

## ORIGINAL COMMUNICATIONS.

TOPOGRAPHICAL REPORT ON THE TOWN  
OF MANDALAY, UPPER BURMA, AND  
ITS ENVIRONS.\*

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The following are notes of the medical geography of Mandalay and its neighbourhood during a residence of five years there. Some points are a little defective through want of proper instruments to go minutely into every subject.

Mandalay, the present capital of Independent Burma, is situated above 22° north latitude and 96° 10' east longitude, on an extensive flat plain on the east bank of the River Irrawaddy, about 600 miles from the sea by the river course.

This plain, which has at various periods formed part of the bed of the river, is bounded on the east by the Shan hills which are on an average over 3,000 feet high; these hills rise from the plain rather abruptly, but here and there send out small spurs into the plain; on the west side by a low range of hills called the Tsagaing hills averaging about 500 feet, and some of the highest peaks about 600.

Looking northwards, you look up the valley of the river Irrawaddy with the hills converging on either side narrowing the extent of the valley; some of the spurs of the Shan hills running down to the river. Looking southerly, you look over a large flat plain of the Irrawaddy where formerly the capitals of Ameerapoor and Ava were situated, although now in ruins. Nearly in the centre of the plain, dividing the valley of the Irrawaddy from the gorge of the Myit-nge, stands the pointed and craggy looking hill Mya-leit, the sides of which are very steep and well defined. The whole plain thus situated is composed of alluvial soil, very flat, or only broken up here and there by small knolls or spurs from the Shan hills, composed of red beds of hard conglomerate-sandstone, with a good deal of sand.

On the west side the Tsagaing ridge stretches from south to north parallel to the river; they do not reach any high altitude, probably the highest peaks being about 800 feet. They are very much broken up and distorted with ravines and water-courses, the softer portions having gradually worn away, leaving the hard and rocky ridges. The whole surface of this is very bare and barren looking, being only covered with small dwarfish shrubs here and there, and during the dry season with almost no herbage. In the ravines and hollows larger trees and some herbage exist, and during the rains the vegetation is more profuse. The rocks are chiefly composed of gneiss and hornblende with layers of limestone. Deeper down in the lower beds it seems to be mica and hornblende with veins of pure quartz. Above all these there are beds of a highly crystalline and white marble in some parts, in others it is of a bluish colour and flaky. These beds can be easily traced along the

top of the ridge for a long way; some of the marble here is of a very pure character, white and crystalline, and some of it is a good deal laminated. Above the limestone the rocks look granitic, composed of feldspar and mica traversed with veins of quartz.

Between this range and the river there runs a separate and lower ridge composed of sand and conglomerate gravel. Farther north these ridges will be seen to become gradually lost in a high and undulating country. On the Western side of these Tsagaing hills there is a small lake with brackish water, and the country around is very barren and bleak. The rocks here are slaty and of a peculiar greenish blue colour. On this side of the Tsagaing range not far from here iron is found in large quantities; the ore is hæmatite, and was said to be of good quality by an English mining engineer. Also farther north I was shown a specimen of copper ore as large as a fist, and I am quite sure half was pure copper and the rest quartz. Both green and blue ores could also be seen.

On looking from the top of the Tsagaing range towards the east, you look down on the river, and beyond that a large flat jheely looking country richly cultivated, terminating abruptly at the Shan hills. This plain is broken up here and there by small hills and undulations, the higher towards the north being the Tsagyen marble hills, and towards the south the high and peaked mountain Mya-leit. The Tsagyen hills are composed chiefly of limestone; these hills are famed for their marble quarries, from which the Burmese Gaudamas and images are made. Beneath the limestone is gneiss and hornblende, and above it a sort of granular quartz. The limestone is very white and pure, and well crystallized. The west side of these hills is abrupt and steep, but the east side slopes away, and presents a white mass glistening in the sun caused by an innumerable number of small chips of marble. When the marble has been polished into images, it has generally a delicate tinge of light blue through it which gives it a semi-transparent appearance.

The high-peaked hill of Mya-leit is also entirely composed of crystalline limestone, and forms the southern limit of the plain on which the capitals of the Burmese have been situated for years.

The Shan range of hills on the eastern side is composed of metamorphic rocks such as granite, gneiss, hornblende and quartzite. These hills rise up suddenly like the steep shores of a rocky coast. In this plain at the foot of the Tsagaing ranges of hills flows the river Irrawaddy, intersecting and dividing it into many islands large and small, chiefly composed of sand. The river during six months of the year overflows its banks; the greatest height of the rise is said to be about 30 feet, and it covers a large portion of the plain in the neighbourhood of the river; and frequently it is difficult to distinguish what is river and what is not. The river begins to rise in May and reaches its highest about August, and gradually subsides within its banks about November.

The soil of this large plain, as might be expected, is alluvial,—chiefly sands and clays with only very little loam.

\* This report has been placed at our disposal by the Surgeon-General, Indian Medical Department, Bengal.



When the river subsides there is very little deposit left, and that is chiefly sandy. As far as I could ascertain, the soil seems to contain a much smaller amount of decaying vegetable matter than one would have been led to expect: certainly much less than most of the banks of other Indian rivers. This is probably due to the Irrawaddy being more of an excavating than a depositing river. The deposit that does take place is seemingly of the older formations, and contains little or organic matter. This, I believe, is one of the chief causes why malarial fevers are less common in Mandalay; and at the fall of the rivers there is no increase in the amount of fever as one would be led to expect if the deposit contained much organic matter. Between the river and the Shan hills on the east this flat level plain is under rice cultivation, and much of it is irrigated by a large lake reservoir on the east of the city of Mandalay. This plain is very fertile, and, unless in the driest season, is covered with herbage. There is no dense jungle in this plain; the trees consist generally of magnificent tops of mango trees dotted here and there; very good specimens of these being found in and around the old capitals, Ameerapoor and Ava. There are many tamarind trees also around the houses, the Burmese being very fond of building their houses under the shade of large trees.

The staple cultivation around Mandalay is rice; anything else at present is cultivated only on a small scale. Gram and peas are cultivated, and could be largely grown. Tobacco is also cultivated on the numerous small sandy islands near the river. Indigo is cultivated at Ameerapoor, and along the valley of the Myet-nga tobacco, nutze and sugarcane. In the neighbourhood of Mandalay wheat and sesamum grow well. On the Shan hills the tea tree grows well, and it is also said that these hills would suit the cultivation of the cinchona. There is no doubt but that with energy and capital great part of Burma around Mandalay could be rendered rich in cultivation. As already stated, owing to the evident deficiency of much organic alluvial deposit, the soil in the neighbourhood of Mandalay cannot be said to be unhealthy. It is certainly more free from fever of a malarial origin than I would have expected after the overflowing of the river.

*Climate and Meteorology.*—The climate of Mandalay is, like the rest of tropical climates, divided into three seasons,—the cold, hot and rainy seasons, though these are not quite so marked as is found nearer the sea coast. The climate is essentially a very dry one, and the average temperature of the year for four years during my residence was 80°. This, taking into consideration that during the cold season the temperature goes down to about 50°, shows that part of the year is exceptionally hot.

The three hottest months are March, April and May, the thermometer ranging from 80° and 86° up to 98° and 107°. During my residence there I have not seen the thermometer rise above 107°, but I have seen it daily rise to 104° during a fortnight of the hottest weather. Even during June, July, August and September the thermometer rises to 92° and 94°, and seldom falls below

80°. But in June as a rule the temperature falls a little, and the character of the heat is less oppressive; this is probably due to the fact that in Lower Burma the heavy monsoon has commenced which cools the fertile plains of Lower Burma and increases the amount of vegetation, thus lowering the temperature of the wind which, though the temperature is again raised by the dry arid lands of Upper Burma, never becomes so hot as it is during the previous months. The rainfall is small in Upper Burma compared with the heavy falls that occur in British Burma. During a period of four years the average rainfall was about 40 inches. Very little rain falls till August; previous to that showers may occasionally fall. In May thunderstorms and dust-storms occur, but seldom much rain. During May, June and July there is seldom more than 2 or 3 inches in each month, and frequently in May none, or only a few tenths. The greatest rainfall is in August, September and October, but even then it seldom or ever rains many hours consecutively. It generally falls in heavy showers, with thunderstorms every other day or so.

The cold season commences in the beginning of November and continues till the end of February. During these months the climate is all that could be wished for, cool and bracing, the range of the temperature is from 54° to 75°. The lowest temperature I have seen registered was 48°. Sometimes a shower of rain falls about Christmas. During a period of the cold season immediately before the hot weather sets in, for a short time, the diurnal range of temperature is very great—often over 30°.

During the cold season fogs on the river are very common, and are sometimes very dense and extend over Mandalay, and sometimes these fogs are not cleared off till about 10 A. M. During the rainy season a great deal of rain is attracted, and falls on the Shan hills to the east of Mandalay, and frequently heavy showers can be seen falling on these hills whilst Mandalay lies sweltering in a boiling heat. Sometimes we can feel the benefit of these showers by a few cool whiffs of wind off these hills after a heavy shower, but as a rule they are only whiffs, and are more tantalising than consoling.

The prevailing winds in Mandalay are southerly and northerly, that is up the river and down. They come from the east, but according to the Burmese they sometimes do, because they say the east wind is unhealthy, probably because it blows over the only part of the country where malaria exists to any extent, and that is the forests and jungle at the base of the Shan hills. Westerly winds are rare, except the north-westers which bring thunderstorms and dust storms. During the dry season in Mandalay I have seen no hot winds such as are found in India, certainly the temperature is high, but there is not that withering and fiery blast that is so frequent in India, and as a rule the temperature falls perceptibly soon after sunset, the wooden houses giving out the heat more quickly than the stone houses in India. During the hot season the wind blows pretty strong, but no one thinks of shutting it out, but rather courts it.

The nights in Mandalay, just as it is in Burma generally,



are cool, and it is seldom that sleep cannot be obtained. The most oppressive time is about August and September when there is a great deal of moisture in the air.

During the greater part of the year the sky is cloudless, and during the dry hot season the district around looks very dry and parched up, there being little or no herbage.

Looking at the climate as a whole, I have had no reason to think during a residence of five years, that the climate is unhealthy, or that it would be unhealthy for Europeans. The number of Europeans who were there while I was stationed there, were too few to generalize upon, but the few who were there never suffered from climatic diseases. The temperature is high for a great part of the year, but, unless for a short time, the diurnal range is not very great. Again certainly there is a good deal in the city of Mandalay to make it unhealthy, such as bad drainage and bad conservancy, both of which may be said to be nil as far as anything that the Burmese do.

I believe the bright and powerful sun acts in a very efficient way as a deodoriser and oxidiser, and the light rainfall makes the want of drainage less perceptible. Still, during the rainy season surface drainage would be of great advantage. The river Irrawaddy is subject to a yearly rise and inundation, and spreads for miles over the valley, covering the land many feet deep. The highest rise is over 30 feet; while I was stationed there it inundated the outskirts of Mandalay. The British Residency was for several months under water, and the house I stayed in had 4 feet of water around it. I have seen a steamer within a few yards of the Residency gate, although during the dry season the river is  $\frac{3}{4}$ ths of a mile distant. A high bank of a canal prevented further inundation. Since then a large bund has been thrown up near the bank of the river which confines the overflow near Mandalay.

The river begins to rise as early as April; this is, I believe, due to the melting of the snows on the southern slopes of the Himalayas at its origin, for at that time rain has not as yet fallen in any quantity in any part of Burma. The river rises gradually, but is subject to frequent rises, and falls within short periods. The temperature, during the dry season, of the water in the river is very low compared with that of wells and other running water. The river reaches its highest about the middle of August, and sometimes rapidly subsides to rise again a second time, although not to such a height as the first. These rises and falls in the river go on throughout the whole time of the overflow, and the Burmese say that the periods of the highest rises takes place at the full moon.

I have endeavoured to find out the truth of this, and certainly occasionally this seemed to be the case; but it might have been a mere coincidence, for the highest rise I have ever seen was when the moon was in the last quarter and I have seen other rises at various periods of the moon's phases.

There is no doubt that this large expanse of water, even before the rains begin to fall at Mandalay, has an excellent effect in lowering the temperature, for it is perceptibly lowered long before the rains fall in Manda-

lay, although much of this may be due to the heavy rainfall in Lower Burma.

The river when it falls leaves little deposit, and what does remain seems to be chiefly sand; it quickly dries up as the river subsides, and is covered immediately with herbage.

This overflow of the river is of great service to the Burmese in the cultivation of rice and other crops, and is immediately taken advantage of in cultivating.

The city of Mandalay, situated on the left bank of the river, lies about a mile from the river, in the centre of a large plain. There is a small hill on the north-east corner which overlooks and commands the whole city; it is about 300 feet high. The city proper is well laid out in the form of a square, surrounded by a high parapeted wall lined with earthwork inside. Outside the wall is also a moat at a distance of about 40 yards, over which there is a bridge on each side of the square, and two on one side. The size of the space enclosed is a little less than a mile square. In the wall there are twelve gates, three on each side. The principal streets pass through from gate to gate, crossing each other at right angles, so also with the smaller streets, thus dividing the city into a number of small squares, the houses of each square facing the street, with the chief man's house in the centre. The King's Palace occupies a large square in the north eastern part of the city. The chief streets are wide, and most of them macadamised after a fashion, but in many of the minor streets not much is done, and during the rains the streets are very bad. The chief streets have a row of trees along each side which affords good shade to the houses. From the top of the Mandalay hill the city has a very regular and well laid out appearance. That portion of the city without the walls, which is probably the largest part, has been laid out on the same plan, the streets always running at right angles to each other, but it is more scattered and not quite so compact as that portion within the walls.

The Burmese houses are generally built of a wooden frame-work filled up with bamboo matting. All these houses are generally well raised from the ground about from 4 to 6 feet; this allows of free circulation of air all round and underneath the houses. In fact these Burmese houses are always well ventilated, as the bamboo matting allows free permeation of air through the house in every way. Some of the wealthier Burmese and some foreigners as Chinese and Moguls build brick houses; but I think the Burmese houses are the healthiest and coolest at night, the only danger in these houses is the risk of fire, which sometimes destroys large parts of the city almost every year. For some time also the Burmese were afraid to build brick houses on account of shocks of earthquakes which some years ago occurred. During my residence there some slight shocks were felt every year, and the direction of the motion seemed to be from south to north. Even now in building brick houses they have always posts in the walls all round at a short distance from each other.

The Burmese estimate the population of Mandalay at 200,000 inhabitants, but this I think is far too much; I should say 110,000 to 120,000 would be nearer the mark.



The *drainage* of Mandalay is almost nil, depending mostly on the natural slope of the ground; along the streets there is a sort of kutchra drain on each side, but this is as often as not filled with rubbish and blocked up. The same exists throughout the whole city, and if it were not that the rainfall is light, it would often be in a very swampy state. But very little would require to be done to produce a good surface drainage, for although it is flat, there is quite ample slope to the river for drainage of storm water.

The *conservancy* of Mandalay is just the same; there is no attempt at any system, and if it were not for the extreme dryness of the atmosphere and powerful rays of the direct sun, certainly the place would become very filthy, as it is when many individuals are collected together, such as the Phoongyees or priests' monasteries, in which the privies are very filthy.

The great conservancy officers are the dogs and pigs, and if any one has a great tendency to become too fond of pork, I think a few days at Mandalay would cure him. Some of the houses have privies; others seem to use any open space or the streets at night. This the powerful sun soon dries, and it becomes mixed with the dust which is very abundant in Mandalay during the dry season.

The system of conservancy most applicable in Mandalay would be the dry earth system, which on account of the dryness could be efficiently carried out.

The *water-supply* in Mandalay is carried out by means of wells, which contain sufficient water throughout the whole year, though they fall considerably in the dry season. Many of these wells seem to be pretty much regulated by the rise and fall of the river, this chiefly on the west side near the river. On the east side this is not the case so much.

I have only been able to examine the water qualitatively, and from what I could judge, there did not seem to be any appreciable quantity of organic matter. Chlorides were present, and also in some wells a good deal of lime salts; this is only to be expected from the large lime strata around Mandalay. During my stay there I saw no endemic disease which I could ascribe to the quality of the water. Goitre does not seem to prevail neither does gravel. The height of the water in the wells varies from about 6 or 8 to 15 or 20. Many prefer the rain water, and say it is much better, and certainly, after it has been allowed to stand a while and then filtered, it gives a very pure water showing few impurities. Mandalay might be easily supplied with water either from the rain or from the metamorphic hills on the east.

*Prevailing Diseases.*—The prevailing diseases in Mandalay are much the same as found in other parts of India—fevers, dysentery and diarrhoea, and pulmonary complaints, especially pneumonia. A very common fever is a fever of short duration, only three or four days, which might be called ephemeral or simple continued fever, being chiefly due to exposure to the sun. It continues for three or four days and subsides, and quinine does not appear necessary at all in the treatment. Intermittent fever is pretty common among the Burmese, but not so much as I would have expected, and

the chief peculiarity of it is that it is seldom accompanied with enlargement of the spleen. I do not remember seeing a Burmese with it, unless he had come in from the forests where he had suffered from severe remittent fever. The principal cause of this I believe to be that the Burmese always live in houses well raised from the ground, thus rendering themselves less liable to chills and the predisposing causes of fever. The other cause I have already mentioned, and that is the character of the deposit, which contains very little organic matter such as is often found in the deposits of rivers in India. Whatever it may be, the fact is there, and I have noticed it all along the valley of the Irrawaddy. In post-mortems even in Rangoon it is seldom that the spleen is enlarged in a Burman. It will be found so in natives of India, but these have probably had it before they came to Burmah. The Burmese in the delta of the Irrawaddy have a quite different appearance from the native of the delta of the Ganges; he is a robust and muscular looking individual, and you seldom or never see a Burman with that pallid, anæmic and cachectic appearance which tells at once of enlarged spleen. The intermitent fever, when it does occur, is seldom of a well marked type, unless some who come in from the forests at the base of the hills.

Remittent fever I have only seen in some who came from these forests.

In fact, one may say that malarial fevers of a well marked type are not very common, at least not so common as in cities generally within the tropics.

The number of Europeans who were there is so small that one cannot generalize on their health. During my residence few if any of them were ever sick, unless occasionally from slight attacks of fever due to exposure to the sun.

Dysentery and diarrhoea occur, but I have not seen very much of the former, nor very severe cases.

Veneral diseases are common enough, and commit frightful ravages among the Burmese. It seems to be of a very virulent type, and frequently it is aggravated by the abuse of calomel which the Burmese use.

The two chief epidemic diseases which visit Mandalay are cholera and small-pox; the latter can scarcely be called epidemic, for it is more endemic subject to epidemic influences; both these diseases carry off a great number of Burmese, especially the small-pox. Vaccination is not carried on, but inoculation is carried on by some Roman Catholic priests, and I have little doubt this often tends to set small-pox agoing.

In some of the epidemics that I have seen the disease was very virulent, and carried off immense numbers in a very short time. Cholera visited Mandalay as an epidemic only once during my stay, and it came up the river where it was raging some time before it broke out in Mandalay. It caused a great many deaths, and was very virulent in the priests' monasteries, where large numbers were collected together and the conservancy was bad.

During the cold season pneumonia occurs sometimes along with fever; this is chiefly due to the cold and want of proper clothing to protect them. Catarrhs are also common in the cold season.



On the whole, taking every thing into consideration, Mandalay cannot be considered an unhealthy city among the Burmese; neither, from what I have seen, would I be led to expect it to be an unhealthy one to Europeans.

In the event of a cantonment or a European quarter being required at Mandalay, I would recommend that it be removed a little distance from Mandalay; the old site of Amearapora would be a good spot, or on the other side of the river at Tsagaing.

Rangoon, 10th October 1879.

## A SYNOPSIS OF RECENT VIEWS REGARDING THE TREATMENT OF ENTERIC FEVER.

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Enteric fever is unfortunately a disease of such frequent occurrence in the practice of medical officers in India, that no apology is needed for introducing the subject to the notice of the profession in this country. It is unnecessary here to discuss the oft-mooted subject of the comparative frequency of typhoid fever in recent times as contrasted with the experience of physicians of the past generation: for, even when making every allowance for possible errors of diagnosis, it is impossible not to be struck with the absence of any mention of the disease in the medical reports of former days. This, however, is a subject that would take us far beyond the scope and purpose of the present paper, and what the writer wishes to direct attention to now is the more practical and important matter of treatment, and with this view he has endeavoured to place before his readers all he has been able to gather of the opinions of the ablest writers and practitioners of the present day in regard to the origin, cause, nature, mode of propagation and treatment of enteric fever; in short, to give a succinct narrative of the etiology, pathology and therapeutics of the disease according to the views of those who, possessing the widest field of experience, bring the closest and most accurate observation and the most intelligent reasoning to bear on the investigation of the subject under review. It is needless to say that no definite order has been followed in quoting the works of the various British and Continental authorities whose opinions are to be found set forth in the following paper.

2. Dr. Maclagan of Belfast, (I believe) who has written much on the subject of enteric fever, says that both the agminated and solitary glands ulcerate and throw off their sloughs in regular order. These glands (glands of Peyer) are found chiefly in the small intestine, increasing gradually as they descend until they reach the ileum, in which situation the mucous surface is found to be absolutely studded with bodies of glandular structure. In the large intestine the solitary glands are found in the upper part, but they soon diminish in number and finally disappear. Dr. Maclagan attributes the so-called relapses in typhoid fever to fresh ulceration of glands from the contact of unhealthy acrid discharges from inflamed glands higher up, and

he thinks perforation of the bowel more likely to occur in such cases. He is therefore in favour of encouraging the alvine discharges, especially in the later stages of the affection, in hopes of getting rid of the sloughs quickly and so lessening the chance of successive contagions, and is strongly opposed to remedies of an astringent character.

3. Dr. Maclagan in referring to the intestinal lesion in typhoid fever, which he describes as a specific inflammation of the agminated and solitary glands, says that it bears the same relation to enteric fever that tonsillitis does to scarlatina. Food should be bland and unirritating—sago, milk, arrowroot, and cornflour, and Dr. Maclagan allows neither beef-tea nor soup of any kind. Diarrhœa may be restrained by Pulvis Doveri gr. iij. to gr. v. and  $\frac{1}{4}$ th grain of Pulvis Ipecacuanhæ. Lime water and milk in equal proportions form an important item of the dietary scale. For a laxative, castor oil is the best preparation,  $\mathfrak{z}$ i for a dose. Excessive diarrhœa may be checked by Acetate of lead, Sulphuric acid or solution of Pernitrate of iron; of the latter Dr. Maclagan speaks favourably. The combination of a little tincture of opium or solution of morphia with the acid has an excellent effect.

4. Referring to these views an Aberdeen physician, whose name has escaped my memory, denies the assertion that the general practice is to check the diarrhœa; speaking for himself, he neither advocates encouragement or discouragement of the alvine discharges, but says he simply seeks the *juste milieu*. Dr. Balbirnie of Sheffield advocates packing in wet sheets for fevers of sthenic type; but for typhoids and fevers of asthenic character generally he prefers a sheet wrung out of hot water covered with blankets in the usual manner and a Mackintosh over all.

5. Dr. Hoffman of Markstett treats typhoid and other fevers on the principle of lowering the temperature by rolling the patient up in sheets wrung out of cold water and surrounded by a woollen cover or dry sheet. The patient is left in this condition until the temperature of the body and covering approximate: about two hours will be usually enough in the case of a child. In the early stage perhaps 20 to 30 minutes. As often as the patient is removed from his envelopes in order to maintain the cooling effect, the whole body is sponged freely with cold water: or if there be comatose symptoms, he is placed in a bath of lukewarm water and cold water poured over him.

6. Dr. Oglesbury of Leeds recommends that the patient should at first be placed in a bath registering 98° or 99°, and remain in it for at least five minutes; afterwards cold water should be gradually added, and only discontinued when the patient complains of its severity.

7. Liebermeister recommends the cold bath in typhoid fever. As soon as (about the 9th day) the fever has declared itself, he commences the employment of the bath. For ordinary cases the temperature is 68° F., and the patient remains in the bath for about ten minutes. This is repeated as often as the temperature rises to 102° F. Sometimes he has given as many as six or seven baths. The effect is to produce a tendency to considerable periodic remissions, of which he takes advantage to