Commission ceased to exercise any direct superintendence over the sanitary works, which were henceforth carried out solely by officers appointed by the military authorities. Very considerable improvements had been already affected, and the foundation had been laid for a system of procedure, which, if fully carried out, would accomplish the objects aimed at in the instructions.

We are desirous of expressing our opinion that the ability and practical skill displayed by Mr. Newlands in directing the defective and irregular supply of labour and materials placed at his disposal were of great value to the public service, and that the three Liverpool inspectors, Messrs. Wilson, Freeney, and Aynsley, who acted under him, discharged their difficult and often dangerous duties at Balaklava and Scutari with zeal, discretion, and success.

At this date the principal sanitary measures in the camp and hospitals were in a forward state. The most important of the improvements, the isolation, drainage, and ventilation of the huts, though progressing, were not completed.

An inspection of the camp was made by Dr. Sutherland immediately after his return from Scutari. The measures for checking the diarrhœal stage of cholera were then being carried out, more or less perfectly, in the different divisions; but there is reason to believe that although many cases of the epidemic were checked in the early stages, the inspection was not so successfully carried out, at least in so far as concerns the discovery of the disease in its earlier stages, as it has frequently been in civil practice, and in the army itself, under other circumstances.

A number of unburied carcases of animals were found in various parts of the camp, belonging chiefly to the French commissariat, but some also to the British camp. The fact was represented to the Commander of the Forces on the 18th July, and the evil was abated. On the same day another communication was addressed by Dr. Sutherland to General Simpson respecting the bad sanitary condition of certain parts of the trenches. At one point the works had to be advanced through places where interments had been made, and offensive emanations had arisen in consequence.

It was also difficult to dig graves deep enough for the burial of those who fell. From the nature of the service, it was found to be impossible to make any proper latrine arrangements, and the effluvia arising from this cause were highly dangerous to the health of the troops, and there was reason to believe that both cholera and diarrhœa had arisen in consequence.

To remedy these evils it was suggested that peat charcoal might be carried in bags to the trenches, and spread over all graves or accumulations of offensive matter. General Simpson at once agreed to adopt this precaution.

At this period there was a great deal of diarrhœa and cholera prevailing among the Land Transport and other camps in the lower levels of the valley of Balaklava, obviously connected with the malaria arising from the ground. Many buffaloes and other animals were pastured in the plain, and the ground was trodden and turned up so that even under the hot July sun the surface was wet and muddy to a considerable extent, showing the wet character of the subsoil. The camps were moved to better ground with advantage to the health of the men.

PART III.

§ I. Cavalry Camps in the Autumn of 1855.

In the middle of June Dr. Milroy was called on by your Lordship to join Dr. Sutherland in the Crimea. At the same time the Admiralty deemed it expedient to put the Commission in communication with the naval authorities in the Black Sea.

Dr. Milroy left England on the 1st, and arrived at Balaklava on the 22nd July, 1855. Two days afterwards a set of instructions were drawn up by the Commission, for the guidance of the inspectors who had been appointed to succeed those belonging to the Commission. These instructions were similar to those under which the works had been previously carried out, and henceforth the duties of the Commission, so

far as concerned Balaklava, were confined to keeping a watch over the sanitary state of the town and harbour, and communicating with the military authorities if any reason arose for doing so. We had occasionally to represent nuisances, and especially the surreptitious deposit of offal and manure on the margins of the harbour, or in the water, but on the whole there was little reason of complaint in these respects.

Immediately after Dr. Milroy's arrival, the Commissioners made a detailed inspection of all the camps and hospitals belonging to the army, and found nearly all those belonging to the Infantry regiments in a good sanitary condition. Such, however, was not the case with some of the Cavalry camps, to which our attention was more particularly called on account of the prevalence of cholera and other epidemic diseases among the men. The positions occupied by the Cavalry in the lower valley of Karani had deteriorated in their sanitary state as the hot weather advanced, and it appeared very desirable, if it could be accomplished, to remove some of the worst camps to higher and better ground. We were at the same time of opinion that much might have been done to improve the camps even where they were.

Except in one or two instances, the cleansing of the picketting grounds was not so well attended to as it might have been. Some latrines were in a neglected and unwholesome condition. Tents were overcrowded. Some of the ground had been broken up into hollows, which had become depositaries of filth. Cases of diarrhœa had passed into developed cholera without previous treatment for arresting the disease.

We considered it necessary to represent these circumstances to the Commander of the Forces on the 24th August, and to recommend the issuing of directions:—

1. For a more perfect cleansing of the camps.
2. For the management of the latrines in the manner recommended on the 17th May last.
3. The serving out of additional tents to affected regiments.
4. The levelling of uneven ground.
5. That, during the prevalence of cholera, a system of inspection, for the discovery and early treatment of diarrhœa, be put in operation, as had been formerly recommended.

The day after these recommendations were sent to General Simpson, Dr. Sutherland left Balaklava for England, on receipt of a despatch from Lord Panmure, requesting his presence with reference to certain contemplated sanitary arrangements for the army.

As much sickness continued to exist in the Cavalry regiments, Dr. Milroy paid frequent visits to the camp, to confer with the medical officers. The cases of zymotic disease then prevalent were generally among the recruits who had lately been sent from home. Many of these were youths of weakly constitution, and unfit to endure the fatigues of the field at once. They had suffered in health from the close, impure air of the horse transports during the voyage out, and arrived in the Crimea during the hot season, and were sometimes marched up to camp in the heat of the day. Not unfrequently they sickened a few days after landing.

Of forty cases of sickness in hospital in the 2nd Dragoons, or Scotch Greys, when the regiment was above 300 strong, thirty-two were among the drafts received since the beginning of the previous month; and out of the entire number, 170, who had arrived during that time, seventy had already been on the sick list. Before the arrival of these drafts, when the strength was from 180 to 200, the sick in hospital averaged from twelve to fourteen.

In the 1st, or Royal Dragoons, there were 138 cases of sickness in August out of a strength of 379. Of this amount of sickness, a very large proportion had occurred among 170 recruits who had joined since June; and all the deaths, ten in number, had likewise occurred among the recruits.

For some time before the battle of the Tchernaia, on the 16th August, the Cavalry were subjected to harassing night duty, and were exposed to the chilly night and morning air, which the men said seemed to strike to their bowels on leaving their close, warm tents.

At the beginning of September, two of the regiments which were suffering most severely were moved from the

lower ground, and encamped on the hill north of Kadikoï. This change was productive of immediate benefit to the health of the troops.

§ II. Inspection of Karabelnaia.

A few days after the capture of Sebastopol on the 8th September, Dr. Milroy received a telegraphic despatch, through head-quarters, from the War Department, directing him to report without delay on the sanitary condition of that part of the city in the British possession, and the approaches to it.

On the first inspection on the 21st September, there was a strong putrid smell from the fosse of the Redan, particularly near its salient angle, and also from different spots on the slope of its northern face, where Russian corpses had been buried only a foot or two under the surface. Measures were at once taken to fill up that part of the fosse, and to cover all the offensive places with a thick layer of earth. The tongue of land to the north of the Redan, between the inner harbour and the Dockyard Creek, affords a fine and salubrious site for buildings, and was occupied by some of the largest public edifices in Sebastopol. The chief of these structures was a great barrack, forming three sides of an immense square, the fourth, or eastern side, being occupied by low store-rooms, latrines, &c. On the space within were numerous ranges of one-storied buildings, guard-rooms, workshops, kitchens, &c. The barrack buildings were in distinct blocks or ranges, so that the inclosed area was exposed to a free perflation at all times. Each block or range consisted of three stories, besides a spacious basement floor and extensive lofty vaults beneath.

From the dilapidated state of the north and west blocks, it was impossible to examine them, for besides being damaged by shot, they had been gutted and nearly unroofed by the Russians, for the sake of their large roof and joist timbers. The south range, although much injured by the fire of the besiegers in many places, admitted of examination throughout. It had continued to be occupied by the enemy to the last. The general plan of each of the stories was

that of a double row of long apartments or wards, arranged longitudinally, and having windows along one side. At each end the rooms ran transversely, and were lighted from two sides. They were all capable of being well ventilated, and in most of them were large square openings in the wall, communicating with warming flues from the Russian stoves in the basement floor. Down the middle and along the entire length of most of the wards was a continuous double line of horizontal or slightly inclined covered bunks, which served for the men to sleep upon, and provided also a place for their clothes and accoutrements. They generally contained a quantity of rubbish, old filthy apparel, decayed bread, rotten straw, &c., which was littered about in all directions, while still more offensive matters existed in most of the small rooms at the end of the wards. The basement floor was in most parts so lumbered up with broken furniture of all sorts, that it was scarcely possible to get along or to pass through any of the rooms. The spacious vaults underneath were paved throughout and well ventilated by tall shafted openings. Here and there they had been used as latrines, but on the whole they were much more free from offensiveness than might have been expected.

Two slanting passages, cut in the soft rock, immediately in the rear of the south face, had served as the chief latrines for the men quartered here, and who served the guns in the small battery which had been constructed along the south face. The regular barrack privies along the east side of the barrack square were in a horribly offensive state, and in numerous places along the different rows of buildings, there were accumulations of decaying refuse, old bones, excrement, &c.

The principal well was in the square in front of the north block. A fire-engine was standing close to it when the place was visited on the 24th September.

The extensive kitchens and ovens were a good deal injured, in part by shot or shell coming in by the roof, and they had partly been dismantled by the Russians before the evacuation. Heaps of semi-putrid fermenting rubbish in barrels and tubs lay about in different directions. The brick-work of the ovens had been pulled down in some places

in order to remove the large boilers, but a number of these valuable utensils remained in different buildings within the barrack-square as well as in the kitchens.

A quantity of Russian black bread was found in the store-rooms. With the exception of a few sacks of flour, no other provisions were to be seen.

Between the south side of the Great Barrack and the slope of the Redan, were a number of other, chiefly public, buildings; but almost all of them were so damaged or dismantled, as to render an examination of them neither easy nor safe. If restored, they would have afforded accommodation for some thousand men. There were scarcely any nuisances about them requiring notice as the buildings appeared to have been evacuated as untenable early in the seige.

The long range of buildings along the east side of Dockyard Creek, and known as the Dockyard Stores, had suffered very little from the fire of the allies. Each block consisted of two floors of lofty rooms, besides extensive vaulted cellars flagged throughout.

It was from these buildings that nearly 1,000 corpses, most of them in a putrescent state, were removed during the first few days of our occupation. The wards were thoroughly cleansed and purified, and the bedsteads scalded and then sprinkled with chloride of zinc. All the rubbish and filth within and around the buildings were burned at once. In their rear were good cooking-places, provided with large boilers set in brickwork. A party of the 3rd Buffs was quartered in one of the buildings which had not been used as a hospital by the Russians.

The chief defect of the rooms was, as usual, defective ventilation. The windows were many feet below the ceiling, and many of them swung only inwards. Two or three covered latrines had been run out from the quay overhanging the water.

Had the position been tenable, there were numerous other buildings about the docks and in Karabelnaia which might have been adapted for winter-quarters if necessary. There was plenty of building stone, and the climate was milder and more sheltered than that of the plateau. The

ground in advance of the British camp, presented many healthy sites for camps, but rather too exposed during the winter months. Some of the lower parts of the Woronzoff ravine would have been most sheltered.

A report on these facts was drawn up by Dr. Milroy, and sent to head-quarters, and to the War Department. Recommendations were made, having reference chiefly to the thorough cleansing and purification of all buildings that might possibly be occupied; the correction, with quicklime and charcoal, of the worst nuisances in the town, and the immediate destruction of others by burning; the filling-up and levelling of the uneven ground within and around the Redan, and of the covered chambers under the parapets, within which many dead bodies had been found, and which were all more or less offensive. Also, the burning of old gabions and useless wood over the spots which had been offensive, and strewing the ashes over them.

Attention was specially directed to the advantages to the troops of having all the large kettles and boilers removed to the camp for cooking their food during the winter, if the army should continue to occupy the plateau.

§ III. Sanitary State of the Occupation in the Autumn and Winter of 1855.

The health of the camp, and of Balaklava, was incidentally benefitted during the autumn and winter of 1855, by certain works carried out by the Army Works Corps after its arrival in the beginning of the season. These works were primarily directed towards the improvement of the communications between the transports in Balaklava harbour and the camps but they had, also, an important bearing on the sanitary state of the occupation.

The line of railway required drainage to keep it from injury during the winter, and deep trenches were accordingly carried along its sides, from the head of Balaklava harbour through the marshy ground to Kadikoi. The incline to the Col was also trenched, and trenches were carried along the railway and its branches to the different divisions of the army. Similar deep trenches were shortly afterwards

carried across the lower part of the valley of Balaklava to drain the line of railway leading towards the Sardinian camp.

During the autumn and winter, part of the army was engaged in forming new lines of road all over the occupation, and in repairing the old roads. In these works the Army Works Corps participated.

From the nature of the ground nearly all the roads required to be drained, and the same system of deep trenching was used as for the railway. The water-courses leading into Balaklava harbour were straightened and improved. These extensive drainage works followed the lines of communication all over the camp, and they exercised a very beneficial influence on the general drainage of those parts of the occupation through which they were carried. The marshy ground from Balaklava to Kadikoi was, to a great extent, drained, and the drainage of the lower part of the valleys of Balaklava and Karani was also greatly improved.

Substantial wooden quays were gradually run along the east side of the harbour, and the former accumulations of filth were either effectually buried under the works or they had ceased to become injurious by having decayed away.

By the middle of September, the amount of cholera and diarrhœa on board ship in the harbour having greatly diminished, and the general health of the shipping being satisfactory, it was deemed unnecessary to continue the services of the medical officers, who had been appointed in May by Admiral Boxer, at the instance of the Commission, and a letter was accordingly addressed by Dr. Milroy to that effect to Admiral Freemantle on the 18th. Occasionally a sporadic case or two of cholera occurred after this period in vessels within a day or so after their arrival, most frequently on board cattle ships, but there were never any grounds for apprehending the spread or prevalence of sickness in harbour. In every instance, neglected diarrhœa of some days' standing, had preceded the attacks of developed disease.

The condition of the head and margin of the harbour continued to attract attention from time to time. From the continued shoaling of the water, a broad belt of black, putrescent mud round the head of the harbour, was exposed

to the hot sunshine, and gave off miasmata. While the quays were being constructed, sufficient attention had not been given to the precautions, respecting the margin of the harbour, laid down in the instructions issued by the Commissioners to the inspectors appointed by the military authorities.

Dr. Milroy called the attention of the Commander of the Forces to these points in the beginning of October, and recommended the covering of the exposed exhaling surface with ballast, the filling-up and covering over of the margin inside the piles for the quay, as directed in the instructions referred to. Vigilance was also recommended to prevent stable-manure being thrown surreptitiously into the harbour.

The points referred to met with prompt attention. The cleansing of the town was, on the whole, well done, although stable-manure was now and then allowed to accumulate.

On one or two occasions it was necessary to represent to the naval authorities that carcases of cattle and sheep had been thrown overboard from ships and permitted to float about the harbour for some days before being towed to sea. As there was reason to believe that this infringement of the regulations of the port was partly due to Sardinian transports, the subject was brought at the same time under the notice of the General Commanding the Sardinian Forces.

It occasionally happened, that when carcases of animals were not towed sufficiently far out to sea, or not slashed so as to sink them, they were deposited by the current on the narrow beach under the Castle Hospital, and occasioned nuisance in the wards. A complaint of this kind was made to Dr. Milroy, on the 30th October, by the medical officers of the hospital. He brought the subject before Admiral Freemantle, and the nuisance was stopped.

During September and October, after a long period of dry hot weather, the water supply at Balaklava began to fail. The fine spring at the head of the harbour yielded less and less, until it failed entirely, and occasioned much inconvenience as well as distress to numerous animals constantly passing in and out of the town. Fortunately the spring, or rather the remains of it, was discovered below the surface

of the road close at hand, and from this the boats of most of the shipping derived their supply; but for many weeks during the hottest weather, animals had to be watered from the impure drainage of the marshy ground brought down by the deep trenches for draining the roads.

Throughout the summer the stream running down the Castle ravine ran to waste and was polluted, and no provision for watering the cattle landed from the transports was made. Bad as it was, this water was sometimes taken for the ships in default of better. Much of the waste might probably have been avoided by engineering works, such as were partly carried out by the Commissariat Works Corps before the final evacuation of the town, and which would have been extended and completed had that event not taken place.

Towards the end of October, Dr. Milroy began a detailed inspection of the whole camp, one regimental camp after another, in each division and arm of the service, to ascertain the progress that was being made for the winter accommodation of the troops. This work was continued till the second week in December. The means and mode of cooking by the soldiers, the consumption of fuel, and the general state of the regimental canteens, were at the same time minutely examined, details in regard to which will be found in Appendix No. II. At the same period Dr. Milroy made a sanitary inspection of the "Royal Albert" at Kazatch, in company with the medical officers of the ship, the details of which are also given in Appendix No. III.

The necessity of completing the roads before winter was the cause of a large part of the army being employed on road making, and the hutting of the troops did not progress so quickly as it might otherwise have done. Some of the hospitals, apparently from the same cause, had not completed their winter arrangements before the cold weather set in. The Land Transport Corps, from the peculiarities of their position, were also backward in their preparations, and many of their sick were still under canvas in the beginning of December, when the weather had fairly broken, and the ground was wet and miry.

It has been already stated that when the camp was first

inspected by the Commissioners, on their arrival in the Crimea, they found the sanitary state of the regimental camps to differ materially. A similar difference was observed in the manner of preparing for the winter, even in regiments close to each other. In one camp the works were more advanced, the ground was better trenched and paved, the huts better ventilated, the cooking arrangements more complete, and the canteen regulations more strict than in another. The difference appeared to be mainly due to the different estimates formed as to the importance or otherwise of sanitary arrangements on the part of the commanding and medical officers of regiments.

Towards the latter end of 1855, the new panelled huts sent out from England for the winter camp arrived in the Crimea, and from their structure these huts afforded considerable facilities for transport and erection, while they were well adapted for the sanitary requirements of the army. While these winter preparations were progressing, Dr. Sutherland returned to Balaklava on the 15th December, after having examined into the sanitary condition of the hospitals at Smyrna, Renkioi, Abydos, Scutari, and Kulalie.

The sanitary condition of the whole occupation had materially improved during the autumn months, and the health of the army generally had also become better.

In the latter part of July, the sick passing through hospital averaged 159 per 1,000 of the force. Zymotic diseases, chiefly fever and diarrhœa, averaged about 87 per cent. of the sick. During the last two weeks of the month, the force averaged 43,240 men, among whom there were 164 deaths, or about 9·8 per cent. per annum; 55 of the deaths were from cholera.

During the month of August the sick averaged 147 men per 1,000, of which 75 per cent. was due to zymotic disease. The mortality was at the rate of 15·28 per cent. per annum, 45½ per cent. of which was due to cholera.

In September, the proportion of sick to force fell to 114 per 1,000. Zymotic diseases still supplied 71 per cent. of the sick in hospital. The mortality during the month was at the rate of 12·3 per cent. per annum, including deaths from wounds at the capture of Sebastopol. Cholera

subsided rapidly during the month, and yielded 9·3 per cent. of the mortality. There were only seven deaths from this disease during the latter half of the month.

For three weeks before the taking of Sebastopol, the admissions to hospital were 59, 52, and 50 men per 1,000, disease and wounds included. On the week of the capture the admissions were 70 men per 1,000. Thereafter the admissions from wounds immediately fell off, and the admissions on the three weeks following were 29, 31, and 21 men per 1,000.

The total sick alone, on the third week before the fall of the fortress, equalled 159 men per 1,000. During next week there was a decrease of 19 men per 1,000. The week following showed an increase of two men per 1,000. On the week preceding the capture there was a further decrease of 22 men per 1,000. The week of the capture added nine men per 1,000 to the sick, exclusive of the wounded. The week following showed a decrease of 24 men per 1,000, and during the two following weeks the decrease was seven and three per 1,000. The reduction in the number of sick, and consequently the improvement in the health of the army was more rapid before the fall of Sebastopol than it was after, in the proportion of 39 per 1,000 for the preceding three weeks, to 34 per 1,000 during the three weeks following that event.

In the month of October, the proportion of sick underwent a further diminution to 91 per 1,000 of the force, and the proportion of zymotic diseases fell to 58½ per cent. of the total sick. The mortality was at the rate of 4·16 per cent. per annum. There were 38 deaths from cholera during the month.

The health of the army was thus progressively improving, and epidemic diseases, especially cholera, had undergone a marked diminution before the commencement of the winter.

The winter preparations were proceeding favourably, and it was evident that the huts were being erected with more attention to sanitary precautions than those of the preceding year.

There was more care bestowed on the preparation of the ground. The site of each camp was trenched, and that of each tent and hut was trenched or drained where necessary. In some instances a foundation of rough stones was prepared on which the timbers were laid, and generally there was less disposition manifested to bank up the huts outside than during the preceding spring. The huts were also erected well apart from each other.

Among the best examples of a winter camp, which came under the notice of the Commission at this period, was that of the Brigade of Guards, on the plateau, on the laying out of which great care and intelligence had evidently been bestowed. There was plenty of space for allowing the air to circulate. The arrangement of the huts was good, and the ground was well trenched and drained, and many of the huts were raised on stone foundations. The ventilation of the huts was generally good. The camp of the 3rd Buffs was also particularly well arranged.

The Highland Division was encamped on some steep sloping ground to the east of Kamara, and afforded a very good illustration of what may be done to secure the healthy state of a not very promising position. Great doubts were at first entertained about the ground. It certainly afforded shelter from the north and north-east winds; but in other respects it was not considered suitable for the regimental hospitals, which were left in a higher and more exposed position, at the request of the medical officers.

The ground selected for the camps of the 79th, 92nd, 42nd, and 93rd, was a large steep bank of debris, consisting of stones and sand, mixed with loam, resting on a highly inclined mountain side, about 500 feet above the level of the sea.

Rising above the site was an extensive water-shed, formed by the irregularly concave line of the mountain ridge, and from the natural inclination of the ground, as well as from the hard impervious nature of the rock underlying, the rainfall was necessarily concentrated on the site of the encampments. Except in this one particular, the situation was a very healthy one for the winter.

The preparation of the ground was a matter of some labour, for it had to be terraced to form level spaces for

erecting the huts and for parade grounds. The huts, from their length, were placed directly across the line of drainage —a position which was inevitable, but which, in all probability, would have resulted in an unhealthy condition of the brigade, had it not been for the very efficient means adopted for cutting off the drainage of the water-shed, and diverting it from the huts. These means were similar to those recommended by the Commission in its instructions on the drainage of huts sent to head-quarters in May 1855.

A deep catchwater drain was cut to insulate the camps from the surface and subsoil drainage of the watershed.

A platform for each hut was thrown forward and completely insulated from the inclined ground behind, and at its sides by trenches, and the area occupied by the hut was effectually drained below the level. On examining these drains, the amount of water running in them, especially after wet weather, was sometimes very considerable, and clearly proved the necessity for the drainage, as well as its efficiency. When the Commissioners examined this encampment after its completion, they had doubts as to whether the position would be a safe one for health after the setting in of warm weather, and they looked with much interest to the sanitary result of the drainage works.

The brigade enjoyed excellent health during the winter and spring; and even during the early hot weather which came on before the evacuation, the regiments forming the brigade were amongst the most healthy in the army.

The winter camping-ground of the 72nd and Royals was upon the slope of the same ridge, further to the south, at an elevation of about 850 feet above the sea, The water-shed above the camps was less extensive than in the preceding case, and the same care was bestowed on the thorough drainage of the sites of camps and huts.

We look upon the experience of the preservative effect of good drainage, as afforded by the Highland Division, as of the greatest importance, for it has clearly proved that a not very promising position can be rendered healthy by attending to suitable precautions of this nature.

The new panel huts were erected of different lengths to suit circumstances. The longest measured about 74 feet in

length, by 16 feet 5 inches in breadth. The height to the eaves was 5 feet 10 inches, and the ridge was 5 feet 8 inches above the eaves. There were five swing windows along each side, and a door at each end. There were two ventilating openings protected by louvres, one over each door, and five large ridge ventilators with zinc plate covers along the roof. The panels were double, for the sake of warmth. The flooring was generally panelled, at least, in the hospitals, which were also furnished with porches, and the roof was formed of panels screwed to timbers.

So far as concerned the health of the troops, these huts were well adapted for their purpose. They were spacious, and had ample means of ventilation. Their defects were the want of eaves to turn the rain from the foundations, and the liability of the roofs to leak, which, however, was readily overcome by covering the joinings with tarred felt or canvas.

The number of men accommodated varied with the size of the hut, the space for each man being about 165 cubic feet. It was small; but, on the other hand, the means of ventilation were ample, and the free use of these is the only way of supplementing the limited space at the disposal of armies in the field.

While inspecting the camps on the approach of winter, special attention was bestowed on the hospitals.

The improvements commenced in the preceding spring had been continued and extended. The wards were clean and airy. The kitchens and other offices of the general hospitals, and of not a few of the regimental hospitals, were models of their kind. The sick appeared to have every obtainable sanitary advantage to aid in their recovery. The function of the Commissioners was, at that period, very much limited to visiting the hospitals occasionally, and to expressing their approval of the sanitary arrangements.

It may, we believe, be safely stated that in no field hospitals could the prospect of recovery of the sick and wounded have been better, than in those in the camp before Sebastopol in the winter of 1855-56.

On the approach of winter, various methods were adopted by the medical officers for protecting their hospitals from the rigour of the climate.

Generally, the space between the outer boarding and the inner lining of the hut, when there was such, was filled with dry earth, a practice far from being safe for the sick, as well as being unnecessary, for air itself is a sufficient non-conductor.

In other instances, rubble walls (as shown in *Fig.* 11) were built against the sides of the huts. Sometimes tarred canvas or blankets were used for protecting the sides, or some non-conducting lining was put up inside. In many cases the ground under the eaves was well paved with stone, and roof gutters were put up to carry the water away from the foundations. The roof ventilation was diminished sometimes to too great an extent. Stoves were generally used for warming. In one well-built hospital, belonging to the Royal Artillery, the ward was rendered cheerful, airy, and warm, by an open fire-place. In some instances, covered corridors were provided for convalescents.

At the end of the year, some of the new panelled huts were erected for hospitals. They possessed great advantages over the Portsmouth hut previously in use, and when whitewashed inside, properly warmed, and the ventilators made use of, they formed as healthy, clean, and comfortable wards as could have been desired; but the eaves were too narrow.

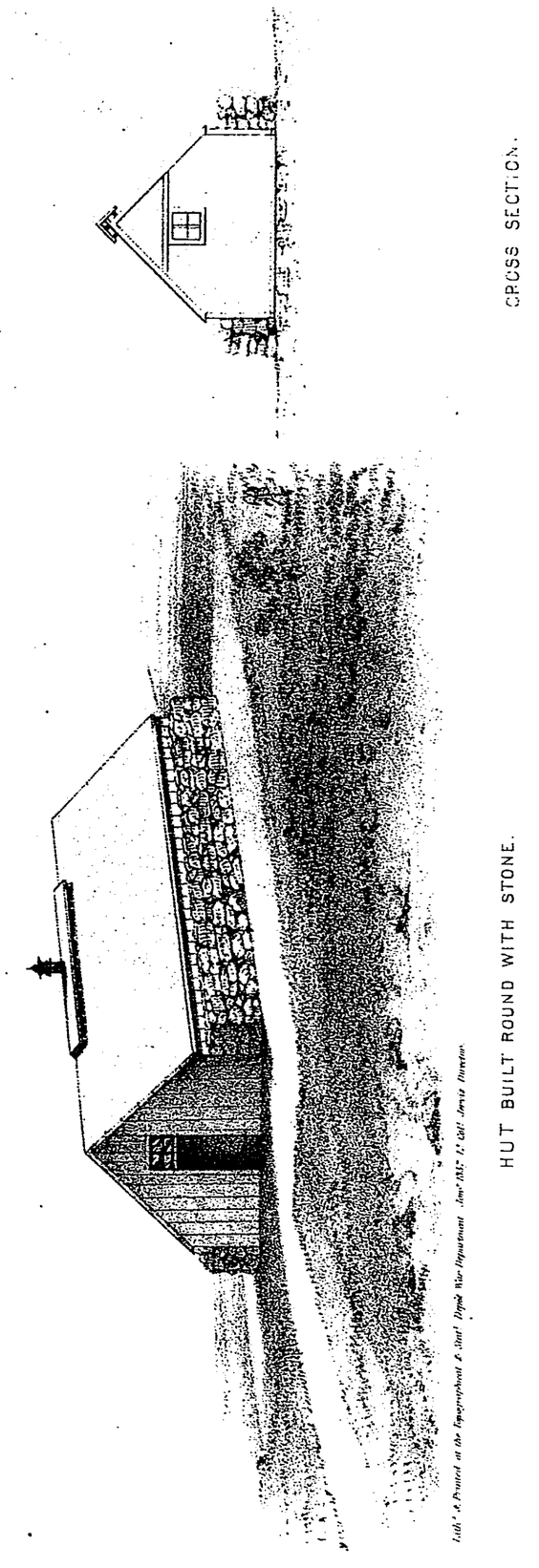
The hospital latrines were generally placed at a proper distance, and suitably protected from exposure.

In the hospitals of the Light Division, the night-chairs were placed in a separate recess, communicating with the hospital, but having a door outside, by which the chair could be removed at once, without contaminating the air of the ward. This was an excellent improvement.

During the depth of winter, the ventilation of many of the hospital huts was unquestionably defective, and in some instances there was none, except from the chance opening of the door.

There was not unfrequently too great a disposition to keep up the temperature of the air inside, at the expense of its purity. The common argument urged on behalf of this practice was the necessity for preserving warmth around the sick. Of all methods of doing so, a defective ventilation is

Fig. 11.



certainly the worst, and the experience of the hospitals proved that it was not necessary.

During the first week of January 1856, we made a detailed inspection of the hospitals throughout the camp, and were gratified to find that the medical officers had preserved the ventilating arrangements entire in not a few instances, while in others they had been modified to suit circumstances. On a careful inquiry, both of the sick and attendants, we could elicit no complaints of cold draughts from the ventilation, except where there were doors unprotected by porches, from which the drafts proceeded.

We felt that it would be impossible to lay down any specific plan of ventilation applicable to hospitals in every portion of the camp, during so variable a winter climate as then prevailed. We were, nevertheless, of opinion that what had been effected by the medical officers in certain regimental hospitals might very well be accomplished in others. We accordingly addressed a communication to Sir William Codrington, on the 15th January, 1856, expressing our gratification with the condition of the hospitals generally, but, at the same time, suggesting that the attention of the regimental medical officers should be called to the ventilation, they being the best judges of the amount of fresh air their sick could bear at low, changeable temperatures. We also stated that when spring arrived, the arrangements formerly in use for a more perfect roof ventilation would have to be restored. This communication was sent by Sir William Codrington to Dr. Hall, with the view of bringing the matter before the medical officers.

It remains further to be mentioned, in regard to these regimental hospitals, that during the remaining period of the occupation of the Crimea, they were kept in a highly satisfactory condition.

It is only justice to the medical officers to state, that we found them, at all times, doing their utmost to keep them so, and that any suggestions we thought it necessary to make were readily attended to. Some of the hospitals, such as those of the 23rd and 33rd Regiments, remained, to the last, models of cleanliness and order, and excited the admiration both of the allies and of the Russian officers who saw

them. The same remarks apply to the General Hospitals, with the exception of that in the 3rd Division, which, from its local position and other circumstances already mentioned, never attained to the same degree of excellence as the others; but it ceased to be much occupied long before the troops left the Crimea.

During the coldest period of the winter of 1855-56, the ventilation in the barrack huts was not unfrequently injuriously interfered with by the men. The ventilators were sometimes entirely closed, or stuffed up with rags, and the evil of defective ventilation was added to that of overcrowding. It need hardly be stated that regiments in which this was done, had their health endangered thereby.

The usual plea was the cold weather, but that it was not a valid one was shown by the fact that there were many barrack huts the ventilators of which were kept open during the winter. Soldiers are embued with the common prejudice, that colds and catarrhs arise from cold air, and they are like, most other people, unaware that fevers and other zymotic maladies are the known results of foul air. They will close up every cranny to escape a cold by shutting out the presumed cause of it, but they never consider that, in doing so, they have effectually shut in the elements of typhus.

The subject is one of so much importance, that it ought at all times to engage the attention of commanding and medical officers of regiments. Whenever fevers of the continued type, especially with a typhoid tendency, appear in a regiment, suspicion should instantly be excited that the men are suffering from foul air, impregnated with animal effluvia, and preventive measures taken accordingly. Sometimes the cause may be defective ventilation, or overcrowding, because overcrowding may be carried to such an extent that the means of ventilation cannot counterbalance it. Sometimes the air may be perceptibly tainted by a foul picketting ground, a dung-heap, a neglected latrine, an improperly constructed drain, or by a damp, unwholesome state of the ground under a tent or hut. From one or more of these causes fevers of the continued type are constantly occurring, especially where bodies of men are congregated together; and whenever such fevers appear, particularly where they

show a disposition to pass into typhus, it may, under ordinary circumstances, be considered certain that some of these removable causes are in operation.*

Such causes usually act most energetically in hot weather; but that they do act injuriously even at very low temperatures is proved by the experience of the army during its last winter in the Crimea; for the statistics show that continued fever did occur, although the cases were few in number when contrasted with their frequency in the rest of the allied forces, a clear proof of the comparative healthiness of the British army, and also of the comparative perfection of its sanitary arrangements.

The same dread of cold, which had led to the closing of the ventilators, also, as the winter advanced, led to the heaping up of earth around the walls of many huts, a practice almost as prejudicial as obstructing the ventilation, by keeping up a damp state of the floor and walls, but certainly of much less consequence during winter than during warm weather. The object, as already stated, is to protect the lower part of the hut from cold drafts, an expedient quite unnecessary, for the same object may be obtained by lining the hut inside to the same height by so simple a material as old newspapers, as we proved by direct experiment. We are glad to be able to state that, in some of the most healthy regiments in the army, the earth had never been heaped against the walls, or the ventilators closed in any of the huts. In these instances the men, so far from complaining of cold drafts, admitted that when the ventilators were closed, the huts became close and unpleasant.

During the winter of 1855-56, the surface of the camps, generally speaking, was kept as clean as the condition of the weather would admit. The usual practice of burning the stable manure could not be efficiently carried out, and considerable accumulations of it were formed at different points;

* Most of the occupants of a certain tent in the French camp had been successively attacked with typhus throughout the whole course of the winter of 1855–56. The tent was struck, and the ground under it was dug up to ascertain whether there was any cause for the disease. The corpse of a soldier, in an advanced state of putrefaction, was found beneath the surface over which the tent had been pitched.

but during the cold season it was not so likely to act injuriously on the purity of the air.

We made a detailed examination of the whole camp during the middle of January of the present year, and, with the exception of the points already mentioned, we had great reason to be satisfied with its sanitary condition. Efficient precautions had been adopted for securing the health and wellbeing of the men, and with what success was evident from the robust appearance of the healthy, and the comforts provided for the sick.

As might be anticipated, the surface of the camp was worse after a thaw, or rather, while the water was drying up; but, upon the whole, the ground appeared to be firmer, and in better condition than during the previous winter at the same period. The rainfall in November 1855, was 3·167 inches, all of which, except less than half an inch, fell on the last six days of the month. There was a little snow on the 27th. Between the 1st and 12th December there fell 2·300 inches of rain. There was a little snow on the 13th, and six inches of snow on the 17th and 18th together. During January 1856, there fell, on thirteen days, 2·499 inches, and about seven inches of snow fell on the 4th, 5th, and 17th of the month. Snow fell on eight days in February, the heaviest fall being on the 1st of the month, and equivalent to 1·294 inches of rain. There was hardly any rain during the month, but the total fall of snow was equivalent to 2·438 inches. The greatest cold of the year was on the 19th December, 1855, when the minimum temperature was as low as 2·5°F. The maximum of the same day was 9°F. The mean temperature in November, was 48·9°; in December 33·3°; and, in January 1856, 40°F.

The whole amount of atmospheric water which fell during the coldest months of the year was by no means excessive; and the ground, consequently, was not in so unfavourable a condition as it was during the earlier months of 1855. It has, besides, been shown that the surface drainage of the occupation had been undergoing a progressive improvement from the road trenching and camp draining. These circumstances, along with the cessation of the harassing siege duty after the fall of Sebastopol,

abundance of excellent food and clothing, moderate fatigue duty, and the generally improved sanitary condition of the camps, all co-operated in improving the health of the army during the winter months.

At the beginning of November 1855, a marked improvement in the health of the army had already shown itself. The admissions into hospital on the week ending the 10th were less than one-half, in proportion to strength, of those admitted on the second week of July after the decline of the cholera, and the proportion of deaths had fallen to less than one-fourth. The percentage of zymotic cases admitted to the total admissions, which in the second week in July equalled 73 per cent., had fallen, in the first week of November, to about one-half that proportion. Out of twenty-one deaths during the latter week, six were from fever, four from cholera, two from diarrhœa, and one from dysentery, showing that, notwithstanding the great improvement in health, upwards of 60 per cent. of the weekly mortality was due to zymotic diseases.

The total admissions during November from the whole army (*exclusive* of the Land Transport Corps, which, from its peculiar circumstances, will be dealt with separately in the following pages), averaged a little more than 2·6 per cent. of the force per week.

The weekly admissions from zymotic disease averaged 31 per cent. of the total weekly admissions, and the deaths from zymotic disease averaged 50 per cent. of the total deaths for the month.

During the month of December the sanitary state of the army progressed favourably. The weekly admissions averaged 2½ per cent. of the force. The percentage of zymotic diseases fell to 28½ per cent. of the total admissions. There were forty-five cases, and thirty-three deaths from cholera during the month, and the deaths from all zymotic diseases averaged 52 per cent. of the total deaths.

In January 1856, the weekly admissions fell to 2·2 per cent. of the force. There were a few deaths from cholera during the month, and 37·9 per cent. of the deaths were due to zymotic diseases, chiefly fevers.

The largest part of the mortality during the month was

due to chest affections. Pneumonia, bronchitis, and catarrh, were the prevailing diseases both of this and of the preceding month. The weekly admissions from zymotic diseases averaged 21 per cent., and in one week it was only 19 per cent. of the total admissions. There were some cases of frost-bite from exposure during intoxication.

There was thus a progressive improvement of the health of the army, even through the depth of winter. During four weeks in November, with an average strength of 35,806 men, the average sick amounted to 3,815, or 10·6 per cent. of the force.

In four weeks in December, in an average strength of 44,858 men, the sick amounted to 4,146 on an average, or equal to 9·2 per cent. of the force.

During four weeks in January, in an average strength of 44,600, the average sick was 3,852, or 8·6 per cent. of the force.

In like manner, the deaths which, during the same four weeks of November, had been at the rate of 44 per 1,000 per annum, fell during the four weeks of December, to 33 per 1,000 per annum; and during the four weeks of January, the mortality was in the ratio of 22 per 1,000 per annum.

It may be useful to contrast the sanitary state of the army at the end of the winter of 1855-56, with what it was at the same period of the winter of 1854-55.

During the last week of January 1856, the total strength in the field, including every department of the army, was 53,701 men, and the deaths 18, or in the ratio of 17 per 1,000 per annum. During the corresponding week of January 1855, the strength in the field was 29,695, and the deaths 338, or in the ratio of 587 per 1,000 per annum.

After completing our inquiry, we addressed a communication to Sir William Codrington, on the 30th January, expressing our gratification at the improving health of the army, and with the amount of attention which had evidently been bestowed on the preservation of its physical efficiency. We, at the same time, called attention to some points which, although of less importance during the cold weather, might, if overlooked, occasion sickness, especially from zymotic diseases on the approach of spring.

1. The camp of the 82nd Regiment, which occupied part of the former site of the Guards' camp, above Balaklava harbour, had been far from healthy before the setting in of the cold weather; and although it had improved during the winter, there was still danger of an increase of disease on the arrival of warmer weather. The surface drainage of this camp was very defective; some of the huts had been banked up with earth, and the ventilation of all of them was deficient. We advised that the defective drainage should be remedied.

2. We especially recommended that the defective ventilation in the barrack huts throughout the camp, already adverted to, should be amended.

3. In some instances we found huts considerably overcrowded, and advised that this should be avoided as far as circumstances would admit.

4. We advised that the earth should be removed from the walls of huts and a trench substituted, as formerly recommended by the Commission.

5. That the manure heaps which had accumulated during the winter, be burned as soon as practicable.

6. That the latrines should be deodorized.

7. That attention should be given to the slaughtering-places.

8. That steps should be taken to insure the more speedy interment of carcases of animals, of which a considerable number were lying about the allied occupation, although hardly any were within the precincts of the British camp.

These recommendations were prospective and precautionary and were carried out for the most part as the season advanced. The necessity for ventilation appeared to be much more recognized in some regiments than in others, for the opening of the ventilators was done in a number of instances shortly after the recommendation had been made, while in other cases it was delayed till the beginning of the warm weather.

In a few of the old huts first erected, no means of ventilation were ever adopted up to the time they were finally evacuated by the troops.

Before this report was sent to head-quarters, the Commis-

sioners had made a detailed examination of Balaklava, in consequence of complaints having reached them as to the neglect of cleansing measures in some parts of the town. On the 25th January, they called the attention of the Commandant to the subject, and steps were at once taken by him to remedy the evil complained of.

During the winter, the sanitary state of the town and harbour had undergone a progressive improvement. The formation and drainage of the roads passing through the town were improved. Substantial quays were constructed along the whole east side of the harbour. The mass of decaying animal and vegetable matter, of which the eastern margin had been originally formed, became decomposed, subsided, and was effectually covered over. A wharf for shipping the sick close to the sick-transports, as had formerly been advised by the Commissioners, had been completed. The horrible effluvia with which the whole atmosphere was polluted, day and night, the year before, had disappeared. The space at the head of the harbour, occupied by one of the graveyards, and by part of the marsh, was needed for the purposes of the Commissariat, and it was accordingly drained and covered over with ballast, and this great nuisance was effectually abated.

The harbour itself was in a most satisfactory condition. Rear-Admiral Freemantle had thinned it of shipping as much as possible; and the harbour-police was vigilantly exercised.

The health of the town and shipping kept pace with the sanitary improvements. There are no accurate statistics on this point. So far as can be judged by the admissions into the General Hospital, Balaklava, these show a falling off from a daily average of 236 sick in hospital in January 1855, to a daily average of 177 in January 1856; but other circumstances may have concurred in producing this result. The comparative absence of sickness in the town, was a subject of general remark.

§ IV. Sanitary Condition of the Troops at Kertch.

Dr. Milroy sailed for Kertch on the 30th January, with the view of ascertaining the state of health and the sanitary arrangements in the Turkish Contingent, and of comparing its condition in these respects with that of the army before Sebastopol.

The strength of the force at this time was between 17,000 and 18,000 men, including 1,600 Europeans. Ten regiments were stationed in and around Kertch, four at Yenikale, and two at Fort Paul.

The Turkish soldiers were generally of a large muscular frame, and covered a great deal of ground when drawn up in line. Their usual age was from twenty to twenty-five or twenty-eight years. That they were capable of very laborious and continued exertion was evident from the great amount of work done since their arrival towards the end of October, in constructing extensive lines of fortified entrenchments, road-making, building of huts, &c., besides their ordinary field-duties. Although a good many of them had passed through the compaign of the Danube, in 1854-55, and were affected with various chronic ailments, or were slightly tainted with scurvy, not a single man had been invalided, but the death-rate had at first been high in consequence.

During the quarter ending December 31st, the weekly admissions into hospital did not exceed 0·7 per cent. of the strength, and the entire sickness-rate was somewhat under two per cent. The deaths had been about 1 in 11 or 12 of the admissions, and at the rate of about 28 or 29 per 1,000 of the force per annum.

Half the admissions into hospital were from different forms of malarial fever, and from diarrhœa and dysentery, and more than two-thirds of the mortality were from these diseases. No case of cholera had occurred during the quarter. Chest affections were next in frequency to zymotic diseases. With the increased severity of the weather in January and February, there had been an increase of sickness, about 2·1 per cent. of the force being affected during the first five weeks of the year. Scurvy manifested itself in the second week of February, and the sick rate rose to

nearly 5 per cent. but without any increase of mortality. A considerable proportion of the men on duty in some regiments were found to be affected. The regiments at Yenikale had suffered the most; and the last regiment that was hutted suffered more than the others. There was no trace of the disease in the 71st Highland Regiment, which was stationed in Yenikale, nor in the two regiments of the Contingent at Fort Paul.

At Kertch, the troops which were hutted in the most exposed situations had most of the disease.

Greater exposure, and more irregular supplies of fresh meat and vegetables, were the apparent determining causes of the scurvy among the troops affected.

A prompt supply of fresh vegetables and lime-juice, oranges, &c., which had been issued, and the removal of the troops from their damp quarters speedily restored the health and efficiency of the Contingent.*

No spirituous liquors were issued to the Turkish soldiers, and it was the universal opinion of the officers of the Contingent, both commanding and medical, that the temperate habits of the Turks in their general diet, had much to do with the low sickness-rate of the force. From the experience of several medical officers in Omar Pascha's army, it appears that wounds heal kindly, and by the first intention, as is known to be the case with races not damaged by intemperance.

The huts which the Turkish soldiers had built for themselves were substantial, and afforded secure shelter during the winter. They were generally more or less buried in the ground, or they had the earth banked up nearly to the eaves. At Kertch, from the quantity of building materials at hand, the walls were of stone, when the earth did not suffice to form the sides. In some, the floors were boarded.

* The usual daily rations in the Turkish army are as follow :—Bread or biscuit, 300 drachmas=33 oz.; meat, 92 drachmas=13 oz. On two days a week no meat is issued. Rice 25 drachmas=$2\frac{3}{4}$ oz. (this is used in soup; but on the two days when no meat is issued, 92 drachmas of rice are substituted. It is then cooked as a pillau); butter, $1\frac{3}{4}$ oz.; salt $\frac{1}{2}$ oz. Vegetables, as onions, haricot beans, peas in variable quantities. The ordinary rations of the Turkish Contingent were nearly as above.

There was usually a small opening in the upper part of the gable walls, and occasionally also in the roof, but in almost every instance these openings were closed. The air inside was further vitiated by the *mangals*, or open braziers, used by the Turks to heat their chambers. In most instances the cooking-place was detached in the rear of the hut; in others, it was under the same roof. The latrine was beyond the cooking-place.

The chief defect in all the quarters was defective ventilation, especially at night. In the town of Kertch as many as fifteen men sometimes occupied a chamber not above ten or twelve feet square, without any opening except the door. The Turkish stables were properly ventilated.

The yards and stable accommodation of the Land Transport Corps were in excellent condition.

A letter was addressed to General Vivian on the points connected with the health of the troops under his command, and the following precautionary measures were recommended for adoption on the approach of milder weather:—

The insulation of the huts from the surrounding earth, so as to leave a clear space round the walls, and the removal of the earth embankments against their sides; more efficient ventilation of all huts, &c.; the frequent exposure of clothes, mats, &c., to the air; lime-washing the interior of huts; trenching the ground, to carry off surface-water; burning all litter and refuse about the camp: the use of *mangals* was discouraged.

Measures for cleansing the backyards of houses, and the margin of the shore at Kertch, had already been commenced under the direction of Dr. M'Pherson, Inspector-General of Hospitals, and of Major Crease, R.E.

The hospitals were spacious, airy, and clean, the beds and bedding all that could be desired, and the patients were well cared for. General Vivian remarked that the good feeling on the part of the Turkish soldiers to their commanding officers was, in the first instance, due in no small degree to the devoted exertions of the Medical Staff, animated by the example of their chief, during a severe outbreak of cholera in May and June 1855, in the camp above Buyukdere.

The 71st Regiment, which had been stationed at Kertch and Yenikale since May 1855, had continued in comparatively good health, the average rate of sickness not exceeding between three and four per cent. of the strength. Of fourteen deaths between June of that year and the end of January 1856, four were from cholera, three from fever, two from dysentery, three from phthisis, one from hæmoptysis, and one from delirium tremens.

The very favourable condition of health of the Turkish Contingent, notwithstanding some obvious sanitary defects in their camps, speaks volumes as to the preservative influence of temperance, and the disuse of intoxicating liquors, and the lesson should not be forgotten. The comparative absence of crime among Turkish troops also deserves notice.

During Dr. Milroy's absence at Kertch, Dr. Sutherland instituted special inquiries with reference to the sickness which had been prevailing in the Land Transport and Army Works Corps; and after Dr. Milroy's return on the 18th February, the state of the camps of both corps was brought under the notice of Sir William Codrington, in order that the measures required for improving their sanitary condition might be carried out.

We shall next proceed to state the circumstances which, from first to last, appeared to the Commission to have led to the great amount of sickness which had existed in these corps, and the sanitary precautions they recommended.

§ V. The Land Transport Corps.

The sanitary condition of the Land Transport Corps attracted the serious attention of the Commissioners from the time they arrived in the Crimea. Their own huts were situated close to the Land Transport camp, at the head of Balaklava harbour, and they had daily opportunities of observing how the men employed in the service, who at that time were chiefly natives, suffered from the bad sanitary state of the whole district.

In the course of the summer, a large number of men, who had been embodied in England for this special service, arrived in the Crimea. Some were sent to Kertch and

Sinope, and the remainder were attached to the army before Sebastopol. The men unfortunately arrived at a period when cholera was prevalent, and, like all new comers, were more susceptible to its action than those who were already acclimatized. They had, moreover, very fatiguing duties to perform during the hot season, and they suffered to a very considerable extent from the diseases then prevailing. Cholera was most fatal among these men in the months of May, June, July, and August 1855. The average strength of the British portion of the corps, *to which this report exclusively refers,* during these four months, was 1,320 men. The total mortality among them was 151, or at the rate of above 34 per cent. of the corps per annum. Of this mortality ninety-eight deaths are known to have arisen from cholera in the camp before Sebastopol.

Cholera declined after this period, and disappeared in December, but by that time fever, which had existed among the corps from the period of its arrival, began to advance. During the five months from November 1855, to March 1856, inclusive, the approximate average strength of the corps was 5,480; and the deaths from fever, chiefly a seven and ten-day fever, with cold stage and head symptoms supervening, amounted to 127 out of a total mortality of 273.

The approximate strength of the corps for eleven months from May 1855 to March 1856, inclusive, was 3,400 men, and the total mortality was 477, or at the rate of 15 per cent. per annum. Of 358 deaths occurring in the Crimea, and the causes of which are known, 319, or 89 per cent., took place from fever, cholera, diarrhœa, and dysentery, affording another proof of the destructive agency of zymotic diseases, and the intimate relation this class of diseases holds to the physical efficiency or inefficiency of an army.

During the winter and spring, the Land Transport Corps suffered from sickness in a considerably greater ratio than the army generally. Until late in the spring of 1856, the sanitary condition of the camps of the corps was by no means so good as that of the army. The corps was some time in becoming organized, and had great difficulties to overcome, and the sanitary condition of the camps, though

defective, would by no means account for the whole mortality. It was obvious that other causes were in operation in producing the highly developed susceptibility to diseased action that prevailed.

Many of the cases in hospital presented general characteristics, similar to those observed among the sick at Scutari, who had suffered during the winter of 1854–55, and indicated the operation of some common cause or causes in both.

It may be here stated, as a reason for believing that there was something peculiar in the high rate of sickness and mortality prevalent in the Land Transport Corps, that in the middle of February 1856, it was found that, out of a strength of 6,132 men, there were 380 sick in hospital, of which 183 were fever cases. At the same date there were 1,432 soldiers attached to the corps, who had thirty-eight sick in hospital, ten of which were fever cases. The sick of the Land Transport Corps was thus about two and a-half times the proportion of sick among the soldiers, and the proportion of fevers in the corps to its strength was above four times what it was among the soldiers.

The chief causes of the excess of sickness and mortality were beyond the powers of the Commission to deal with, for they were connected with the structure and duties of the corps. So far, however, as the sanitary condition of the camps was concerned, we gave such instructions as appeared necessary for the removal of defects which came under our notice. At first the same instructions issued in regard to the encampments of the army were sufficient to include the requirements for the Land Transport Corps. But towards the end of 1855, when the strength of the corps was greatly increased, its organization more advanced, and the sanitary condition of its camps by no means so good as that of the army, the Commission deemed it necessary to issue separate instructions for the camps of the corps.

With this view we made several inspections of the camps and hospitals of the different battalions. We examined the men in the camps, and the sick in the hospitals. We compared their physical condition and state of health with that of the soldiers attached to the battalions, and made a minute examination of the huts,

tents, and stables, and also of the whole ground occupied by the camps.

The first thing that struck us was the difference in physical constitution between the men in the corps and the men in the army. Many of the former were puny, ill nourished, and badly developed. Altogether they were an inferior race, a large proportion of whom would not have been accepted as recruits; many bore the marks of intemperance and bad habits, and the previous occupations of most of those we examined had not been such as to fit them for the severe duties and exposure incident to the service.

For example, we saw one instance of a boy sixteen years of age, who had been two months in the Crimea, one of which had been passed in the hospital, and he was then about to be sent to Scutari.

Another, aged twenty, had passed half his time in hospital, and was sent to Scutari.

A third, aged twenty-one, had been in the Crimea three months, and had been twice in hospital from fever, four weeks the first time, and three weeks the second time. It was stated to us that about a fourth part of the men who arrived were affected with syphilis.

During the time of their imperfect organization the men were exposed to privations. Sometimes they went without breakfast; at other times their meals were very irregular, or the men went without them, contenting themselves with whatever they could pick up. Though there did not appear to be much drunkenness, there was drinking, and that worst kind of it, which consists of relieving exhaustion by stimulants instead of by food. The men were up early and late; they were exposed to fatigue in all states of the weather. They got wet without the means of changing their clothes. There were often no proper arrangements for cooking, and the food was badly prepared. The means of personal cleanliness were defective. The work was often excessive; and the men had no Sunday rest.

These causes, during the time they existed, were quite sufficient to account for much of the predisposition to camp diseases which prevailed.

They were gradually remedied by the better organization

of the corps, and by an improved sanitary state of the camps, and as these improvements were effected, and the weather became better, the health of the corps advanced, camp diseases declined, and towards the latter part of the occupation the Land Transport Corps approximated more closely in health to the army itself.

During the winter of 1855-56 much was done to improve the sanitary condition of the camps, and towards the middle of February the Commission, in the prospect of spring arriving, brought the condition of the camps under the notice of Sir William Codrington, in order that the necessary improvements might be expedited. At that time the camps of the different battalions of the corps were scattered over the occupation from Kamara to the right of the army in the camp before Sebastopol.

There were two or three battalions in the valley of Karani, on the sites of the camps occupied formerly by the Cavalry, before their removal to Scutari, and several on the sloping ground, intersected by the railway below the Col. There was also one at the head of the Col.

The worst, as to sites, were the camps in the valley of Karani, and these camps showed a large proportion of sickness from epidemic disease. The ground of nearly all the camps was more wet and muddy than it ought to have been, and the surface drainage was defective, notwithstanding the excellent fall of the ground. Many of the barrack and hospital huts had been erected without proper preparation and trenching of the ground. There were lines of huts erected across the natural line of drainage, with the earth heaped high against the walls. In one such line the drain for removing the roof water, and the surface drainage of the sloping ground above the line of huts, was formed in the heaped-up earth, close to the wall of the hut, and fifteen or eighteen inches above the level of the floor. The consequence of this arrangement was, that the water filtered down under the boarding of the huts, and made the earth damp. On having some of the boards removed, the ground underneath was found covered with fungus. These huts had furnished many cases of disease to hospital.

The majority of the barrack huts were without any efficient means of ventilation, and, under the circumstances, the huts were overcrowded.

The camps and stables of the different battalions were, with one or two exceptions, by no means as clean as they ought to have been.

There were large manure heaps too close to the huts and tents, and it was a usual practice to form the manure into walls for stables and stable yards.

In one camp the burial of dead animals was imperfectly done.

All the camps were not in the same condition. All were improving, but some had advanced more than others.

The Commission deemed it requisite to advise the adoption of the following sanitary improvements in a communication respecting the camps of the Land Transport Corps, addressed to General Sir William Codrington on the 26th February, 1856:—

1. That the most scrupulous cleanliness should be observed in all camps and stables, the ground swept and kept clean whenever the weather permitted, and all the refuse removed, and forthwith burned. Also the removal and burning of all manure used for walling as soon as it ceased to be required for protection.

2. That wherever a camp occupied ground naturally wet, the surface should be trenched for the removal of surface water.

3. The removal of the earth from the walls of all huts, and the draining of the site of each hut to the depth of at least twelve inches below the level of the floor.

4. The taking up of the boarding of the huts, and in all cases where the surface of the ground beneath was found damp or mouldy, the upper layer of earth to be removed, and the surface covered with quicklime before relaying the boarding.

5. To wash the interior of the huts with quicklime wash.

6. The huts to be ventilated by ridge and end ventilators, similar to those in the new panel huts in the camp.

7. The burying of all dead animals three feet below the surface of the ground, with some peat charcoal thrown over each carcase before the earth was filled in.

8. The deodorizing of all latrines with peat charcoal, and opening fresh ones where requisite.

During the early part of the winter the battalion hospitals of the Land Transport Corps, consisted of marquees, with damp unboarded floors, and small huts ill adapted for the treatment of the sick. At the time these hospitals were first examined by the Commissioners, they found the huts in a defective state as regards draining and ventilation. There were, however, two large hospitals, called the Right and Left Wing Hospitals, situated on the ridge dividing the valley of Karani from that of Balaklava, which, at the date of our communication to Sir William Codrington, were in excellent condition. The ground had been carefully prepared and catchwater drained. The huts completely isolated from the surrounding ground, and drained below the level of the foundations. The new panel huts recently sent out from England, were used as wards, and their means of ventilation rendered fully available. They were also lime-washed inside. The wards were light, clean, and well-aired. They exhibited, n successful operation, the improved sanitary arrangements for hospital huts, recommended by the Commission in the month of May 1855.

We had every reason to be satisfied with these hospitals, the excellent sanitary condition of which was due to the careful superintendence of Dr. Taylor, principal medical officer of the corps, and we advised their being copied in the other hospitals of the Land Transport Corps. The hospitals of the 3rd division were also good.

Subsequent to the date of these recommendations, a considerable improvement in the camps and huts of the corps progressively took place. Dr. Sutherland, who, after Dr. Milroy's departure for England, went over all of them frequently to watch the sanitary condition of the camps, and to suggest such improvements as appeared requisite, communicated with Dr. Taylor, on the 23rd April, on their then state. By that time, a most marked improvement had taken place in all the camps. The isolation, drainage, and ventilation of the huts, the cleansing of the surface of the camps, the removal and burning of manure heaps, and the internal lime-washing, had all progressed; and the boarding, in many huts, had been

taken up to remove the damp earth. The burial of dead animals had also been more carefully attended to. Some camps and huts were not so far advanced as others, and as the warm weather was approaching, it was necessary to recommend that the works should be more rapidly executed. The ground where dead animals had been buried, was found to exhale offensive effluvia, to correct which, it was advised that manure heaps should be placed over the spot and burned, which produced charcoal sufficient to absorb the offensive emanations.

The instructions were promptly complied with, and during the latter part of the occupation of the Crimea, there was very little to complain of in the sanitary state of the Land Transport Camps. When it is considered that a large extent of the area of these camps was occupied by stables and picketting-grounds, and that large troops of animals were kept close to the tents and huts of the men, it was creditable to the officers that the camps arrived at so good a sanitary condition, and that the health of the men improved in so marked a degree.

During the six weeks preceding the 31st May, 1856, the mortality among an average strength of 3,866 men, forming the unattached part of the corps, was nine, or at the rate of 2 per cent. per annum; and among an average strength of 2,693 men, attached to the divisions of the army, there were four deaths, or at the rate of about 1·3 per cent. per annum.

The sick in hospital at this period were men of greater vigour, and the general appearance of the corps evinced improved stamina. There is no reason to doubt, that in a short time the corps would have become as healthy as the army itself.

The following facts deserve notice, as illustrative of the circumstances under which disease sometimes originates in camps.

In the beginning of April, seven men of the M division of the Land Transport Corps, who had been at Kazatch on duty, were seized with maculated fever, and two of them died. Both Kazatch and Kamiesch were in a bad sanitary state at the time, and the wind wafted over them carried a sickly odour for a considerable distance to leeward. It was

stated that maculated fever was prevalent there. The men who were attacked, were intemperate, and used to drink a very bad coarse brandy largely sold at Kamiesch. The floor of the hut in which they slept while in quarters in their division, was below the level of the ground, and the earth was heaped up against its sides. The floor was damp and soft, for want of drainage. These seven men were the only men in their hut, or division, attacked with maculated fever.

§ VI. Army Works Corps.

The Army Works Corps began to arrive at Balaklava early in August 1855, and on the 19th of the month it was encamped partly above the head of Balaklava harbour, and partly near the stationary engine on the railway, on some ground sloping down towards the road descending into the valley of Karani. The corps, on its arrival, consisted of strong healthy men, apparently well selected for the works they had to execute. They received a high rate of pay, and for reasons on which we cannot enter, there was some laxity of discipline among them, and as a consequence, there was a great amount of intemperance.

Immediately on its arrival, the corps was engaged in trenching the line of railway from the head of Balaklava harbour upwards to Kadikoi. The weather, at the time, was very hot; the sun's rays, intensely powerful. The epidemic influence of cholera was prevalent; and the work in which the men were engaged consisted in turning over and exposing the soil along a marshy, unwholesome district. Under these circumstances, it is not at all surprising that the corps should have suffered from cholera, as well as from other zymotic maladies.

The greater proportion of the sickness in the corps took place shortly after its arrival in the Crimea.

The total strength was 2,708 men. Up to the middle of February of the present year (1856), a period of six months from their arrival, there had been 966 cases of sickness and 92 deaths among them. There were many more cases of sickness at first than were entered on the list, for at that period no accurate records were kept, and there was no

hospital for the sick of the corps. Subsequently, towards the end of 1855, a very good hospital was erected close to the camp, near the stationary engine.

The total cases of sickness registered give a sick rate of 71 per cent. of the corps per annum, and the deaths were at the rate of 6·8 per cent. per annum. About 50 per cent. of the sickness, and 75 per cent. of the deaths, took place from zymotic diseases. There were 70 cases and 52 deaths from cholera, 142 cases and five deaths from diarrhœa, 217 cases and three deaths from dysentery, and 61 cases and nine deaths from fever.

The corps afterwards consisted of three divisions, the first of which remained in the camp, at the stationary engine. It was 1,325 strong.

The 2nd division, 985 strong, occupied a camp on the plateau, close to the line of railway, of which it took possession on the 16th November, 1855.

The 3rd division, consisting of 398 men, was encamped on the old marsh at the head of Balaklava harbour, on the 1st January, 1856.

The site occupied by the camp of the 2nd division was a very good one; that occupied by the camp of the 1st division was by no means a bad one; but the camp of the 3rd division was placed on the worst piece of ground in the whole British occupation.

The great bulk of the sickness and mortality fell to the lot of the 1st division, which was attacked with cholera, diarrhœa, and dysentery, immediately on landing.

Up to the date already mentioned, when the returns were obtained, the annual rate of sickness of this division was 850 men per 1,000, and its mortality at the rate of 128 deaths per 1,000 men per annum.

The sickness of the 2nd division, from November 16 to February 15, was at the rate of 530 cases per 1,000 per annum, and the deaths were at the rate of 24 per 1,000 per annum.

During the month and a-half the 3rd division had occupied their camp, the amount of sickness during the period of lowest temperature of the year, was such that even at that rate, the whole division would have passed through

the hands of the medical officer four and a-half times in the course of the year. The cases of continued fever and diarrhœa were so numerous, in proportion to the force, that by themselves these two diseases would have been the means of bringing the whole division nearly one and a-half times under medical treatment in the course of the year.

The causes of most of the sickness and mortality of the corps were those already mentioned.

The excess of sickness in the 3rd division, over the amount in the other divisions, was, beyond all doubt, mainly occasioned by the bad camping-ground that had been selected.

Great pains, it is true, had been taken to improve it by deep trenching and draining, but the site itself was irremediably bad, and ought never to have been occupied.

The winter camps of the Army Works Corps were formed of rows or lanes of huts, shaped like prisms, with triangular flat ends.

The floor or lower side of the prism was 36 feet long and 20 feet broad, and the vertical height of the ridge was 12 feet. Each hut was intended to accommodate 27 men, and would afford 160 cubic feet of space per man. Each hut had a door at either end, and the triangular pieces over the doors were so hinged as to fall outwards from the top for ventilation.

The plan was not a good one, because it admitted the drifting in of rain or snow, and threw the stream of cold air on the men nearest the openings. The practical result was that the triangular piece was kept shut, and the ventilation dispensed with. The defect was partially remedied by having a triangular flap, nearer the ridge, hinged to open inwards instead of outwards, but the Commissioners were of opinion that a more permanent mode of ventilation was required.

The space allowed for each bed was two feet wide, but from the form of the hut, the men's heads were directly under the sloping roof at night.

Some huts had boarded floors; others had only the damp clay surface of the ground. Complaints used to be made of the closeness and unwholesomeness of the air inside, and of illness arising from it.

On the 1st March, after having completed the examination of the camps of the Army Works Corps, the Commission deemed it to be necessary to represent their condition to his Excellency the Commander of the Forces, and to request permission to communicate with the Acting Superintendent of the corps with the view of having the camps put in a better sanitary state before the spring arrived. On receiving the requisite authority, the Commission addressed a communication to the Superintendent pointing out the great excess of sickness and mortality which had taken place in the corps, and drawing attention to the remedies required for the future prevention of disease. We pointed out:—

That some of the camp and hut drains had no sufficient fall to empty themselves of their contents, and were, moreover, made depositories for foul water directly opposite the hut doors.

That the floors in some huts were damp and muddy, and that they should either be boarded or paved with stones, or that sand and quicklime should be thrown over the floors and the whole rammed hard.

That the ridge boards of the huts should be raised three inches all the way along, to ensure adequate ventilation, and made to overlap sufficiently to keep out rain or snow; or that three of the usual zinc ventilators should be put into each hut.

That from the form of the huts, it would be necessary to reduce the number of men in them, when the weather became warm; and that, in the case of the 3rd division, it would be necessary to reduce the inmates of each hut by one-third during the month of March.

That the medical officer attached to each division of the corps should be directed to attend to the sanitary condition of his camp, and that, amongst other obvious duties, he should be directed to see:—

That the bedding and clothing of the men be frequently exposed to the sun and air.

That the surface of the camp be kept scrupulously clean, and all refuse buried or burned.

That the camp trenches and drains be kept clear.

That the ventilation of the huts be properly attended to, and that the huts be cleansed and lime-washed.

That the latrines be deodorized.

The Commissioners further advised that the use of spirituous liquors by the men be discouraged, and that malt liquor be substituted for the ordinary ration of rum, and lastly, that, notwithstanding these precautions, it might become necessary to abandon the camp of the 3rd division of the corps altogether.

After this period, the health of the corps improved, but the number of sick and of admissions from disease continued in larger proportion from the 3rd division up to the end of April 1856, when the departure of the corps from the Crimea rendered any further interference on the part of the Commission unnecessary.

When the reports on the Land Transport and Army Works Corps camps were sent to head-quarters, Dr. Milroy left Balaklava on his return to England, on the 8th March. On his way home he inspected the hospitals and camps at Scutari and Kulali, and also the Cavalry camp of the Turkish Contingent on the Sea of Marmora, and the hospitals of that force at Buyukdere, and on the Golden Horn.

The Cavalry Division had been encamped at Scutari since November 1855, and occupied huts erected by Major Gordon, R.E. These huts were extremely good in a sanitary point of view. The sites had been prepared and trenched, the flooring well raised from the ground, so as to have ventilation beneath. The roof ventilation was ample. They were all clean, and had a trim, bright appearance. A large box latrine, with flushing apparatus, erected at Haidar Pascha by Mr. Unsworth, Surveyor to the Commission, had acted well, and others were about being erected, to replace the offensive latrines in use. There was no serious sickness, but during the week ending March 31st, about 7 per cent. of the Cavalry force was on the sick list. Bowel complaints were prevalent. There was a high rate of sickness, also, among the Polish Legion. The worst evil in the camp was the large accumulation of stable dung and other refuse, which occasioned nuisance and atmospheric impurity, and for the destruction of which two furnaces were erected by Mr. Unsworth by Dr. Milroy's advice, as already mentioned.

§ VII. Sanitary State of the Occupation in the Spring of 1856.

Early in spring, the condition of the slaughtering-places attracted the attention of the Commission, and it was stated that the Commissariat Department experienced considerable difficulty in preventing offensive effluvia from them. A communication was therefore addressed to Commissary-General Drake, advising that the offal should be buried at least three feet below the surface, and peat charcoal thrown over it before the earth was filled in.

This plan was found, by experience, to be perfectly sufficient to do away with the nuisance.

As the spring advanced, a strict oversight was kept up on the sanitary condition of Balaklava, and on the state of the public health, in case there should have been appearance of epidemic disease, similar to that which prevailed a year before. The excellent sanitary state in which the town was kept, met its due reward, in the absence of any unusual amount of sickness either on shore or afloat.

Towards the end of April, it was ascertained that a few cases of typhus fever had appeared in the Suttlers' Bazaar at Kadikoi, and Mr. Arnold Taylor was directed at once to make an inspection of the whole place.

He reported that the traders had a committee of themselves for keeping the bazaar clean, and that no less than £200 a month was raised by subscription for the purpose. The committee found their own labourers, twenty in number; and it was at one time the custom for a sergeant to superintend the cleansing. He had been withdrawn at the time, and the cleansing had been neglected. There was a great deal of filth and refuse among the huts, and in the back-yards; many of the huts were dirty and overcrowded. There was a deficiency of latrines, and much filth lay about the hill-sides. The streets of the bazaar were in a very bad condition, and had foul water lying on the surface.

A communication on the subject was addressed to the Commandant, who at once dispatched one of his inspectors to Kadikoi, and the following measures were recommended for improving the place:—

A thorough cleansing of the surface, especial attention being paid to the cleansing out of existing open channels, and for drainage by cutting new ones.

The inspection of all yards attached to stores, and of all cellars underneath huts, so that any offensive refuse found in them might be removed and burned.

The systematic and daily removal of all refuse from huts, from the fishmarket, and from open booths.

The lime-washing of any dirty and unwholesome huts.

The erection of latrines, and the covering over of all filth that could not be removed.

Immediate orders were given by Lieutenant-Colonel Harding for putting the place in as good a state as possible, and no further complaint was made about it, and there was no more fever.

During the spring and early part of the summer, up to the period of the final evacuation, the town of Balaklava itself continued in an excellent sanitary condition. It was free from nuisances; the streets and back premises were well kept; the universal application of limewash to the houses and sheds gave the place a clean and cheerful aspect. The wooden quays and landing-sheds had effectually covered and protected the shore from filth, the atmosphere was free from unwholesome smells, and there was no disease worth mentioning.

The troops, during the time of their embarkation, were thus effectually protected from malaria such as existed during the preceding year, and which, if present, might have laid the foundation of attacks of disease on board ship during the home voyage.

The camp was inspected almost daily by Dr. Sutherland; but with the exception of an occasional suggestion for the more effectual burning of the manure, or for the cleansing of the surface vacated by the troops, nothing was required. A constant watch was also kept over the health of the troops, in case any epidemic disease should appear among them. With the exception of two mild cases of cholera, and a little diarrhœa, the health of the troops continued good to the end. It gradually improved during the spring months preceding the evacuation.

During February, the weekly admissions averaged 2 per cent. of the force, and the weekly deaths were 0·025 per cent., equal to 13 per 1,000 of the force per annum. The sick averaged about 64 men per 1,000. The weekly admissions from zymotic diseases averaged 20 per cent. of the total admissions, and the zymotic deaths were 41 per cent. of the total deaths. The proportion of deaths from chest affections was about the same as that from zymotic diseases.

The sick during March averaged two admissions per cent. weekly, and the weekly deaths averaged 0·021 per cent., or less than 11 per 1,000 per annum.

The admissions from zymotic diseases averaged only 17·8 per cent. of the total admissions, and the deaths from the same class of maladies averaged 25 per cent. of the total deaths. The chief mortality of the month arose from chest affections, which also formed the bulk of admissions into hospital. The total average sick were 60 per 1,000.

In April there was a still further improvement in the health of the troops. The weekly admissions fell to 1·7 per cent. of the force, and the weekly deaths averaged ·021 per cent., or about 11 per 1,000 of the force per annum. The total sick averaged 55 per 1,000 men during the month. Admissions from zymotic diseases averaged 20 per cent. of the total admissions, and 38·3 per cent. of the total deaths were due to these diseases.

In May the army arrived at its most healthy state. The weekly admissions into hospital averaged a little more than 1·6 per cent. of the force, and the weekly deaths 0·017 per cent., or a little more than 8 per 1,000 of the force per annum.* The sick in hospital during the month averaged 51 per 1,000 of the force. The weekly zymotic admissions averaged a fifth of the total admissions, and the zymotic deaths averaged 37 per cent. of the total deaths.

* This death rate is about the same as exists in the healthier districts of England for males of the army ages, and might be further reduced by sanitary improvements.

But assuming the present unimproved country rate as an attainable standard for the whole of England, we are at once struck with the very unhealthy condition of the army in home stations. It appears from the Army Statistical Report, 1853, that the mortality among infantry of the line in the United Kingdom is 16·8 per 1,000 per annum from disease alone,

During the winter and spring months, from the beginning of November 1855 to the end of May 1856, there was hardly any scorbutus in the army. The total cases admitted into hospital during that period was only 122, of which one proved fatal. A scorbutic tendency was also present in one of the regiments, but the disease never assumed an appearance to excite more than ordinary attention. The cases appeared to have been exceptional. The scorbutic habit, which existed in the army during the winter of 1854-55, never returned, and the scorbutic forms of disease, which were present when the Commission first went to the East, gradually diminished, and finally all but disappeared.

This, unfortunately, was not the case with diseases connected with or aggravated by the use of intoxicating liquors. During the winter and spring there were at least 38 or 40 deaths occasioned immediately and directly by intoxication, the men having never recovered from the first shock of the alcoholic poison. Many other deaths followed in a few days on specific acts of drunkenness from rapidly-fatal diseases occasioned by them, and much sickness not ending in death must be referred to the same evil. Bad and unwholesome liquors had something to do with the result, but excess had more. There can be no doubt that the use of alcoholic stimulants exercised a very sensible effect on the amount of disease and mortality in the army.

On comparing the health of the army for the period preceding the evacuation of the Crimea, with what it was twelve months before, we find that during five weeks ending May 5, 1855, the sick, exclusive of wounded, averaged 10 per cent. of the force. During the corresponding five weeks of 1856, the sick, including the remaining wounded, averaged just half that amount.

---

while in the Foot Guards it is 19·8 per 1,000. In the model dwellings of the Metropolis, the mortality for all periods, from infancy to old age, has ranged between 12·6 and 13·9 per 1,000 per annum, a little more than half the mortality of the Metropolis for the same years. On comparing the mortality in these dwellings at all ages with the picked lives of the army, we have a most convincing proof of what may be done, and how much requires to be done for the sanitary improvement of the soldier.

The loss of efficiency from invaliding and sickness in the army also very much exceeds what is experienced by the working classes at the same ages.

During May 1855, the weekly admissions from disease averaged 39 in every 1,000 men, and the deaths from disease, exclusive of wounds, were in the proportion of 135 deaths per 1,000 men per annum. During May 1856, the weekly admissions from all causes averaged 16 per 1,000 men, and the deaths were a little more than eight per 1,000 men per annum. Excluding the mortality from cholera in May 1855 the deaths from other diseases would still be five times the number, proportionally, of the deaths in May 1856.

The percentage of zymotic diseases was also very much less than it was in 1855. Thus in May of that year, out of every 100 cases of sickness admitted into hospital, 64 (or, excluding cholera), 60 cases were of zymotic disease, and out of every 100 deaths from disease, 90 took place from zymotics, such as cholera, fever, diarrhœa, &c.

During May 1856, out of every 100 cases admitted into hospital, 25 were from zymotic disease, and out of every 100 deaths, 37 were from zymotic causes.

From the beginning of January 1856, till the 31st May, when the army began to leave the Crimea, a period of twenty, two weeks, the mortality in the army was at the rate of 125 deaths in 10,000 of the force per annum; while for ten weeks in 1855, immediately preceding the setting in of the hot weather, and when cholera had reached its acme, the deaths from disease alone were at the rate of 1,764 per 10,000 of the force per annum, or fourteen times the mortality of 1856 for the period mentioned.

During the same period of 1856, when the British troops in the Crimea were in a better sanitary condition and more healthy than they are in barracks at home, the French army before Sebastopol was decimated by typhus and other zymotic maladies chiefly connected with the defective sanitary state of most of their camps, and the overcrowded, unventilated, and unwholesome condition of tents, huts, hospitals, and transports. The Russian army, after its withdrawal from Sebastopol, was encamped in unhealthy positions, and suffered greatly from zymotic diseases, arising from the same class of local sanitary defects.

Part of the improvement in the health of the British

army was doubtless due to the subsidence and final disappearance of cholera. Sufficient fresh diet and clothing,* and the cessation of harassing duties, especially by night, likewise contributed much to this favourable result; but the

* The following list of the component parts of the soldier's daily ration, shewing their approximate value at the end of April, 1856, was furnished by Commissary-General Drake :—

		s.	d.
Meat.—1¼lbs. fresh	at 7½d. per lb. ..	0	9¼
Or 1lb. salt meat ..	10½d. „ ..	0	10½
Bread.—1½lbs. fresh	4d. „ ..	0	6
Or 1lb. biscuit ..	3½d. „ ..	0	3½
Groceries.—1 oz. coffee ..	10½d. „ ..	0	0¾
Or 1 oz. tea ..	1s. 6½d. „ ..	0	1¼
Or 1 oz. cocoa ..	4d. „ ..	0	0¼
Or 2 oz. sugar ..	28s. per cwt. ..	0	0⅜
Or 2 oz. rice ..	28s. „ ..	0	0½
½ gill rum	4s. 2d. per gall. ..	0	0¾
1 oz. lime juice	2s. 4d. „ ..	0	1¼
¼ oz. pepper, ½ oz. salt }	between 8 men or less	0	$0\frac{2}{100}$
½ tallow candle in summer	to 12 men, at 7½d. per lb. ..	0	0½
2 do. do. in winter	do. do. ..	0	1
Fuel.—4½lbs. wood at 7s. 6d. per chechic of 5116lbs.		0	0¾
Or 2¼lbs. coal at 60s. per ton	..	0	0¾
Or 1⅝lbs charcoal at 10s. per 100 okes=281lbs.	..	0	0¾

Extra Issues.—2 pints rum, 1lb. sugar } for every 25 men, to take with lime-juice.

Preserved vegetables (the ration being marked in squares) and fresh vegetables, the ration of which is 1½lbs. potatoes and ¼lb. onions, are also issued in one or other of these forms daily.

On the average the troops got salt meat three days a week, and fresh meat four days in the week, the issue of fresh bread or biscuit being in the same proportion.

The following list of extra clothing issued to the men was supplied by Major Ross, Acting Quartermaster-General, Balaklava :—

2 Jerseys.
2 pair woollen drawers.
2 do. do. socks.
2 do. do. mitts.
1 cholera belt.
1 fur cap.
1 Tweed lined fur coat.
1 comforter.

Besides which each regiment had a proportion of sheep-skin coats for sentries, &c.

main operative causes of the remarkably improved physical condition of the army must be sought in the improved sanitary state of the whole area occupied by Her Majesty's forces. Balaklava had ceased for months to be a focus of pestilence, dangerous to the health of men who entered it. The sanitary defects of drainage and ventilation, already indicated in camps, huts, &c., had been mostly removed, and great care was bestowed on the personal hygiène of the army. The extensive drainage works executed along all the roads, railways, and their branches, which intersected the occupation in every direction, and the network of smaller drains covering the entire area of the camp, had afforded the requisite means of egress for the surface and subsoil water, and had improved the condition of the atmosphere and dried the subsoil.

It was the co-operation of these various elements which preserved the army in such a condition of health, as to enable it to leave the Crimea, after all the fatigue and exposure incident to a long siege, and to the lengthened occupation of a comparatively small area of ground, in a state of efficiency almost, if not altogether, unparalleled in the annals of modern warfare.

Notwithstanding so favourable a result, it is still a question whether the amount of zymotic disease in the army might not have been further diminished. A fourth part of all the cases admitted into hospital during the four weeks ending in May 31, 1856, at the period when the army was beginning to leave the Crimea, and when it was in its most healthy condition, were still cases of fever, diarrhœa, and dysentery, and out of 31 deaths during these same four weeks, 11 took place from fevers and 3 from diarrhœa.

Making every reasonable allowance for slight attacks of fever and other diseases of the class, brought on by topographical and climatic peculiarities, by night exposure, or by personal carelessness, we are still met by the fact that 45 per cent. of the deaths during these four weeks arose from a class of diseases which have been greatly mitigated, or almost banished from model lodging-houses, situated in densely peopled districts of the metropolis, by rigid attention to sanitary regulations.

We cannot admit that there is anything so peculiar in the circumstances in which the soldier is placed, even in the field, as to render it impossible, if not to prevent, at all events greatly to mitigate these diseases. The result of the sanitary precautions which were adopted, has proved incontestably how much may be done in an army to arrest their development, and diminish their fatality. And why might not more be done?

The great losses in war are occasioned not in battles or sieges, and not by local diseases affecting particular organs, but by zymotic diseases which are intimately connected with, if they do not entirely proceed from an altered state of the blood. Whatever tends to the production of this vitiated condition, whether it be defect of healthy material, arising from bad or deficient nutriment, suppression of the excretory functions from defective clothing, or direct poisoning by miasmata, especially such as arise from the bodies and breath of human beings, or from putrescent matter in camps, endangers the efficiency of an army.

We consider it in the highest degree probable that had the means of ventilation supplied by the huts been systematically made use of; the numbers of men somewhat diminished, so as to have afforded a larger cubic space per man; had it been practicable to have kept animals outside the camps, and thus to have prevented all collections of manure within their limits; had the water been so distributed as to have prevented its being fouled by chalk, clay, or even by more deleterious impurities; and had drinking of ardent spirits been greatly diminished, if not prevented, a still further diminution of the zymotic cases might have been obtained.

§ VIII. Sanitary State of the Camp at the period of the Evacuation.

It only remains further to describe the sanitary condition of the British occupation at the period when it was handed over to the Russian authorities.

After the conclusion of peace, the Russian Government dispatched a Commission to examine the country before the return of the inhabitants, and to adopt such precautionary measures for the protection of health as might be deemed necessary. Two of these gentlemen, M. Rosenberger, *Conseiller d'Etat actuel*, and Dr. Metzler, came to Balaklava early in May, and requested information on the subject from Dr. Sutherland, and also advice as to the best means of mitigating typhus in Russian towns where it had appeared. A map showing the position of the British burial-grounds, and also the spots where the ground was most saturated with organic matter, was prepared through the kind attention of Sir William Codrington. Dr. Sutherland went over the area with the Commissioners, and drew up a brief sketch of its sanitary state, with the precautionary measures required, of which the following is the substance. It was sent to head-quarters and forwarded, along with the map, to Simpheropol.

The British Burial-Grounds.— The burial-grounds belonging to the regimental and general hospitals of the British army are under strict regulations. Only one body is placed in a grave, and the corpse is in most instances interred without any coffin. No common graves are permitted. Each grave is dug from $4\frac{1}{2}$ to 5 feet deep. Occasionally powdered charcoal or quicklime are used to disinfect the surface of the grave. Ample space is invariably given for each interment. As regards the cemeteries of the British army, it is not necessary to adopt any additional sanitary precautions.

After engagements or skirmishes in the trenches it was the common practice to bury the dead in the trenches or near the batteries. After a slight skirmish, one grave was generally appropriated to each body. But when the losses were severe, as at Inkermann or at the Redan, the dead

were buried in trenches of some depth, sometimes as much as 8 or 10 feet, the trench being afterwards filled up to a level with or above that of the surrounding surface.

The general surface is so much altered of late that it is difficult now to recognize the battery trenches which have served as burial-places. It is believed, however, that they were of such a depth that no dangerous exhalations from them need be apprehended.

In the French cemeteries the dead from the hospitals have sometimes been buried in the common graves. The Sardinian burial-grounds are under similar regulations to those of the British.

Balaklava.—At present the sanitary condition of this village is excellent. A sanitary police, having charge of the health of the inhabitants, has been in existence for more than a year.

Besides, the public works which the war has rendered necessary, the quays, magazines, the railway, &c., have compelled the carrying out of various permanent sanitary operations, which have made a great change for the better since the beginning of 1855. Previous to the month of March 1855, the Eastern practice of throwing into the harbour refuse and the carcases of dead animals was generally followed. At this period also there was a tract of swampy ground at the head of the harbour, in which many human bodies and dead carcases had been buried. The putrid exhalations from this spot were very dangerous. Twelve months, however, have now elapsed since the whole surface was disinfected with powdered charcoal and quicklime, and then covered with sand. At the beginning of the present year the surface was again renewed, so that no exhalations now take place from it.

It may, therefore, be fairly said that, as far as sanitary regulations go, Balaklava is in a good state. But after its evacuation by the British army, it will be advisable carefully to examine the village and the neighbourhood, to gather together any offensive matter that may be lying on the surface, and to destroy the same by fire. There is a lime-kiln at the head of the harbour, where all organic matter could be easily burned.

The latrines ought to be disinfected with powdered charcoal, and then filled up with fresh earth.

It will not be prudent to use the water of the wells, either for drinking or cooking purposes. All the water from these sources is affected by the saturation of the surrounding ground with organic matter. There are, however, two sources, one flowing down the Castle ravine, and the other at the old fountain near the head of the harbour, both of which yield excellent water, particularly the latter.

At the north-west corner of the harbour there is a Turkish burial-ground, on which stable litter has been burned. This burial-ground might be covered over with some inches of earth. The burned litter has already produced charcoal enough to disinfect the spot.

Kadikoi.—Numerous carcases and much animal refuse have been buried between the harbour of Balaklava and the rising ground on which Kadikoi church stands.

There is an accumulation of this kind at the foot of the hills on the right hand in going from Balaklava to Kadikoi. There is another and still larger accumulation nearer Kadikoi church. Hundreds of dead animals, and the offal from a large slaughtering-place where thousands of cattle have been slaughtered for the British army, are buried at this spot, at a depth of five feet from the surface. Latterly powdered charcoal and quicklime have been used to disinfect it, but as the ground is marshy, time will be necessary for the decomposition of the animal remains.

The bazaar at Kadikoi is kept clean by the inhabitants under the superintendence of a provost-sergeant. But after the evacuation this ground should be left unoccupied, in order that by exposure to the sun and air it may become thoroughly purified.

On the other hand an immense extent of deep surface drains have been made in the same neighbourhood, and these will, without doubt, improve the health both of this part of Balaklava plain and also the lower portion of Karani valley.

In following the road by Karani valley, there is an angle where the road bends and passes between the hills to join the main road from Balaklava to Sebastopol. It is in this angle, and to the left hand side, where many cavalry horses

which died during the winter of 1854-55 are buried. Litter has been burned over the burial pits, and powdered charcoal and quicklime have been scattered over them, so that there is now nothing to fear.

The British Camp on the Plateau.—The sanitary regulations in force throughout the British camp are so strict, that after the evacuation the only precautions necessary will be, to burn any organic matter that may remain, and to leave the surface exposed to the air, the sun, and the rain. Nature herself will do all that is wanted.

Kamiesch and Kazatch.—Both these places being in the occupation of the French, their sanitary condition could not be interfered with, but it is believed to be far from good.

Sanitary Precautions against typhus fever.—1. In passing through the country an army ought not to crowd dwelling-houses either in towns or in rural districts. As much as possible the army should be camped in the open field.

2. The same observation holds good with regard to the sick of an army. They should be treated as much as possible outside of towns, under canvas or in field hospitals.

3. The following rules ought to be adopted in towns as precautionary measures:—

a. To cleanse and purify all streets, courts, stables, and cattle-sheds. Dunghills and all collections of organic matter should be removed and destroyed.

b. To cleanse and disinfect all latrines, drains, and open channels. Powdered charcoal will at once destroy the smell from latrines, but quicklime is better for drains and channels.

c. To whitewash all barracks, casernes, hospitals, houses, and living rooms, inside and out with quicklime. This precaution is specially necessary wherever typhus fever prevails.

d. In the latter case all overcrowding amongst the inhabitants should be prevented, and if necessary the infected houses should be cleared of their occupants, till they are cleansed and whitewashed.

e. Ample ventilation should be given to all barracks, casernes, hospitals, dwellings, rooms, shops, stables, and to all confined places, such as cellars and the like.

f. Exposure to air and sun of household goods, furniture, wearing apparel, &c.

g. The use of all alcoholic liquors should be discouraged.

Dr. Sutherland remained in the Crimea until the evacuation by the troops was so far advanced that there appeared no further risk of epidemic disease. He left Balaklava on the 20th June, and returned to England after having inspected the hospitals at Scutari.

PART IV.

PRACTICAL CONCLUSIONS.

The experience obtained in dealing with the sanitary condition of the hospitals on the Bosphorus, and with that of the British occupation in the Crimea, appears to the Commissioners to warrant the deduction of the following practical conclusions:—

Respecting the Hospitals on the Bosphorus.

I.

That the impure state of the air in the hospitals at Scutari, arising from the defective condition of the drainage and ventilation, and the cubic space for the inmates, which the Commissioners found on their first examination of the buildings, were sufficient to account for a large proportion of the excess of mortality then existing among the sick, and also for the violent outbreak of cholera among the troops in November 1855, and that, except in their greater intensity, there was nothing either in the nature of the defects or in their results which differed from what has been usually observed elsewhere.

To avoid similar occurrences, in buildings about to be taken possession of for hospital or barrack purposes, it is requisite:—

II.

That the local position of the building be carefully examined to ascertain the sanitary topography of the site; whether there be any marshes, wet ground, unwholesome mud banks, sea beaches, or other sources of malaria in the