 3° 25′ East in 1939.
(Changing by about 15″ annually).

International No. I-38 K

No. 2 J
KARIND


SINNEH
BAZRASH
Unsurveyed
Karind
Telephone Office
Tea house
Military Post
Gendarmerie Post
Gendarmerie Post Khusrauabad
SHAHABAD (Harunabad)
Mahidasht
Kermānshāh 5 m.
Kermānshāh 15 m.
Kermānshāh 23 m.
Kermānshāh 28 m.
Qizilhaji Rustam 10 m.
Khānaqin 14 m.
Zuhāb 8 m.
Gilān 5 m.
Alīabyār 3 m.
Hulwān 44 m.
Ilām 54 m.
Ilām 34 m.
Changa Jangah 3 m.
Gārāmāb 2 m.
Dizgārān 5 m.
Razāvar 5 m.
Qarāsū 10 m.
Sinneh 26 m.
Sinneh 30 m.
Halabja 10 m.
Darīān 12 m.
Arvamān 32 m.
Pasand 6 m.
Tang-i-Takhtah
Tang-i-Shuwan
Tang-i-Garao
Tang-i-Ahmad Kuchik
Ab-i-Zimkān
Ab-i-Razāvar
Ab-i-Qarāsū
Ab-i-Kashkān
Ab-i-Lenja
Ab-i-Zarīnkāh
Ab-i-Qarāsū
Ab-i-Kashkān
Ab-i-Razāvar
Ab-i-Zimkān
Ab-i-Kashkān
Ab-i-Qarāsū

MAP N° 21

I.38.L.

KERMANSHAH.

ĀSTĀNS Nos. 5 & 6.

Compiled from various sources.
(See compilation index).

ĪRĀN

Mean Grid North, in this sheet, is 1° 21′ East of True North.
Magnetic Declination about 4° 0′ East in 1942.
(Increasing by about 1′ annually).

No. I-38 L
KERMĀNSHĀH

Railways, broad gauge: double, with milestone; single.
" other gauges: double; single.
Mineral line or tramway. Telegraph line.
Roads, metalled, with kilostone; unmetalled.
Cart-track.
Pack-track and pass. Foot-path.
Unsurveyed stream. Doubtful information.

Index to Sheets.

I-38 E	I-38 F	I-39 A
I-38 K	I-38 L	I-39 G
I-38 Q	I-38 R	I-39 M

Scale 1 Inch to 4 Miles **QUARTER INCH** or 1 : 253,440.
Miles 5 4 3 2 1 0 5 10 Miles
Metres 5000 0 5000 10000 15000 20000 Metres
Contour interval 250 feet. Contours are approximate.

Administrative Index.

ĀSTĀN No. 5

Boundary, international: demarcated; undemarcated.
" province or state: do do
" district: sub-division.
Boundary pillar: surveyed; unsurveyed.
Heights in feet above mean sea level:
Bench-mark: geodetic: canal. BM 1417 .1417
Trigonometrical station. Intersected point △1417 .1417

0° 47′ E. of GREENWICH.

MAP, N°22

I.38.E.

MARIVAN.

ĀSTĀN Nos. 4 & 5.
SULAIMĀNĪYA DIVISION.

ĪRĀN, ʿIRĀQ

Mean Grid North, in this sheet, is 0° 48′ East of True North.
Magnetic Declination about 3° 35′ East (in 1939)
(Changing by about 15″ annually)

International No. I-38 E
No. 2 I
MARIVĀN


Mīl Dolābī
Mīl Kabūd
Bard-e-Spī Shira
Hazan Māla
Bard Bora
Marivān
Avroman
Khurmal
Shāho
Kani Miran
Bāsnmāh
Biyāna
Tawela
Nūsmeh
Darīān
Pawah
Kūh-i-Shāhū
Kūh-i-Kaje Kaje
Kūh-i-Chīnāreh
Kūh-i-Mullā Kutbī
Kūh-i-Chehil Chashmeh
Kūh Spīkānī
Kūh Makkar Saifasūr
Kūh Sultān Ahmad
Kūh Udalān (Tableh Kūh)
Tayrikalān
Kamushārā
Mūlīnābād
Takavasan
Khūrkhūreh
Kara Bakia
Kīzil Uzūn R (Perennial)
Zambūri
Chulagh
Ōlyān Darreh
Shilair (Perennial)
Qizilja Sū
Deh Dezli R
Sīrwān R (Perennial)
Kal-i-Darak
Kūh-i-Shāhū
Kūh-i-Sūr
Kūh-i-Kūsalān
Kūh-i-Kūsalān
Kūh-i-Kūsalān

Map N° 23.
I.38.F
BIJAR.

ĪRĀN

ĀSTĀNS Nos. 4 & 5.

Compiled from various sources.
(See compilation index)

Mean Grid North, in this sheet, is 1° 21′ East of True North.
Magnetic Declination about 3° 45′ East in 1942.
(Increasing by about 1′ annually)

No. I-38 F
BĪJĀR

Railways.. Standard and broader gauges, double, single
.. other gauges: double; single
Mineral line or tramway. Telegraph line.
Roads, metalled, with milestone; unmetalled.
Cart-track.
Pack-track and pass. Foot-path.
Unsurveyed stream. Doubtful information.

Index to Sheets.

J-38 W	J-38 X	J-39 S
I-38 E	I-38 F	I-39 A
I-38 K	I-38 L	I-39 G

QUARTER INCH or 1 : 253,440.
Scale 1 Inch to 4 Miles
Miles 5 4 3 2 1 0 5 10 Miles
Metres 5000 0 5 8 10 15 Kilometres
Yards 5000 0 5000 10000 15000 Yards

Administrative Index.
ĀSTĀN No. 4
ĀSTĀN No. 5

Boundary, international: demarcated; undemarcated.
.. province or state: do do
.. district; sub-division.
Boundary pillar: surveyed, unsurveyed.
Heights in feet above mean sea level:
Bench-mark: geodetic; canal. BM 1417 .1417
Trigonometrical station. Intersected point. △1417 .1417

MAP N°24.
J.38.W.
SAQQIZ.

ĪRĀN

ĀSTĀN No. 4.

Mean Grid North of Grid C / Grid B in this sheet, is 0° 57′ East / 0° 48′ East of True North.

Magnetic Declination about 3° 45′ East (in 1939).
(Decreasing by about 15″ annually).

NO. J-38 W
(I & A.C. No. 1 L)
SAQQIZ

MARĀGHEH

H J
H
Ā
B
O
V W
W
H J

Miyāndūāb
Taqīābād
Kalb-i-Raza Khān
Bukān
Mulla Liār
Sain Diz
SAQQIZ
Telephone Office
Armani Bulagh
Sarab Dagh
Kāshāvar
Hammāmiān
Kurmish
Deshband
Girdenelik
Akhān
Markhoz
Turjān
Miradeh
Karaul-Khāna
Bogdakandi
Darreh Ābi
Nakasur
Pirumaran
Kuchak Khāru
Yazi Bulāghī
Kuhneh Kotel
Zarrineh
Nāniniāz
Siader
Aichi
Qishlāq
Mamujam
Tamujeh
Matru
Shivāh
Balajā
Nazu-darreh
Kabarlu
Bakhchala
Khurdeluke
Dergasleman
Sartekaltu
Yarenān
Haidar
Ford
Tea house
Qishlāq Hasan Agha
Chaqa-An (Perennial)
Chinaqa Yaia
Harfanam
Tamujeh (Tamujeh Ka)
Mamujam Tea house
Qara-gez
Qara-man
Qara-chal
Qara-darreh
Qara-Qush
Aziz Kand
Akhoasla
Sayidābād
Kazana
Kani Ali Girda
Kani Kalen
Kazanli Harijlai
Halakan
Yunjar
Chichakata
Kaka-Tappeh
Khātūnābād
Mahmūjuk
Mastanawa
Hasanābād
Khurja
Ak Tappeh
Qizil Kalasi
Tumwa
Hutasud
Michasu
Ozan
Jambegli
Magamli
Chahramak
Zaranja
Yusuf Kand
Zamanad
Chodelijan
Kyzan Kandi
Zamīnābād
Kateyad
Oglanji
Kiyur
Magburi
Khalakh
Khalaqh
Aq Tappeh
Kizkurgi
Kūjukh
Marmar-Dāgh
Türki Wiran
Qizil Kabir
Ja Jutli
Qarah-Chai (Stone)
Gulzar
Sursan
Hin Bulagh
Chugli
Gug Aghach
Yarlig
Sanjud
Sulaimānābād
Telephone line
Husainābād
Mian Bulagh
Incha
Bāghcha Mishah
Tappeh Bür
Kharkhar
Bayān Dāgh
Darzivali
Karaburar
Sārūq Chai (Perennial)
Arabāgh Ali
Mishtaki
Nughara
Amaba (Toghiara)
Darreh Khur
Aliyān
Darreh Panbaqo
Bzah Bulagh
Yārdui Telephone line
Ma'sūcābād
Qu Tashki
Karatto
Kupribakhsh Washki
Kazanau
Siah Nāv
Zālu
Chichi Khar
Allābād
Nasarābād
Tezawa
Duzakh-darreh
Karize
Amān
Sāhib
Mīlleh-i-Sāhib
Sunateh
Chaupan Qara
Jivian
Tūmandāb
Takht
Arau
Jūnian
Kaleh Jūq
Kaleh Dr.
Mirzā Mirānshāh
Gendarmerie Post
Hasanābād
Shamseh
Jairan Minār
Tairan Minar
Chashmeh Safid
Kali Charmi
Fatehābād
Sir
Ab-umbār
Shahwali
Khakibak
Qal'a-kun
Qurbāw Ali
Khawja Kand
Qizil Kaleh
Hasanābād 8 m.
Takan Tappeh 6 m.
Bijar 59 m.
Sinneh 55 m.
Sinneh 66 m.
Yizmala 2 m.
Barnjan 1/2 m.
Darreh Ziārat 2 m.
Eski Baghdad 7 m.
Shukh Chopan 5 m.
Pesh Bulagh 3 m.
Mahābād 18 m.
Mahābād 24 m.
Sāneh 12 m.
Malik Kandi 10 m.
Zangirābād 4 m.
Targavar 7 m.
Gel Kand
Shorchat
Aliakand
Ak kend
Amir Kand
Zuimūdābād
Husainābād
Bar
Ozan
Chaer
Gul Tappeh
Chukchi
Kalachi
Turkmāndkandi
Kal-tega
Khāni Sayid Ismānli
Yaskand
Akshawa
Jam Bulagh
Ahmadābād
Darvish Ali
Kāni Gurga
Kāni Zorab
Kāni Bulāgh
Gaveshale
Sulaimān Kand
Farrukh Zād
Ahmadawa
Serkel
Khebeki
Kāni-zerin
Sunj
Kharmelia
Salkhawa
Arlukh-jaru
Karawa
Chekusha
Merkrān
Kāni Lal
Kāni Jūni (Perennial)
Alisun
Chami-Saqqiz
Tawa Kuran
Arabuglū Kuara
Qandeman
Kāni Panka
Darbesar
Naubar
Pir Muhammad
Muhammadābād
Kul Tappeh
Ak Bulagh
Jamoga
Kazallan
Saidawa
Karawa
Karawa-jaru
Sharikand
Karize
Tuzalka
Tuhut
Beijn-bazar
Kipioh
Kuchak
Kuchak Jaru
Mandil-bazar
Girdiglan
Baghdaja
Darreh Mian
Shibanawa
Zakhri
Kakawa
Bagdasar
Kulkuls
Pirumaran
Nakasur
Darreh Ābi
Musra
Jaushan
Darreh Ziārat
Yewaklān
Tajajar
Rangrazal
Shalākh
Qara-qez
Qara-man
Qara-gez
Qara-chal
Qara-darreh
Kaleh Shin
Sumaqdeh
Katraglula
Kandesuran
Khoremta
Gavra-kaleh
Palang Dezh Cham
Palang Dezh
Sarsav
Kezhezan
Yarenān
Southern limit of Grid C
Kuh-e-Khureh Ghar
Zarrineh Rūd
Qara-Qush
Aziz Kand
Akhoasla
Sayidābād
Kazana
Kani Ali Girda
Kani Kalen
Kazanli Harijlai
Halakan
Yunjar
Chichakata
Kaka-Tappeh
Khātūnābād
Mahmūjuk
Mastanawa
Hasanābād
Khurja
Ak Tappeh
Qizil Kalasi
Tumwa
Hutasud
Michasu
Ozan
Jambegli
Magamli
Chahramak
Zaranja
Yusuf Kand
Zamanad
Chodelijan
Kyzan Kandi
Zamīnābād
Kateyad
Oglanji
Kiyur
Magburi
Khalakh
Khalaqh
Aq Tappeh
Kizkurgi
Kūjukh
Marmar-Dāgh
Türki Wiran
Qizil Kabir
Ja Jutli
Qarah-Chai (Stone)
Gulzar
Sursan
Hin Bulagh
Chugli
Gug Aghach
Yarlig
Sanjud
Sulaimānābād
Telephone line
Husainābād
Mian Bulagh
Incha
Bāghcha Mishah
Tappeh Bür
Kharkhar
Bayān Dāgh
Darzivali
Karaburar
Sārūq Chai (Perennial)
Arabāgh Ali
Mishtaki
Nughara
Amaba (Toghiara)
Darreh Khur
Aliyān
Darreh Panbaqo
Bzah Bulagh
Yārdui Telephone line
Ma'sūcābād
Qu Tashki
Karatto
Kupribakhsh Washki
Kazanau
Siah Nāv
Zālu
Chichi Khar
Allābād
Nasarābād
Tezawa
Duzakh-darreh
Karize
Amān
Sāhib
Mīlleh-i-Sāhib
Sunateh
Chaupan Qara
Jivian
Tūmandāb
Takht
Arau
Jūnian
Kaleh Jūq
Kaleh Dr.
Mirzā Mirānshāh
Gendarmerie Post
Hasanābād
Shamseh
Jairan Minār
Tairan Minar
Chashmeh Safid
Kali Charmi
Fatehābād
Sir
Ab-umbār
Shahwali
Khakibak
Qal'a-kun
Qurbāw Ali
Khawja Kand
Qizil Kaleh
Hasanābād 8 m.
Takan Tappeh 6 m.
Bijar 59 m.
Sinneh 55 m.
Sinneh 66 m.
Yizmala 2 m.
Barnjan 1/2 m.
Darreh Ziārat 2 m.
Eski Baghdad 7 m.
Shukh Chopan 5 m.
Pesh Bulagh 3 m.
Mahābād 18 m.
Mahābād 24 m.
Sāneh 12 m.
Malik Kandi 10 m.
Zangirābād 4 m.
Targavar 7 m.
Gel Kand
Shorchat
Aliakand
Ak kend
Amir Kand
Zuimūdābād
Husainābād
Bar
Ozan
Chaer
Gul Tappeh
Chukchi
Kalachi
Turkmāndkandi
Kal-tega
Khāni Sayid Ismānli
Yaskand
Akshawa
Jam Bulagh
Ahmadābād
Darvish Ali
Kāni Gurga
Kāni Zorab
Kāni Bulāgh
Gaveshale
Sulaimān Kand
Farrukh Zād
Ahmadawa
Serkel
Khebeki
Kāni-zerin
Sunj
Kharmelia
Salkhawa
Arlukh-jaru
Karawa
Chekusha
Merkrān
Kāni Lal
Kāni Jūni (Perennial)
Alisun
Chami-Saqqiz
Tawa Kuran
Arabuglū Kuara
Qandeman
Kāni Panka
Darbesar
Naubar
Pir Muhammad
Muhammadābād
Kul Tappeh
Ak Bulagh
Jamoga
Kazallan
Saidawa
Karawa
Karawa-jaru
Sharikand
Karize
Tuzalka
Tuhut
Beijn-bazar
Kipioh
Kuchak
Kuchak Jaru
Mandil-bazar
Girdiglan
Baghdaja
Darreh Mian
Shibanawa
Zakhri
Kakawa
Bagdasar
Kulkuls
Pirumaran
Nakasur
Darreh Ābi
Musra
Jaushan
Darreh Ziārat
Yewaklān
Tajajar
Rangrazal
Shalākh
Qara-qez
Qara-man
Qara-gez
Qara-chal
Qara-darreh
Kaleh Shin
Sumaqdeh
Katraglula
Kandesuran
Khoremta
Gavra-kaleh
Palang Dezh Cham
Palang Dezh
Sarsav
Kezhezan
Yarenān
Southern limit of Grid C
Kuh-e-Khureh Ghar
Zarrineh Rūd

Railway:—Broad Gauge: Double with Mile-stone. Single
„ Other Gauges: Double Single
Mineral Line and Tramway. Telegraph Line
Road:—Metalled with Mile-stone. Unmetalled
Cart-track. Camel-track or Trade route
Mule-path, with Pass symbol. Foot-path
Unsurveyed or doubtful routes
Well-(1) Water. (2) Oil. Mine. Spring. Grave
Mosque or Imāmzāden. Fort. Watch-tower. Deserted Village

Geographical Section, General Staff, No. 3919.
Published by War Office, 1942.
2nd Edition 1942.

1000/4/42. No 2. RER SEC. R.E.

Index to Sheets.

1	G K O	1
	H L P	
2	E I M	2

International Numbering.

J-38 P	J-38 Q	J-38 R
J-38 V	J-38 W	J-38 X
I-38 D	I-38 E	I-38 F

Scale 1 inch to 4 Miles, or 1:253,440.

Miles 5 4 3 2 1 0 5 10 Miles

Metres 5000 0 5000 10000 15000 20000 Metres

Contour Intervals 250 feet.
Contours are approximate.

Cutting points of Grid C / Grid B have been shown to the South / North of the grid line 300,000 metres (Southern limit of Grid C), by ticks along the edge of the sheet with values in sloping type.

INCIDENCE OF LETTERS ON GRID C

H	J

2,300,000 — 300,000

INCIDENCE OF LETTERS ON GRID B

Q	R
V	W

1,600,000

Administrative Index.

ĀSTĀN No. 4

Boundary of different countries. with pillars. (i) Surveyed. (ii) Unsurveyed
„ „ „ „ Undemarcated
„ „ Province. (i) Demarcated. (ii) Undemarcated
„ „ District
Great Trigonometrical Survey Bench-mark — B M 1417
Trigonometrical Station. Intersected Point — Δ Khari 1417 · 1417
Heights-(i) Approximate. (ii) Relative — 1417 · 1515
Post Office. Telegraph Office. P. O. & T. O. combined — P O T O P T O
Caravanserai. Halting Place. Camping Ground — Car: H P C G

Compiled and Published originally under the direction of the Surveyor-General of India 1924 and revised to 1940
Heliographed by O.S.O. 1942.

TO GIVE A REFERENCE ON THIS MAP

LETTER — See LETTERS ON MAP
FIGURES — DISREGARD THE SMALLER FIGURES IN THE BORDERS, which give full co-ordinates from o
USE THE LARGER BORDER FIGURES or those printed on the face of the map.

POINT KARABURAR LETTER H

0′ E. of GREENWICH.

MAP N°25

J. 38. V.

MAHABAD

ĀSTĀN No. 4. ERBIL
AND SULAIMĀNĪYA DIVISIONS.

ĪRĀN, ʿIRĀQ

Mean Grid North of Grid O / Grid B in this sheet, is 0° 19′ East / 0° 16′ East of True North.
Magnetic Declination about 3° 40′ East (in 1939).
(Decreasing by about 15″ annually).

No. J-38 V
(I & A. C. No. 1 H)
MAHĀBĀD

RIZĀIYEH

MAHABAD (SAQQUBULAGH)

BILEBAN MOUNTAINS

SULAIMĀNĪYA

Scale 1 inch to 4 Miles, or 1:253,440.

Miles 5 4 3 2 1 0 5 10 Miles

Metres 5000 0 5000 10000 15000 20000 Metres

Contour intervals in ʿIrāq area 250 feet.
Contour intervals in Īrān area 280 feet (taken from Russian maps).
Contours and clinometric heights are approximate.
The ʿIrāq-Īrān boundary has been taken from half-inch ʿIrāq maps published in 1929-30.
Most of the streams in this sheet are perennial.

Cutting points of Grid C / Grid B have been shown to the South / North of the grid line 300,000 metres (Southern limit of Grid C), by ticks along the edge of the sheet with values in sloping type.

Railway:—Broad Gauge: Double with Mile-stone. Single
" Other Gauges: Double. Single
Mineral Line and Tramway. Telegraph Line
Road:—Metalled with Mile-stone. Unmetalled
Cart-track. Camel-track or Trade route
Mule-path, with Pass symbol. Foot-path
Unsurveyed or doubtful routes
Well-(1) Water. (2) Oil. Mine. Spring. Graves
Mosque or Imāmzādeh. Fort. Watch-tower. Deserted Village

Index to Sheets.

1	C G K	1
	D H L	
2	A E I	2

International Numbering.

J-38 O	J-38 P	J-38 Q
J-38 U	J-38 V	J-38 W
I-38 C	I-38 D	I-38 E

Administrative Index.

ĀSTĀN No. 4 ĪRĀN

1 ERBIL, ʿIRĀQ.
2 SULAIMĀNĪYA, ʿIRĀQ.

Boundary of different countries. with pillars. (i) Surveyed. (ii) Unsurveyed
" " " Undemarcated
" " Province. (i) Demarcated, (ii) Undemarcated
" " District
Great Trigonometrical Survey Bench-mark. B M 1417
Trigonometrical Station. Intersected Point. △ Khari 1417 · 1417
Heights-(i) Approximate, (ii) Relative. ·1417 ·1417
Post Office. Telegraph Office. P. O. & T. O. combined. P.O T.O P.T.O
Caravanserai. Halting Place. Camping Ground. Car: H P C G

Geographical Section, General Staff. No. 3919
Published by War Office. 1942.
2nd. Edition 1942.
1000/4/42. No 2 REP. SEC. R.E.

Compiled and Published originally under the direction of the Surveyor-General of India 1922 and revised to 1940
Heliographed by O.S.O. 1942.

TO GIVE A REFERENCE ON THIS MAP

LETTER See LETTERS ON MAP
FIGURES DISREGARD THE SMALLER FIGURES IN THE BORDERS, which give full co-ordinates from origin, viz. 220000
USE THE LARGER BORDER FIGURES or those printed on the face of the map.

MAP Nº 26
H. 39. B.
RAM. HORMUZ

ĪRĀN — FIRST EDITION

Mean Grid North, in this sheet, is 2° 25′ East of True North.
Magnetic Declination about 3° East in 1936.
(No annual change).

W A Z I R I S T A N

K A R D H I

M A I D O Z A B A D

H A S A N K I Y A R I

A L K H A M Ī S

H A R Ī D A B U A L A I M A H

S A L Ā M Ā T

B A V I E H (Summer)

K Ū H - I - S H A H A R A

K Ū H - I - Z A G R O S

K H U Z I S T A N

U N S U R V E Y E D

K H Ī D H R - I - S U R K H

M A K A W A N D

G U R G A H

T A F A R A K H A

B A N I K H A L I D

B A R A N G I R D

Q A L ' E H - I - T Ū L

B U L A W A S I

G U N D A K H A R G A L

M A I D Ā N - I - Z A R G

D A S H T - I - D Ā N A

T A M B Ā K U K Ā R

L A H A B A R I

Z A N G Ī N A

Rām Hormuz (Rāmuz)

Khodeja

Shārūn

Mai Dāud Pāin

Mai Dāud Bāla

Khaneh Riza Kull

Hāji Kal

Qal'eh-i-Tūl

Izeh

Shalamir

Bunneh Majidi Bahrām

Bunneh Qa'li Mardān

Saida Bāra

Kizaiyar

Mirbācheh

Shākheh (Arab Rashid)

Maidān

Baiyūr

Uvila

Magām

Lagaita

Haur Shākheh

Awafi

Shahaibi

Karayim

Cultivated valley with numerous Arab and Turk encampments

Ford in dry weather

Liable to floods in winter

Motorable in dry weather

Marsh

Broken plateaux (Clay & small stones)

Harīd Abu Alaimeh

Bunneh Canal

Rūd-i-Namak

Rūd-i-Ummu'l Khwāja

Rūd-i-Shūr (Perennial)

Rūd-i-Zard

Rūd-i-Putang (Perennial)

Rāmuz R. (Salt)

Marūn R.

Jarrāhi R.

Darreh-Kundak (Perennial)

Darreh Sulaimāni (Perennial)

Darreh-i-Daraz

Darreh Jak

Gūpāi Rūdkhāneh (Perennial)

Muwailah R. (Salt)

Ab-i-Garmak

Ab-i-Gandu

Ab-i-Bundān

Ab-i-Darreh Qir (Perennial)

Ab-i-Bulfaris (Perennial)

Ab-i-Lashkar (Perennial)

Ab-i-Zard (Perennial)

Ab-i-Shūr (Perennial)

Ab-i-Gulgir

Ab-i-Lashkar

Ab-i-Ahmadia (Perennial)

Ab-i-Gunjishk

Ab-i-Shūr

Ab-i-Khaneh Sardeh

Ab dih Wais

Ab-i-Ahmadia

Ab-i-Garmak

Ab-i-Darreh Qir

Ab-i-Bulfaris

Ab-i-Gandu

Ab-i-Bundān

Ab-i-Lashkar

Ab-i-Zard

Ab-i-Shūr

Ab-i-Gulgir

Ab-i-Ahmadia

MAP N° 27
H.39.N.
HINDIJAN

Mean Grid North, [illegible]

Magnetic Declination about 3° East in 1936.
(No annual change)

Y Z

D E

Tomb of 'Ali Hādi

Khar Faraih

Wakhāmeh

Water flows at maximum flood

Liable to floods in Winter

Limit of navigation for small boats

Khalafābād

Hamūd (Sayid)

Tiltiyeh

Cultivated plain

Dubaiyāra

Well

Camps

Harwāni

JARRĀHI R (Perennial)

Chamm Butliyeh

Matūl

Waibe

Motorable

Wheat cultivation

Ford

Rohāneh

Gumbazun

Alluvial cultivated plain

Mirriyeh

Bunvār

Maksar

Ford & Ferry

Bunvār-Rizaiq

Maksar 'Atiqeh

Kurdūniyeh

Suvaiyeh

Haddāmeh

Simon-zadeh Wais

Dūb al Mir Saraimeh

Kahūs

Thilith

Khamzeh

Takhair

Haskeh

Khvājeh

Sidaireh

Maqtu' Badrani

Maqtu' Bayyani

Area flooded through irrigation ditches at maximum river level

Zaliyeh

Grass and bush

Marsh

Naizār ('Arab camp)

Motorable in dry weather

Cultivation

Marghzār R S

Southern Section TRANS IRANIAN RAILWAY (4 ft 8½ gauge)

Ravine

Flat cultivated area

Marsh

Motorable in dry weather

Oil pipe line follows road

H A H R

Mound Mūghar-i-Jān Shikāt

M S

KHURRA

Sar Bandar R S

Landing ground

Bandar Ma'shūr Wireless Stn

(Perennial)

Tidal flats partially covered at high water

Bandar Shāhpūr R S

KHŌR MŪSA

Tidal mud flats intersected by shallow channels

Qabr an Nākhuda

Bunneh I (In ruins)

Rās Tanūb

Mud flats

Dry in patches at low water

KHŌR MŪSA CHANNEL

KHŌR GHAZLĀN

Dara I

D E

Fasht al Mairiz

5 fathoms

Deh Mulla

Ferry

Zuhreh (Hindiāb) R (Perennial)

Cham Khalaf 'Isa

Duraihak

Gulakh Domaneh

Cham Khurnūk

Fail

Sarkhurreh

Jirī

Nāsirābād

Cham Tang

Cham Kalgeh

River fordable above this

Kurreh Pa

Jābirābād

Sāhibābād

Chehil Mani

Husainābād

Zulmābād

Cham Murād

Cham Rahmāni

Grass covered plain

POL

CG

Ferry

Landing ground

Hindian

Maliki

Darlakeh

Gharābi Buzurg

Gharābi Kuchik

Cham Sha'bāni

Gaz 'Ali

(Perennial)

Abad Illāhi

Badrāni

Puz Sefid

Faraiz

Kaparkāh

Shrimeh

(Perennial)

Nathl-i-Bagush

Shāh Mīr Nu'mān

Customs

Tuvaisheh

Hutse

Nearly dry at high water

Rās al Bahrgān

5 fathoms

P E R S I A N G U L F

Baria

Āsiāb

Lunjir Canal (Perennial)

Qalandari

Suvaiyeh

Qal'eh Mashraqi

Gargari Pāīnīn

Gargari Bālāi

Shirābād

Ghūleh

Gulakh Boleh

Amir al Mūminin

Moakhdad

Chamkarda

Lunjir

Qal'eh Timsh

Kūh-i-Mīshun

Chāh-i-Shīrīn

Kūh-i-Pāzahr

Wireless Stn.

Motorable

Good grazing

Butūri

Bandar Dīlam 19 m.

Behbehān 18 m.

Behbehān 19 m.

Qal'eh-i-Lāsak 10 m.

Qal'eh-i-Lāsak 7 m.

Kūh-i-Hamūd

Jāīzān

Deh Nau

Jūlaki

Mārūn R (Perennial)

Ford in dry weather

Ford in dry weather

Motorable

Motorable in dry weather

Motorable

Motorable in dry weather

Motorable in dry weather

Motorable

Motorable

Motorable in dry weather

Motorable

Motorable in dry weather

Motorable in dry weather

Motorable in dry weather

MAP N°28
H.39.I

BEHBEHAN

ĀSTĀN No. 7.

ĪRĀN

Mean Grid North, in this sheet, is 2° 57′ East of True North.
Magnetic Declination about 3° East in 1936.
(No annual change).

International No. H-39 I

NO. 10 J
BEHBEHĀN

50° 0′ E. of GREENWICH.

Z A G H R O S

B E H B E H Ā N

D A S H T - I - G A Z

K Ū H - I - G I L Ū Y E H

K Ū H - I - K A M A R

K Ū H - I - T A Ḵ T

K Ū H - I - H U L A I G U N

K Ū H - I - J A Ḥ R Ā M

B U S H I R E

P E R S I A N G U L F

E A

Bandar Dilam

Khairābād

Tul-i-Kuchik

Tul-i-Gap

Tul-i-Bibi Bashdah

Tul-i-Barm-i-Shur (Salt)

Tul-i-Mukhanat

Tul-i-Gurepān

Tul-i-Sangar

Tul-i-Bāghi

Tul-i-Muhammad Taqi

Tul-i-Kuchik

Tul-i-Gap

Tul-i-Kuchik

Tul-i-Kharbal

Tul-i-Kand Sigun

Tul-i-Mukhanat

Tul-i-Barm-i-Shur (Salt)