

Reprint.

THE TIBET MISSION FORCE, 1903-1904.

- (1) MEDICAL REPORT.
- (2) SANITARY REPORT (LINES OF COMMUNICATION).
- (3) EXTRACTS FROM GENERAL MACDONALD'S REPORT.

MEDICAL REPORT ON THE TIBET MISSION FORCE, 1903-1904.

(a) *Medical Personnel.*

The *Medical Strength* was thirty medical officers, of whom four were of the Royal Army Medical Corps and twenty-six of the Indian Medical Service, with eight Assistant-Surgeons and sixty-seven Hospital Assistants.

The *Field Hospitals* numbered two sections of British and ten of native, namely, Nos. $\frac{D}{21}$ and $\frac{A}{2}$ British, and $\frac{B}{42}$, $\frac{C}{56}$, $\frac{D}{57}$, $\frac{A, B, C \& D}{71}$ and $\frac{B, C \& D}{76}$ Native.

Two *Native General Hospitals* were established, one of 200 beds at Gangtok for the feverish season and afterwards at Siliguri, and the other of 100 beds at Alipur. For British troops the station hospital at Lebong (Darjeeling) was used as a British Base Hospital.

No medical store depôt was required, as Calcutta was so near to Siliguri by rail, and the Native General Hospital at Gangtok kept a stock of medicines.

(b) *Physical Geography and Medical Topography of the Country.*

The Force marched from the Indian plains at the railway terminus of Siliguri (310 feet only above the sea-level), up across the Sikkim and Chumbi Himalayas to the centre of Tibet. The track at first led through the submontane sál forest to the gorge of the Teesta River, and up that malarial gorge through slate and shale formation for about fifty miles to Upper Sikkim. Thence it zigzagged steeply up through gneiss and granite into temperate and alpine forest and out on to the bare rocky uplands above Gnatong and Changu, where the track crossed a high southern spur of the Himalayas by the Jelep or Nathu passes, 14,390 feet and 14,300 feet respectively, above the sea-level, and descended over 4,000 feet into the valley of Chumbi, in the outer Himalayas, to the east of Sikkim and bordering Bhutan. From Chumbi (9,700 feet) the track ascended the pine-clad valley of the Mo River to the bare shingly plain of Phari (14,500 feet) swept by icy dust-storms, thence it crossed the main axis of the Himalayas by the Tang pass (15,200 feet) on the flanks of Mount Chumolhari to the great plateau at Tuna (14,900 feet) where, and in the Upper Chumbi Valley, the greater part of the force spent the winter.

In the early spring, at the end of March, the Force continued its advance to Gyantse, passing down Tuna-Guru plain, past the lakes of Rham and Kala and through the Zamdang defiles to the broad flat-

bottomed cultivated valley of Gyantse, an offshoot of the Tsangpo valley of Western Tibet, at an elevation of 13,200 feet.

The advance to Lhasa, after the storming of the Gyantse Jong on July 6th, led up the north-eastern branch of the valley, up the Neru River to Gabshi, thence through a series of defiles to the glacier-lined Karo pass (16,500 feet) beyond which the track descended into the basin of the great land-locked Yamdok Lake (about 15,000 feet). Proceeding along the shore of this lake for about twenty miles, the track climbed over the mountain ridge, separating the lake basin from the Tsangpo valley, by the Khamba and Dok passes (16,500 and 16,700 feet respectively), and descended to the Tsangpo River at the iron-bridge ferry or Chaksam (12,100 feet), where on both sides of the river were luxuriant fields with several large walnut and other trees. On crossing the Tsangpo, the path led up the bank of its tributary, the Kyi River, for forty miles to Lhasa, through several bold defiles of limestone rock, banded by granite.

Lhasa itself is situated on the right bank of the Kyi River on a marshy, partially cultivated plain encircled by bare rocky hills rising to a height of 3,000 feet or more above the plain, which here was about 12,300 feet above sea-level. The troops were encamped on a gravelly part of the plain about a mile to the north of the city.

(c) *Its Vegetable and Animal Products.*

The chief vegetable products in Western and Central Tibet are barley, wheat, oats, peas, mustard, potatoes, turnips, radishes, cabbage, onions and other vegetables, and a few walnuts and peaches. Aconite (*A. ferox*) also occurs wild throughout the valleys. The chief animal products are wool, yak-tail, fly-whisks, furs, sheep and sturdy ponies and mules. The wild asses which roam over the plains are not utilised.

In the Chumbi Valley the hardy cereals, wheat, barley, and peas, are cultivated only for local requirements. Wild madder is exported in bales. A few herds of the great stag or Shao inhabit the upper forests of this valley.

(d) *Climatic Peculiarities.*

The climates to which the Force was exposed were unprecedented in their rigour and range. They extended from the tropical climate of the Terai and Lower Teesta gorge to the arctic cold of the great passes and the inclement Tibetan winter, combined with the trying effects of the rarefied air of these immense altitudes on the respiration and heart. The cold frequently was positively painful, especially when the wind blew. The lowest temperature recorded during the winter was on the Tang pass on the night of January 7th, when the thermometer registered minus 26° F., or 58° F. below the freezing point. In December and the early part of January, until the bitter dust-storms set fully in, the Lower Chumbi Valley had fairly bright and cloudless skies during the day, although during the nights the temperature fell to 20° of frost. The garrisons at Phari and Tuna, and the convoys which daily crossed the passes, led a miserable existence all winter tormented by the cold and icy wind and altitude. At the end of January chill fogs swept up the valleys, resolving themselves into drizzling sleet in the lower valleys, and clogging snow and blizzards in the upper valleys and passes. With

The Tibet Mission Force

March milder weather set in with frequent slight falls of snow and a marked rise of temperature in the sunshine. At Gyantse snow fell during every month of summer. The rainfall was very considerable. At Gyantse and Lhasa about thirty inches must have fallen during the summer and autumn. Partial statistics for Chumbi and Gyantse are given in Appendix I. The lower line of communication in the Teesta gorge was closed during the most malarial season of the year, in midsummer and autumn, and the traffic sent by way of the Ghoom Station of Darjeeling and Kalimpong.

(e) *Principal Diseases with their Causes.*

The general health of the troops has been very good, despite the great vicissitudes of climate to which the men have been exposed, and the great altitudes at which the operations have been carried on. The greater portion of the sickness and deaths was attributable to the climate. The total number of deaths and men invalided up to September 30th, 1904, excluding war casualties, were 411 and 671, respectively, and of these 202 and 405 were due to the climatic conditions:—

	British Troops	Native Troops	Followers	Totals
Total deaths excluding war casualties ..	4	102	305	411
Deaths due to climate	4	60	138	202
Invaliding, exclusive of war casualties ..	44	192	435	671
Invaliding due to climate	29	149	227	405

There was only one case of scurvy, notwithstanding the frequent absence of fresh vegetables; the large ration of fresh meat doubtless contributed to this happy result.

Amongst *British troops* the principal diseases were diarrhoea, bronchitis, rheumatism, remittent and enteric fevers. The causation of these were, respectively, indigestible or insufficiently-cooked food, cold and chill, malaria and heat of sun. The source of the enteric infection was not traceable. Except a few non-commissioned officers and men of departments the British troops were not exposed to the rigours of the Tibetan winter, having come up from India in May.

Native troops suffered most severely from intermittent fever. After this came bronchitis and pneumonia, then dysentery, diarrhoea, rheumatism and frost-bite. Dilatation of the heart was not infrequent. Venereal disease was uncommon in Tibet proper, but fairly prevalent in Sikkim and in the lower Chumbi Valley. A mild epidemic of mumps occurred in the summer, and some cholera in the lower Teesta Valley. Snow-blindness, owing to the general use of goggles, was very rare and mild, until the return march when snowbound at Phari in October, when about 200 cases occurred. The cause of the intermittent fever was doubtless brought from India, as the disease occurred chiefly about 2,000 feet, after a chill, though in many cases it may have been contracted in passing through the malarial Terai and lower gorges, despite the prophylactic issue of quinine. Further particulars regarding this continued and intermittent fever, as

well as the cholera and enteric epidemics, are detailed in the Sanitary Report.

Diarrhoea and dysentery were largely due to the difficulty of cooking food, owing to the lowering of the boiling point by the lessened atmospheric pressure of the high altitude, the scarcity of fuel and the rapid radiation in the excessive cold. Pneumonia and bronchitis were due chiefly to exposure to the cold and high altitudes. They were especially common at Phari in the winter months, where the barracks were badly ventilated and filthy, and the acrid smoke of the argol fires irritated the respiratory passages. At Tuna pneumonia was mostly confined to those sentries who were exposed to the excessive night cold. Frost-bite scarcely occurred until the first heavy fall of snow, although the actual cold then was less than previously; and most of the cases were complicated, if not in part caused, by burns, through placing the frozen limbs too close to a fire. The mumps epidemic commenced amongst the Nepalese coolies and spread thence to the Gurkhas mainly.

Followers suffered chiefly from intermittent fever, diarrhoea and dysentery, bronchitis and pneumonia, from the same causes as native troops. They also had a good deal of debility, apparently from impoverished blood and continued work at high altitudes.

An attempt was made to ascertain whether the increased frequency of breathing in these high altitudes produced any expansion of the chest. Men of the 40th Pathans and 19th Punjabis from the Punjab plains had their chests measured before entering the hills and again after a residence of five months in high altitudes. The result showed a slight increase in chest capacity. Some observations were also made on the effect of altitude on the corpuscles and hæmoglobin of the blood.

(f) *Wounds—Description and General Treatment Adopted.*

There were 161 killed and wounded in action :—

	British Troops	Native Troops	Followers	Totals
Killed in action	4	21	5	30
Died of wounds received in action ..	..	16	2	18
Non-fatal wounds " " ..	20	91	2	113
Other war casualties, explosions, drowning, &c.	11	22	..	33
Of latter, died	4	10	..	14

The variety of the wounds met with calls for remark, as the Tibetans were armed with weapons from the most primitive to the most modern.

Sword-cuts were numerous and all healed well, in some cases with wonderful rapidity. Contusions from stones were not uncommon, mostly severe lacerated contusions of the scalp. The wounds caused by the Lhasa-made Martini pattern rifles with their large bore (about .550) were invariably severe, and often shattered bones extensively, the bullet emerging by a very large exit wound. In fact, the result was akin to that of an explosive bullet. Wounds caused by the smaller smooth-bore matchlocks generally became very septic, especially when the bullets lodged, as they were generally wrapped in dirty cloth or tow to make

them fit the bore of the musket. Again, the wounds caused by the balls of the large "jingals" in Gyantse Jong, varying from 4 ozs. to nearly 4 lbs. in weight, caused terrible wounds, which were generally rapidly fatal from shock. As was to be expected, such wounds as were due to modern small bore high velocity rifles healed quickly and without trouble. The general treatment adopted was the application of a "First Field Dressing," which was not removed for several days if no discharge showed through, and no excessive pain or fever occurred. In this connection it is to be noted that the application of the waterproof jaconet of the new first field dressings over the pad of gauze, as directed, seems a mistake, as it tends to keep the wound moist and so acts as a poultice; whereas the drier simple wounds are kept the more rapidly they heal. Suppurating and complicated wounds were treated on the usual antiseptic principles.

The wounded Tibetans were treated by our surgeons in tents or huts near our posts.

An application for an X-ray apparatus was not complied with, with the result that three cases had to be sent back to India with their bullets unremoved.

(For subjects (g) to (n) see separate Sanitary Report by Sanitary Officer Major Aldridge, R.A.M.C.).

(o) General Working of the Medical Service in the Field.

At the railway base at Siliguri, a section of a field hospital was established as a base hospital, which when the force became increased, was replaced by a general hospital. The latter was located at Gangtok (5,000 feet) for the rains, and afterwards moved to Siliguri, whilst a second native general hospital at Alipur received the invalids at the railway terminus in Calcutta, and despatched them to their stations in India.

As the force advanced a section of a field hospital was established at each chief post along the long line of communications; and at each of the smaller intervening posts a hospital assistant with a pair of panniers and hospital comforts was left. Needless additional difficulty and delay were experienced in establishing these sections, owing to the first field hospital having been issued as an indivisible unit without the extra establishment and tentage necessary for forming independent sections.

At these posts along the communications, hospital huts were built on a standard plan for the protection of the local sick and sick convoys against the cold and snow of the upper tracts and the rain of the lower valleys.

The unusual difficulties of transport over such lofty hill-tracks compelled a reduction in the weight of the equipment of the field hospitals. This was reduced by one-fourth its weight (as detailed in the departmental report) by eliminating non-essential articles, with a gain in efficiency, it can be said, after this reduced scale has stood the test of a year's constant strain.

The unprecedented physical difficulties of transport over the steep mountain tracks and in such high altitudes, necessitated several modifications in the ambulance for the transport of the sick. As the Indian *kahars* were manifestly unsuited for this work, and had proved on the

Khamba Jong line almost incapable of carrying a loaded *dooly* above 8,000 feet amongst the hills, they were replaced by several hundred hardy Tibetan and Sikkimese *dandywalas* from Darjeeling, temporarily enlisted for this purpose. These were quite undisciplined, and had to be trained to their duties. The Sikkimese proved a failure, nearly all of them deserting after the first few days. The Tibetans, on the other hand, were an undoubted success on the whole; for, although about 70 per cent. of them deserted within the first few months through fear of our defeat by their kinsmen, those who remained and a batch of Garhwalis recruited at Naini Tal, did practically all the carrying of sick and wounded in the fighting force at the front. I have accordingly suggested in the departmental report that a few of these Tibetan and Garhwali *dandywalas* should be permanently enlisted in the Army Bearer Corps for service in Jalapahar and Lebong, and in the Naini Tal, Chakrata and Lansdowne station or regimental hospitals, where they could be properly trained, and form a nucleus for a larger cadre for employment in hill warfare.

The form of the regulation *dooly* and stretcher proved most unsuitable for work in these hilly regions. The ordinary regulation *dooly* was so heavy and cumbersome that it could not be carried even in an empty state up many of the steep tracks, but had to be unshipped and carried up in pieces; and at sharp turns and zigzags it was positively dangerous to its occupant and bearers. It was thus practically useless for continuous transport in the hills and too heavy for transport on the high plateaus. Two Amesbury *doolies* were tried experimentally, and proved to be a vast improvement over the ordinary *dooly*, in lightness, manageability and handiness, and comfort for the patient. A few suggestions for the further improvement of the Amesbury are detailed in the departmental report.

Blanket stretchers were also found to be quite useless for steep hill transport, and dangerous to the patient, as no manner of tying him in could prevent his slipping out.

For the steeper passes several ambulance chairs were constructed by Lieutenant-Colonel Waddell, I.M.S., to be carried on men's backs on the framework, on which the Tibetans are accustomed to carry their own loads, and they proved of service.

Latterly the hammock devised by Major A. R. Aldridge, R.A.M.C., was used with much success. It weighs, with its two poles and canvas cover, about 24 lbs.; with one pole only, 15 lbs. It is peculiarly well suited for narrow zigzag hill paths, and holds the man securely against falling out even on the worst ground. During the present campaign four of these hammocks have been regularly used for nearly four months with the sick convoys proceeding every eight or ten days between Chumbi and Gangtok, a distance of forty miles, including the Nathu and minor passes, and have latterly been the only means of transferring helpless patients over this difficult part of the line of communications. This Aldridge hammock should certainly replace the blanket stretcher used by regiments for hill warfare.

Hathaway's crutch-support for riding saddles was tried extensively and found useful; its obvious defects and their remedy are detailed in the special departmental report.

Ekkas were used as sick transport on the Phari-Kangma Plain, to eke out other ambulance; and on the Teesta cart road from Rangpo to

Siliguri ran ambulance bullock *tongas*. The great length of the communications, extending for over 300 miles from the base across such difficult country, with numerous posts, absorbed such a large number of the field hospitals, that not more than one section per battalion, and usually less, was available for the fighting forces, and this proved sufficient.

On the advance to Lhasa two sections of field hospitals were fixed at Gyantse as an advance base, and their ambulance utilised for convoys of sick along the Lhasa road.

The Principal Medical Officer was able to inspect all the posts along the line of communications at least once, and most of them several times; but when the Lhasa column advanced, and was for a time practically cut off from immediate communications with the lower line, a senior medical officer (Major Aldridge, R.A.M.C.), was appointed for the lines of communications.

Altogether the medical service in the field worked very well under an exceptionally severe and prolonged strain, which was trying to all.

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Principal Medical Officer Tibet Mission Force.

MEDICAL AND SANITARY REPORTS (LINES OF COMMUNICATION).

(g) *Principal Diseases.*

Cholera was known to exist in various villages in the Teesta Valley in May, and on June 2nd an outbreak began among local persons employed by the Supply and Transport Corps between Siliguri and Riang. In all, forty-four cases were reported, thirty-nine of which were at Sivoke, the majority being grass-cutting coolies, and the remainder local cart-drivers.

Investigations on the spot pointed to the infection having been acquired at a spot about four miles on the Siliguri side of Sivoke. No cases occurred among the troops or Government followers living in the camps.

During the remainder of June isolated cases occurred at or near all the posts as far as Gangtok, thirty-three in all, but, with the exception of two bullock-drivers, none of the cases were in persons living in the military camps, but in road and grass-cutting coolies.

On July 4th and 5th eight cases occurred in the camp at fifth mile beyond Gangtok. All these were Sikkim coolies who arrived on the 3rd and had, therefore, acquired the infection on the way up.

During the latter part of June four cases occurred at Gangtok, and on June 30th an outbreak commenced, practically confined to Government coolies recently arrived and encamped there; there were twenty-two cases in all, the last on June 25th.

These coolies were encamped below the bazaar, and, it is believed, took their water from some springs in the hill below the bazaar, where some of the imported cases had occurred. The pipe water-supply of Gangtok was above suspicion, but did not reach the camp.

During July, August, and up to September 2nd, when the last case was reported, twenty-one more isolated cases occurred at various posts from Siliguri to Changu.

In all 128 cases were reported, including one sepoy, two enlisted followers, and thirty-one other Government followers; the remainder being persons belonging to the country, and not living in the military camps.

Although cases were treated at fifteen posts from Siliguri to Changu, yet, with the exception of the outbreak among the Sikkim Coolie Corps at Gangtok, in no case did the infection spread in any camp.

The means adopted to prevent the spread consisted of the provision of protected water-supplies for all posts; isolation of cases, and the provision of special tents or huts for this purpose: disinfection or destruction by fire of clothing and utensils used by the sick, and of huts. In two cases traffic was temporarily diverted from the routes infected. In the case of troops marching over the infected route drinking water was boiled. In the case of the infected Coolie Corps the men were temporarily isolated.

Enteric fever was not prevalent on the lines of communication; this was probably owing to the very small number of British troops. Three cases occurred in British soldiers, and one in a sepoy. In three of these the diagnosis was confirmed by the agglutination test. Two cases in Tibetans also came to my notice; in one, fatal in the second week, the lesions in the intestines were typical of the disease, and in the other the disease ran a typical course with hæmorrhage from the bowel, and the blood serum agglutinated a dead culture of *B. typhosus* in a dilution of 1 in 40 in thirty minutes.

A very considerable number of cases of continued fever of a severe type and somewhat high mortality occurred at various posts from Phari to Gyantse, that is at altitudes of 13,000 to 15,000 feet. Though returned as "remittent fever" they had not the characteristics of malarial fever, and in the few in which I had the opportunity of examining the blood malarial parasites were not found.

Malarial fevers were prevalent in the Teesta Valley and among the Indian coolies employed on the Mathu-La Road. Of 300 cases in which the blood was examined by Captain Turnbull, I.M.S., malarial parasites were found in 57: benign tertian 28, quartan 3, and malignant tertian 26.

Most of these cases occurred at or near Changu at an elevation of about 12,800 feet, and no mosquitoes were found there; the remainder at Rangpo, where only *Stegomyia fasciata* and *A. Listoni* were found. It is therefore probable that the infection was acquired either in India or while the men were coming through the Teesta Valley. Mosquitoes were, however, occasionally to be found at elevations up to 15,000 feet (Tuna), but none of those which I caught belonged to any of the species known to convey malaria. No evidence was obtained that fresh malarial infections occurred in Tibet proper.

Dysentery and diarrhœa on all parts of the line, and pneumonia at the higher altitudes, have accounted for a large proportion of the sickness and deaths, and have existed at all times of the year, but neither has appeared in epidemic form.

Cardiac diseases have accounted for an unusual proportion of deaths; no doubt owing to the effects of severe work at high altitudes on hearts already diseased. A number of men have also been invalidated for disordered action of the heart with physical signs of dilatation: these, for the most part, seem to recover with rest at lower altitudes.

Other diseases.—Two cases of relapsing fever occurred at Rangpo in Kashmir coolies who had arrived about sixteen days previously. The spirillum was found in their blood by Captain Turnbull, I.M.S. The disease did not spread.

Small outbreaks of mumps occurred at several posts.

Fifty-two coolies at Rangpo suffered from symptoms of poisoning from eating the seed (nut) of the *Jatropha curcas*. The symptoms were those of severe gastro-intestinal irritation with hæmorrhagic stools in some cases, and collapse. None of the cases were fatal.

A fatal case of poisoning occurred at Lingmathang in a mule-driver from eating some berries; but as he had eaten several different kinds, the one or ones causing the fatal symptoms could not be identified. The symptoms were diarrhœa, vomiting and collapse. Death followed in about two hours after the onset of the symptoms.

(h) *Water Supplies.*

Of the thirty-one standing camps from Siliguri to Gyantse which were occupied, the water-supplies of all except Siliguri, Gangtok, and Tuna, were derived from rivers or streams.

At Siliguri wells were used. These were unprotected, and the following recommendations were made and carried out: the wells covered, pumps provided at the side, and the water pumped to tanks outside a fence thirty yards in diameter, round the well. A separate place to be provided for washing.

At Tuna, one unprotected well existed close to the collection of Tibetan houses around which the post was established, and in ground obviously extensively fouled; water was drawn in any available vessel. This was recommended to be closed, and water obtained from a marked spot in the stream close by.

At Gangtok there is a good piped supply from springs well situated. As this did not reach the camps of the Ekka Corps, a subsidiary piped supply from a well-situated spring was provided. Some springs also exist below the bazaar, obviously liable to dangerous pollution; they should not have been used and were condemned, but it is believed that some coolies, temporarily occupying a camp adjacent to them, used this water at a time when cases of cholera were occurring in and near the bazaar; a small outbreak of cholera occurring among these coolies.

Of the supplies derived from rivers, the Teesta, Amo-chu, and Nyang-chu, though somewhat turbid during heavy rain, and to some extent liable to pollution from camps and villages higher up, yet the volume and rapid current of the rivers were in most cases sufficient to reduce the risk of conveyance of disease by this means to a minimum.

At Gyantse, however, the river water during the rains is extremely turbid from silicious matter, which takes long to subside; besides which there are a considerable number of villages on the banks. Alum had little effect in clearing this water, and sedimentation tanks dug at the side of the river failed to retain the water. A well was dug, twenty feet deep, close to the river, but no water found. Norton tube wells for use of the winter garrison are being sent up, and though a suction pump at this altitude will not raise water more than some eighteen or twenty feet, yet, by sinking the pump in a dry well, it is anticipated that a satisfactory supply will be obtained.

An analysis of this river water, taken on September 7th, gave the following results:—

	Parts per 100·00
Total solids	62
Chlorine	·5
Nitrites	Present
Nitrates	Considerable
Total hardness	16
Ox. required at 80° F. in 15 mins.	·15

The camps supplied from small streams were mostly in the Teesta Valley and Sikkim. These supplies were selected as being free from contamination from villages above; but there was great risk of pollution by followers in the camps themselves, as it was found impossible to enforce their taking water only from the allotted spots. To obviate this, in ten cases the water was piped from some distance above the camp, in one case a distance of a mile, in bamboo pipes raised well off the ground. These answered admirably, provided the source was watched to prevent grass-cutters and other local people employed in the camp locating themselves above the intake. In two cases this occurred, and they were removed and their huts burned.

The supply for Chumbi was similarly piped in a wooden channel from a stream. Analysis of the water gave the following results:—

	Parts per 100·00
Chlorine	1·5
Nitrites	None
Nitrates	None
Total hardness	3·5
Ox. required in 15 mins. at 80° F.	·8
Ammonia, free	Considerable

Number of micro-organisms growing on agar in four days at 37° C., 494 per cc.

The large amount of organic matter was accounted for by decaying vegetable matter in the stream. After removing this the ox. required was reduced to ·4.

(i) *Rations.*

The rations issued to native troops and followers were not always of good quality. Of a consignment of sixty tins (30 lbs. in each) of atta, all of the nine which I examined were quite unfit for food, containing large numbers of maggots and weevils. In a considerable number of other cases atta, rice, and ghee were found to be decomposed or attacked by moulds or insects.

A more rigid inspection by a competent officer of these rations before despatch would have avoided both the waste of transport and in some cases the issue of food which was unfit for consumption.

The locally procured Bhutia rice was of very poor quality, containing much husk and earth; and likely to predispose those eating it to bowel complaints, which were very prevalent. "Sampa"—parched barley ground into flour—obtained locally, was issued to some extent instead of atta or rice; it was not liked by the men, chiefly on account of the difficulty of making chupatties from it, owing to the small proportion of gluten. When taken in the form of porridge it seems a nutritious food. The low boiling¹ point of water at the high altitudes reached, necessitates

¹ Brought to notice of the Director-General, Contracts and Registration, by the Principal Medical Officer, His Majesty's Forces in India.

prolonged boiling of food to render it fit for eating. In the case of cereals, and particularly of dhall and peas, the temperatures (about 87° C. at 15,000 feet) are scarcely sufficient to soften the envelopes of the starch grains. The allowance of wood was not sufficient for this, and when not locally procurable by the troops an increase of the allowance would have been very desirable.

Potato chips require such prolonged soaking that they are of little use on the march. The following were the scales of rations issued:—

Rations for British Troops.

Bread	1½ lbs. daily
Fresh meat (inclusive of bone)	1½ lbs. „
Fresh vegetables—	
Potatoes, 12 oz. }	1 lb. daily.
Mixed vegetables, 4 oz. }	
Rice	2 oz., 3 times a week
Tea	1 oz. daily
Sugar	2½ oz. „
Salt	½ oz. „
Fuel	3 lbs. „
Pepper	1 oz. „
Jam	1 tin „

In lieu of 1 lb. of fresh vegetables the following can be issued:—

Potato chips	3 oz. daily
Pickles	1 oz. „
Pickle vinegar.. .. .	½ oz. „

Rations for Native Troops and followers.

Atta or rice	1½ lbs. daily
Dhall	4 oz. „
Ghi	2 oz. „
Goor	1 oz. „
Salt	½ oz. „
Tea	1 oz. „
Chillies	¼ oz. „
Turmeric	¼ oz. „
Garlic	¼ oz. „
Ginger	¼ oz. „
Fuel (to extent locally procurable)	1½ lbs. „
Meat (mutton or goat inclusive of bone)	28 oz. weekly

Atta-eating men will have the option of drawing ½ lb. rice instead of a similar quantity of atta, and *vice versa*.

Rations for Darjeeling Coolie Corps.

Rice	2 lbs. daily
Dhall	8 oz. „
Ghi	2 oz. „
Salt	1 oz. „

Rations for Tibetan Dandy Bearers.

Rice	1½ lbs. daily
Meat	1 lb. „
or	
Dhall (in lieu of meat)	8 oz. „
Ghi	2 oz. „
Salt	1½ oz. „

(j) *Spirits and Malt Liquors.*

An issue of rum, 1 oz., or tea, ½ oz., and goor 1 oz. in lieu, was made occasionally during particularly inclement weather to units employed on road-making or other hard work.

(k) Medical Comforts for the Sick.

These were, with one exception, of good quality; but of one particular brand of condensed milk between 70 and 80 per cent. were bad.

(l) Clothing.

The scales of clothing issued were liberal and well devised, and in spite of the fact that a considerable number of cases of frost-bite occurred, it is difficult to see how they could have been much improved on.

It is, perhaps, questionable whether the benefits obtained from the Gilgit boots were sufficient to compensate for the extra bulk and weight to be carried. They are useless in wet weather, and many of the men never wore them at all.

More frequent renewals of socks would have been of advantage, as they became worn out very quickly.

Some of the waterproof sheets were of poor quality, and after short use allowed moisture to pass through them.

Khaki serge would have been more suitable to the climate than drill.

The following were the scales:—

Ordinary Scale for British and Native Troops and followers.

Blankets, barrack	2
Coat, warm	1
Mittens	1 pair
Balaclava cap	1
Waterproof sheet	1

Special Scale for British and Native Troops and followers for Winter Months only.

Poshteen	1
Razai	1
Woollen gloves	1 pair
Fur-lined gloves	1 "
Lamb's wool vest	1
Overalls	1 pair
Comforter	1
Gilgit boots	1 pair
Goggles	1 "

N.B.—One extra blanket and one pair of woollen drawers were also issued.

Nepalese and Tibetan Scale.

Coat, warm, followers'	1
Jersey	1
Pyjamas	1 pair
Blankets, country	2
Waterproof sheet	1
Balaclava cap	1
Boots, followers'	1 pair

(m) Sanitary Condition of Camps, Latrines, and Transport Lines.

The maintenance of satisfactory sanitary conditions in standing camps, occupied for several months by small bodies of troops, sufficient only for guards and escort, and large numbers of transport drivers and followers employed daily with transport duties, must necessarily be a matter of some difficulty.

The difficulties in the present case have been considerably increased, in many of the camps, by the heavy rainfall.

A system of pail latrines was used by the hospitals, the contents of

the pails being buried at a distance from camp; or, if from infective cases, burnt.

Trench latrines were used by troops and followers, but scarcity of labour for a time at certain camps, led to the digging of trenches being neglected, and a very foul condition of the land round the camps resulted.

The proper disposal of litter, either by burial or burning, does not seem to be accepted by transport units as part of their duties.

If done regularly the amount of labour involved is not great, but when large accumulations have been allowed to collect, as happened at several camps, its disposal in rainy weather is not easy.

In certain camps this was undoubtedly largely responsible for the enormous numbers of flies which accumulated, and which are a recognised means of spreading certain diseases particularly prevalent in camps.

(n) *Conservancy Establishments.*

The conservancy establishments of regiments and of field and general hospitals were sufficient, but the various transport units, mule, bullock, and coolie corps, were not provided with any conservancy establishments.

A certain number of sweepers were provided for general duties at the standing camps, including the small hospitals under hospital assistants which were improvised at posts where there were no field hospitals. At several camps these were not sufficient for the purpose, and in some cases the local supply and transport store-keepers seemed to be under the impression that these men were intended only for duty in their stores. As it required some weeks for sweepers obtained from India to reach the further posts, the sanitary condition of the camps suffered in consequence. I think a sufficient establishment of sweepers should be attached to all transport units.

Chumbi, Tibet,
October 19th, 1904.

A. R. ALDRIDGE, Major, R.A.M.C.,
Special Sanitary Officer and S.M.O.,
Lines of Communication, Tibet Mission Force.

EXTRACTS FROM A REPORT, No. 1584-A., DATED CAMP FORT WILLIAM, NOVEMBER 30TH, 1904, FROM BRIGADIER-GENERAL J. R. L. MACDONALD, C.B., R.E., COMMANDING TIBET MISSION ESCORT, TO THE ADJUTANT-GENERAL IN INDIA.

Composition of Force.

Infantry.—The Infantry with the Force was: Half a battalion, Royal Fusiliers; 19th Punjabis; 23rd and 32nd Pioneers; 40th Pathans; 8th Gurkhas.

Of the above, the 23rd and 32nd Pioneers and 8th Gurkhas have served throughout the campaign during the trying winter operations of 1903-1904. The wing, Royal Fusiliers and 40th Pathans, joined the Force in June, 1904, and the 19th Punjabis a month later. The Infantry taking part in the winter operations of 1903-1904 had excessively trying times, calling for great fortitude and endurance, long marches at great altitude with most trying climatic conditions. The Pioneers had also roads to construct in frozen soil and under great difficulties, whilst throughout the strictest military precautions had to be taken. Under all these hardships the men played up splendidly, and performed their

onerous duties in the most soldier-like manner, whilst excellent discipline was maintained.

Mounted Infantry.—There were three companies, each 100 strong, employed with the Force. The 1st Company, composed of men from 23rd and 32nd Pioneers and 8th Gurkhas, was raised locally, and the remaining two companies were raised in India, and were composed of Pathans and Punjabis; the 3rd Company only arriving half-way through the operations.

Engineers.—Two companies of Sappers and Miners.

General Notes.

British Infantry.—The metal *pakhals* were found to wear out and leak badly where the hose pipe joins the zinc body, and a better attachment seems desirable.¹

Cooking pots are very heavy, and require one mule per company to carry them.

Aluminium cooking pots are recommended, when the cooking pots of two companies could be carried by one mule.

Softer material should be used for the men's braces and straps.

The provision of a percentage of cutting tools is much required. Twenty-five *kukris* per company would be most useful in camp and could be carried by the men.

A small number of waterproof capes, say twenty per battalion, should form part of the Field Service Equipment, and are very necessary for guard duties in rainy countries.

Each man carried one day's rations on his person, and his great-coat, *poshteen*, or "British warm coat" on his back. The obligatory mules for great-coats were thus available for other purposes.

The number of *pakhals* taken was reduced to one per company.

A large saving in tentage was effected by using 45lb. bell-tents with ten fighting men or twelve followers in each tent; the tents proved satisfactory.

Baggage was of course increased by need of special warm clothing.

The allowance of mules for coffee-shops was increased to one per company, as the supply could not depend on providing extras.

A certain number of mules was allowed for officers' mess, and no private transport allowed.

Native Troops.—Twenty waterproof capes per battalion should be issued as part of Field Service Equipment.

Mounted Infantry.—The present khaki cord breeches should be made of stouter material and cut like knickerbocker breeches to prevent them splitting across the knees and seat.

Putties to be bound for two feet round lower edge with leather to prevent fraying from stirrup leathers.

Only light men should be selected for a course of Mounted Infantry. The men sent up were nearly all very heavy powerful men, much heavier than necessary.

Field Engineering.—The actual Coolie Corps sent up also were not

¹ Brought to notice of Director-General, Contracts and Registration, by the Principal Medical Officer, His Majesty's Forces in India.

always of the best stamp to stand the exceptional rains of Sikkim. All these various causes combined to make the road cost a good deal more than it need have done.

Supply and Transport.—*Tarpaulins* are weighty and wear out soon. Willesden rot-proof canvas is lighter and more durable.

The old pattern 45lb. *bell-tent* is much more suitable and economical than the 20lb. tents authorised for mule corps. The 45lb. tent holds twelve drivers easily. The 20lb. tent barely accommodates four.

Fodder and Kits.—It was found that, instead of each animal carrying a proportion of its fodder for the day, a custom which led to sore backs, it was better to carry this in bulk on separate mules, and that each driver divided his kit in three waterproof bags, and thus distributed his kit over the three mules in his charge. This saved much transport and worked satisfactorily.

The supplies sent up were on the whole very good except the *rum*, which was of inferior quality and taste.

To guard against deterioration from the heavy rains, perishable articles were sealed in tins; this saved much loss and proved satisfactory.

Some *emergency rations* for the troops might also have been given, as well as a ration of Erbswurst consolidated soup, both of which would have been found most useful for issue on occasions when fuel was scarce and ordinary food difficult to cook.

The material of the warm *pyjamas* issued to native troops is not good, and soon wears out and tears easily. The life of a pair of pyjamas on service is only about two months. Puttoo pyjamas, costing less, were found to be far more durable.

Poshteens, when issued to British troops, should be of larger size than those supplied.

The *waterproof sheets* of brown material issued to the Fusiliers were unsatisfactory; the old pattern white waterproof sheet was found superior.

Medical.—The report of Lieutenant-Colonel Waddell, C.I.E., I.M.S., Principal Medical Officer to the Force, together with the Sanitary Report on the Lines of Communication, by Major Aldridge, R.A.M.C., is attached, and I have little to add thereto.

The medical arrangements with the Force worked quite well and were adequate.

The following few points I would, however, mention :—

(1) That all British and Native Field Hospitals sent on any campaign should be so organised that they can at once be split up into sections without any further demand for extra establishments to enable them to act independently when required.¹

(2) The regulation dooly and stretchers were not suitable to mountain operations, being too heavy and cumbersome. The Amesbury dooly was found light and serviceable, and Major Aldridge's hammock was found successful in place of the blanket stretchers.²

(3) The formation of a small corps of hill bearers, suitable for works on high mountains, would be useful, as the ordinary dooly bearer is quite useless above 9,000 feet.³

¹ All essential *personnel* and all *material* are capable of this division already.

² Further trials of these and of other ambulance appliances are being made.

³ Under consideration.

APPENDIX I.

METEOROLOGICAL OBSERVATIONS, BY MAJOR A. R. ALDRIDGE, R.A.M.C.

(Chumbi Rainfall and Temperature.)

The rainfall of Gangtok, as recorded by the Meteorological Department of Bengal, is 146·36 inches (average of four years) and of Yatung, in the Chumbi Valley, 57·01 inches (average of three years).

The following records of rainfall and temperature were made during the late expedition :—

CHUMBI RAINFALL AND TEMPERATURE.

Date	RAINFALL INCHES (recorded at 8 a.m.)					
	January	February	March	April	May	June
1904						
1st	·01	·02	·00
2nd	·24	·04	·01
3rd	·20	·01	·00
4th	·36	·00	·30
5th	·00	·02	·20
6th	·77	·54	·05
7th	·00	·03	·02
8th	·00	·15	·00
9th	Nil.	..	·28	·18	·00
10th	·01	·01	·00
11th	·17	·11	·05
12th	·45	·02	·51
13th	·22	·21	·27
14th	·21	·15	·32
15th	Nil.	..	..	·91	·10	·42
16th	·71	·16	·35
17th	·09	·24	·00
18th	·00	·00	·19
19th	·28	·00	·53	·01
20th	·47	·00	·00	·41
21st	·01	·00	·00	·52
22nd	·00	·12	·00	·04
23rd	·01	·40	·00	·45
24th	·75	·49	·21	·22
25th	·00	·63	·02	·50
26th	·00	·02	·01	·20
27th	·00	·09	·97	·30
28th	·00	·00	·99	·00
29th	·00	1·31	·38	·63
30th	·00	·00	·00	·10
31st	·06	..	·00	..
Total	4·58		7·69	5·55	6·07

CHUMBI RAINFALL AND TEMPERATURE.—Continued.

Date	Recorded at 9 a.m.		Date	Recorded at 9 a.m.	
	Rainfall inches	Temperature of air		Rainfall inches	Temperature of air
1904.			1904		
July 1st	·35	59	August 1st ..	·07	57·2
" 2nd	·15	59	" 2nd	·37	..
" 3rd	·05	..	" 3rd	·09	..
" 4th	·02	60	" 4th	·04	..
" 5th	·05	..	" 5th	·27	..
" 6th	·00	..	" 6th	·64	..
" 7th	·05	60	" 7th	·15	..
" 8th	·06	60·8	" 8th	·07	..
" 9th	·06	60	" 9th	·20	..
" 10th	·02	60	" 10th	·08	..
" 11th	·01	60·8	" 11th	·09	..
" 12th	·05	60·8	" 12th	·22	..
" 13th	·14	60·8	" 13th	·04	..
" 14th	·02	59	" 14th	·08	..
" 15th	·11	59	" 15th	·02	..
" 16th	·66	59	" 16th	·04	..
" 17th	·25	60	" 17th	·19	..
" 18th	·04	59	" 18th	·14	..
" 19th	·06	60	" 19th	·19	..
" 20th	·05	59	" 20th	·00	..
" 21st	·28	59	" 21st	·01	..
" 22nd	·06	59	" 22nd	·14	..
" 23rd	·14	59	" 23rd	·02	..
" 24th	·46	59	" 24th	·01	59
" 25th	·21	59	" 25th .. ..	..	60
" 26th	·43	59	" 26th	·06	59
" 27th	·26	58	" 27th	·01	59
" 28th	·34	57·2	" 28th	·20	58
" 29th	·26	57·2	" 29th	·10	59
" 30th	·04	58	" 30th	·28	59
" 31st	·06	58	" 31st	·28	58
Total	4·68	..	Total	4·10	..

CHUMBI RAINFALL AND TEMPERATURE.—Continued.

Date	Recorded at 9 a.m.			Date	Recorded at 9 a.m.		
	Rainfall inches	Temperature of air	Minimum temperature		Rainfall inches	Temperature of air	Minimum temperature
1904				1904			
Sept. 1st ..	·12	57·2	..	Oct. 1st ..	·01	48·2	36·5
" 2nd ..	·33	57·2	..	" 2nd ..	·01	48·2	36
" 3rd ..	·02	59	..	" 3rd ..	·01	48·2	37
" 4th ..	·05	57·2	..	" 4th ..	·01	48·2	37
" 5th ..	·40	57·2	..	" 5th ..	·02	49	38
" 6th ..	·40	57·2	..	" 6th ..	·01	50	39
" 7th ..	·10	57·2	..	" 7th ..	·01	50	40
" 8th ..	·01	57·2	..	" 8th ..	·00	50	43
" 9th ..	·32	59	..	" 9th ..	·00	50	44·5
" 10th ..	·07	57·2	..	" 10th ..	·04	50·8	42·5
" 11th ..	·36	57·2	..	" 11th ..	·06	49·5	46·5
" 12th ..	·05	55·4	..	" 12th ..	·00	51·5	44
" 13th ..	·14	55·4	..	" 13th ..	·00	49·5	45
" 14th ..	·26	57·2	..	" 14th ..	·00	50·5	44
" 15th ..	·07	57·2	..	" 15th ..	·00	45·5	42
" 16th ..	·06	57·2	..	" 16th ..	·00	..	..
" 17th ..	·05	57·2	..	" 17th ..	·00	..	..
" 18th ..	·01	57·2	..	" 18th ..	2·22	..	..
" 19th ..	·03	57·2	..	" 19th ..	(snow) ·49	..	..
" 20th ..	·00	57·2	..	" 20th ..	·00	..	..
" 21st ..	·03	57·2	..	" 21st ..	..	..	..
" 22nd ..	·68	57·2	..	" 22nd ..	..	..	..
" 23rd ..	·01	51·8	..	" 23rd ..	..	..	..
" 24th ..	·05	55·4	50·5	" 24th ..	..	..	..
" 25th ..	·94	53·6	50	" 25th ..	..	..	..
" 26th ..	1·12	52·8	44	" 26th ..	..	..	..
" 27th ..	·01	52·8	45	" 27th ..	..	..	..
" 28th ..	·01	52·8	43	" 28th ..	..	..	..
" 29th ..	·01	52·8	42	" 29th ..	..	..	..
" 30th ..	·01	50	38·5	" 30th ..	..	..	..
" 31st ..	..	..	..	" 31st ..	..	..	..
Total ..	5·69	..	..	Total ..	2·89	..	..

APPENDIX II.
METEOROLOGICAL OBSERVATIONS.
GYANTSE TEMPERATURE.

Date	TEMPERATURE (recorded at 8 a.m.)		Date	TEMPERATURE (recorded at 8 a.m.)	
	Maximum	Minimum		Maximum	Minimum
1904.			1904.		
April 1st .. ..	..	..	May 1st	78	33
„ 2nd .. ..	..	..	„ 2nd	67	33·5
„ 3rd .. ..	..	..	„ 3rd	48	25
„ 4th .. ..	..	..	„ 4th	70	28·5
„ 5th .. ..	..	..	„ 5th	80	31
„ 6th .. ..	..	..	„ 6th	78	36
„ 7th .. ..	..	..	„ 7th	73	29
„ 8th .. ..	..	..	„ 8th	81	32
„ 9th .. ..	..	..	„ 9th	78	37
„ 10th .. ..	..	..	„ 10th	76	24
„ 11th .. ..	..	..	„ 11th	75	30
„ 12th .. ..	..	..	„ 12th	74	33
„ 13th .. ..	..	..	„ 13th	75	31
„ 14th .. ..	..	..	„ 14th	79	37
„ 15th .. ..	..	..	„ 15th	86	34
„ 16th .. ..	..	..	„ 16th	89	34
„ 17th .. ..	..	..	„ 17th	79	35
„ 18th .. ..	..	..	„ 18th .. ..	..	33
„ 19th .. ..	..	27	„ 19th	71	31
„ 20th .. ..	..	30	„ 20th	73	28·5
„ 21st	72	25·5	„ 21st	79	28
„ 22nd	82	31·5	„ 22nd	75	27
„ 23rd	77	31·5	„ 23rd	80	39
„ 24th	75	29	„ 24th	85	35·5
„ 25th	72	31·5	„ 25th	81	35
„ 26th	69	30·5	„ 26th	79	34
„ 27th	77	32	„ 27th .. ..	..	41
„ 28th .. ..	..	39	„ 28th	70	45
„ 29th	60	29	„ 29th	80	41
„ 30th	73	25	„ 30th	83	38
			„ 31st	82	37

The Tibet Mission Force

GYANTSE RAINFALL AND TEMPERATURE.

Date	Recorded at 8 a.m.			Date	Recorded at 8 a.m.		
	Rainfall inches	Temperature			Rainfall inches	Temperature	
		Maximum	Minimum			Maximum	Minimum
1904				1904			
June 1st	83	38	July 1st ..	·02	73	48
" 2nd	75	41	" 2nd ..	·18	75·5	43
" 3rd	70	39	" 3rd ..	·00	75	46
" 4th	85	40	" 4th ..	·00	78	46
" 5th	81	45	" 5th ..	·00	78	52
" 6th	71	44	" 6th ..	·00	75	52
" 7th	81	37	" 7th ..	·02	81	50
" 8th	82	41·5	" 8th ..	·01	75	49
" 9th	89	44	" 9th ..	·05	82	45
" 10th	75	39	" 10th ..	·00	83	46
" 11th	73	39	" 11th ..	·00	89	53
" 12th	70	43	" 12th ..	·23	80	51
" 13th	79	44	" 13th ..	·01	62	49
" 14th	77	45	" 14th ..	·55	69	40
" 15th	72	42	" 15th ..	·35	67	42
" 16th	80	45	" 16th ..	·11	61	48
" 17th	82	48	" 17th ..	·00	68	42
" 18th	81	47	" 18th ..	·00	65	43
" 19th	81	47	" 19th ..	·00	74	47
" 20th	77	43	" 20th ..	·00	75	48
" 21st	63	46	" 21st ..	·06	72	47
" 22nd	70	44	" 22nd ..	·10	68	55
" 23rd	76	45	" 23rd ..	·00	70	47
" 24th	80	46	" 24th ..	·00	72	44
" 25th	79	47	" 25th ..	·70	68	43
" 26th	78	48	" 26th ..	·02	68	42
" 27th ..	·00	79	49	" 27th ..	·00	71	42
" 28th ..	·55	76	44	" 28th ..	·00	73	41
" 29th ..	·04	68	43	" 29th ..	·00	72	43
" 30th ..	·12	65	49	" 30th ..	·00	73	44
" 31st	" 31st ..	·00	73	44
Total ..	·71	..	..	Total ..	2·86	..	..

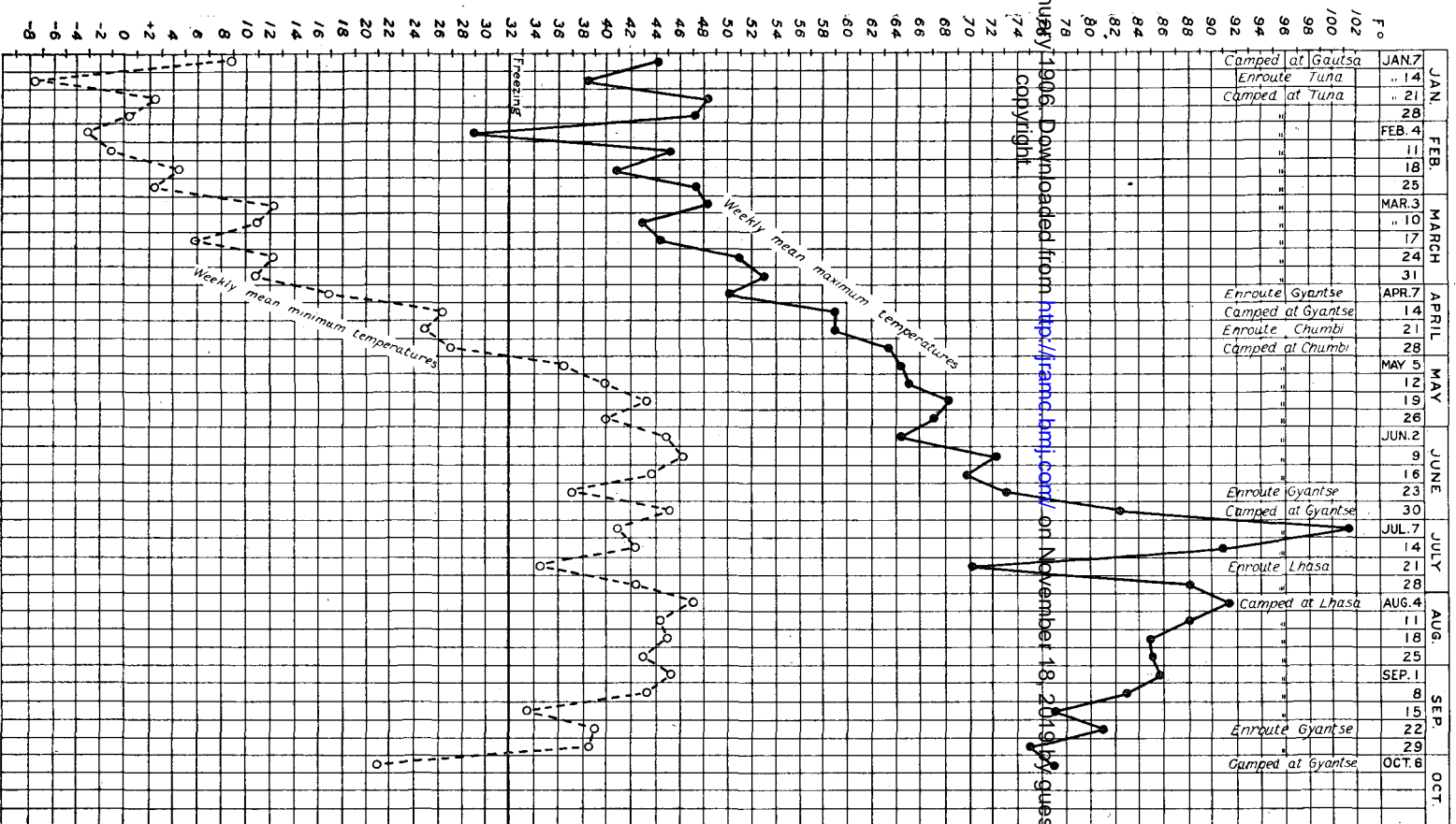
GYANTSE RAINFALL AND TEMPERATURE.—Continued.

Date	Recorded at 8 a.m.			Date	Recorded at 8 a.m.		
	Rainfall inches	Temperature			Rainfall inches	Temperature	
		Maximum	Minimum			Maximum	Minimum
Aug. 1st ..	·00	75	47	Sept. 1st ..	..	64	43
„ 2nd ..	·00	75	44	„ 2nd ..	..	70	44
„ 3rd ..	·07	76	42	„ 3rd ..	..	64	40
„ 4th ..	·60	78	43	„ 4th ..	..	68	42
„ 5th ..	·50	72	45	„ 5th ..	..	67	39
„ 6th ..	·18	60	46	„ 6th ..	..	69	43
„ 7th ..	·19	73	44	„ 7th ..	..	61	40
„ 8th ..	·70	59	39	„ 8th ..	..	67	44
„ 9th ..	·16	59	39	„ 9th ..	..	68	43
„ 10th ..	·00	68	45	„ 10th ..	..	57	..
„ 11th ..	..	69	46	„ 11th ..	..	58	..
„ 12th ..	..	63	46	„ 12th ..	..	61	..
„ 13th ..	..	70	..	„ 13th ..	..	60	..
„ 14th ..	..	67	47	„ 14th ..	..	64	..
„ 15th ..	..	63	45	„ 15th ..	..	67	..
„ 16th ..	..	73	49	„ 16th ..	..	68	..
„ 17th ..	..	75	46	„ 17th ..	..	67	..
„ 18th ..	..	..	42	„ 18th ..	..	58	30
„ 19th ..	..	69	45	„ 19th ..	..	..	40
„ 20th ..	..	74	44				
„ 21st ..	..	73	41				
„ 22nd ..	..	73	40				
„ 23rd ..	..	72	42				
„ 24th ..	..	72	43				
„ 25th ..	..	72	44				
„ 26th ..	..	62	43				
„ 27th ..	..	63	39				
„ 28th ..	..	67	43				
„ 29th ..	..	69	42				
„ 30th ..	..	63	38				
„ 31st ..	..	65	44				
Total ..	2·40	..	..		

APPENDIX III.

TEMPERATURES EXPERIENCED IN THE TIBET MISSION FORCE, 1904.

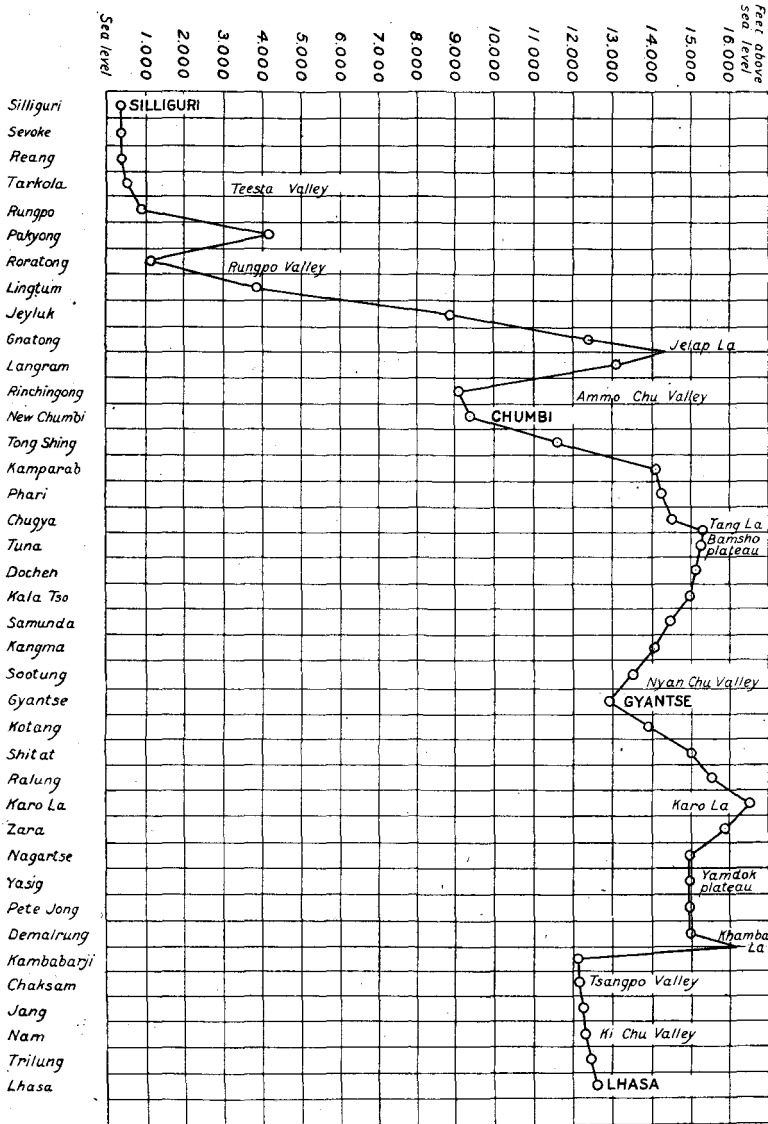
(Recorded by Captain T. B. Kelly, I.M.S.)



APPENDIX IV.

CHART OF ALTITUDES TRAVERSED BY THE TIBET MISSION FORCE.

(Compiled by Captain T. B. Kelly, I.M.S.)



The Tibet Mission Force

APPENDIX V.

WASTAGE¹ IN OFFICERS AND MEN OF THE TIBET MISSION FORCE.*European Officers of British and Native Regiments.*

Period	Average strength for the period	Admissions	Deaths ²	Invalids	Killed in action
From November 14th, 1903, to December 31st, 1904	77	40	2	..	4
Ratio per 1,000 .. ..	..	519·5	25·97	..	..
Average annual strength	89	40	2	..	..
Ratio per 1,000 .. ..	..	449·4	22·47	..	..

British Troops.

From January 1st, 1904, to November 4th, 1904	285	181	3	..	..
Ratio per 1,000 .. ..	..	635·1	10·53	..	..
Average annual strength	242	181	3	..	..
Ratio per 1,000 .. ..	..	747·9	12·40	..	..

Native Troops.

From March 13th, 1903, to December 31st, 1904	2,024	3,036	120	34	34
Ratio per 1,000 .. ..	..	1,500·0	59·29	16·80	..
Average annual strength	3,627	3,036	120	34	..
Ratio per 1,000 .. ..	..	837·1	33·09	9·37	..

¹ As supplied by Principal Medical Officer, His Majesty's Forces in India, to Intelligence Branch, Army Headquarters.

² Excluding killed in action.