

Report to the Right Hon. Lord Panmure, G.C.B., &c.;, Minister at War, of the proceedings of the Sanitary Commission dispatched to the seat of war in the East, 1855-56 / presented to both Houses of Parliament, by command of Her Majesty, March 1857.

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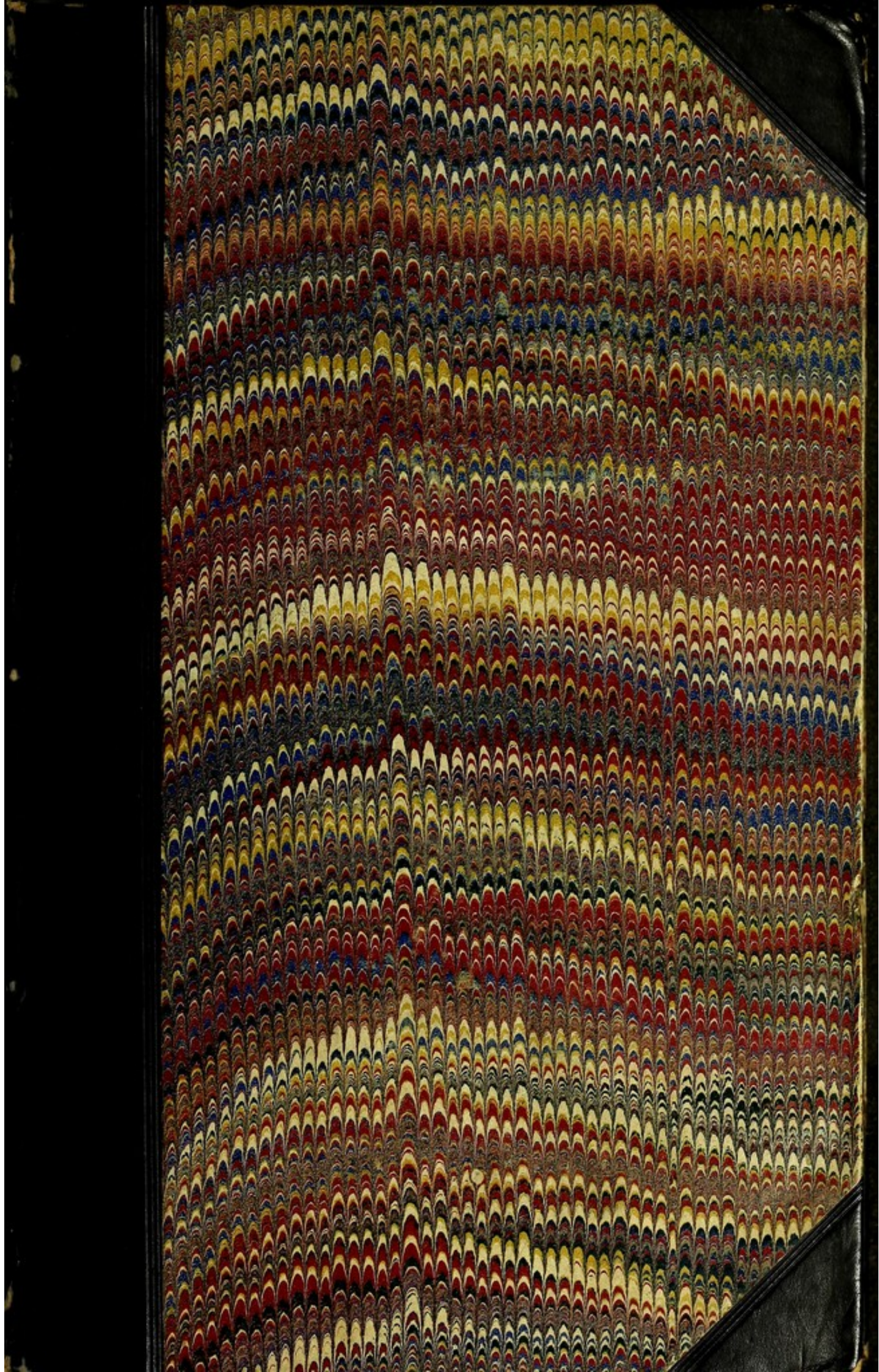
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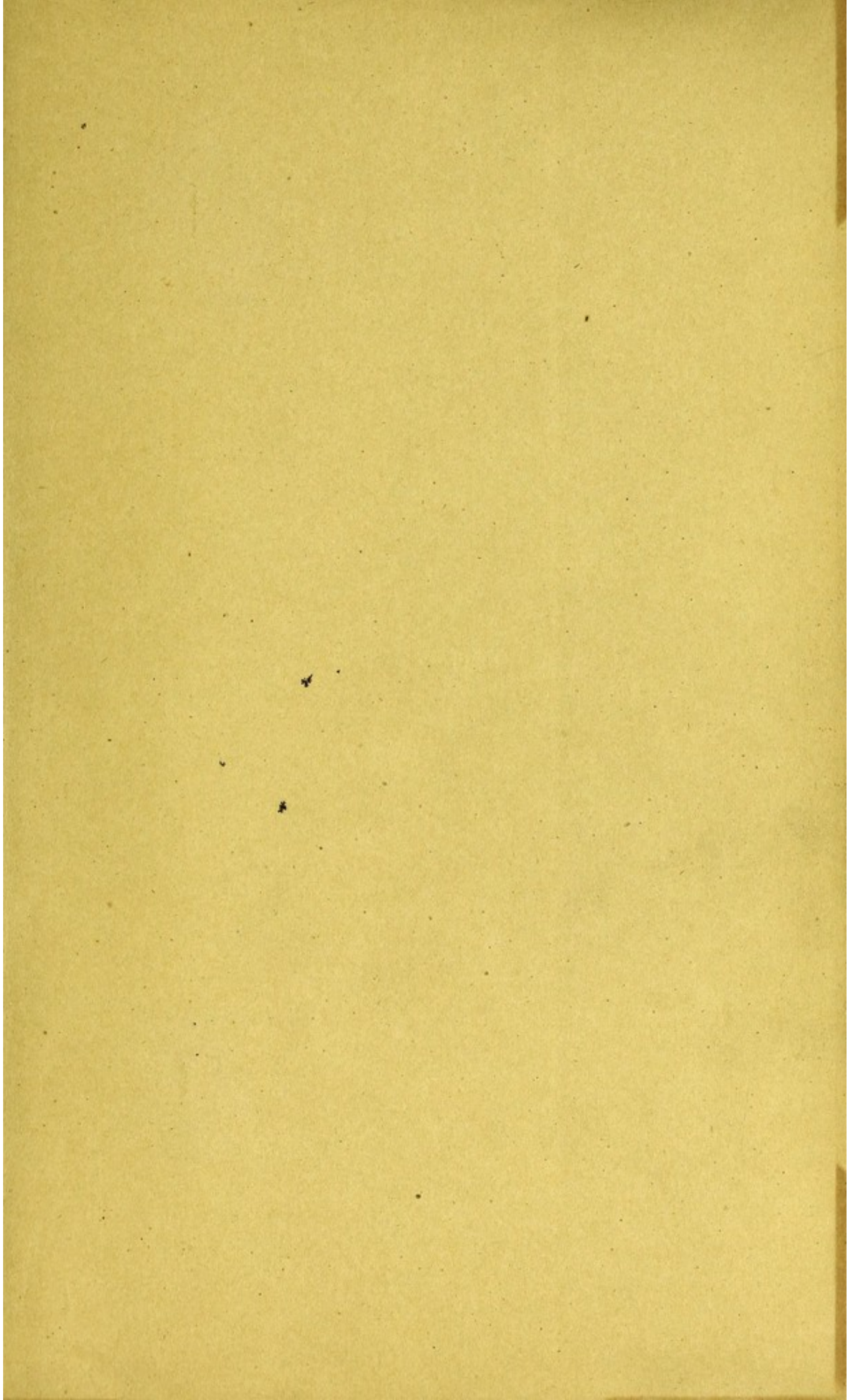


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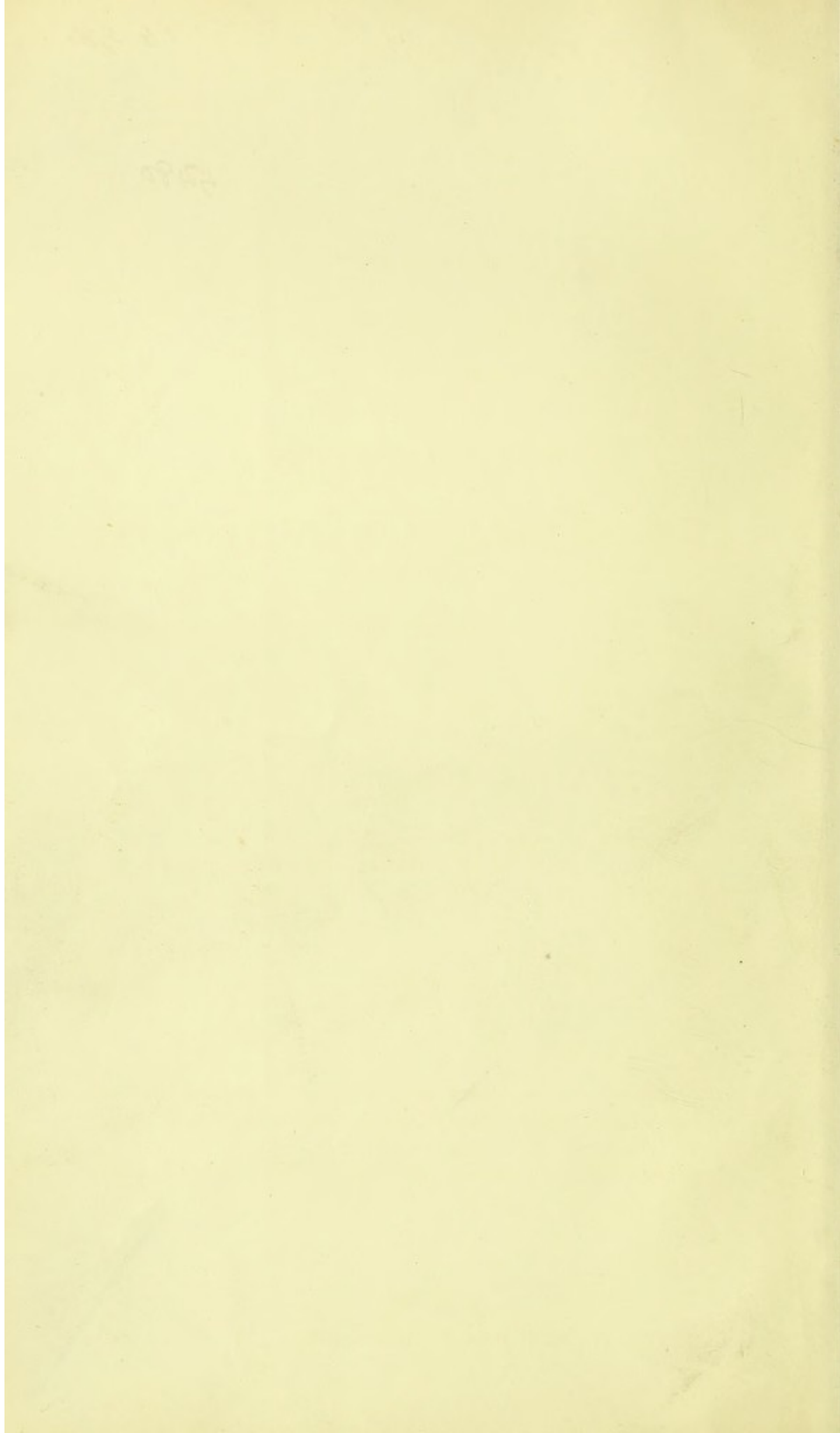
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REPORT

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REPORT

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TO THE

RIGHT HON. LORD PANMURE, G.C.B., &c.,

MINISTER AT WAR,

OF

THE PROCEEDINGS OF

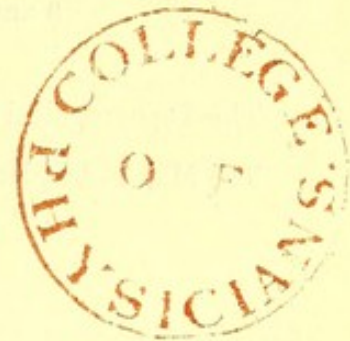
THE SANITARY COMMISSION

DISPATCHED TO

THE SEAT OF WAR

IN

THE EAST.



1855—56.

*Presented to both Houses of Parliament, by Command of Her Majesty.
March 1857.*

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DIGEST OF THE REPORT

OF THE

SANITARY COMMISSIONERS ATTACHED TO THE ARMY IN THE EAST.

1855-6.

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Letter of Instruction from Lord Panmure, dated 19th February, 1855	1 to 4
<p>Gave directions to inspect and report on, and powers to urge and enforce sanitary regulations for, the Hospitals on the Bosphorus, and in the Crimea; the transports and hospital ships; any new hospitals that might be established for the Army in the East; the harbour at Balaklava; and the Camp before Sebastopol. Forbade all interference in the treatment of the sick.</p>	
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PART I.

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3. The Palace Hospital, p. 20. Its form and dimensions; part unsuited to hospital uses; bad drainage; bad ventilation.

4. The Stable Hospital, p. 21. Situation bad, wholly unfit for a hospital; its immediate evacuation obtained.

5. The Hospital Burial-ground, p. 21. Mode of burial; too many bodies buried in one grave or pit; regulations enjoined.

6. Hospital at Kulali, p. 23. Its form and site; not a very healthy position; ease of landing the sick; sanitary defects; bad drainage; effluvia from the privies; presence of Turkish stables injurious; ventilation imperfect, and wards overcrowded; bad water; fever caused by these defects; sanitary improvements enjoined, p. 24.

7. Landing of the sick and wounded, p. 26. Two landing-places at Scutari; the one inconvenient, and the road very steep, the other much better. The care paid to the sick and wounded in landing was most gratifying, p. 26. Difficulty of landing the sick at Scutari in bad weather; not the case at Kulali.

8. Hospital Ships on the Bosphorus, p. 27. By no means well adapted for the purpose. Typhoid fever prevalent on board; causes of this; remedies proposed, p. 28; disapproval of floating hospitals.

9. Naval Hospital at Therapia, p. 28. Its form and site; sanitary defects, common to Turkish buildings; fever prevalent; ventilation deficient; atmosphere infected; drainage bad; wards overcrowded; sanitary improvements proposed to Admiral Grey, p. 29.

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Visit to the Russian prisoners at Constantinople, p. 30; their removal recommended.

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2. The Barrack Hospital, p. 43, much improved; progress of the works satisfactory.

3. The Palace Hospital, p. 43, improved, but still ill adapted for hospital uses.

4. Kulali Hospitals, p. 44, much improved in every respect except drainage, which was still bad.

5. Naval Hospital, Therapia, p. 45, improved.

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Crimea 79 to 85

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Clear indications, in the mortality attending recent arrivals, of the existence of local predisposing conditions, p. 84. There was, at this period, a prevailing epidemic constitution over the whole East, and this rendered all persons exposed to it liable to attacks of zymotic diseases; in addition to this, there were undeniably present other localizing causes of disease. The allied occupation afforded no exception to the general rule, that, given an epidemic influence, the effects of that influence will be most marked where there are damp and filth, and foul air, where there are defective drainage or cleansing, nuisances, overcrowding, defective ventilation, and impure water, p. 84; at the same time, the predisposing effects of personal conditions, fatigue, exposure to harassing and exhausting duties, drinking, &c., must not be overlooked.

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Description. Population from 500 to 600; configuration of harbour; its local position cannot be considered healthy; besides these local sanitary defects, other causes of disease came into operation; harbour filled with shipping, town overcrowded with inhabitants and with horses and cattle, putrescent organic matter accumulated where most hurtful; difficulty of removing this; every sort of refuse thrown into the harbour, whose margin became a mass of filth, manure, offal, and dead carcasses of animals, p. 87; the marsh at the head of the harbour used in the winter of 1854-55 as a place of interment, where the corpses, laid almost in water, were sparingly covered with earth; the latrines were insufficient, and nuisances covered the hill sides; the state of the harbour was most unsatisfactory; the mass of corrupting matter in it, increased by the action of the salt water, produced the most horrible smells, and endangered the public health both in Balaklava and the camps near it, p. 88; fevers were prevalent, passing into typhus.

Commissioners met in Balaklava April 6, 1855; statements of Dr. Gavin and Mr. Newlands; chief difficulty in carrying out improvements was the want of labour, which was never overcome until the Army Works Corps arrived, p. 90; the Commissioners were obliged to restrict their requirements to measures of necessity only; precautionary measures enjoined, p. 91; Report to Lord Raglan; difficulty of obtaining labour; death of Dr. Gavin, p. 93. 500 labourers asked for, 155 only granted; Mr. Newlands returned to Liverpool, and the direction of the sanitary works reverted to the military authorities, p. 94.

Progress of improvements, exertions of Admiral Boxer, p. 96.

In May, after great heat and heavy rain, the cholera appeared on board ship; a system of medical inspection organized, the harbour divided into three districts; instructions to the medical inspectors, p. 97. Extracts from reports of the inspectors; attention required as to the sanitary condition of ships used for the transport of animals; the emanations from the margin of the harbour proved to have been the most powerful localizing causes of the pestilence; inability of charcoal, though a deodorizer, to remove the effects of organic effluvia, p. 100; instance of the "Chester," a charcoal vessel; development of cholera checked by the precautionary measures taken, p. 102. Sanitary works pushed on; extracts from diaries of the inspectors; removal of the manure and offal by barges or by burning; improvement of the sanitary state of the town of Balaklava, p. 103.

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Position of the Camps.

The Marine Heights	107
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Medical topography; hard, dry, and well drained, but exposed to rapid changes of atmosphere, high winds, and sea fogs; generally the ground had been well prepared for the erection of the tents and huts, and they were in good sanitary condition, except as regards ventilation, which was deficient.

The Camp of the 79th Highlanders	109
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Sites of upper huts badly prepared; earth heaped up against their sides, drainage insufficient, ventilation bad; lower huts were in a very unhealthy position, ground wet, and earth in contact with sides for two or three feet in height.

Report of Sir Colin Campbell that fever had been very prevalent in these huts; statistics of the disease; wetness of the subsoil caused the floor to be very damp, and the huts were overcrowded; removal of the men from the lower huts, recommended by the Commissioners, carried out by Lord Raglan; consequent abatement of fever; subsequent history of the huts; occupied by the 31st Foot, cholera and diarrhoea became prevalent; afterwards occupied by the Artillery, with a like result; and were then pulled down, when the ground was found exuding water at every pore, p. 109.

The Camp of the Royal Artillery in the hollow	113
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Was not well situated for health. Much water was found here, and a good deal of manure left about.

The Guards' Camp	114
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Situation not very good, means of drainage ample; the damp clay ravines near were not wholesome. Much attention had been paid to the preparation and improvement of the camping ground, but earth was heaped up against the walls, and the ventilation was bad.

The Land Transport Camp	115
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The topographical position, in April 1855, was one of the worst in the whole occupation; the ground was covered with filth, manure, and offal; numerous fever cases. This camp was afterwards moved.

Proceedings of the Commissioners—*continued* . . . 64 to 148

Cavalry Division Camps, in the Valley of Karani. 115

Description of the valley; well calculated for winter protection, but became an impassable clay swamp after heavy rain; ground not marshy, but sufficiently wet to emit malaria in hot weather; great prevalence of zymotic diseases. Space overcrowded with men and animals; malarious emanations from the ground resulted. Accumulation of stable manure; when burnt, the operation imperfectly carried out. The best mode of disposing of the organic refuse of a fixed camp is the Indian mode of employing a furnace like a lime-kiln. Difficulty of erecting such furnaces in the Crimea; two erected at Scutari in 1856. In the Crimea, those camps where there were large numbers of animals were the most unhealthy; some excess of sickness in the Cavalry and Artillery camps. Sanitary defects of the huts in the Cavalry Division; foundations not properly prepared or drained; earth raised against the sides; ventilation defective. One Cavalry regiment, which was under canvas, had little or no fever.

Sanitary Condition of the Camp before Sebastopol . . . 119

Camp of the Guards 119

Excellent site, natural drainage good, and the position healthy.

Camps of the 3rd and 4th Divisions, and part of the 1st 119

On an elevated position; ample facilities of drainage; open to the free sweep of the winds. In some parts, the surface was deeply covered with wet retentive clay. Camps on such ground not the most healthy on the plateau, and when cholera first appeared, in May 1855, it seemed to attack them by preference.

Camp of the 2nd Division 120

Not very good, being clayey; in parts it was better.

Camp of the Light Division 120

Natural drainage good; the position a healthy one, except the lowest points.

Camp of the Naval Brigade, under 3rd Division . 120

Site good for winter protection, but close to a swampy ravine. Camp removed.

The site of the camp before Sebastopol was, with limited exceptions, as healthy a district as could have been found within the whole occupation, but it was, of course,

exposed to those local and climatic conditions common to the country, which are known to give rise to periodic fevers, p. 120.

Before communicating with the Commander of the Forces, the Commissioners made several inspections of the Camp. It was found remarkably clean, and the external sanitary arrangements on the whole well attended to. There was considerable difference in the condition of different camps, which appeared to depend very much on the pains taken by Commanding Officers and Surgeons. There were some Regimental Camps in regard to which it would have been difficult to have suggested improvements, p. 121.

Sanitary defects were, however, observable in various parts of the camp, p. 121.

1. The huts were Portsmouth huts, the boarding was single throughout, the majority had only partial floors; they had no independent means of ventilation, and, when used as hospitals, the thin boarding was hardly sufficient protection either from the cold or from the intense sun heat. The ground was not properly prepared, the site was sometimes undrained, or badly drained, the floor below the level of the surrounding ground, earth was piled against the sides, the surface drainage around was defective. This damp condition of the subsoil is one of the most common local causes of disease; is fraught with danger to health wherever it exists, and especially in fixed camps, p. 121.

2. Tents. The spaces between were generally sufficient, sometimes not so. The most obvious sanitary defect in the tents was the want of ventilation; the air-holes were of too small a size to be of use, the atmosphere was consequently foul. Animal effluvia absorbed by the earth; hence tents are apt to become unhealthy, unless the ground is changed; and hence the faint, sickly, unwholesome odour, observed after the removal of camps. This peculiar odour was especially observed to last for days on camping ground vacated by the Allies after the conclusion of peace, p. 122.

Necessity for frequently removing the tents. This could not be done in one instance, when recommended by the Commissioners, as the tents were stated to be too much decayed to admit of removal, p. 123.

Common practice in pitching tents to dig a circular pit, and to pitch the tent over it; often no provision made to drain off the water collected in it. Charcoal used to remove the effects of the consequent damp; fatal results of this, p. 123

3. Latrines badly made, kept open too long, and were not deodorized, p. 124.

Proceedings of the Commissioners—*continued* 64 to 148

4. Burial of the carcasses of dead animals in many cases not well performed, not being buried at a sufficient depth, p. 124.

5. Slaughtering-places well conducted, and caused no offensive smell; a slaughtering-place of the French Commissariat caused much nuisance, p. 124.

6. British burial-grounds sixty-six in number; except those killed at Inkermann and the Redan, the dead were buried in single graves; the interments were conducted with care and decency, and the grounds decorated by the soldiers with great taste and feeling, p. 124.

7. Manure heaps; the stables and picketting-grounds were in tolerably good condition, the manure was swept up, and on the whole well burned, p. 125.

Sanitary Improvements recommended for the Huts during the warm weather 126

The hospital huts of the Naval Brigade, erected according to the recommendation of the Commissioners, presented all the necessary improvements.

General recommendations for the Camp 127

Appearance of cholera in the Camp, and Sanitary Precautions recommended by the Commission 129

Military and Naval Hospitals in the Crimea 131 to 144

1. The General Hospital at Balaklava 131

A stone building; was a Russian school-house; consisted of two divisions, one built against the slope of the hill, with windows only on one side; was unhealthy, and fever had originated in it; Portsmouth huts added; main objection was its position, from the bad sanitary condition of the neighbourhood; ventilation good, wards well lime-washed and very clean, the latrines in a bad state, water good.

This hospital being used for natives, and latterly as a transit hospital for sick about to leave the Crimea, was at times overcrowded; with the above exceptions, its sanitary condition was as satisfactory as could be expected, p. 133.

2. The Castle Hospital 133

Situated on one of the finest natural positions that could have been selected, natural drainage excellent, esplanade towards the sea, always dry; consisted of huts; the Portsmouth huts were defective from absence of independent means of ventilation, and from the thinness of the sides and roof; the Chester huts were much better,

Proceedings of the Commissioners— <i>continued</i>	64 to 148
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more roomy, capable of better ventilation, and the sides were double; the latrines were at a considerable distance from the hospital. Few hospitals can show more favourable results than were exhibited by the Castle Hospital; it was originally intended for wounded, but a few sick were afterwards admitted, p. 133.

3. The Monastery, or St. George's Hospital 135

Consisted of a square of huts similar to the Chester huts, site well isolated, and drained by trenching; one large hut was formed of corrugated iron, a substance ill adapted for a hospital, whether in hot or cold weather; water supply obtained from wells; the site was naturally a good one, without local sources of malaria except a French cattle yard a quarter of a mile away; the chief cases were ophthalmia.

4. The General Hospital of the 3rd Division 136

Consisted of Portsmouth huts. Its site was raised above the general level of the plateau, and it had ample means of natural drainage, but the soil, being a tenacious clay, hardly admitted of improvement by draining, and became a complete swamp after rain. The huts were too close together, and too near the camp; they were undrained, had earth against the sides, and were ill ventilated. This hospital gradually fell into disuse.

5. The Regimental Hospitals 137

For the most part consisted of two or three Portsmouth huts placed among the tents and huts of the regiment; occasionally there was a hospital marquee; sanitary precautions were for the most part taken by the medical officers; modes of improving ventilation; the best was one adopted in the Light Division, viz. cutting a large square opening in the middle of the roof, and covering it with a louvred turret. With exceptions, the regimental hospitals were generally in a good sanitary condition. The best marquee hospital was that of the Guards, when in the front in the summer of 1855. Ventilation of field hospitals, its importance as saving transport by increasing the power of accommodation, p. 139.

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APPENDIX

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 Committed by the Legislature
 Prepared by the Geological Survey, under the direction
 of the State Geologist, and published by the State
 Printer, Albany, 1864.

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INSTRUCTIONS.

War Department, February 19, 1855.

GENTLEMEN,

HER MAJESTY having been pleased to assent to your proceeding on a sanitary mission to Constantinople and the Crimea, you are instructed to obey the directions which follow.

The utmost expedition must be used in starting on your journey, in the journey itself, and in the execution of all that is necessary at the place of your destination.

On your arrival at Constantinople and Balaklava, you will put yourselves instantly into communication with Lord William Paulet, Admiral the Honourable F. Grey, and Lord Raglan respectively, and you will request of them forthwith (according to the official directions they will have received) full powers of entry into every hospital, infirmary, or receptacle, of whatsoever kind, for the sick and wounded, whether ashore or afloat.

You will inspect every part of such infirmaries, ascertain the character and sufficiency of the drainage and ventilation, the quantity and quality of the water supply, and determine whether the condition of the whole is such as to allow, by purity of the air, and freedom from overcrowding, fair play and full scope to medical and surgical treatment for the recovery of health.

You will call to your aid for this purpose, whether as witnesses or as guides, any of the officers or attendants that you may require.

The result of your inspection and opinions, together with a statement of all that is necessary should be done, whether in the way of arrangement, of reduction of numbers in the wards, cleansing, disinfecting, or of actual construction, in order to secure the great ends of safety and health, must be laid as speedily as possible before Lord William Paulet, Admiral Grey, or Lord Raglan, as the case may be, or such persons as may be appointed by them to that special duty, and you will request them to give immediate directions that the works be completed.

As no time is to be lost, you may reserve your detailed and minute reports, and give in the first instance a statement only of the things to be done forthwith.

The Engineer Commissioner will be expected to conduct the inspection along with his colleagues, and to devise, and to see executed all such structural arrangements as may be declared indispensable.

You will examine the modes whereby the sick and wounded are conveyed to the transports, or to the hospitals ashore or afloat.

You will take care that, so far as is possible, all evil influences from without be removed, so that the air inhaled by the inmates of the hospitals be not contaminated. It is reported, for instance, that the hospital-ship in the harbour of Balaklava is much surrounded by dead carcases.

As a necessary consequence, you will order that the dead be interred at a sufficient distance from the hospitals. You will lay down rules both as to the time and mode of interment, consulting, of course, the convenience of the constituted authorities.

Should any other hospital or receptacle for the sick be decided on, while you are on this expedition, you will

examine it, and state all that must be done for health, decency, and comfort.

You will not interfere in any way with the medical and surgical treatment of the patients, nor with the regulations prescribed to the nurses and attendants.

Upon your arrival at Constantinople, you will determine among yourselves in what way you can best carry out the objects of your mission.

It is important that you be deeply impressed with the necessity of not resting content with an order, but that you see instantly, by yourselves or by your agents, to the commencement of the work, and to its superintendence day by day until it is finished.

It is your duty, in short, to state fully, and urge strongly, for adoption by the authorities, everything that you believe will tend to the preservation of health and life.

The camp must also come under your immediate and anxious attention.

You must consider, and apply with the least possible delay, the best antidotes or preventives to the deadly exhalations that will be emitted from the saturated soil whenever the warmth of spring shall begin to act on the surface.

You must consider how all decaying substances, present and future, may be removed speedily, or otherwise disposed of with safety. Also in what way the feculent matter of the camp may be rendered innocuous.

You will pay special attention to the harbour of Balaklava, and state your opinion as to the best mode of cleansing it, and of keeping it clean from the accumulations of filth floating on the surface. It will be desirable to ascertain, not only for the convenience of the transport of the sick, &c., but also for the removal of all kinds of nuisances to the outside of the harbour, whether jetties might not be easily constructed.

As stated in your instructions relating to the hospitals, so here you will, with the utmost possible dispatch, lay your plans before the proper authorities, in order that they may be carried into execution.

I have, &c.

(Signed) PANMURE.

JOHN SUTHERLAND, Esq., M.D.

HECTOR GAVIN, Esq., M.D.

ROBERT RAWLINSON, Esq., C.E.

REPORT
OF THE
PROCEEDINGS OF THE SANITARY COMMISSION
DISPATCHED TO
THE SEAT OF WAR IN THE EAST.

MY LORD,

THE Sanitary Commission dispatched to the seat of the late war in the East was not merely a Commission of Inquiry. Its duty, as laid down in the instructions issued by your Lordship on the 19th of February, 1855, was not simply to examine and report on the sanitary condition of Her Majesty's Forces and of the vast hospital establishments belonging to the British army on the Bosphorus; its work was intended to be mainly of a practical kind, and, while using all diligence in ascertaining whether any and what removable causes of disease connected with the camps and hospitals existed, the Commission was directed to represent such defects to the military and naval authorities; to issue instructions for their removal, and to see that their instructions were complied with.

The Commission was precluded from interfering with the treatment of the sick or with the discipline of the wards, and in like manner it could not interfere with anything connected with the personal hygiene of the soldiers. It had, in a word, to deal with the hospitals, but not with the sick, and with the camp, but not with the troops.

At the period of their appointment, the Commissioners had no specific information as to the extent or nature of the sanitary defects with which they would have to deal, nor of the kind of works which might require to be executed; neither had they any knowledge of the amount or quality of the labour or materials which might be at the disposal of the military authorities in the East.

There was, moreover, no opportunity of making inquiries on these points, for the Commissioners had to leave London within three days of their appointment. All they could do, was to request that a supply of materials most likely to be required for the hospitals, such as perforated zinc plates, piping, &c., should be sent to Scutari with as little delay as possible; and that they might be accompanied by a few skilled officers whom they might place at the disposal of the military authorities for the organization and direction of the native labour employed in those special sanitary works and measures which the Commission might see necessary to recommend.

Such assistance appeared to be indispensably necessary to liberate the Commissioners from the personal superintendence of minute details of works, and to enable them to exercise a general oversight of sanitary operations, extending from Smyrna to the camp before Sebastopol.

This request for assistance and materials was at once complied with by your Lordship.

It was necessary that the officers selected should be men who had had sufficient experience; and knowing that a Sanitary Act had been longer in operation in Liverpool than in any town in Great Britain, application was made to the Mayor for three sanitary inspectors, who were at once placed at the disposal of the Commission. Mr. James Newlands, Borough Engineer of Liverpool, also offered his services for a short time, with the concurrence of the local authorities, to direct the Inspectors in their duties, and his offer was accepted. Mr. Arnold Taylor was appointed Secretary to the Commission.

The Commissioners, with their officers, left London on the 22nd February, arrived at Constantinople on the 6th March, and commenced their examinations of the hospitals at Scutari the same afternoon. Their proceedings were continued, day by day, until the instructions for the sanitary improvement of each hospital were completed and sent to Lord William Paulet and Admiral the Honourable F. W. Grey. On the 2nd April, the Commissioners proceeded to the Crimea, where they were joined by Dr. Milroy, on his arrival from England, on the 22nd July following.

We have now the honour to report to your Lordship

the results of our inquiries and observations as to the sanitary condition of the hospitals, and the improvements carried out in conformity with the instructions given to the naval and military authorities.

PART I.

§ I. THE HOSPITALS ON THE BOSPHORUS.

The Bosphorus, from its northern entrance in the Black Sea, until it joins the Sea of Marmora, at Stamboul, has very much the appearance of a river flowing between lofty and beautifully wooded banks, studded with palaces, houses, barracks, mosques, and gardens. The strait is about twenty miles in length, and varies in breadth from about a third of a mile to a mile. It has several bends and bays, and its general direction is from north-north-east to south-south-west. The deepest part of the channel is about sixty fathoms. There are strong currents and eddies in several places, which are powerfully affected by the force and direction of the winds on the Black Sea and on the Sea of Marmora.

The Strait appears to have been formed by some great natural convulsion, which has disrupted the neck of land between the two seas. Its shores are broken into round-topped hills, valleys, and ravines, between which the water flows, giving its varied character to the surface. These hills rise from the water's edge to the height of from 400 to 500 feet; the valleys and ravines ascend between the hills to the general level of the country. Some of the hills near the Bosphorus are upwards of 1,000 feet high.

Towards the opening of the Sea of Marmora, the shore presents, on the eastern or Scutari side, an elevated rocky margin from 100 to 150 feet in vertical height.

The lowest geological formation of the district is clay-slate, which forms the mass of the high grounds on the southern half of the Bosphorus. Over this rock, at Kulali, are beds of limestone. The formations of the country have been much disturbed by volcanic forces.

The immediate surface of the ground is formed of loam and clay often very dense and plastic. There are no marshes of any consequence in the vicinity of the Bosphorus, but the country is, to a great extent, uncultivated and undrained, and there is a general tendency to periodic fevers similar to those found over other uncultivated lands of the East.

The climate has a high mean temperature, and is subject to extremes. The summer sun heats are often intense, and so are the winter colds. The proximity of such large masses of water keeps the air moist; night and morning fogs are very frequent, but they are usually dispelled by the heat of the day.

So far as concerns the topographical and climatic features of the country, the banks of the Bosphorus are as well suited for hospitals as any part of the East; and there was sufficient convenience of access from the seat of the war.

The larger hospital establishments in possession of Her Majesty's forces were at Scutari, directly opposite Stamboul, and at a distance of about a mile and two-thirds from Tophana.

The hospital at Kulali, is about four miles above the mouth of the Bosphorus.

The Royal Naval Hospital was at Therapia, opposite the entrance to the Black Sea, and about five miles below it. All the hospitals except the last, are situated on the eastern or Asiatic side of the Bosphorus.

The ground occupied by the British hospitals at Scutari, is part of an undulating plateau, the sides of which, for the most part precipitous, dip on the north-west into the Bosphorus, and on the south-west into the Sea of Marmora.

The extent of open ground within which the hospitals are situated, is about a mile and a-half in length, by three-quarters of a mile at its greatest breadth.

On the north-west, next the Bosphorus, a prolongation of the town of Scutari intervenes between the area and the sea. On the north-east is the great cemetery of Scutari. Towards the south, the ground extends to Kadikoi, and the Sea of Marmora bounds it on the south-west.

Beginning from the landing-place on the Bosphorus, the

ground rises rapidly towards a ridge having an elevation of 98·75 feet at the cliff overhanging the Sea of Marmora, and attaining a height of 208·81 feet near the cemetery.

The great Turkish barrack, known as the "Barrack Hospital," is built across this ridge of ground. From the barrack, the surface falls to the south-east, towards a water-course opening on the level of the Sea of Marmora. The large washing establishment for the hospitals was situated in this hollow close to the sea. The surface rising again, forms part of an irregular plain of some extent, on which is situated a large hospital belonging to the barrack, and about a third of a mile from it. This building is the second in dimensions, and was known as the "General Hospital." That part of the plain on which it stands is ninety-six feet above the sea level. The ground falls towards the east from this hospital, and forms a broad, shallow valley, with a small stream running through it. In this valley is situated a kiosk and buildings attached to it, which formed the "Palace or Haidar Pascha Hospital." The buildings are about thirty-five feet above the sea level, and are at a distance of fifty chains inland. Beyond them, to the south and south-east, there is a low ridge which forms the boundary of the area occupied by the hospitals at Scutari.

There was another small hospital consisting of a few wards over a stable near the barrack. There were also some temporary wooden erections used chiefly for convalescents within the barrack square.

Except a few houses at Haidar Pascha, there were no buildings of consequence besides those used for hospital purposes within the area described. It was quite open and exposed to the sea breezes. The soil is loam, thinly covered with turf, and there were no local sources of malaria, with the exception of some undrained ground at Haidar Pascha.

1. *The Barrack Hospital.*

The Barrack Hospital first demanded the attention of the Commissioners, as being the largest of the establishments

at Scutari. It consists of a vast quadrangle with a lofty tower at each corner, and a square in the centre. The building is situated at the south-western extremity of the town of Scutari, from which it is separated by a broad ill-paved street. It occupies a crest of land at the point where the Bosphorus joins the Sea of Marmora, and between the sea cliff and the hospital wall is a spacious esplanade. The elevation of this cliff is 98·75 feet above the sea, and the highest point of the land opposite the barrack gateway is 148·27 feet. The ground slopes rapidly from the crest of the ridge towards the north-west and south-east.

The building is arranged in a parallelogram, the longest sides of which are 840 feet, and the shortest 630 feet. It is three flats in height, and there are eighty-four windows arranged in threes, extending in a straight line in each flat on the shortest side, and one hundred and seventeen windows similarly arranged along each flat on the longest side.

The barrack overlaps the crest of the ground, and rests on its summit and two sides; the result of which circumstance is that a considerable part of the building, that is to say, its lower flat, is unfit for hospital purposes, and was used for stores. The two upper flats are continued round the square, while the lower flat is only partially so. Another result of the configuration of the ground is that the rainfall flows downwards on two sides towards the walls of the hospital.

The natural facility for drainage is all that could be desired, provided advantage had been taken of it when the barrack was erected.

The whole line of buildings forming the four sides of the square is divided longitudinally into barrack-rooms and corridors by a wall perforated with small windows and doors, affording access from the corridors to the rooms. The barrack-rooms which were used as wards face outwards, while the corridors face inwards to the square.

The rooms are large and lofty, and have generally three windows, much too small for their cubic contents, and the heads of these windows do not reach to within five or six feet of the ceiling. The window space in the corridors is considerable, and the heads of the windows come up much

closer to the ceiling. The different flats of the building communicate by large roomy stone staircases.

Four detached buildings within the courtyard, one at each angle of the square, and communicating with the corridors, contain the privies. These buildings open into each line of corridors by two large doors, one on either side of the angle. By this arrangement each corridor in the circuit of the building communicates with the privies by eight doors. The privies consist merely of a marble slab with an opening communicating with a vertical pipe of red tile carried down into a drain at the basement of the building. The privies, and the galleries between them and the corridors are lighted by a number of glazed windows, which we found were all closed, so that there was a direct communication between the sewers, which were loaded with filth, and the corridors and wards of the hospital.

The corridors were paved with unglazed tile or porous stone, materials ill adapted for the floors of hospitals, on account of their absorbent powers. The floors of the wards were of wood, some portions of which were not in good condition.

Both wards and corridors were used for the sick at the time of our inspection, and the corridors had two rows of beds placed close together.

Having given this general outline of the structure of the Barrack Hospital, we shall next proceed to state those sanitary defects, which, in our opinion, were calculated to interfere injuriously with the medical treatment and recovery of the sick.

The first step taken by the Commissioners was to examine carefully the outskirts of the hospital, to ascertain whether there were any external causes likely to affect the purity of the surrounding atmosphere.

The site of the hospital, as already stated, is open and airy, overlooking the sea on two sides, and on a third side facing the open country; on the fourth side it is contiguous to one extremity of Scutari, which, like all Turkish towns, we found to be in a bad sanitary condition. The paving was rough and badly laid, and the channelling very defective. The surface in many places was filthy, and had putrefying

mud lying in hollows, and there were nuisances among the houses. The ravine already mentioned to the south-east of the hospital, contained offensive deposit, which tainted the air on that side of the building. There was some refuse, and several dead dogs lying close to the hospital walls.

The surface of the inner square was uneven, badly formed, imperfectly drained, and very dirty.

On entering the hospital, the first thing that attracted our attention was the defective state of the ventilation.

Excepting a few small openings here and there, there were no means of renewing the atmosphere within the hospital. The large cubic space above the top of the ward windows always retained a considerable amount of hot and foul air for which there was no escape. There was not even an open fire-place connected with the building, and the wards were heated by stoves, the pipes of which passed through a small hole at the top of one of the windows.

There was no communication between the wards and corridors in the majority of instances, except by the doors, and hence that free circulation and perflation of the atmosphere, so necessary in military hospitals, was impossible.

The wards and corridors being both occupied by sick, they could, in fact, be considered only as two hospitals built back to back, with the foul air in each intermingling by the doors.

The effluvia from the privies had free access to the corridors, and added materially to the impurity of the air.

We found the whole of the Turkish sewerage belonging to the Barrack Hospital in a defective condition. The sewers and drains were badly formed, badly constructed, badly laid, and untrapped.

It may be here stated generally, that all the buildings used as hospitals were sewered. Turkish sewers are made of rubble-stone, or coarse brick-work. The bottoms are flat, rough, and uneven; there are no means of external ventilation, no means for cleansing or flushing, and the ends or mouths of the sewers at Scutari opened above the level of the sea, and were exposed to the action of the winds, which, in certain directions blew into the sewer-end, and carried the foul emanations from the deposits within them through the

pipe drains to the privies, and thence into the corridors and wards where the sick were placed. It was stated to us that a change of wind had been observed to be attended by an accession of fever cases from among the sick, and that existing fever cases put on a more aggravated form. We found that the winds to which these results were attributed blew in the direction of the open mouths of the sewers. These sewers were, in fact, cesspools of the most dangerous description, through which, and through the privies the wind forced sewer gases directly into the wards of the hospital.

The exhalations escaping through the defective walls and covers of sewers, where they happened to pass close to or underneath occupied rooms, could in some instances be distinctly observed within the rooms, and there is reason to believe that fatal cases both of fever and cholera arose from this circumstance among the inmates.

At the time of our first examination, the Barrack Hospital cannot be said to have been much overcrowded, as the estimated cubic space for each patient was from upwards of 850 to 1,000 cubic feet.

Overcrowding, however, is a relative term, the meaning of which must be settled with reference to other considerations besides the amount of cubic space. Lofty wards, such as were the corridors, may have apparently a large cubic space allotted to each patient, and may, nevertheless, be overcrowded, if the beds be too close together, and the cubic space mostly above them. The corridors had at the time two lines of beds, and we are of opinion that they were overcrowded from that circumstance. Again, the capabilities of a hospital for thorough ventilation also affects the question of overcrowding. A well-ventilated ward will accommodate with safety a larger number of sick than one of the same dimensions not well ventilated.

On a careful consideration of all the circumstances, we arrived at the conclusion, that the corridors could not with safety have more than one row of beds.

Connected with this question of overcrowding, we may state, that we found a considerable portion of the Barrack Hospital in use as a *depôt*. We considered that the presence of so many soldiers and other persons not necessary for the treat-

ment of the sick, was a source of danger, from occupying cubic space within the building, and increasing the impurity of the air from the defective privy drainage, of the truth of which opinion we had subsequently two striking confirmations.

All the hospitals had a water supply. That for the Barrack Hospital was found to be hardly sufficient in amount for so large a number of sick. The water was not so pure as could have been desired, and it was received into tanks within the barrack square.

Speaking generally, we were of opinion that the walls of the wards and corridors were not so clean as they might have been.

There were false floors in the wards, which had been used as sleeping berths for the Turkish soldiers, and which had the bedsteads of the sick placed on them. There were also box seats along the walls of the wards, for the use of the soldiers. We were of opinion that there ought to have been no such inclosed spaces capable of collecting dirt and foul air within the wards, and that it would have been advisable to have removed the whole of this useless woodwork before the sick were put into the wards, had there been time and means for doing so.

On several occasions, both in the barrack and other hospitals, we saw the excreta of patients in utensils under the beds, instead of having been at once removed.

Within the barrack square, a number of wooden sheds had been erected; part were occupied by soldiers belonging to the depôt, and part were intended to be used as convalescent wards. To the latter of these were attached a series of open privies communicating with a drain, but having no means of flushing or cleansing.

The ventilating arrangements of these convalescent wards were defective.

While stating pointedly the sanitary defects we found in the Barrack Hospital, we think it only justice to add that there was abundant evidence that the military authorities had been actively engaged, before our arrival, in improving this hospital, and much had evidently been done with that object.

The additional works required by our instructions for improving the sanitary condition, not only of the Barrack

Hospital, but of all the other hospitals, were of far greater extent than we at all anticipated, and it was obvious that, under any circumstances, much time would be necessary for their execution.

The following were the measures which the Commission directed to be put in force for improving the Barrack Hospital.

1. Mr. Newlands was requested to examine carefully the vicinity of the hospital and the square, and to organize a system of constant cleansing and removal of nuisances; to determine the points to which the refuse might safely be carried, and to give the necessary instructions to the inspector charged with the superintendence of this department.

These instructions met with the approval of the Commission, and the men and materials for carrying them out were supplied by Lord William Paulet.

The inspector was required to start his men at five o'clock every morning, to sweep the whole ground surrounding the hospital; to divide his men into gangs to sweep the streets of Scutari nearest the hospital, and to see the refuse removed directly to the place of deposit; to appoint a man to each dirty locality, to see that it was kept clean; to see that all dead animals were immediately buried; to see the hospital refuse immediately removed; to cover any accumulations which did not admit of removal with charcoal and fresh earth. The inspector was further required to report his proceedings once a week.

In order to facilitate the cleansing, it was further advised that the surface of the ground should be equalized; that proper channels for surface drainage should be formed; that the paving should be repaired and laid down, where necessary, for access to the hospital; that suitable dust boxes, baskets, wheelbarrows, and tools should be provided.

To remove the nuisance from the open ditch in the ravine on the eastern side of the hospital, we directed that the ditch should be covered over as far as its point of outfall. We further directed, for the improvement of the barrack square, that the unpaved parts should be formed, and coated with broken stone or gravel.

2. To remedy the defective ventilation, the Commis-

sion recommended that the upper portion of the windows should in all cases be opened, and the current of air modified by the insertion of perforated zinc plates, louvre boarding, or otherwise, that adequate space for the escape of foul air should be provided as near as possible to the ceiling of each ward, and that the staircases should be used for ventilating shafts by openings being made through their ceilings to the roof.

3. In order to diminish, as far as practicable, the injurious emanations proceeding from the sewers and privies, it was directed that the outfall sewers of the hospital should be extended, and a canvas cover placed over their mouths to prevent the wind driving the effluvia into the hospital; that three openings for ventilation should be made in each main sewer, between the hospital and the outfall, with a water trap at each ventilator, and a man-hole for cleansing: water tanks for flushing the sewers were also directed to be placed immediately outside the walls of the building. These tanks consisted of hogsheads, each having a large wooden valve, covering a pipe communicating with the head of each sewer. The inspector was directed to see that these flushing tanks were filled with water three times a-day, and the valves opened by himself.

All the privies, sewers, and drains were directed to be thoroughly cleansed, and their contents deodorized and removed. It was further directed that peat charcoal should be freely used as a deodorizer for these purposes.

The upper parts of the windows in the privies and in the galleries connecting them with the corridors were at once removed so as to allow the emanations to escape into the external atmosphere.

4. In order to obviate the evils of overcrowding, we directed that in all cases the amount of space for each patient, exclusive of ventilating shafts and window recesses, should not be less than 1,000 cubic feet, and that considering the state of the ventilation, no more than one row of beds should be permitted in any of the corridors.

5. We found that negotiations were in progress by which a larger supply of water would be obtained from the Turkish authorities. We recommended the filtering of the water to

remove impurities, the cleansing and covering of open water tanks, and the construction of lavatories for the sick.

6. We directed the frequent use of quicklime-wash for the purpose of cleansing the walls and improving the atmosphere in the wards and corridors. This we considered one of the most important sanitary precautions which could be adopted. Experience has shown that all porous substances, such as the plaster of walls and ceilings, and even woodwork, absorb the emanations proceeding from the bodies and breath of the sick. After a time, the plaster becomes saturated with organic matter, and is a fresh source of impurity to the air of the ward. It hence follows that unless the walls and ceilings of hospitals be constructed of absolutely non-absorbent materials, it is necessary, at short intervals, to use some application capable of neutralizing or destroying the absorbed organic matter. Of all known materials quicklime wash is the best and cheapest for this purpose. Its effect in freshening the air in crowded wards and rooms is immediate, and it is one of the most efficacious agents for mitigating the virulence of epidemic disease.

7. We were of opinion that the erection of sheds in the hospital square was likely to interfere with the ventilation of the hospital itself, and that the open privies attached to them would add impurity to the external air. They had been erected, however, and were partially in use, and it was, therefore, necessary to consider how far the evil could be obviated.

With this view the Commission directed that the inclination of the drains leading from the privies should be improved, and that a flushing tank should be erected, the valve of which was to be opened at stated times each day, so as to wash away the whole of the contents.

The sheds themselves we also directed to be thoroughly ventilated at the roof.

8. We directed the immediate removal of the excreta of the sick out of the hospital.

Lastly, in anticipation of the heats of summer, we advised the removal from the building of all soldiers or persons not necessary for the care and comfort of the sick.

2. *The General Hospital.*

This hospital is a large quadrangular building, 440 feet by 340, consisting of three flats (except on the north-east side, where there are two flats) with a court inside. So far as the accommodation of the sick is concerned, it contains somewhat less than two-thirds of the space of the Barrack Hospital. It was the best of the hospital establishment at Scutari, both as to structure and arrangements. When we first examined it, we found it scrupulously clean, and from its open isolated position, there were fewer of those external removable sanitary defects which we found in the neighbourhood of the Barrack Hospital, with the exception of the overcharged burial-ground belonging to the hospitals, and which lay much too close to its walls.

The General Hospital, like the Barrack Hospital, is divided longitudinally all round into wards and corridors; the wards facing outwards, and the corridors facing towards the courtyard. But it differs from the Barrack Hospital in one important particular, namely, that the wards and corridors communicate not only by the doors but by numerous large lofty windows in the division wall, so that by proper management of the windows, by the introduction of perforated zinc panes, and by suitable ventilating openings at the ceiling of each ward, a thorough ventilation could be at all times secured.

The privies of this large building are situated in four square towers, built on the outside of the hospital, instead of being within the square, as in the Barrack Hospital. One of the towers is situated at each angle of the main building, and communicates with the interior by means of a gallery opening into each corridor. The windows of these galleries were all closed at the time of our examination, and as the structure of the privies and the arrangement of the drainage were essentially the same as in the Barrack Hospital, the effluvia entered the corridors, and could be easily detected within them at some distance from the doors.

This constituted the main sanitary defect of the General Hospital, but it was a very dangerous one, and neutra-

lized, to a great extent, the advantages possessed by the building.

The flooring of the wards and corridors was formed of square slabs of Maltese stone, which from its soft and porous nature was continually wearing away, so as to impregnate the air with dust and to soil the bed linen. It was an inconvenience rather than a defect, and was partially remedied by the military authorities substituting wooden flooring in some of the wards.

Part of the courtyard was laid out as a garden, and another part was used as a thoroughfare. This latter part was damp and uneven, from defective formation and want of drainage. The kitchens were at that time undrained, and water was lying on the floor.

Both wards and corridors were used for the sick, but the disposable means of ventilation were such that the hospital could hardly be said to be overcrowded.

The improvements required for the General Hospital were essentially of the same character as those directed by the Commissioners to be carried out at the Barrack Hospital.

1. The state of the sewerage demanded our first attention, and we directed that the main sewer should be extended, with similar appliances for external ventilation and for flushing as those recommended for the Barrack Hospital.

2. The privy drains, which at the time passed under the building, were directed to be diverted into a sewer outside the building.

3. The upper window sashes in the privies and galleries were directed to be removed, so as to prevent, as far as practicable, effluvia from entering the corridors.

4. The privies, sewers, and drains were directed to be thoroughly cleansed, and their contents deodorized with charcoal and removed.

5. The drainage of the kitchen was to be improved, and the surface of that portion of the inner court used as a thoroughfare was directed to be formed, and coated with stone or gravel.

6. Permanent and independent ventilating arrangements by perforated zinc panes in the windows and ventilating

openings at the ceilings, were directed to be introduced for the wards, the same as those for the Barrack Hospital.

7. It was directed that not less than 1,000 cubic feet of space should be allowed for each patient.

8. That lime-washing should be practised at intervals throughout all the wards and corridors, and that proper lavatories for the sick should be provided.

3. The Palace Hospital.

The Palace, or Haidar Pascha Hospital, consisted of three buildings:—1st. The hareem apartments; 2nd. A theatre and ball-room; 3rd. A kiosk, situated in the grounds, and used as a hospital for sick officers.

The buildings were chiefly of wood, and the locality they occupied, although raised above the sea sufficiently to admit of drainage, was, from the want of it, little better than a swamp, and water was lying on its surface at the time of our visit.

The buildings were situated at a short distance from each other.

We found the apartments of the hareem intricate in structure, badly ventilated, overcrowded, and altogether not well suited for hospital purposes. A large open privy had been erected for this portion of the establishment without any drainage, the foul exhalations from which tainted the air to a considerable distance.

The theatre and ball-room, which together formed a long, lofty wooden building, were by far the best portions of the hospital. The wards were large and lofty, well adapted for the treatment of the sick, and had but one defect, namely, the ventilation, for which no suitable provision had been made. The privies attached to this part of the hospital were placed over a running stream; but at the time of our visit, offensive exhalations arose from them, in consequence of some temporary obstruction. They were, however, well removed from the sick wards.

The kiosk was an ordinary private dwelling, and appeared to be tolerably well adapted for its purpose.

The water was obtained from wells.

There was considerable difficulty in dealing with the most prominent sanitary defects of the Palace Hospital, on account of there being no proper outlet for the drainage, and the distance to which the outfall would have had to be carried in order to reach the sea.

We considered it nevertheless necessary to direct that the low marshy ground in which the hospital is situated should be at once thoroughly drained; that the privy accommodation should be improved by flushing through the drains if eventually found to be practicable; and if not, that movable boxes should be provided, and their contents frequently removed; that the privies should be thoroughly cleansed and deodorized; that lime-washing should be used; and that all parts of the hospital should be thoroughly ventilated by panes of perforated zinc inserted in the windows, and by suitable openings as near the roof as possible.

There was a closed gallery between the theatre and ball-room, in which there were a few patients. We directed this portion of the hospital to be disused, as it was unfit for sick.

4. *The Stable Hospital.*

This hospital consisted of four wards, over a line of stables belonging to the Barrack Hospital, and at a short distance from it.

The situation was, in our opinion, a bad one, and the relative position of the wards and stables, besides the generally foul condition of the place, rendered it unfit for the reception of sick. We are glad to state that this hospital was immediately evacuated.

5. *The Hospital Burial-ground.*

The burial-ground for the hospitals at Scutari is situated on a cliff overhanging the Sea of Marmora. The ground follows the line of the cliff, and is of an oblong irregular form. Part of it, devoted chiefly to the interment of officers, occupies the space of ground between the cliff and the wall bounding the outer courtyard of the General Hospital.

The portion which was being used at the time of our visit for the interment of common soldiers is situated at a distance from the hospital boundary wall, on a bank sloping towards a stream of water flowing from Haidar Pascha to the sea.

At that period the interments in the officers' burial-ground took place in single graves ; but the mortality among the men in the hospitals had been, and was still, so considerable, that it was the practice to bury the dead in common graves.

The plan adopted was to dig shallow graves of sufficient size to hold the number of corpses expected. These were wrapped in sheeting, and placed side by side, as close as they could be laid : the graves were filled up with earth, which was also heaped over them. In one such grave we saw twenty-two corpses interred.

It was notified to us that the Turkish authorities considered this plan of burial injurious to health, which it was very likely to be, especially in warm weather.

The only hospital liable to be affected by the emanations from the ground was the General Hospital.

Considering the large number of dead which had already been interred, as well as the current daily proportion, it appeared to us that some regulation as to the mode of burial was absolutely necessary for the protection of the health of the General Hospital.

The comparative smallness of the area of the burial-ground rendered it impracticable to open a grave for each corpse. We thought it sufficient to direct that no interment should take place within one hundred yards of the wall inclosing the General Hospital ; that no more than one layer of corpses should be placed in any grave or trench ; that a space of not less than twelve inches should be left between each body ; that the grave or trench should be at least six feet deep below the ordinary level of the ground ; that a layer of peat charcoal should be placed over the bodies instead of lime, which was used at the time ; that all interments should take place during the morning and evening, and not during the heat of the day ; and that with respect to the ground already occupied, a layer of peat charcoal be

at once laid over it, the ground levelled, and sown with grass-seeds.

6. *Hospital at Kulali.*

This hospital consisted of two large buildings, one of which was a Turkish cavalry barrack, having a range of stables underneath part of it. The buildings occupied three sides of a square, which was completed by a range of sheds formerly used as stables, but which were being converted into hospital wards by thoroughly cleansing and ventilating them, concreting the floors and plastering the walls.

Kulali barrack is situated on the Asiatic side of the Bosphorus, about four miles above Scutari. Its front presents a long line of brick-coloured buildings rising immediately from the level of the water. The Bosphorus is bounded at this point by a steep range of limestone hills, and the square of the barrack has been built in a small valley where the hills recede a little from the water.

The other portion of the hospital is a pile of buildings erected against the steep hill-side, close to the barrack, and above it.

Considered as a whole, the site of this hospital could not be deemed a very healthy one. The barrack buildings were the least adapted for the purpose, except a large riding-school at the north-eastern extremity, which formed an excellent ward.

The hospital had, however, one advantage—that the sick could be landed close to the entrance in all weathers, which was not the case at Scutari. It might be considered, therefore, as a complement to the other hospital establishments on the Bosphorus.

The chief sanitary defects connected with the vicinity of the hospital were the following:—

The ground about it was irregular, wet, and dirty. The courtyard was not paved, and the surface was soft and damp. The natural configuration of the ground caused the water from the higher land to drain down towards the hospital site, keeping the neighbouring ground generally in a

moist condition, breaking out in springs upon the hill-side, and running over the surface.

The sanitary defects within the building were of a far more serious character.

We found a considerable area of the basement under the wards and officers' quarters fronting the Bosphorus occupied by about fifty Turkish privies, the emanations from which pervaded the whole of this part of the building, and could be traced even into the courtyard.

On the same basement, and under other wards and quarters, there were stabled 200 Turkish cavalry horses, and as a consequence, the wards and quarters above were pervaded by the exhalations. From these defects fever and diarrhœa had originated within the building, amongst the sick, medical officers, and nurses. There were during the month of March twenty-two cases and four deaths from fever, including one of the lady nurses, all originating within the building.

The wards already occupied by sick were long roomy apartments, extending the whole height of the building, which had two rows of windows on each side, one above the other. A wooden gallery carried round the wards at the height of the second row of windows, partially divided the ward into two flats, but left the ventilation free up to the roof. The beds for the sick were placed underneath, and also upon these galleries. At the time of our first examination we found the ventilation very imperfect, and the wards overcrowded.

The interior of the wards required lime-washing.

The water supply to the hospital contained vegetable-tissue and threads of fungus.

The stable-sheds, which were being converted into sick-wards, were not completed, and suggestions were required for improving the ventilation, and for giving more cubic space for the sick.

To remedy the sanitary defects enumerated, the Commissioners directed :—

1. That eight new privies should be erected outside the barrack, with provisions for draining, flushing and cleansing ;

that in the meantime those in the basement fronting the Bosphorus should be cleansed and deodorized; and that on the completion of the improved arrangements they should be abandoned and covered over.

2. That the sick wards and quarters over these privies, and also the wards over the stables, should be abandoned as soon as new wards and quarters could be got ready.

3. That overcrowding should be prevented by allowing not less than 1,000 cubic feet of space for each inmate, and in no instance placing the beds nearer than six feet from centre to centre.

4. That to insure adequate ventilation, the upper rows of panes in each window should be removed, and perforated zinc plates inserted; that the upper part of windows in partitions between corridors and wards should be permanently opened; and that adequate space for ventilation should be provided as near as possible to the ceiling of each ward.

5. That all the wards should be thoroughly lime-washed at frequent intervals.

6. That the land outside the barracks should be properly drained, the water-stream diverted, and the whole neighbouring ground regularly cleansed at short intervals.

7. That the unpaved portion of the barrack-square be formed, and coated with broken tile, stone, or gravel.

8. That the water-tanks be examined, and cleansed when necessary, and the water in future filtered.

9. That peat charcoal be used as a deodorizer in the removal of all offensive matter.

10. We found the burial of the dead conducted with suitable precautions, and the only direction which we deemed it necessary to give was, that interments should not take place during the heat of the day.

The upper portion of the hospital, situated on the slope of the hill, was in many respects much superior to the Cavalry Barrack. It consisted of wards and corridors communicating freely with each other by doors and windows, but it had one structural disadvantage, arising from its position, that the slope of the hill rose considerably above the floor of the wards, so that a thorough perfusion of the building from back to front was hardly practicable.

The chief evil, however, was the offensive condition of the privies which were within the building, and unfortunately at such an elevation that water could not be obtained to cleanse them except by hand labour.

The remedies applied to the sanitary defects of this building were in principle the same as those already mentioned.

7. Landing of the Sick and Wounded.

The Commissioners, while making a detailed examination into the condition of the hospitals, directed their special attention to the means in use for conveying the sick and wounded from the transports to these establishments.

There were two points at Scutari at which the sick were landed. One of these was on the Bosphorus, directly under the north-west wall of the Barrack Hospital, and the other was to the south of the General Hospital, where the ground slopes down to the Sea of Marmora. At each of these places there was a jetty, alongside which large boats could be conveniently moored.

The ascent from the landing-place under the Barrack Hospital was very steep, and the road not a convenient one. The ascent from the southern landing-place to the General Hospital was more easy but more distant.

The sick ships arriving from the Crimea were anchored as near as practicable to the jetties, and the sick and wounded slung over the ships' sides on stretchers into the boats, or, if they were able to descend the steps, they were carefully assisted to do so.

On our arrival, the boats used for the purpose were open, but during the summer, covered barges were employed. On arriving at the jetty, a fatigue party, with stretchers and proper superintendents were in waiting. The sick and wounded were lifted on stretchers, or assisted to disembark, as the case might be. They were carried slowly on men's shoulders, or supported in walking up to the hospitals.

Whenever we saw the sick disembarked, it was impossible not to feel gratified with the care with which they were treated both by the soldiers and officers.

We considered it to be unnecessary to make any recommendations on this head.

The chief disadvantage attending the landing of the sick at Scutari was the frequent bad weather, especially at those seasons when a larger number were likely to arrive, and the exposed nature of the anchorage, which rendered communication with the shore by boats very uncertain at times. From this disadvantage the hospital at Kulali was exempt. There was deep water close to the hospital, in which ships could be moored, and the sick and wounded could be landed at all times. There was a small steamer attached to the hospitals, which was of great use in assisting in the conveyance of sick and wounded.

8. *Hospital Ships on the Bosphorus.*

In addition to the hospital establishments at Scutari and Kulali, two ships, one the "Bombay," the other an old Turkish line-of-battle ship, were used at the time of our arrival for sick and convalescent soldiers.

We carefully examined both these ships, and found them ill adapted for their purpose. We ascertained that, after the reception of some sick soldiers on board, a low typhoid fever broke out and prevailed to some extent in the Turkish ship, and to a very great degree on board the "Bombay." In the latter, it originated in the orlop deck, first attacking the orderlies, and then spreading to the crew and some of the convalescents, and only declining when the numbers on board were reduced.

On examining into the probable causes of this outbreak of disease, we arrived at the conclusion that the unhealthy state of the ships proceeded:—

From poisonous miasmata arising from the foul state of the bilge-water.

The prolonged confinement to bed of a number of persons in a low-ceiled, confined space.

Defective ventilation, chiefly in the orlop deck of the "Bombay."

Overcrowding.

Incomplete lime-washing.

To remedy these defects, the Commission recommended:—

1. That the condition of the bilge-water should be frequently examined, the water deodorized when necessary, and frequently pumped out.

2. That more effectual cleansing and lime-washing be carried out.

3. That overcrowding be diminished, and the use of the ships restricted to convalescents.

4. That more effectual means of ventilation be at once adopted.

While giving these directions, we deemed it to be our duty at the same time to point out that ships, especially when moored in such positions as those occupied by the "Bombay" and the Turkish line-of-battle ship, were by no means the best places for the reception of convalescents, and that a well-arranged convalescent institution on shore would be far preferable to the use of floating hospitals of any kind.

9. Royal Naval and Marine Hospital at Therapia.

This establishment consisted of two separate buildings, one a Turkish private residence, chiefly constructed of wood, and used for the reception and treatment of the sick, the other a kiosk belonging to the Sultan, and partly in use as a convalescent hospital.

Both buildings are situated close to the shores of the Bosphorus, and their basements are only a few feet above the water-level. The ground rises from behind them to an elevation of above 500 feet.

The kiosk is situated in a fine garden; its rooms, staircases, and landings are spacious and lofty; the means of ventilation are amply sufficient, and the building presented many sanitary advantages.

The private residence used as a hospital had the customary defects of Turkish houses, and, as a consequence of these sanitary imperfections, upwards of two-thirds of the low typhoid fever cases treated within it had originated in the building. Fever prevailed throughout all the wards and

rooms; and, beside the cases among the patients, three out of nine female nurses had been affected.

The ceilings of the wards were not lofty enough. The windows did not reach the ceiling; most of the upper sashes would not open. There were no flues or open fire-places, and, at the time of our inspection, the windows had generally to be kept closed, on account of the coldness of the weather; the means of ventilation were thus very deficient.

The impurity of the internal atmosphere was increased by the improper position and faulty construction of the Turkish privies, some of the doors of which opened directly into the wards and rooms occupied by the sick. Chloride of zinc had been used for disinfecting these privies, but they were still offensive.

The drainage of the building was defective, the drains being merely trenches on the level of the Bosphorus, filled with water, having no current in them.

Some parts of the hospital were overcrowded. The water supply was good and abundant, and the arrangements for the interment of the dead were satisfactory.

The following directions were transmitted to Rear-Admiral the Hon. F. W. Grey, for remedying these defects:—

1. That the ventilation be immediately improved by the introduction of suitable openings near the ceilings of the wards, and by removing the upper panes in the windows, and inserting perforated zinc plates or wooden louvre boards instead; and further, that where practicable, curtains should be substituted for the ward doors.

2. That to diminish overcrowding, the beds be placed apart at a distance of not less than six feet, measured from centre to centre, and that at the same time, each patient should have at least 1000 cubic feet of space.

3. The Turkish privies, in the basement of the hospital, to be deodorized and closed up, and that those in the upper and middle floors of the building be converted into water-closets, and ventilated through the roof.

4. The drains to be thoroughly cleansed and their contents deodorized and removed.

5. As in the case with the other hospitals on the Bos-

phorus, directions were given for the regular and immediate removal of all refuse from the building.

We have pleasure in stating, that before our visit to this hospital, the officers of the establishment had been using their best efforts to improve its sanitary condition, though much still remained to be done.

Having concluded the preceding statement of the removable sanitary evils which the Commission found in all the hospitals on the Bosphorus, and the measures for remedying them, it remains to be mentioned, that the directions with respect to the military hospitals were embodied in two reports addressed to Brigadier-General Lord William Paulet, and transmitted to his Lordship on the 15th March, 1855. The report in regard to the two hospital-ships in the Bosphorus, was sent to Rear-Admiral the Hon. F. W. Grey, on the 17th, and that respecting the hospitals at Therapia, on the 27th March.

The total sick in the military hospitals, when the directions for their improvement were issued were as follows:—

				Sick.
Barrack Hospital	..	..	..	1,800
General	„	..	..	899
Palace	„	..	..	467
Kulali	„	..	..	949
Total	..	..	..	<u>4,115</u>

On the 16th March, the Commissioners received a communication from Lord William Paulet, assuring them that all instructions and suggestions pointed out in their reports would be strictly carried out as far as his Lordship was enabled to do so.

Similar communications in regard to the directions for the hospital-ships and the Naval and Marine Hospital at Therapia, were received from Rear-Admiral the Hon. F. W. Grey, on the 18th and 29th March.

We may here state incidentally, that in consequence of its having been represented to the Commission that the buildings occupied by the Russian prisoners at Constantinople, were in a defective sanitary state, Mr. Rawlinson

inspected them, and found the Turkish barracks, where the prisoners were kept, in so bad a condition, that they could not be improved except at great expense, and he therefore advised Admiral Grey to remove the prisoners to a more healthy place.

As soon as the examinations of the various establishments were completed, and the necessary improvements determined on, Mr. James Wilson, one of the Liverpool Inspectors was directed to proceed to Scutari to report himself to Lord William Paulet, and to carry out the instructions for surface-cleansing at the hospitals there. Similar instructions were also given him for the cleansing operations at Kulali.

On the 14th March, the Commissioners made an order directing Mr. Newlands, and Messrs. Freeney and Aynsley, the Inspectors, to proceed to Balaklava with a letter of introduction to the Commander of the Forces. Mr. Newlands was directed to commence the sanitary inspection of Balaklava and the neighbourhood immediately on his arrival, and to draw up an estimate of the cleansing staff and appliances required for improving its sanitary condition to be ready for the Commissioners on their arrival in the Crimea.

In conformity with a resolution of the Commission, our late colleague, Dr. Gavin, left Constantinople for the Crimea on the 21st March, Dr. Sutherland proceeded to Smyrna to inspect the hospital there on the 22nd March, and Mr. Rawlinson remained at Constantinople to initiate the works at Scutari, Kulali and Therapia, the details of which had been explained to that able officer, Captain Gordon, R.E., who undertook, with the greatest readiness, to carry them out.

Dr. Sutherland arrived at Smyrna on the 24th March, and proceeded immediately to the hospital there, where he saw Colonel Storcks, the Commandant, and Dr. Meyer, who had charge of the medical arrangements.

At that time, doubts were entertained as to whether the site of the Smyrna Hospital was such as to be conducive to the recovery of the sick, and the facts on this head were amongst the very first that demanded attention.

Dr. Sutherland received evidence on the subject from

Dr. James M'Craith, who had practised as physician in Smyrna for eight years, but had known the country for the last eighteen years, and Mr. Charles Wood, M.R.C.S., surgeon to the British hospital at Smyrna, and who had practised for eighteen years in the city. Dr. Sutherland also examined the sanitary condition of the hospital itself, and of that part of the town of Smyrna in its vicinity. He likewise visited, in company with Colonel Storcks, the Quarantine establishment, which it was proposed to use for convalescents, and several sites in the neighbourhood of Smyrna, with the view of ascertaining how far they would be suitable for convalescent stations.

We next proceed to state the result of these inquiries.

10. *Civil Hospital at Smyrna.*

This establishment consisted of a large Turkish barrack, situated close to, and almost on the level of the sea, at the south-west angle of the city of Smyrna. The building forms three sides of a square, open to the bay on the fourth side, so that the whole range of the barracks is exposed at all times to the sea breeze, and to the summer wind, the "Imbat," which blows directly from the sea to the hospital from 9 A.M. to 6 P.M.

The sea in front of the hospital was clean, and contained no decaying matter. Behind the buildings is an enclosed square, which contained the washhouses, kitchens, stables, &c., and on the south-west side of it is a large open space of ground on which it was proposed to build hospital sheds if necessary.

The building was thus entirely open on two sides; but on the other two, it had the streets of the town of Smyrna coming close up to its walls.

With reference to the sanitary condition of the vicinity, it may be stated, that the whole of the lower district of Smyrna, extending along the sea-shore, affords perhaps one of the worst examples of the neglect of sanitary precautions anywhere to be met with.

It occupies low and flat ground, receiving the drainage of the higher portions of the town and of the mountain

ridge, the site of the ancient city, behind it. A considerable portion of the modern city, along the sea-beach, is built on the filth of the town, which has been carried down and thrown into the water in order to bank out the sea and to obtain building space.

This is done by pushing out the houses on piles, so that the sea comes underneath their floors, and the vacant space is filled up by throwing in rubbish, filth, and decaying matter of all kinds.

This foul subsoil is traversed at short distances by open sewers passing under the houses and crossing the streets, and these sewers are bridged over by a few planks, to admit of the passage of traffic.

To a stranger the exhalations arising from the soil, and from the filthy streets and sewers in the lower portions of the town, are sometimes overpowering, especially in the bazaars, which are only long lines of narrow dirty streets, covered over between the ranges of houses in such a way as to preclude the free circulation of air and admission of light.

The drainage, paving, and cleansing are all as bad as can be, and, indeed, the bad sanitary condition of these lower districts of Smyrna, is more than sufficient to account for the pestilential fevers and plague epidemics from which the town has suffered almost from time immemorial.

The only wonder is, that pestilence in some form is ever absent from such places as Smyrna, Constantinople, Dardanelles, Samsoun, &c., all of which exhibit the same general indications of neglect of the most ordinary sanitary precautions.

At Smyrna, there is, besides, a large extent of marshy ground, lying to the east and north-east of the town, at the opposite extremity to that at which the hospital is situated.

The streets in the immediate vicinity of the hospital, although bad enough, were not in so bad a condition as those further removed; but still there can be no doubt, that although the site of the hospital was by far the most open, the best drained, the cleanest, and the most healthy in the town, the general atmosphere must have been more or less affected, according to the state of the wind, by the bad sanitary condition of the town itself.

The evidence of the medical witnesses already named, goes to show that continued, remittent, and intermittent fevers are the prevailing diseases; that in autumn, cases of fever occur with yellow skin, and apparently allied to yellow fever; that cases of a pernicious fever called the "remittent malarial fever," occur during spring and autumn; that occasionally, epidemic remittents show themselves; that, although there had been no plague for eighteen years, there had been three cholera epidemics within that period, and that the houses where these diseases prevail, are precisely the houses built on the foul foundations already mentioned.

The high average temperature, which is 80° in summer and 60° in winter, no doubt aggravates the effect of the many and powerful local causes of disease.

The evidence of the medical gentlemen, as well as personal observation, went to prove that the site of the hospital, although low, was certainly the most healthy in Smyrna, but that fevers would be likely to occur in the basement flat of the building.

It is, in fact, a rule in that part of the country that the lower flats of houses are unhealthy, and for people to sleep as high above the ground as they can.

Besides the defective sanitary condition of the streets in the neighbourhood of the hospital, there was a considerable extent of foul open ditches close to the boundary wall, and one of these ditches passed immediately in front and on one side of the medical officers' quarters.

The general drainage of the site of the hospital was imperfect. In some places water was lying on the surface, and the drains passing under or close to the hospital required examination.

Open privies were still in use, but were in process of being replaced by water-closets.

The building, like the hospitals at Scutari, consists of wards and corridors, communicating freely with each other by doors and windows. There were thus considerable structural facilities for ventilation, and all that was required was that these means should be properly made use of, and a few ventilating openings introduced where there was not a sufficiently free current of air.

The hospital was rather overcrowded with sick, and the wards and corridors required frequent lime-washing.

On examining the basement it was quite evident that it was unfit for the reception of sick, both from its defective construction and from the fact of the floors resting directly upon the ground. On inquiry it appeared that fever cases had already occurred, to some extent, among the patients and orderlies in this part of the building.

The burial-ground was situated on a lofty hill behind the hospital. The only defect in it was that the graves were too shallow on account of the rocky nature of the soil.

Having completed the examination of the hospital, Dr. Sutherland sent to Colonel Storcks, on the 28th March, the following instructions for the requisite sanitary improvements :—

1. That the streets nearest the hospital should be cleansed daily, and the hospital square kept free of nuisances.

2. That the open ditches in the neighbourhood of the hospital should be cleansed, and where necessary laid with tiles or covered over.

3. That the drains passing under or close to the hospital should be examined and cleansed, and where necessary relaid and kept clear by flushing. That ventilating openings should be made in the drains at a distance from the hospital, to prevent the sea or wind driving the foul air into the building. Also that all water lying on the surface of the ground should be drained away.

4. That the condition of the privies should be carefully attended to, and those disused, cleansed, disinfected, or otherwise rendered innocuous. That the water-closets then being substituted for open privies, should be carefully kept clean, and their ventilation made altogether distinct from that of the hospital.

5. That special attention be paid to the thorough ventilation of the hospital by making use of existing facilities, and by providing ventilating openings in any corners where the air could not be sufficiently changed by the present means of ventilation.

6. The immediate removal of all excreta from the hospital.

7. That the wards and corridors on the ground floor should cease to be used either for sick or convalescents.

8. That not less than 1,000 cubic feet of space should be allotted to each patient.

9. That all the wards and corridors should be thoroughly washed with quicklime at short intervals.

10. That all water used for the sick should be filtered.

11. That no interment should take place during the heat of the day, nor in a grave less than five feet deep.

It was in contemplation to extend the hospital accommodation at Smyrna, either by the erection of hospital sheds on the vacant ground in the vicinity, or by the adaptation of the quarantine buildings for the reception of the sick or convalescents.

In the event of sheds being erected, a recommendation was made that their floors should be raised three feet above the level of the ground to cut off the emanations proceeding from it; that the ground itself should be thoroughly drained, and that the same sanitary principles should be applied in the sheds as in the hospital itself.

The quarantine establishment of Smyrna is situated at some distance to the west of the hospital, and consists of sheds for the reception of merchandize, and other buildings for the accommodation of travellers undergoing quarantine. The establishment is erected close to the sea-shore, and a few feet above its level. It covers a small area of ground, in a kind of recess of the sea-coast, with high land behind it. No provision had been made for diverting from the site the surface water flowing from the hills, and as a consequence it flooded the site of the buildings so as to render it marshy and unhealthy. The drinking water was also very bad.

There appeared to be no objection to the use of this building for a few convalescents, provided such necessity arose, and provided also that the surface waters were diverted from the site, the drinking water filtered, and the upper flat of the building used in preference to the ground-floor, all of which was recommended to be done.

Between the hospital and the quarantine station was a large slaughter-house, which was also recommended to be placed under regulation to prevent nuisances from it.

Colonel Storcks, who had been most actively engaged in improving the Smyrna hospital, gave immediate orders for carrying out all the improvements, in which he was efficiently seconded by Dr. Meyer, medical superintendent, and by Mr. Brunton, the engineer attached to the hospital.

Before leaving Smyrna, Dr. Sutherland made inquiries as to sites for a convalescent establishment near the city. Three villages were named as the most healthy in the neighbourhood, Dourlack, Bournabat, and Boudjah. Several sites were found near the two latter villages, which would have answered the purpose.

Dr. Sutherland left for Constantinople on the 29th March, and arrived there on the 31st.

Dr. Milroy visited the hospital at Smyrna in the middle of July, on his way from England to Constantinople. At that period there were only 104 sick in it, and 400 beds were vacant. There were also about 100 convalescents at the Lazaretto, ready to return to the Crimea. The sick appeared to be progressing favourably, and scarcely any cases had arisen spontaneously in the building since the use of the basement floor had been discontinued. The state of the wards and corridors left nothing to be desired in point of cleanliness. They were also well ventilated. The water used for drinking was regularly filtered. Wherever old drains had been opened, they had been found charged with cesspool deposit, an immense quantity of which had been removed from different points close to the hospital walls.

At this time the beach in front of the hospital was covered with myriads of dead locusts, which perceptibly tainted the air. The only point calling for special notice was the unwholesome state of the stables in the rear of the hospital, respecting which Dr. Milroy addressed a letter to General Storcks, and the nuisance was immediately corrected.

The Smyrna Hospital was again inspected by Dr. Sutherland on the 9th November, 1855, shortly before it was converted into a barrack. It contained very few sick, and its sanitary condition continued good, with the exception of the basement, the damp exhalations from which rendered the wards unfit for occupation by troops, unless the floors

were previously covered with concrete, which he recommended to be done.

§ II. PROGRESS OF THE SANITARY WORKS AT THE HOSPITALS ON THE BOSPHORUS.

IN conformity with a special clause in the instructions issued to the Commission, Mr. Rawlinson, as already stated, remained a short time at Constantinople to superintend the initiation of the sanitary works at the various hospitals on the Bosphorus.

These works, although not of greater extent than was barely necessary for the removal of the more urgent sanitary defects, involved improvements requiring special materials and better skilled labour than could be obtained at Constantinople for their execution. It was of course requisite to make the best use of whatever means were available on the spot, and the improvements which could be carried out with these means were at once proceeded with.

The special materials required were on their way from England, where they had been ordered in anticipation by the Commission, but they could not arrive at Scutari for several weeks after the instructions had been issued by the Commission to the military authorities.

Dr. Sutherland and Mr. Rawlinson visited the hospitals on the 31st March, and up to that date the instructions were being carried out to the following extent:—

External cleansing was began by the Inspector with a staff of thirteen men, on the 17th March, and up to the end of the month there had been removed from the precincts and square of the Barrack and General Hospitals 556 hand-carts and large basketsfull of filth and rubbish, and two tons of filth from Kulalie; twenty-four dead animals, including two horses, had been buried, and the sewers of the Barrack Hospital, for which flushing-tanks had been erected, had been flushed out twenty-two times.

Cleansing, deodorizing, and general improvement of the sewers and drains leading from the Barrack and General Hospital to the sea, including arrangements for external ventilation and for flushing, were in progress.

The cleansing, whitewashing, and deodorizing by means of peat charcoal of all the privies at the Barrack, General and Palace Hospitals; the erection of flushing apparatus at the new privies erected in the barrack square; and the improvement of all privies within the hospitals, by removing the upper portions of the windows external to the corridors, so as to secure, as far as practicable, to the privies a ventilation separate from and independent of that of the corridors.

The lime-washing of wards and corridors, the repairing of the floors where necessary, and the removal of some of the old wood-work from the wards of the Barrack Hospital.

The formation of channels round the outside of the shed hospitals in the square of the Barrack Hospital, and the improvement of the ventilation of these sheds by means of louvred turrets constructed in the roofs.

The cleansing and partial repairing of the inner squares of the Barrack and General Hospitals. Macadamized stone was being broken for their further formation and improvement.

The water-tank at the Barrack Hospital had been cleansed and roofed over, and additional works of water supply were ready to be begun by Captain Gordon, R.E., as soon as the requisite permission could be obtained from the Turkish authorities.

The regulations respecting the burial-grounds were being enforced.

With regard to the hospitals at Kulali:—

The drains had been examined and cleansed.

The privies had been lime-washed.

The inner square of the Barrack Hospital there had been partially repaired, and stone was being got ready for completing the whole of the surface.

An additional supply of water, the works for which had been begun by Captain Gordon, R.E., before the Commissioners arrived at Constantinople, was being brought to the hospital.

The surface cleansing of the neighbourhood was being carried out.

The burial of the dead was being practised in accordance with our instructions.

At the same date, there were several important directions that had not been carried out.

The overcrowding of the Barrack Hospital had not been entirely remedied. The sick had not been removed from the wards over the privies and stables at the hospital at Kulali, and the ventilating arrangements at all the hospitals were still defective. The receptacles in the wards for the refuse and excreta had not been emptied or removed with sufficient regularity.

The delay in improving the ventilation arose from the non-arrival of the materials from England.

The other matters were represented to Lord William Paulet, by the Commissioners, both personally and in writing, and were attended to.

With regard to the Naval Hospital at Therapia, the works for its improvement had been commenced by Admiral Grey, and were being carried out with all possible despatch. The convalescent ship "Bombay" was shortly cleared and closed, as also the Turkish line-of-battle ship.

It thus appears, that at the time of the departure of the Commissioners from Constantinople for the Crimea, on the 2nd April, the works devised and ordered for improving the sanitary condition of the hospitals, especially those for removing the dangerous defects in the drainage, had upon the whole made satisfactory progress.

Copies of the directions respecting the hospitals, made by the Commissioners, had been sent to the War Department as soon as they were issued; and a letter in reply, dated 30th March, was received from your Lordship by the Commissioners, while in the Crimea, expressing your Lordship's anxiety about the progress of the works, and requesting to be informed how far the instructions had been complied with. A communication was in consequence addressed to Lord William Paulet, on the 14th April, requesting information on the further progress of the works.

A report was received in reply, dated 21st April, in which his Lordship showed that, besides the works and measures completed when the Commissioners left Constantinople, the following additional steps had been taken to give effect to the instructions :—

The drainage of the ground round the *Palace Hospital* had been improved; the obstructions in the privies removed; the closed gallery between the ball-room and theatre emptied of sick, and the number of sick much reduced throughout the hospital.

The *Stable Hospital* had been discontinued.

In the *Barrack Hospital* the beds in the corridors had been almost all reduced to one row. At least 1,200 cubic feet of space had been allowed to each patient. Lime-washing was in continual use: the excreta were removed as soon as possible from the wards. The outfalls of the Barrack Hospital sewers had been extended and protected from the action of the wind, three ventilating openings had been made in the main sewer, and a wooden flushing-tank had been placed over each drain. The inclination in the sewer at the sheds in the Barrack Hospital square had been improved, and flushing-tanks for the privies erected. Barracks for convalescents, and for the soldiers of the depôt, were being constructed outside the Barrack Hospital.

The sewers at the *General Hospital* had been extended, altered, improved and ventilated in the same manner as those at the Barrack Hospital.

At the *Hospital at Kulali* the privies in the basement fronting the Bosphorus had been abandoned and closed. The sick wards and officers' quarters over the privies and stables had been abandoned. Overcrowding had been remedied as directed; the upper halves of windows between wards and corridors had been removed, and the ventilation generally improved by partial removal of windows. The excreta of the sick were immediately removed from the hospital. Lime-washers were constantly at work. Lavatory accommodation had been provided. The barrack square had been drained, and coated with broken tile and gravel. The improvements suggested in regard to water-springs had been carried out, and a filter bed was being constructed.

The permanent ventilating arrangements in the hospitals had not yet been completed, on account of the non-arrival of the materials from England.

The cleansing operations at all the hospitals were proceeding energetically.

The melancholy death of Dr. Gavin, and the urgency of the sanitary works at Balaklava, rendered it impossible for either of the remaining Commissioners to return to Constantinople as soon as was intended; but we received information from time to time which satisfied us that the works at the hospitals on the Bosphorus were proceeding in a satisfactory manner. On the 21st June, however, Dr. Sutherland went to Constantinople, and made an examination of all the hospitals, and the following was their condition at that period:—

1. *The General Hospital.*

This hospital was in a satisfactory state. The walls and floors of the wards and corridors were scrupulously clean, and the lime-washing had been very well attended to.

The directions issued by the Commissioners had been efficiently complied with, especially in the important matter of ventilation. Perforated zinc panes had been introduced into the windows, and wooden ventilating shafts, from fifteen to eighteen inches square, had been carried up from the ceiling of each ward to the space under the roof of the building, and louvred turrets had been erected on the roof to admit of the escape of foul air passing up the shafts from the wards. There was a powerful current up all these shafts, and they were answering their purpose most effectually.

The privies were clean, and the odours from them had been much diminished by flushing the sewers, although, from their defective structure, there was still an open communication between the sewers and the interior of the hospital.

The window-sashes of the galleries had been removed and a free current of air intervened between the privies and the corridors.

There was nothing approaching to overcrowding in any part of the hospital, and many beds were vacant.

The external drainage works were nearly completed, and the flushing of the sewers was regularly done.

The courtyard had been drained, and its surface was nearly formed. The floor of the kitchen had also been drained.

2. *The Barrack Hospital.*

The sanitary condition of this large establishment had undergone a marked improvement. There was no overcrowding in either wards or corridors. The ventilation had been greatly improved by the introduction of panes of wire-gauze and perforated zinc into the windows. There had not been sufficient time to introduce a separate ventilating shaft for each ward to fulfil the requirements of the instructions, but this essential improvement was about to be proceeded with.

The wards and corridors were perfectly clean, and lime-washing appeared to be thoroughly and continuously carried out.

The privies were well managed and ventilated, and as free from odour as the bad condition of the sewers and drains rendered possible.

The flushing of all the sewers and drains was regularly done according to the instructions.

The sheds in the interior of the barrack square were clean and free from odour, and not overcrowded. The ventilating turrets had been completed, and acted extremely well. The flushing of the privies was also efficiently done.

Arrangements for the accommodation of the depot had been completed, and it was being removed out of the hospital.

3. *The Palace Hospital.*

The hareem portion of this hospital had been somewhat improved in its ventilation. The swampy ground outside had been surface drained; but not sufficiently so, on account of the want of a proper outlet. The offensive privy had been drained into a deep cesspool without materially improving its condition. There had been two deaths from cholera in the hareem; fortunately there were very few patients there at the time, and it was advised to be used as little as possible.

The hospital in the theatre and ball-room had been

greatly improved by the insertion of ventilating panes in the windows, and of ventilating openings in the ceilings. The wards were clean and in good condition. The privy of this part of the establishment was still offensive, and required proper drainage. Hardly a single case of fever had occurred in the building.

Excepting the fundamentally defective condition of the Turkish drainage of the hospitals at Scutari, and the still incomplete state of the ventilation of the Barrack Hospital, these vast establishments had thus, at the beginning of the warm weather, been put into a good sanitary condition, and the spirit of the directions issued by the Commission had been complied with so far as time and means had permitted.

4. The Hospitals at Kulali.

The barrack portion of this hospital had undergone great improvements; the wards and corridors had been thoroughly lime-washed, and were clean. The ventilation of the wards had been improved by the introduction of large square ventilating shafts passing through the ceiling and roof, and surmounted by louvred turrets. The windows were kept open, and the ventilation was sufficient. There was no overcrowding. The fifty Turkish privies under the front wards had been permanently closed and covered over; the wards over them were no longer used for sick; the Turkish horses had been removed from the stable, and the air in the neighbouring wards had become comparatively pure. The new wards were completed, and were clean and well ventilated: only one of them was in use.

The upper hospital, with the single exception of the drainage, was in a satisfactory condition as to cleanliness, lime-washing, and ventilation, and there was no overcrowding.

Considering their less favourable construction, the hospitals at Kulali had been nearly as much improved as those at Scutari.

A filter bed for filtering the water at Kulali had been completed.

5. *Naval and Marine Hospital at Therapia.*

The instructions of the Commission in regard to this hospital had been substantially carried out. The privies in the basement of the building had been closed, and water-closets substituted for those in the upper and middle floors. The ventilation was sufficient, and there was no overcrowding.

6. *Burial-Grounds.*

The sanitary condition of the great burial-ground at Scutari had been improved according to the directions issued by the Commission, and the burial of the dead at all the hospitals was properly conducted.

7. *Cleansing and Removal of Nuisances.*

The cleansing and removal of nuisances had been diligently carried out by the Inspector of the Commission at Scutari and Kulalie. The streets and lanes of the town nearest the Barrack Hospital were kept quite clean. The whole surface of the ground round the Barrack and General Hospitals was cleansed every day, and also the interior of the squares; and peat charcoal was freely made use of wherever required in deodorizing all filth previous to removal.

The staff of men engaged in these sanitary works was well organized, and everything outside the walls of the buildings at all likely to injure the purity of the air, was speedily and carefully removed, and all dead animals at once buried.

The sewers at the larger hospitals had not unfrequently to be opened to remove the accumulated filth which almost choked them up. This was done by men under the Inspector, and the matter was always deodorized before removal.

The flushing tanks placed over the sewers outside the walls at the Barrack and General Hospitals, and those connected with the latrines, were filled by hand labour by the

Inspector's men, and he himself regularly discharged the contents of these tanks into the sewers at stated times every day. By these means the sewers were kept as free from deposit as their radically defective construction would permit.

The privies were deodorized and flushed regularly; those under the wards at Kulali had been cleansed and deodorized before being finally closed up.

The great point in these important sanitary precautions was doing the work regularly. Nuisances were prevented, and the air within the hospitals purified.

The Inspector's daily reports extend from March 17 to July 11. It appears from them that the men employed on working days averaged twenty-three per diem.

The flushing of the sewers at the Barrack Hospital was begun on the 24th March, and in the course of the ensuing week the sewers at the Barrack and General Hospitals were opened and cleansed by direction of the Commission. There were 100 hand-carts of filth removed from these sewers, after having been deodorized with peat charcoal.

In the month of March, from the 17th to the 31st, as already stated, there were collected and removed 556 hand-carts full of refuse from the ground around the hospitals, from the squares, and from the adjacent streets of the village, and also from cleansed sewers. Two tons of filth were removed from the vicinity of the hospital at Kulali. From the time the flushing apparatus for the sewers was erected at the Barrack Hospital the sewers were flushed twenty-two times. There were twenty-four dead animals buried.

In April there were 1,329 hand-carts, or large basketsful of refuse, swept up and removed. The sewers were flushed forty-three times, and the hospital latrines, for which flushing tanks had been erected, were flushed out fifty-one times. Eight dead animals, including three horses and a cow, were buried.

In May there were 1,159 hand-carts, or large baskets of refuse removed. The hospital sewers were flushed forty-three times, and the latrines forty-four times.

The filth and refuse removed from the vicinity of the hospitals in June, amounted to 1,544 hand-carts or basketsful. The flushing tanks for the sewers and privies at the

General Hospital were completed at the beginning of the month. Ninety-five flushing operations were carried out with the sewers at the Barrack and General Hospitals. The latrines and privies at both hospitals were flushed out ninety-six times. There were also two dead horses buried.

Up to the 11th July, the date when the Inspector's daily reports cease, there were removed 526 hand-carts full of refuse from the ground near the hospital. The sewers at the two hospitals were flushed out thirty-six times, and the privies and latrines thirty-six times.

Besides the amount of cleansing and prevention of nuisances carried out by the men placed at the disposal of the Inspector of the Commission, there was much filth removed from the Palace Hospital and from Kulali by a staff of men employed by the Purveyor; the Inspector confining his duty in regard to these men to seeing that the work was well and carefully done.

In the beginning of July the system of cleansing had been so well organized that it appeared to be unnecessary to detain the Inspector much longer from his duties in Liverpool, where he was required. Dr. Sutherland, therefore, recommended Lord William Paulet to appoint two men as Inspectors, one at Scutari, the other at Kulali, to remain for a short time under Mr. Wilson's instruction, and to succeed him on his return home.*

* The following abstract of a few of the Inspector's daily reports may be useful as showing the manner of proceeding, and the amount of cleansing, and the removal of nuisances required to fulfil the intention of the instructions issued by the Commissioners:—

On the 26th March there were fourteen men employed at the Barrack Hospital sweeping the ground outside, and the square inside. Removed forty hand-carts of filth and rubbish from the ground and from the privies. Swept the streets and removed ten large basketsful of filth. Employed four men in carrying water to the flushing tanks, and flushed the sewers of the hospital three times. Employed six men in removing filth from the vicinity of the General Hospital. Swept the ground outside and removed ten hand-carts of filth from it. Visited all the three hospitals at Scutari.

27th March.—Four men carrying water to flushing tanks at Barrack Hospital. Flushed the sewers three times. Six men removing contents of a large sewer opened in the barrack square, and forty-two hand-carts of filth removed from it, after being deodorized with peat charcoal. Six men swept the ground inside and outside the hospital and the adjacent streets; twenty

The following is a summary of the work done during the period of Mr. Wilson's inspectorship :—

Hand-carts or large basketsful of filth removed	..	5,114
Sewers and latrines flushed (times)	.. ..	466
Carcases of animals buried	.. ..	35

8. *Improved Health of the Hospitals.*

We have already given the numbers of sick in each hospital at the time when the regulations were issued.

The following table gives the numbers for the week ending July 7, the period when the inspection was made :—

			Sick.
Barrack Hospital	.. ..	802
General .. ..	.. ..	348
Palace .. ..	.. ..	98
Kulali .. ..	.. ..	355
		1,603	
Total	.. ..	1,603

During the time when the sanitary improvements directed by the Commissioners were being carried out, a marked improvement took place in the health of all the hospitals. Part of the result appears to us to be due to the less severe character of the cases sent from the Crimea to Scutari ; but

large basketsful of filth removed, and three dead dogs buried. Five men employed at the General Hospital, who swept all the ground in the vicinity, and removed the contents of a sewer, fourteen hand-carts full were removed, after being deodorized with peat charcoal. Privies also deodorized with peat charcoal.

April 11.—Twenty men employed at the Barrack Hospital; twelve carrying water for flushing sewers and privies. These were flushed twice each. Two men swept the ground about the hospital, and six men removed the filth and rubbish. Forty hand-carts full taken away. Six men cleansed the ground around the General and Palace Hospitals; twelve hand-carts full of filth and rubbish removed. Purveyor has other men employed at these hospitals. Visited Kulali, and found that six men employed by Inspector had been taken on Purveyor's book. Purveyor has about twenty men removing refuse, and taking it down the Bosphorus in boats.

The hospitals are getting into a clean state.

April 19.—Twenty men employed at the Barrack Hospital; twelve carrying water to the flushing tanks. Sewers and privies flushed twice each.

there can be no doubt that the favourable change in the health of the hospitals advanced simultaneously with the progress of the sanitary works. All the sanitary measures adopted—the external cleansing, the deodorizing, cleansing, flushing, and structural improvements in sewers and drains, the limewashing of wards and corridors, the cessation of overcrowding, and the improved ventilation—had for their object the removal of numerous causes of atmospheric contamination which existed around, under, and within the hospitals at the time they were first examined, so as to preserve the purity of the air in the wards as far as it might be practicable to do so.

The palliating effect of the constant flushing of the

Two men employed sweeping, and nine men removing refuse. Fifty-nine hand-carts of filth and rubbish removed from the ground and from a sewer which had been opened. Charcoal used for deodorizing. Buried a dead horse lying near the hospital. Four men employed in surface cleansing at the General Hospital, and twelve hand-carts of filth and rubbish removed.

May 10.—Twenty-one men employed at the Barrack Hospital. Water carried by twelve men for flushing sewers and latrines, which were flushed twice each. Three men engaged in sweeping, and six in removing forty-three hand-carts full of refuse. Obtained assistance of the firemen, and flushed the sewers and privies at each angle of the hospital, with the fire-engine. Several tons of water were thrown down them. Three men employed in surface cleansing at the General Hospital, and eleven hand-carts of refuse removed. Visited Kulali, and the Palace Hospital and found all correct and clean.

May 25.—Twenty-two men engaged. Water carried as usual for flushing sewers and latrines. Ground swept, and thirty-nine hand-carts of refuse removed. Cleansing staff at the General Hospital removed fourteen hand-carts of refuse from the surface. General and Palace Hospitals kept very clean.

June 20.—Eighteen men employed at the Barrack Hospital; twelve in carrying water for flushing tanks. Sewers and latrines flushed twice each. Ground in the vicinity of the hospital swept, and thirty-nine hand-carts of filth and rubbish removed. Six men employed on similar duties at the General Hospital. Sewers and latrines there flushed twice each. Ground about the General Hospital cleaned, and sixteen large basketsful of filth and rubbish removed.

Visited the General Hospital and those at Kulali, and found all clean.

July 11.—Cleansing and flushing the sewers and latrines at the Barrack Hospital, done by fourteen men; and thirty-six hand-carts of filth removed from the ground and streets. Surface round General Hospital cleansed, and seventeen large basketsful of refuse removed. Water carried to tanks and sewers, and latrines flushed twice each.

Visited General and Palace Hospitals, and found them clean.

sewers was most beneficial. The wards were clean, bright, and airy. The sick had been much reduced in numbers, and those who remained looked more healthy than the inmates of the wards formerly did. With the exception of the defective structure of the drainage, the open privies, and one or two minor points, it is doubtful whether, at that time, any hospitals in existence presented greater advantages for giving full scope for the effective treatment of the sick, so far as that depended on cleanliness and on purity of the air.

The mortality among the sick had fallen very considerably, as will be seen by the following table of the percentages of deaths to the sick remaining and admitted into hospital for six periods of twenty-one days each, from March 17, when the sanitary works were commenced, to June 30:—

Twenty-one Days Ending	Barrack.			General.			Palace.			Kulalie.		
	Remain and Admitted.	Deaths.	Deaths to Sick per cent.	Remain and Admitted.	Deaths.	Deaths to Sick per cent.	Remain and Admitted.	Deaths.	Deaths to Sick per cent.	Remain and Admitted.	Deaths.	Deaths to Sick per cent.
March 17	2482	186	7.49	1227	144	11.73	686	51	7.43	1127	133	11.80
April 7	2495	99	3.96	1011	60	5.93	460	15	3.26	1094	66	6.03
„ 23	1988	65	3.26	801	21	2.62	399	11	2.75	875	30	3.42
May 19	1574	33	2.09	691	18	2.60	263	4	1.49	895	16	1.78
June 9	1180	19	1.61	567	17	2.99	183	8	4.37	627	5	0.79
„ 30	1408	15	1.06	524	8	1.52	242	2	0.82	610	4	0.65

During the month of May, when cholera prevailed in the Crimea, it also appeared at several points on the Bosphorus. At the end of the month, a few cases occurred in the General Hospital, and there was some diarrhœa among the sick. A drain on the south side of the building, 30 feet from the outside wall, had been opened to remove some obstruction in it. On the north side of the building, and about the same distance from the wall, were two manholes connected with a sewer, which had been left open. There was smell perceptible from all of these openings.

A single case of cholera occurred in a ward opposite one of the manholes. The other cases occurred on the south side of the building, opposite the opened drain. A nurse, in

another part of the building also had cholera. There was no further extension of the disease.

About the middle of June, cholera still prevailed in one or two villages on the Bosphorus, and it appeared on the 28th in the rooms of the Barrack Hospital occupied by the soldiers in *depôt* there. The Commission had formerly recommended the removal of the *depôt* from the hospital as a sanitary precaution, and the preparations being nearly completed, it was located outside the hospital on the 2nd July. In the four days from the 28th June, there had been in all, fourteen cases and nine deaths in the establishment. Ten of the cases took place in soldiers occupying the barrack rooms on the south-east side of the building. These rooms were by no means clean. The windows were low, and the ventilation inadequate. The rooms were besides rather crowded.

There was diarrhœa in the hospital at the same time, and two cases of cholera occurred among the sick. There was another case in the convalescent sheds in the square, and one in a shed opposite to it occupied by soldiers.

The cholera disappeared on the removal of the *depôt*.

At this period, the water supply for the hospitals was undergoing improvement. Permission for extending the supply had been obtained from the Turkish authorities and Captain Gordon, R.E., was executing the necessary works.

The source of the water was situated between four and five miles from Scutari, and is a natural spring issuing from the side of a lofty hill. The country between the source and Scutari is undulating and furrowed with ravines, and the spring was being conducted in red, unglazed, earthen pipes, about six inches in diameter, joined together by spigot and faucet joints. A trench, three to four feet deep, was being dug along the line of contour following the sinuosities of the ravines. At the bottom of this trench was placed a layer of concrete, in which the pipes were laid. The joints being made tight with fine hair mortar; a thick layer of coarser mortar was then laid over the pipes, and the earth filled in to the surface. Several springs along the course of the pipe were being connected with it. On examining the water at

various points along the line, it was found by Dr. Sutherland to be pure and good, and the impurities complained of at the Barrack Hospital, as well as the scanty supply, appeared to have proceeded from the circumstance that the old pipes had been laid too near the surface, and had been broken where the pipe crossed a public road.

Such is the usual Eastern manner of supplying towns with water. Springs taken at their source are preferred. If large, they are enclosed in buildings; if small, a well is dug to receive the spring, and carefully covered over. Earthenware pipes convey the water to the point of delivery, and there are settling wells with wash-out pipes and air-shafts along the course of the pipe. Tanks on the top of stone columns or buildings receive the water, which is distributed thence by pipes made of sheet-lead soldered. The water-taps at the fountains are well made. Some of them are elegant in form. Any overflow is received into marble basins for public use.

Notwithstanding the generally satisfactory condition of the hospitals at the beginning of July, they had all the very serious defect so often referred to, arising from the state of the drainage, a defect which might at any time give rise to most injurious consequences, especially if the number of sick were to be increased, and the hospitals at all overcrowded, or if any unusual epidemic influence were to prevail.

After several careful examinations, and much consideration of this subject, and remembering at the same time the unknown extent and duration of the military operations in the East, it appeared to the Commissioners that they would be incurring a very grave responsibility if they did not correct completely those defects, even at the cost of procuring from England materials and skilled labour.

After all that could be done in the way of temporary improvement, cleansing, and flushing, the drains under and near the hospitals, from their inherent bad construction, were still nothing but cesspools, communicating by open tubes with the interior of the hospitals; and it is an established fact that drainage of this defective description

gives off emanations which are, perhaps, of all known agents, the most certain in predisposing groups of persons, whether sick or healthy, to attacks of cholera, diarrhoea, dysentery, and fever, while they interfere at the same time with the successful treatment of the sick.

It was resolved, therefore, that Mr. Rawlinson, who had returned to London in the end of June, should communicate with your Lordship on these defects, and point out the means of remedying them.

It was recommended that drain-pipes, pan-closets, iron-piping, &c., should be dispatched to Scutari, and that a small party of the Army Works Corps, made up of skilled workmen, should go out with the materials. The proposal was acceded to, and the ship "Mary Ann" was dispatched early in October with thirty-four men of the Army Works Corps, and the requisite materials. Mr. Hugh Unsworth, having had considerable practical experience in the details of sanitary works, was selected, on account of his special knowledge, to superintend the proposed improvements, in accordance with instructions he received from Mr. Rawlinson.

The objects in view were to make the whole drainage of the hospitals efficient; to abolish the open privies attached to the wards, and to substitute soil-pans, as had already been done successfully in the Naval Hospital at Therapia; to construct proper urinals and lavatories for the sick; to drain effectually the ground and buildings of the Palace Hospital; and, in short, to put the whole of the establishments in such a condition as would make them suitable for any emergency that might arise in the course of the war.

§ III. THE HOSPITALS DURING THE WINTER OF 1855-56.

Mr. Unsworth, who had been dispatched overland, arrived at Scutari on the 11th November, and proceeded to make surveys for the works, in anticipation of the arrival of the "Mary Ann," which did not reach Scutari before the beginning of December.

Dr. Sutherland, who had returned from England to Scutari, went over all the hospitals with Mr. Unsworth, and

pointed out to him the defects to which remedies were to be applied.

At that time considerable changes had taken place in the hospitals. The comparatively healthy condition of the army in the Crimea had thinned them of sick. The Palace Hospital was no longer necessary, and was being converted into a barrack; and in all the other establishments there was abundance of spare room.

Preparations were being made at Haidar Pascha, and large stables were being erected, for the reception of the Cavalry Division from the Crimea for the winter. There was a considerable number of men in the depôt, and the south-east side of the Barrack Hospital had been cut off from the remainder of the building, and set apart as barracks for the German Legion and the Osmanli Horse Artillery.

The sick wards of the Barrack Hospital were in a good sanitary condition, and they had been further improved since the previous examination by carrying up a separate ventilating shaft from the ceiling of each ward to the roof of the building. The winter ventilation was thus completed.

The general condition of the hospital did not appear to be so satisfactory as it was before the re-occupation by troops of the part of the building whence the depôt had been removed in July, notwithstanding the evident care which had been exercised by Major-General Storke in separating as completely as practicable the barrack portion from the sick wards.

There were 989 men in the barrack-rooms, which were certainly overcrowded. The ventilation was defective. Neither the rooms nor the corridors were so clean as they might have been, a circumstance attributable to the dirty habits of the men. The privies and drains connected with them had become very foul, and the most offensive odours from them could be traced, not only along the corridors towards the barrack-rooms, but also into the hospital part of the building. The same conditions were in fact reproduced, though in a more aggravated degree, as existed when the same part of the hospital was occupied by the depôt during the previous spring.

It unfortunately happened that the epidemic influence of cholera had manifested its presence on both sides of the Bosphorus, and the French troops at Stamboul were attacked.

A few cases appeared in the village of Scutari on the 9th November, and on the 13th it attacked some men among the troops in depôt, and also in the hospital among the German Legion and Osmanli Horse Artillery. The outbreak was a most severe one while it lasted, and death in not a few instances ensued within a very short time after the accession of the disease.

It lasted altogether about a fortnight, during which period there were about 225 cases, nearly three-fourths of which proved fatal. The severity of the attack was over after the first few days. There were a few cases among the troops at Haidar Pascha, at the General Hospital, at Kulali, and in the barracks of Galata Serai, at Pera, but, with the exception of these scattered cases, the outbreak was confined to the troops in the Barrack Hospital and to the huts of the depôt, which were beyond the walls of the buildings, but on the same side as the rooms where the German Legion and Osmanli Horse Artillery were quartered.

Immediately on the appearance of the disease, Dr. Linton, Principal Medical Officer at Scutari, communicated with Dr. Sutherland as to sanitary precautions he was desirous of adopting to arrest the progress of the outbreak. Dr. Sutherland accordingly met Major-General Storks and Dr. Linton on the subject, when it was arranged that the troops within the hospital should be camped out; that the troops in depôt should be thinned; that the barrack-rooms should be ventilated; and all the part of the hospital where the troops were, cleansed and limewashed. The privies were also to be cleansed and deodorized. Medical officers were directed to keep up a rigid inspection of the men for the discovery and treatment of premonitory cases, and warm belts were to be issued to the troops.

The necessary orders were immediately given by Major-General Storks, who himself selected the camping-ground to which the troops were removed. Everything having been prepared, the German Legion and Osmanli Horse

Artillery were camped out on the 18th November, at a distance of about three miles from Scutari, after which the disease speedily disappeared from among them. The other precautionary measures were also put in force, and were attended by an immediate decline in the number of cases. The admissions, which had been thirty-four, forty-one, and thirty-three, for the three days preceding the removal of the troops, fell to eight, ten, and six on the three following days, but only three of these cases occurred among the camped-out troops.

Up to the date of their removal from the Barrack Hospital, $5\frac{1}{2}$ per cent. of the German Legion and Osmanli Horse Artillery, 989 men strong, had been attacked by cholera, and nearly 2 per cent. of the force had died. While among the troops, 2,030 in number, in the sheds of the depôt outside the building, where the ventilation was much freer, and the men not so crowded, the cases, up to the same date, amounted to $2\frac{1}{2}$ per cent. of the strength, and the deaths to a half per cent.

A good deal of choleraic and simple diarrhœa prevailed at the same period among the troops and also in the hospital, and there were a few cases of cholera in the wards. Several valuable officers, who were exposed to the very offensive effluvia proceeding from the defective drainage, fell victims to the pestilence, and there were fatal cases among the civilians, and among the medical staff attached to the hospital.

The *hospital part* of the building, although under the same roof with the *barrack part*, suffered very little, and there was no reason for this except its superior sanitary condition.

The *General Hospital* was at this period in an excellent sanitary state, and had in no degree deteriorated since it was last examined.

The *hospitals at Kulali* were also healthy, but required drainage-works. There were very few sick in the lower hospital, and the upper one had been emptied.

There was a small wooden hospital being erected at *Galata Serai*, for the use of the Artillery there, which appeared to be tolerably well arranged.

On carefully examining into the requirements at the hospitals, and considering the diminution of sick and the change of circumstances since the means for improving the hospitals had been dispatched from England, it was determined that the works should be commenced at Haidar Pascha, where the sanitary conditions were the most defective, because the Cavalry regiments were being quartered there.

The ground was a deep, muddy swamp, in a hollow, receiving the drainage from the higher ground above, and having no sufficient outlet for the water. It was so bad in many places as to be almost impassable. The roads were in a similar condition, and required drainage and making. The latrine arrangements were imperfect, and there was no drainage for removing the filth.

Mr. Unsworth, surveyor to the Commissioners, was directed to make the necessary surveys for draining the whole area of the lower ground of the camp, and for conveying the filth and foul water direct to the Sea of Marmora.

He accordingly drew up a report and estimate for the works, which was transmitted to Dr. Sutherland, and sent by him to Major-General Storks, on the 1st December, for his approval, with a request that the materials specified might be placed at Mr. Unsworth's disposal, from time to time, as he might require them.

The ship "Mary Ann" arrived at Scutari on the 6th December, and as soon as accommodation had been prepared for the Army Works Corps party, the works were commenced and the materials discharged from the ship.

When the estimates were completed, Dr. Sutherland went to Renkoi and Abydos to examine the hospitals there. The following is an account of their sanitary condition:—

Civil Hospital at Renkioi.

This large establishment was under the superintendence of Dr. Parkes, and the structural arrangements which had been devised by Mr. Brunel, C.E., were in charge of Mr. Brunton, the Resident Engineer. The site it occupied was a sloping bank of sand projecting into the Dardanelles on

its eastern side, and about seven miles above the entrance of the strait.

There is deep water on both sides of the site, and on either side there was a wharf for landing the sick, which was being connected by short railways with the corridors of the hospital.

The sand-bank rises inland from sixteen to seventy feet in height above the level of the sea, into low sand-hills resting on a range of tertiary hills about 1,000 feet high. The whole area occupied by the hospital is cut off by deep natural gullies from the heights behind in such a way that none of the drainage from the higher land could reach the site. The sand, moreover, was so porous that after heavy rain, the surface became dry in an hour or two.

There is no marsh land near the hospital-site, and no source of malaria excepting that general malarial character incident to a rich, undrained, uncultivated country with a high average temperature. The position selected was one of the best that could have been found, so far as its sanitary relations were concerned.

Water could not be obtained from wells on account of the dryness of the subsoil; but there were natural springs of excellent water near the summit of the range of hills, which were conducted to the site by simple engineering works, similar to those already described, and with the execution of which the native workmen are familiar.

The several springs selected to supply the hospital were covered over at their source, and each conveyed by a branch pipe of red earthenware to a small main of the same material, for a distance of about three miles, to a covered masonry reservoir, on an elevation considerably above the hospital. From this reservoir, iron pipes conveyed the water down the corridors between the hospital wards, and there were hydrants all along for drawing water for use, and for fixing hose in case of fire. There were the usual branch pipes for supplying the water-closets, urinals, and lavatories. The average daily yield of water was at the time 20,000 gallons.

The wards were large, lofty, wooden huts, many times more capacious than any in the Crimea, arranged so as to

form three lanes perpendicular to the sea, ensuring, thereby, a free sweep of the sea breeze among the huts. The ends of the huts in which the doors were situated, faced to the lane, and the space between them was covered over so as to form a corridor in which the convalescents might take exercise, and by which the communications of the hospital might be kept up in all states of the weather.

Inside, the wards were divided longitudinally into two halves, by partitions about half the height of the ward, and each ward could accommodate four rows of beds.

There was a range of swing windows along each side under the eaves, and a space between the roof and end walls was left open for ventilation.

The drains for these buildings were formed of square wooden boxes, connected with larger square wooden trunks, laid in concrete, and carried down to the sea, under the surface of which they were covered with masonry. Each trunk had a ventilating shaft close to the outlet, to prevent the dash of the sea from driving foul air into the hospital. A flushing pipe was connected with the head of each sewer. Each ward had eight water-closets, with urinals and lavatories, all abundantly supplied with water, and outside the ward. There can be no question that this hospital offered great sanitary advantages for the recovery of the sick. The situation is one of the best the country affords. The wards were clean, lofty, and admitted of any amount of ventilation. There was abundance of space for the sick. The arrangements for supplying water, water-closets, &c., were unexceptionable as regards health.

Earthenware pipes would have been better and safer for drainage than the wooden trunks, which would probably have become leaky if the hospital had been used for a length of time.

The only points of improvement which suggested themselves in regard to this hospital were, that there was no roof guttering, and the heavy rains of the season endangered the dryness of the ground under the wards; and that there might have been a somewhat freer use of the means of ventilation. Both of these points were stated to Dr. Parkes, and would receive attention.

The Hospital at Abydos.

The hospital at Abydos is situated about ten miles above the hospital at Renkioi, and on the same side of the Dardanelles.

It was nearly disused at this period, and was perhaps the least adapted for hospital purposes of all the buildings in the British occupation.

It was part of a quarantine establishment, situated nearly on the water-level, and with high land rising immediately behind it. The hill had been cut away to find space for the walls; and the section of the ground rose nearly to the level of the top of the windows.

The internal arrangements were unsuitable, although a great deal had been done to improve them.

It was just such a place altogether as would be most likely to originate fever among the sick; but happily it had ceased to be used on account of better accommodation having been provided.

Dr. Sutherland returned from Abydos to Constantinople on the 9th December, 1855. By that time, the cholera at Scutari had subsided. The engineer had commenced his preparations for the works there, beginning at Haidar Pascha.

The mud was cleared away, and tile drains laid down for draining the foundations of the road about the palace, and for forming the roads with stone, which had to be quarried and broken for the purpose. This was done by direction of Major-General Storcks. Though not properly a sanitary work it was a very necessary and useful one.

In the course of January 1856, the road-making was continued. A catch-water drain was dug to divert the surface water from the hollow at the hareem. A trench from five to eight feet deep was partly cut from Haidar Pascha to the Sea of Marmora for laying down a fifteen-inch pipe sewer to convey away the drainage of the latrines and refuse water from the site of the camp. Some works of immediate necessity connected with the drainage of the nurses' quarters in the Barrack Hospital were also done.

During February the main drainage was completed.

The fifteen-inch sewer pipe was laid down, and the road-making continued. Improvements of the drainage at the Barrack Hospital, and works for substituting soil-pans for open privies were commenced. Sanitary works were likewise carried out at the huts of the depôt nearest the Barrack Hospital. Trapped pipe drains were laid down to convey away the refuse water which used to be discharged into the water-course to the south-east of the hospital. The worst part of this course had been covered over, as advised by the Sanitary Commission.

In the beginning of March a number of men were engaged in examining the drainage of the Barrack Hospital, and as soon as the examination was completed, a plan and estimate was made by the engineer for fixing in the north-east angle of the building thirty-six soil-pans and six urinals, with proper pipe drains and flushing cisterns, with pumps to supply them with water. The estimates for the works were sent to Dr. Sutherland at Balaklava, and returned by him for approval to Major-General Storks at Scutari on the 14th March. The works at Haidar Pascha were progressing. Branch drains were laid down, and a large latrine, with suitable flushing arrangements for washing out the contents into the main sewer, was constructed.

The road-making was also proceeded with. The drainage works were extended, and the mouth of the main sewer at the Sea of Marmora was completed and trapped.

Further improvements were made in the drainage of the Barrack Hospital, and a number of water-closets with flushing cisterns were put up. One of the Turkish drains, loaded with filth and sewer deposit, had to be destroyed on account of its bad condition. Nine hundred yards of land drains were laid down at Haidar Pascha to improve the surface.

Dr. Milroy visited the hospitals at Scutari, and also the Royal Naval Hospital at Therapia, in the month of April, on his return from the Crimea to England, and found them in excellent sanitary condition, as far as regarded cleanliness and ventilation, and there was abundant space for the sick. The works for improving the drainage of the Barrack Hospital, which were then in progress, showed that even after all the flushing which the sewers had under-

gone, their condition, when opened, was so very bad that nothing short of the reconstruction which was in progress would have obviated the dangers to which the sick would have been exposed had the events of the war led to the full occupation of the hospital, especially while epidemic disease prevailed.

The improvements in the hospitals were continued in April, until the conclusion of the peace suspended the works by rendering them unnecessary, and the health of the army in the Crimea was so good, that from the beginning of February to the middle of April, 1,060 sick was the total number embarked at Balaklava for all the hospitals and for home. From the continued improvement in the health of the army, the hospitals were becoming gradually evacuated. The contingency, therefore, which the sanitary works at the hospitals were intended to meet, happily never arrived.

It was no longer necessary to keep up the establishment at Kulalie, and it was converted into a barrack for the German Legion, and the Barrack and General Hospitals afforded more accommodation than was necessary for the sick.

Whatever sanitary defects may have been connected with these hospitals when first given over to Her Majesty's forces, and whatever increased mortality among the sick may have arisen from these defects, and beyond all question there were local causes connected with the buildings of so serious a nature as to endanger life, not only among the sick but among the well, it is most satisfactory to know that they were either removed by suitable works, or kept under by the vigilance of the military executive, and that the sanitary condition of the hospitals underwent no material deterioration after having been once improved.

During the seventeen weeks which intervened from the 14th July, when Dr. Sutherland examined them with reference to the results of the improvements which had been carried out, and the 10th November, 1855, immediately before the outbreak of cholera among the troops, there had passed through the hospitals 9,070 sick, among whom there were 203 deaths, a fraction more than 22 deaths in 1,000 sick.

The following table shows the proportions for each of the hospitals:—

Mortality in the Hospitals at Scutari from the 14th July to the 10th November, 1855.

Hospitals.	Remained and Admitted.	Total Deaths.	Deaths to Sick. per cent.
Barrack	4,759	87	1·82
General	1,607	58	3·60
Palace	1,149	22	1·91
Kulalie	1,555	36	2·31

Had the whole drainage of the hospitals been relaid, and the open privies replaced by water-closets during this period, the mortality would have shown a still greater reduction.

The improvement in the health of the hospitals continued to the last, and when visited by Dr. Sutherland at the end of June 1856, immediately before they were finally evacuated, they were as healthy as the state of the drainage admitted.

The Commissioners cannot conclude this part of their report without expressing their acknowledgements to the military and naval authorities having command at the hospitals on the Bosphorus for the ready assistance afforded by them on all occasions.

They would at the same time bear their testimony to the devotion of the medical officers in fulfilling their onerous duties; and to the benign influence of that other ministering agency which has added a new name and a fresh glory to the annals of female heroism.

PART II.

THE CRIMEA.

IN the preceding pages we have thought it advisable to place under one view, irrespective of order of time, the facts in regard to the sanitary condition and subsequent improvement of the British hospitals situated within the Turkish territory, and we shall next describe the sanitary state of the allied occupation before Sebastopol, with the measures laid down in the instructions issued by the Commission for its amelioration.

The first step taken by the Commissioners on their arrival in the Crimea, in the beginning of April 1855, was, of course, to deal with those defects which they found to be most urgent, especially at Balaklava; but they did not neglect other more general subjects of inquiry respecting the topography, climate, water, &c., all of which had to be considered in their relations to the health of the troops.

These inquiries were carried out from time to time as opportunity offered, but it may be well that the results should be given, before entering on the consideration of the more local and removable causes of disease.

§ I. TOPOGRAPHY OF THE ALLIED OCCUPATION.

The allied occupation in the Crimea, at the beginning of April 1855, was limited to the plateau before Sebastopol, and the sea coast mountain range extending from San Georgeo to Marine Heights at Balaklava. Shortly afterwards, the occupation was extended to beyond Kamara on the east, and to the Tchernaiia on the north. Later in the season, the basins of Varnoutka and Baidar, and the mountain ridges to the north of them, were likewise occupied. A sketch of the topography and geology of the entire district is given in the Appendix, and also the special local circumstances connected with the diseases of the country. It is unnecessary, therefore, to do more than state the general results as far as these were likely to influence the sanitary condition of the army.

Considered in relation to the health of the troops, the ground occupied by Her Majesty's forces in the Crimea cannot be said, as a whole, to be peculiarly unhealthy, perhaps with the exception of the site of Balaklava itself and the marshy ground extending from the head of the harbour to Kadikoi. The neighbouring valleys generally are deep and narrow; the natural drainage defective; the subsoil apt to become saturated with water; and the sun's rays are reflected strongly from the bare rocks. The lower part of the basin of Balaklava, extending to the east of Kadikoi, was marshy from its defective drainage, and consequently unhealthy.

Nearly the whole surface of the area occupied by the army consists of loam and clay, underneath which, on the plateau, there is a spongy, calcareous, rocky subsoil, retaining water. From the hard, impervious nature of the rock on the eastern side of the occupation, the rainfall is concentrated on comparatively small surfaces on the bottoms of the valleys, consisting either of porous debris, or of loam or clay. In not a few places, there are impervious beds, underlying water bearing deposits on hill slopes, either retaining the water or turning it out along the edge of the impervious bed, so as to keep large areas of ground towards the valleys almost constantly wet in all states of the weather.

A high average temperature, with an intensely hot sun, is very likely to generate malaria under such circumstances, and to predispose to attacks of periodic fevers, which are the chief diseases of the country. The fevers are not usually malignant in character. They are very much what might have been anticipated from the local climate and topography, and would, in all probability, be eradicated or greatly mitigated by cultivation and drainage, as has been the case in the chalk districts of England. In certain situations, however, especially during autumn, these fevers assume a more dangerous tertian or remittent form, with biliary derangement.

The marshy heads of the sea inlets are all unhealthy, and the malaria from the mouth of the Tchernaiia is, at certain seasons, considered to be dangerous. Their effects are said to have been felt as far as Sebastopol. The influence of these marshes could hardly have been experienced in the British camps; but we were informed that cases of fever of a remit-

tent type, with a tendency to pass into typhoid and continued forms, had been admitted into hospital in April 1855, from the regiments nearest to Inkermann Heights, which overhang the marshy ground. The French camps on Fedoukine Heights, in the valley of the Tchernaiia, suffered from intermittent and remittent fevers.

It has been stated that ophthalmia used to be prevalent in Sebastopol, and there are local causes sufficient to account for it. The streets are unpaved, and the whole ground is covered with a very light, white calcareous dust, which is driven about by every breath of wind. From this state of the surface soil in dry weather, dust storms at times took place over the occupation, and during some of them, the dust has been raised in columns nearly 1,000 feet high during the hot season. The air, moreover, was frequently of an excessive degree of dryness, which, conjoined with the intense sunlight, reflected from white surfaces, and dust, was very likely to produce ophthalmia.

The surface of the plateau had no shelter from the winds or cold of winter, but, on the contrary, it received the full influence of the cold blasts sweeping from the north and north-east from the lofty snow-covered mountain ridges which overtopped it.

The subject of the waters of the district will be discussed more at length in the following pages; but it may be stated generally, that if any injurious influence was exercised on the health of the troops by the water they made use of, it arose from no natural bad quality of the water, but from foreign admixtures, arising from the manner in which it was collected and distributed.

There are no natural topographical conditions within the occupation which by themselves could have occasioned the disease and mortality among the troops during the winter and spring of 1854-55.

§ II. CLIMATE.

Meteorological observations were carried on for too short a time to enable an accurate estimate to be formed of the climate of the allied occupation in the Crimea. So far as these observations go, however, they afford tolerably reliable

results from which to judge of the effect likely to be produced by the climate on the health of the troops.

Observations were kept irregularly by various persons in Balaklava, but there was no regular series except those kept at the Castle Hospital by Drs. Jephson and Matthew. The instruments made use of were an aneroid barometer, a maximum and minimum thermometer, a wet and dry bulb thermometer, by Negretti and Zambra, a sun thermometer, and an air thermometer. The instruments were placed on the north side of one of the huts, about 320 feet above the sea, and overhanging it. From this circumstance, and from partial observations elsewhere, it is probable that the Castle Hospital observations represent a sea climate rather than a land climate; that the mean temperature in the close land-locked harbour of Balaklava, with its overhanging mountain slopes reflecting the sun's rays, was higher than at the Castle Hospital, at least during summer; and that the extremes of heat and cold, as well as of dryness, were greater on the plateau before Sebastopol.

The following table gives the monthly means and ranges, from April 1, 1855, to May 31, 1856, as deduced from the observations kept at the Castle Hospital, Balaklava:—

MONTH.	Barom. Mean.	Barom. Range.	Mean Temp.	Mean Daily Range	Mean Max.	Mean Min.	Mean Dry.	Mean Wet.	Mean Sun Temp.	Days of Sunshine.	Rain.
1855.	Inches.	Inches.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.		Inches.
April.....	29·463	·962	50·3	21·3	64·1	40·7	57·0	59·0	68·1	22	2·345
May.....	·544	·748	62·9	23·2	74·8	51·3	[64·6*	58·5*	81·0	29	5·308
June†.....	·624	·480	71·2	23·9	83·6	59·8	..	..	96·4	29	3·825
July.....	·543‡	·474‡	73·1§	22·9§	84·7§	62·2§	76·8||	67·9||	99·3§	29	4·003
August.....	·574	·385	73·0	22·5	84·5	61·5	76·6	68·0	107·5	28	2·776
September....	·634	·535	58·6	19·1	68·0	48·7	61·2	51·9	87·9	23	No data.
October.....	·610	·540	59·1	18·7	70·5	50·0	61·0	55·5	81·4	27	·118
November....	·651	·870	48·9	13·7	54·9	41·0	49·3	45·7	82·4	16	2·067
December....	·503	·950	33·3	11·3	39·3	28·9	35·1	33·9	55·2	13	2·400
1856.											
January.....	·469	·760	40·0	9·4	46·0	35·0	40·8	39·9	59·0	15	2·439
February.....	·536	·715	36·2	12·4	42·5	30·0	38·0	35·7	58·8	15	2·438
March.....	·500	·870	32·6	15·7	40·5	25·0	35·9	33·2	65·8	22	2·012
April.....	·481	·465	47·9	18·1	56·4	38·9	50·5	44·27	80·9	26	1·203
May.....	29·408	·605	60·9	20·2	71·0	50·7	62·9	56·6	85·4	25	1·529

* 12 days.

† 29 days.

‡ 28 days.

§ 29 days.

|| 21 days.

The highest observed sun temperature was on the 14th August, 1855, on which day the sun thermometer indicated 125°F . The highest observed shade temperature was 99°F . on the 23rd July; and the lowest observed temperature was $2\cdot5^{\circ}\text{F}$. on the 19th December, 1855.

On comparing the climate of the allied occupation with that of the metropolis for a series of years, we find that in April 1855, the excess of mean temperature at Bala-klava over Greenwich was $3\cdot8^{\circ}\text{F}$.; in May, $9\cdot5^{\circ}\text{F}$.; in June, $11\cdot9^{\circ}\text{F}$.; in July, $11\cdot3^{\circ}\text{F}$.; and in August the excess was $11\cdot9^{\circ}\text{F}$. In September, $1\cdot8^{\circ}\text{F}$.; in October, $9\cdot4^{\circ}\text{F}$.; in November, $4\cdot6^{\circ}\text{F}$.; in December, the Crimean temperature was $7\cdot1^{\circ}\text{F}$. under the London mean of the month. It was $1\cdot7^{\circ}\text{F}$. above the London mean in January 1856. In February it was $2\cdot6^{\circ}\text{F}$. below the London mean, and $9\cdot2^{\circ}\text{F}$. below the same mean in March. In April the Crimean temperature showed an excess of $1\cdot4^{\circ}\text{F}$., and in May of $7\cdot5^{\circ}\text{F}$. above the London mean.

The daily mean range of the month was in excess of that of Greenwich. In April 1855, the excess was $+4\cdot4^{\circ}$; in May, $+4\cdot1^{\circ}$; in June, $+4\cdot1^{\circ}$; and in July, $+5\cdot4^{\circ}$. In August it was $+4\cdot5^{\circ}$; in September, $+1\cdot8^{\circ}$; in October, $+5\cdot1^{\circ}$; in November, $+3^{\circ}$; in December, $+2\cdot3^{\circ}$. In January, 1856, it was $+1\cdot2^{\circ}$; in February, $+1\cdot9^{\circ}$; in March, $+1\cdot5^{\circ}$; in April, $+1\cdot2^{\circ}$; and in May, $+1\cdot1^{\circ}$.

So far, then, as can be ascertained by the observations, the Crimean climate, during the period of the allied occupation, may be characterized as one of extremes. Intense summer heat and sun radiation, and severe winter cold. The observed difference of air temperature in July and December was $93\cdot5^{\circ}\text{F}$.; and the difference between the highest sun temperature and the lowest air temperature was $122\cdot5^{\circ}\text{F}$. The daily variations were also at times excessive. During the hot season, the daily maximum shade temperature ranged from 72° to 99°F ., while the minimum ranged from 44° to 72°F . The sun temperature, to which the troops were exposed day after day during the same season, varied from 110° to 125°F . The passage from the sunshine to the shade was attended by a fall of temperature of from 32° to 44°F . A sun temperature of 120°F . was followed

by a fall of from 50° to 60° F. at the minimum period of the same night.

Occasionally the winds were hot and sultry, and during winter the effect of the severe colds was much increased by high winds. The cold continued late in the spring, partly from the continuity of the Crimea with the great steppes of Southern Russia, and partly from the late continuance of snow on the mountain ridges to the north and north-east of the occupation.

The dryness of the air was sometimes excessive, and its transparency so great that it was difficult to judge of the distance of objects without practice.

Fogs prevailed to a greater or less degree during the colder months, occasioned apparently by the difference of temperature between the Black Sea and the land. During certain times when the fog hung over the sea the water presented an appearance of intense blackness. When the wind blew from the sea to the land the current was suddenly carried upwards by the coast precipices to a height of 1,000 or 1,500 feet, and deposited vapour as it ascended, which rolled over the land as sea fog while the sun was shining brightly on the water below.

The barometric means, so far as could be ascertained by the aneroid barometer, were steady and the range under one inch.

As regards its relation to the health of the troops the Crimean climate was a trying one. The amount of intense solar radiation to which the troops were exposed during the summer heats through the day, not inaptly compared to the sensation of melted lead falling on the skin, alternating with a comparatively low night temperature, and the vicissitudes produced by the direction of the wind, all tended to cause sudden chills of the surface, and to increase the predisposition to those fevers incident to the country. The exhaustion produced by the heat often led to the use of stimulants, or to sleeping in the open air, both of which were no unfrequent causes of zymotic disease. Up to a certain point cholera was observed to increase in severity as the summer temperature rose. During autumn the intense dry day heat

was often followed by a cold north wind at night, or towards morning, succeeded by attacks of diarrhœa among the troops.

The winter differed from that of similar latitudes in other parts of Europe in its want of steadiness. There was no continued frost, followed by a regularly increasing temperature, but a constant oscillation of weather, and cold, moist winds produced by the peculiar climate of the Black Sea.

The cold and variable spring climate was an evident cause of catarrhal and chest affections which prevailed extensively among the troops.

Natives usually guard against inclemencies by wearing warm clothing early in the winter and late in the spring, and light clothing only during the very hot weather.

By attention to such precautions, by proper regimen and shelter, the variations of the climate might of course be provided against; but we apprehend there can be little doubt that without these precautions the Crimean climate is one very likely to affect injuriously the health of foreign troops exposed to it.

From any information we were able to obtain, it appears that the climate of the great undercliff sheltered by the huge sea coast precipices of the south of the Crimea is much milder in winter than any other Crimean climate.

§ III. WATER SUPPLY WITHIN THE BRITISH OCCUPATION.

One of the earliest subjects to which the Commissioners directed their attention was the amount and quality of the water available for use of the army. They examined carefully, and in different states of the weather, the sources of water over the whole of the ground occupied by the troops, and they were about to bring the subject under the notice of the Commander of the Forces, when they received a request from his Excellency on the 15th May, 1855, for assistance and advice in the matter.

The area of the water shed of that portion of the plateau before Sebastopol occupied by the British forces, may be taken at from eighteen to twenty square miles.

Making allowance for loss from surface drainage and evaporation, the rainfall over this area filters into the porous and fissured beds of stratified limestone of the plateau, and appears in the form of springs at any favourable point of issue.

Considered with reference to the water supply, the edge of the plateau overhanging the plains of Balaklava and the Tchernaiia and the line of heights to the north-east of San Georgeo, may be described as the highest level; from which the ground slopes towards the north-west. In doing so it is gradually hollowed into a number of superficial depressions ending in ravines becoming deeper as they approach Sebastopol harbour, and giving outlet to the natural drainage of the plateau.

Within the British occupation there were several of these hollows ending in five ravines considerably depressed below the average level of the plateau.

These hollows were partly filled with a loose porous calcareous debris, capable of absorbing and retaining a large quantity of water. From the porous rock and debris the water escaped in springs at the heads of the ravines; some springs yielding a much larger quantity than others, but none of them sufficient in amount to form the stream running in the ravine lower down. Some of the springs near San Georgeo, after flowing for a few hundred yards on the surface, were again absorbed and lost to sight.

The water at its point of issue was clear and good; but if the springs were not caught at that point they became muddy by running over the debris or loam of the surface when that was trodden under foot, as was generally the case, or after rain. At a number of points the springs did not come to the surface at all, but their position was distinctly marked by greener vegetation, or by a softer condition of the ground; the water in such instances finding its way beneath the surface down to the lower levels, and escaping into the streams in the ravines increased their volume.

The Russian farm-houses in some instances derived their supply from these superficial springs; but in situations where they could not be rendered available it had been the custom

to dig large wells or tanks of moderate depth, and to build the well of rubble stone, set in cement, and lined inside with cement.

The quality of the water was naturally the same as that of all waters filtered through porous tertiary limestone rocks. It was clear and wholesome, though, perhaps about 16° of hardness; but its condition, when taken for consumption, depended of course on the provisions made for collecting, storing, and distributing it for use. With proper care, the water was of as good a quality as was required for the health of the troops, but if suitable precautions were not adopted, it would, of course, become loaded with calcareous and loamy particles derived from the soil, rendering it less wholesome and by no means agreeable to use.

At the time of our examination the quantity issuing from the springs appeared to us to be far from representing the available supply, which we had no doubt could have been considerably extended by opening out the springs, so as to draw on the natural reservoir in the strata, by cleansing, and deepening existing wells or by digging new ones. Several of these springs, combined in a ravine near the Monastery, we gauged on the 15th May, 1855, and found them to yield 35,000 gallons per day of 24 hours, and this yield could have been much increased by very simple engineering appliances.

At that date, several capacious open tanks were being cleared out in two of the ravines. These tanks, however, had been formed on loamy or clayey ground, and as a necessary consequence the water was apt to become muddy unless it were kept perfectly undisturbed.

The supply for the troops was not drawn from the inlet pipe, the water from which was generally comparatively pure, but from the tank itself, by dipping with canteens and buckets, and the water carried to the camps was muddy and less wholesome than it might have been.

The best way for obtaining an abundant supply of pure water under the circumstances in which the army before Sebastopol was placed was:—

1. To have opened the spring heads as already mentioned.

2. To have received the water from the spring into a covered chamber, from whence it could have been drawn by a pipe or pipes for use.

3. To have received the overflow into covered tanks or reservoirs to be drawn from thence only by pipes with taps.

4. All wells should have been cleared out, puddled round the top, and protected by a low wall.

5. All the sources of supply should have been carefully guarded.

The horse troughs were generally supplied by the overflow from the tanks, and the men washed their clothes in the streams in the ravines. The ground around the water tanks and troughs was generally very sloppy from being unpaved. Where water was drawn from wells much was spilt on the surface from carelessness, and flowed back to contaminate the well.

So far as concerned the adequacy of the supply on the plateau, we arrived at the conclusion that unless the quantity of water were increased by proper engineering works, such as those mentioned, and unless additional means of storage were provided to pound the augmented supply, there would be considerable danger of a deficiency before the end of the dry season.

Descending towards Balaklava the upper part of that valley, towards the Col, had a stream of water running down it, derived from springs flowing from the lofty hill-sides south of the Col. This water, if properly economized, would have supplied a large number of troops. Near its source, however, it was fouled both by the Turks and French; and, for want of care, became so polluted in a very short time as to be unfit for consumption.

Below this point, a number of dead animals had been thrown into the bed of the stream, and by the time the stream arrived at Kadikoi it was useless.

In the adjoining valley of Karani, there are a number of springs near the village, flowing from the ridge which closes the valley at the top. The rills from these springs become enlarged in volume by the drainage from the hill-sides, and finally form a small stream from which the Cavalry camps in

the valley derived their supply. It appeared to us, that by suitable arrangements, the quantity of water from these springs might have been increased to a considerable extent.

There was a pure and abundant spring belonging to the Sardinian Head-quarters at Kadikoi, which was drawn from a pipe laid down for the purpose.

The town of Balaklava has abundant sources of water; the most remarkable of which is the ancient well at the head of the harbour, which derives its source from the limestone hill on the east of the harbour.

This water was pure and good, but from the want of a little improvement in the well, the water flowed over the road, keeping it constantly wet and muddy, and the amount so wasted, was very much greater than was used.

Another similar spring, but much less in quantity, flowed from under the hill on the west side of the harbour.

An important source of water is derived from Marine Heights, under which, and about 570 feet above the level of the sea, is an upland valley intervening between the conglomerate and limestone resting upon it. This valley is filled with porous debris, overlying impervious beds, and the water arising from the rainfall crops out all round the margin of these beds, and appears in the form of springs running down the hill-sides, on the one hand towards the plain of Balaklava, and on the other, towards the ravine separating the castle rock from the hills to the east of the town.

These latter springs form a considerable stream supplying the Castle Hospital, and flowing down the ravine into the harbour. Part of the water appears, in former times, to have been conducted along the ridge at the Castle Hospital to tanks and covered reservoirs, which remain partly entire, or in ruins within the walls of the Castle. This large water stream was never rendered available for use, because no precautions were adopted to prevent its being polluted by washing from the ships, &c., and even by worse nuisances, in its short and rapid descent from its source. A recommendation was made by the Commissioners on the 11th April,

1855, for covering over this stream to render it useful as an additional source of water supply. At a subsequent date, on the 17th July, a recommendation was made to have the stream guarded and protected from pollution.

So great was the amount of water at Balaklava from all these sources, that after making allowance for a reduction of three-fourths of the amount during the hot season, it was found that even then there would have been water enough in the immediate vicinity of the town to have supplied the whole British army, provided it could have been carried to the camps.

In all parts of the camp, the manner of supplying water to the horses appeared to the Commissioners to require improvement. It was usually accomplished by receiving the stream, or overflow, into a long trough, the overflow from which went into another trough, and so on, for a number in succession. By this arrangement, the water became more and more polluted in each successive trough, until it not unfrequently happened that the horses would not drink it. The evil admitted of easy remedy, by supplying the water to each trough separately, and in this way the whole line of troughs could have been in use. The total length of trough was too small for the number of horses to be watered, and there was not a little loss of time and some quarrelling in consequence.

Another prominent defect at Balaklava, was the want of watering-troughs for cattle landed from the transports. These animals were generally kept several days without water during the voyage from the ports of the Black Sea, where they were shipped, and were landed in this state and driven to the depôts without water, even in the hottest weather. A few yards of piping, of which there was plenty in Balaklava, laid from the stream in the Castle ravine to a few troughs on the cattle-wharf, would have permanently supplied the want. We represented this defect at the time, and it was finally remedied by the Commissariat Works Corps early in the present year, 1856.

These various points connected with the water supply were brought under the notice of the late Field-Marshal

Lord Raglan, in communications on the subject addressed to his Lordship on the 16th and 26th May, 1855.

We therein pointed out, that the water-supply from the springs in different parts of the camp before Sebastopol, might be increased in quantity in the manner already pointed out.

That the water should be conducted from the sources by pipes only.

That tanks and reservoirs should be covered. That piping should be laid to facilitate the distribution of the water.

That filter beds could easily be made if found to be requisite.

That additional lengths of watering-troughs should be laid down, and each trough supplied independently.

That all watering-places should be drained and paved, so as to preserve the surface hard and clean.

In making these recommendations, the Commissioners were aware of the want of certain materials required for carrying them out; but they stated at the same time that every requisite article, as well as skilled labour, could be got at Constantinople, where the whole practice of distributing water is perfectly well understood; and they also expressed their opinion, that were the improvements carried out, the camps before Sebastopol and at Balaklava, would have a sufficient supply of water during the ensuing summer. Mr. Rawlinson also offered his services in planning the necessary works.

The Commander of the Forces was most desirous of giving effect to any improvements the Commission might suggest, and he directed Captain Ewart, R.E., to consult with Mr. Rawlinson on the subject; but, unfortunately, before an appointment could be kept, Mr. Rawlinson was obliged to return to England.

In the course of the summer and autumn of 1855, during a long drought, there was some deficiency of water in the camps; but as various improvements had been carried out for increasing and distributing the supply, the deficiency was not so great as it might have been.

The previous removal of a large number of French troops to positions within reach of the canal of the Tchernaiia, relieved the other water sources, and opened up the exhaustless stores of the Tchernaiia itself.

Before concluding this part of our Report, it may be useful to mention a few practices which were adopted for obtaining water.

The usual way of conducting water all over the East, is to lay down earthenware pipes from the spring to the point of delivery; a plan well adapted for fixed camps in certain positions. One of the best illustrations of this mode of supply existed on the plateau, where some wet ground was opened, two springs discovered, and joined into one by separate pipes laid in the ground and covered over. The water flowed from the end of the delivery-pipe clear and wholesome.

One of the Sardinian establishments in the valley of Balaklava derived its water supply from a small source on Marine Heights, a considerable distance off. The water flowed down the hill-side in a carefully-cut drain, and arrived comparatively pure.

Some distance further to the east, a large spring was discovered, at the foot of a hill, which might have been delivered in excellent condition by a short wooden spout; but, instead of this simple expedient, considerable labour had been spent in digging a hole, into which the spring flowed; and as the water was drawn by dipping, it need hardly be stated that it was muddy, and scarcely fit for consumption. The remedy was pointed out on the spot.

A ready way of obtaining clear water was to knock the ends out of a couple of casks, to dig a well in any position where water was likely to be found near the surface, and to put in the casks one over the other, so as to form a sort of wooden well and filter.

The water for the Russian Inkermann batteries was obtained from a porous bed of debris near the top of one of the ravines, 500 feet above the sea, by digging, and inserting large gabions, to keep up the sides of the well thus formed.

The camps on Marine Heights were supplied by sources near the surface of the ground in the upland valley. With reference to these springs, it may be stated that when the Turkish troops were camped higher up the hill than the site of the sources, one of the first things they did was to dig latrines close to the spring heads. We represented this to head-quarters at the time. Such things are in constant danger of happening in camps, and the circumstance is mentioned here to show the necessity of carefully watching and protecting the whole neighbourhood of water-sources from similar dangerous nuisances.

The camps of the Highland Division at Kamara, which were formed there at the end of the year 1855, were abundantly supplied with pure water; the lofty hill slopes above the encampments are covered with beds of porous debris, the springs from which had been conducted by the native population through pipes, so as to form fountains. These were repaired in a tasteful manner by the men, and so left at the period of the evacuation. The water of one of these fountains was received and stored in a succession of barrels, from which it could be drawn pure and good.

Other instances of storage in barrels occurred, and it appeared a simple and efficient method, for it admitted of drawing by dipping, and yet the water did not become muddy.

In conclusion, we are of opinion that the water supply within the British occupation was naturally wholesome in quality, and admitted of being made sufficient in quantity; and that where the water was deficient either in purity or amount, such defect admitted of easy remedy.

§ IV.—SANITARY CONDITION OF THE BRITISH ARMY IN THE CRIMEA.

We shall next give a detail of the steps taken by the Commissioners for improving the sanitary condition of the town and harbour of Balaklava and the camp before Sebastopol; but, before doing so, it is requisite to give

such a general account of the health of the troops, at the period of our arrival in the Crimea, as may be necessary to show the diseases from which they chiefly suffered, and to prove the necessity for the measures which we recommended for adoption.

The approximate sanitary statistics in the following pages were deduced week by week from abstracts prepared by the Secretary to the Commission, of the regimental and divisional medical states, placed at our disposal by Sir John Hall, K.C.B., to whom we were indebted for much information respecting the health of the army, and for facilities in examining the camps and hospitals.

In the beginning of April 1855, the health of the army, when compared with that of males of the same ages elsewhere, was by no means good. It was, nevertheless, hardly below what has hitherto been the usual standard of armies in the field, and its health was better than that often experienced by armies similarly circumstanced.

On the week ending April 7, the sick and wounded amounted to 124 in every 1,000, or nearly to an eighth part of the army. The wounded were only 5 per cent. of this proportion. The force amounted to 31,610 men.

During the five weeks ending May 5, when cholera began to appear, the average sick and wounded may be stated at 109 men per 1,000, and of this number 100 were from sickness alone. The sick from disease was 10 per cent. of the army, and the sick from wounds was less than a hundredth part of the army. No less than $61\frac{1}{2}$ per cent. of the total disease belonged to the class usually called zymotic diseases, namely, fevers, diarrhœa, dysentery, and cholera. Half of the whole sickness prevalent in the army during those five weeks was due to fevers alone.

Asiatic cholera, which had showed itself slightly in the camp, advanced during the week ending May 12, and forty cases were admitted into hospital twenty of which proved fatal. The total admissions into hospital during the week were equal to 37 per 1,000 of the force. One half the admissions was due to the zymotic class of diseases, and about a seventh part to wounds.

The deaths during the week were at the rate of 10 per

cent. of the force per annum, and no less than 78 per cent. of the mortality arose from zymotic diseases.

On the week ending May 19, there were 1,621 admissions, including 92 from wounds, and of this number 1,066, or 65 per cent., were due to zymotic diseases. There were 194 cases and 109 deaths from cholera. The total mortality was at the rate of 23·7 per cent. of the force per annum, and 80 per cent. of the mortality arose from zymotic deaths, chiefly from cholera.

During the succeeding week, ending May 26, the admissions equalled 40 men per 1,000, and 59 per cent. of these admissions arose from the zymotic class, which also occasioned 88 per cent. of the mortality. There were 101 cases and 68 deaths from cholera during the week.

The mortality for the week was at the rate of 15·6 per cent. of the force per annum.

Above 10 per cent. of the admissions, and less than a tenth part of the deaths, arose from wounds.

On the week ending June 2, there were 113 cases and 58 deaths from cholera. A twelfth part of the army was on the sick list, and the weekly deaths averaged $12\frac{1}{2}$ per cent. of the army per annum. 5·3 per cent. of the admissions and 5·6 per cent. of the deaths arose from wounds, while 64 per cent. of the admissions and nine-tenths of the mortality arose from zymotic disease.

On the following week, ending June 9, 274 cases and 145 deaths occurred from cholera. The total sick amounted to 104 men per 1,000; the admissions equalled 66 per 1,000, and the deaths were at the rate of 32 per cent. per annum. 57 per cent. of the admissions and 80 per cent. of the deaths were again due to zymotic disease, chiefly fever and cholera.

The week ending the 16th June gave 199 cases, and 121 deaths from cholera. The total mortality was at the rate of 26 per cent. per annum; $17\frac{1}{2}$ per cent. of the total admissions and 16 per cent. of the total deaths arose from wounds. The zymotic class of diseases furnished $63\frac{1}{2}$ per cent. of the admissions into hospital, and 77 per cent. of the deaths during the week. 95 men per 1,000 were on the sick list.

The week ending June 23 shows a large increase of sick and wounded, from the advance of the cholera and the attack on the Redan. The proportion of sick rose to 130 men per 1,000; the admissions for the week equalled 100 men per 1,000. 1,659 wounded men were admitted, being 40 per cent. of the total admissions, and there were 85 deaths from wounds, or 30·8 per cent. of the total deaths, which, during the week, amounted to 276, or at the rate of 35 per cent. per annum.

The zymotic class of diseases still vindicated its deadly superiority over one of the bloodiest struggles of the whole war. No fewer than 1,912 zymotic cases, or $46\frac{1}{2}$ per cent. of the total admissions, went into hospital; and there were 178 deaths from the same class of diseases, equal to 64·4 per cent. of the total mortality, in hospital, during the week.

The following week, ending June 30, showed 138 men per 1,000 of the army sick.

The increase was due to zymotic disease. The admissions during the week equalled 70 men per 1,000, and the deaths were at the rate of 33·8 per cent. per annum. There were 351 admissions and 177 deaths from cholera, and there were 1,197 admissions and 9 deaths from diarrhœa. The total zymotic cases admitted were 2,179, or 75·6 per cent. of the total admissions, and the same class of diseases furnished a mortality of 207, or 77 per cent. of the total deaths.

During the week ending July 7, the cholera materially diminished. The admissions from this disease had fallen to 95, and the deaths to 66. The zymotic class, nevertheless, supplied 72 per cent. of the total admissions, and 64·3 per cent. of the total deaths. 8 per cent. of the total admissions and 31·4 per cent. of the deaths were due to wounds. The total admissions during the week were 60 men per 1,000 of the force, and the total mortality was at the rate of 17·6 per cent. of the force per annum.

On the week ending July 14, cholera subsided still further, and yielded 65 cases and 51 deaths. Fever, diarrhœa, and dysentery still retained their ascendancy. The zymotic class yielded 73 per cent. of the new cases, and 71 per cent. of the deaths during the week. The admissions from wounds

were 8·8 per cent of the admissions, and they yielded 26 per cent. of the total deaths, which were at the rate of 13·5 per cent. per annum.

The experience of these ten weeks, intervening between the 5th May and the 14th July, are sufficient for the purpose of illustrating the sanitary state of the troops. The period selected includes the interval between the first advance of spring temperature and the setting in of the fierce summer heat. It includes the commencement and first decline of the cholera. It comprehends a period of harassing and dangerous duty in the trenches, and one terrible assault.

The average strength of the army during the ten weeks was 38,507 men. The total admissions into hospital were 22,541, or 58 per cent. of the force, and the deaths, exclusive of those at Scutari, were 1,643, or 4·2 per cent. of the force.

The admissions from wounds were 3,858 or 10 per cent. of the force, and the deaths from wounds were 334—0·87 per cent. of the force.

The admissions from all diseases, excluding wounds, were 18,683—48·7 per cent. of the force, and the deaths from disease alone were 1,309—3·4 per cent. of the force, or 17·6 per cent. per annum.

The admissions from the zymotic class of diseases were 14,142, and the deaths 1,264, equal to 37 per cent. and 3·2 per cent. of the force respectively.

The admissions from all other diseases, not zymotic, were 4,541, and the deaths 45.

It thus appears that only 17 per cent. of the total admissions, and 20 per cent. of the total deaths were due to wounds, exclusive of deaths in the field, the remainder being due to diseases of various classes; that 74½ per cent. of the total diseases admitted into hospital were of the zymotic class; and that 96 per cent. of the total mortality from disease alone were zymotic deaths.

Of the 14,142 admissions from zymotic diseases, diarrhœa supplied 6,736 cases, 70 of which, or a little more than 1 per cent., proved fatal.

There were 1,709 cases and 955 deaths from cholera—a mortality of 55·8 per cent.

Dysentery afforded 824 cases and 13 deaths, or about $1\frac{1}{2}$ per cent. of the cases.

The various classes of fevers supplied 4,873 admissions and 226 deaths, or 4.6 per cent. of the fever cases.

The diseases classed under the general denomination of "fevers" yielded a low proportional mortality. They consisted to some extent of the usual fevers incident to the country and climate; and many of the slighter cases arose from drinking, lying out, or from exposure to the sun's rays. Such cases seldom lasted above a few days, and the soldier was soon discharged to duty. A considerable proportion of the cases were of the ordinary continued type, and some were of a typhoid character, marking in either case the operation of causes other than those specially connected with the country or climate.

While inquiring into the sanitary state of the troops, we were struck with the comparatively small amount of sickness in the Naval Brigade serving in the camp before Sebastopol, and we applied to Dr. Smart, R.N., surgeon to the brigade hospital, for information on the subject, requesting him to state the reasons why, in his estimation, the brigade had suffered less than the army. His report, which contains points of interest to the service, we have appended. It appears from it that the average strength of the brigade, from October 2, 1854, to April 30, 1855, was 1,200 men; that the cases treated in hospital equalled 5 per cent. of the force per month; that there had been 40 deaths during the period, being at the rate of 57 deaths per 1,000 of the force per annum; that 84 per cent. of the cases, 423 in number, and all the deaths except one had occurred from cholera, diarrhœa, dysentery, and fever. All the cases of sickness, except 59, took place during the months of October, November, and December, 1854, and at the period of our inquiry the brigade was healthy.

The great prevalence of zymotic diseases, their predominating influence on the physical efficiency of the army, and the known fact that means had been successfully applied, even in crowded cities at home, for mitigating their ravages, arrested the attention of the Commission at the commencement of the inquiry, and we saw that it would be with the local

favouring causes of these maladies we would chiefly have to deal.

There can, we apprehend, be little doubt that the unfavourable conditions in regard to diet, clothing, fatigue, and shelter to which the army had been exposed during the preceding winter still, to some degree, exerted their influence on the constitutions of the men who had passed through them, and that a certain amount of the existing predisposition to zymotic disease might be fairly attributed to these circumstances. Some of them, it is true, had by this time ceased, and the diet of the army underwent a most beneficial improvement shortly after our arrival, from the supply of fresh meat, vegetables, and bread. Notwithstanding these improved conditions, zymotic maladies were increasing in frequency, and the men who suffered most from the severer forms were the new arrivals—a clear indication of the existence of local predisposing conditions. There was, at this period, a prevailing epidemic constitution over the whole of the allied occupation, and in fact over the whole East, specially indicated by the outbreak of cholera in the army, and this epidemic state appeared to have rendered all persons exposed to it liable to attacks of zymotic diseases of other types besides cholera. The advance of spring, and the rise of temperature, had likewise called into operation local causes of sickness, which had been accumulating since the commencement of the occupation, but had lain comparatively dormant during the cold weather. These causes did not differ in kind from those which are observed elsewhere to determine the specific action of epidemics on the human organism.

In this respect the allied occupation afforded no exception to the general law, that, given an epidemic influence, the effects of that influence will be most marked where there is damp, and filth, and foul air; where there is defective drainage, want of cleansing, nuisances, overcrowding, defective ventilation, and impure water.

Certain positions exhibited these defects, or some of them, in so marked a manner, that the only remedy, in the absence of other means, was change of position. In other instances, from the more intense heat of the climate, local conditions, which otherwise might have appeared com-

paratively harmless, became of great importance to the public health.

While making this general statement, we would, at the same time, not overlook the predisposing effects of personal conditions. In the Crimea, drinking, fatigue, exposure to harassing and exhausting duties, exercised the influence they do elsewhere; but neither would these things by themselves, nor the climate, nor the existing epidemic constitution, account for the extent of zymotic disease, from which the army suffered at this time.

Whatever the amount of such influences, the Commissioners had no power to interfere with them. Their duty was to recommend, and to see to the removal or abatement of all sources of local malaria, or other local causes of disease, so far as the means at their disposal enabled them to do so.

In carrying out their instructions, the Commissioners directed their attention, in the first place, to the town of Balaklava, as that point of the occupation where improvement was most urgently needed, and as soon as the sanitary works required there were commenced, they proceeded to examine the camps.

§ V. SANITARY CONDITION OF BALAKLAVA.

The topographical peculiarities of Balaklava have been elsewhere briefly described. Considered in relation to the health of the inhabitants and of the shipping, they require some further detail. Balaklava is a small town, capable, at the time of our inquiry, of containing from 500 to 600 people, built on a bank of debris, resting on a steep hill-side, and receiving all the surface water from the ground above its level. The water of the harbour came close up to some of the houses. The harbour is about 850 yards long, measured from the Castle Rock to the head, and about 260 yards wide. Like other seaports in tideless seas, the water preserved nearly the same level, except when acted upon by winds and sea currents, through the agency of which alone could its mass be renewed. Along the east and west sides, the harbour is bounded by ranges of steep, rocky, limestone hills, from 600

to 800 feet high. On the south, it is divided from the sea by the Castle Rock, rising to the height of 469 feet, and round the base of which the entrance to the harbour winds. On the north end the hills open, leaving between them a narrow, marshy plain, through which the drainage of the valley of Balaklava flows into the head of the harbour. At a comparatively recent period, the harbour extended further inland than it does at present. It appears to have shoaled gradually by the amount of detritus brought down by the stream, and by rain storms, and the portion so filled up had become a noisome marsh, in which salt and fresh water intermingled. The area of this marsh was about ten acres, but it went on increasing in area, for the upper end of the harbour continued to shoal during the whole period of the occupation, and when the troops left the Crimea, there was marshy land where the sea had flowed not many months before.

North of the head of the harbour, the ground was marshy as far as Kadikoi, about three-quarters of a mile distant, and it there joined the lower and wetter part of the plain of Balaklava.

The town has no communication with the sea, except by the water entrance to the harbour, on account of the precipitous rocks by which the harbour is inclosed.

The water supply for the town and shipping was derived from the sources already described, and also from shallow wells dug in the debris on which the town is built. The water so obtained was not so pure as that derived from the natural sources.

The local position of Balaklava cannot be considered as naturally healthy, and under the most favourable circumstances would probably give rise to periodic fevers at certain seasons.

The native houses are built of the rubble stone of the district, or of stone scabbled into rough courses. The walls are set with mud and a little lime, timber for bond being freely used. The rooms are small and low, the walls thick, the windows small, the roof overhanging, and covered with common red earthenware tiles. In many cases there were external galleries and staircases, protected by overhanging

eaves. Some of the windows were double glazed. The fireplaces were low, and the flues small. In many situations the foundations of the house had been dug out of the hill side, so that the earth came up several feet against the back walls, rendering the lower flats damp and unwholesome. The subsoil moisture in these houses rose by capillary attraction above the level of the ground, and showed its presence very decidedly on the lime-washed walls, a sure sign of an unwholesome house. Much sickness, chiefly fevers, originated in these houses after the occupation. Five or six cases were taken out of the basement of one of them. More mischief from this cause would have been produced during the summer and autumn of 1855, had many of the houses not been pulled down by Lieutenant-Colonel Harding the Commandant, and huts erected in their stead.

Besides these local sanitary defects, incident to the town before its occupation, other causes of disease came into existence as soon as it was taken possession of by our troops.

The harbour became filled with shipping. Every available accommodation within the town was crowded with inhabitants. There were stables and other places for a large number of horses and cattle. A considerable number of Turkish and Croat labourers were located in the town and in its immediate vicinity. Many thousands of men and a large number of animals came into and left the town every day on the service of the army. And for all this increase of population and traffic there were no adequate cleansing or other sanitary measures provided. The consequence was, that putrescent organic matter accumulated in the very places where it was most likely to do harm. Had there been any road past the cliffs leading out to the sea, it would have been comparatively easy to have removed the whole town refuse, and to have turned it into the water at a distance; but, unfortunately, there was no such road. It might have been removed in large boats or barges, as it subsequently was, but there were none until a later date, when one or two large Russian barges were obtained. There were neither suitable roads nor means of transport to have removed the manure to a distance inland, and, instead of leaving it among the houses

of the town, it was judged better, apparently, to throw it into the harbour. This appeared to have been the special place of deposit for every kind of filth and refuse; and the Commissioners found on their arrival, that nearly the whole of the eastern margin of the harbour—that part nearest the town, and directly under the sterns of the shipping, where men were at work unloading stores for the army, was composed of a mass of organic matter, consisting of filth, stable manure, bellies and offal of slaughtered animals thrown overboard, amongst which had been imbedded numerous carcasses of dead animals. The railway was, we believe, carried along the upper margin of the harbour, partly on stable manure which had been laid down there.

The great mortality which took place in the winter of 1854-55, led to the use of the marsh at the head of the harbour as a place of interment, into which a large number of dead were put close to the line of the public road. The bodies appear to have been laid almost in water, and so sparingly covered with earth, that portions of the clothing, and even of the remains, protruded through the surface at the time we first examined it. Close to this graveyard a number of animals had also been buried.

There had been during the preceding months an excessive mortality among the Mohammedan part of the population, and the dead had been imperfectly buried in a graveyard of their own at the head of the harbour, but on its west side.

There were a few old buildings at the lower end of the town, under the Castle Rock, where cattle had been slaughtered. The ground behind these buildings was saturated with blood and offal, the smell from which was overpowering.

The number of latrines was insufficient either for the stationary or movable population; and this circumstance, conjoined with the habits of the native population, had led to the existence of nuisances both on the hill-sides and within the town.

The state of the harbour was also very unsatisfactory. It was full of shipping, the filth and refuse of which, as well as the blood and offal of the animals slaughtered on board, were thrown into the water, and left to float about till they

were either carried out to sea by winds or currents, or deposited on the margins of the harbour to increase the putrefying mass already there. Dead cattle, goats, sheep, and fowls were often thrown into the harbour, and were seen floating about.

The practice of throwing refuse organic matters upon the margins of seaports is common all over the East, and is a very obvious cause of the liability of these towns to plague, fevers, and other pestilential diseases. All such matters as are not consumed by the troops of dogs in every town, are left to decay, and infect the atmosphere perennially, until the neighbouring population become ripe subjects for pestilence. Even this equivocal protection did not exist at Balaklava, for all the dogs had been summarily destroyed.

Besides the exhalations immediately proceeding from the putrid matters themselves, organized structures from decomposing the sulphates in sea water, cause the evolution of large quantities of sulphuretted hydrogen gas, which of itself is a powerful aerial poison. The horrible smells arising from it were a constant source of complaint at Balaklava, and especially on board ship. On warm still nights the stench used to be so overpowering as to prevent sleep. In similar weather the effluvia from the putrid marsh and graveyard at the head of the harbour used to be sickening. There was hardly any escape from the malaria, except high winds happened to prevail. The air moving up the harbour was tainted by the state of the margin, and that moving from the north passed over the putrid marsh before reaching the town and shipping.

It is hardly necessary to state that the public health in Balaklava and the camps in its immediate vicinity was endangered by this condition of the town and neighbourhood, and that it was not safe for men to pass even a few hours in the town while on duty. Fevers were very prevalent even early in spring, and not unfrequently passed into typhus. Fever was prevalent in the camp of the Guards above the head of the harbour, and especially so in the Land Transport camp, close to the marsh. The hospital attached to this latter camp frequently contained hardly any other than severe fever cases.

The huts first occupied by the Sanitary Commission were in the same locality, and all the inmates of these huts suffered from fever within ten days or a fortnight of their occupation.

It was matter of general remark that a large proportion of the men engaged on fatigue duty in the town suffered from illness of a similar character. When cholera prevailed, men coming from more healthy districts, and remaining for a short time in the town, were exposed to the well-known danger of being more readily attacked than residents.

These, then, were the chief points regarding the sanitary condition of Balaklava with which the Commissioners had to deal.

It has been already stated that Dr. Gavin had, in consequence of a resolution of the Commission, left Constantinople for Balaklava on the 21st March; Mr. James Newlands and two Inspectors having preceded him the week before, and that Mr. Newlands had been directed to prepare a statement as to the measures more immediately required for cleansing the town.

The first meeting of the entire Commission at Balaklava was held on the 6th April, 1855, and Dr. Gavin laid before the Commission a statement of the sanitary defects requiring remedy. On the 9th, Mr. Newlands sent in his suggestions; and after the Commissioners had made a minute personal inspection of the whole town and its vicinity, they adopted Mr. Newland's memorandum as the basis for cleansing operations.

They found that Lieutenant-Colonel Harding the Commandant, and Rear-Admiral Boxer had been using their best endeavours to improve the sanitary condition of the place, but the great obstacle that had been experienced by both—that which had left so much that was essentially necessary undone—was want of labour and means of transport. This difficulty, which had been anticipated by the Commissioners before they left England, met them at the outset of their work, and although the Commander of the Forces and the heads of departments were ready to consider, and, as far as they had the means, to give effect to the instructions of the Commissioners, the difficulty was

never overcome until the Army Works Corps was sent to the Crimea. The army itself was fully occupied with the severe and harassing duties involved by the siege works, and by guarding the lines; there was no native labour procurable within the occupation. The labourers brought from Eupatoria, Constantinople, and elsewhere, were by no means efficient. They were unskilled and most expensive, and there was difficulty experienced in adding to their numbers.

It was perfectly evident that the Commissioners would have to restrict their requirements to measures of the barest possible necessity, and to trust more to efficient direction and organization of a small staff of men than to numbers.

The following were the precautionary measures more immediately required for the town:—

1. The covering over of the burial-grounds at the head of the harbour with lime or charcoal, and then with earth.

2. The covering of all ordure, and all collections of animal and vegetable organic matter with lime, or charcoal and earth; and the burning of all such refuse as could be safely destroyed by fire; also the use of charcoal and lime to collections already covered, from which nuisance might be found to proceed.

To prevent the recurrence of similar evils, it was requisite:—

3. To erect a sufficient number of latrines in convenient situations, and to provide for their management and regulation.

4. To provide a staff of men with carts and handbarrows, to collect and remove refuse.

5. To provide a slaughtering-place for animals at present slaughtered on board ship.

6. To provide barges for collecting and conveying out to sea the refuse of ships now thrown into the harbour; also the refuse of the slaughtering-place and of the town.

7. Lime-washing, outside and in, of all filthy houses, and cleansing and levelling of all uneven surfaces where water and filth collect.

Besides these precautions, which were of immediate necessity, the Commissioners were further of opinion that, in the event of any lengthened occupation of the town, it

would be very desirable to fill up the shoal at the upper end of the harbour; to construct temporary quays along the east side of the harbour; to form covered channels for offensive water; to cover the stream of water running down under the Castle Rock, to prevent fouling of the water; and to name the streets and number the houses, for the greater facility of ascertaining the locality of nuisances.

These points were embodied in a report addressed to the Commander of the Forces on April 11, 1855, in which the Commissioners at the same time expressed their conviction, that such was the extent of the local evils to be remedied, that there would be danger of an outbreak of disease on the setting-in of the hot weather. The Commissioners further stated in their report that officers fully acquainted with superintending the practical details of sanitary operations had been sent out by Her Majesty's Government, and that they were ready to give every assistance in their power in aiding in the execution of the requisite measures if they were enabled to do so.

Before this report was sent to head-quarters, a number of men had been placed at the disposal of the Commission for executing work of immediate necessity, but they had been withdrawn for what appeared to be more urgent work. There were thirty-three men on an average so employed for seven days. They were removed on the 9th April, and there were none returned till the 17th, when twenty-three labourers were put to work.

On the 15th a letter was received from Lieutenant-General Simpson, requesting the Commission to send an estimate for the number of men and the amount of materials that might be required for carrying out the works recommended in their report of the 11th, in order that Field-Marshal Lord Raglan might at once endeavour to procure them; but stating at the same time that the demands of the service were so urgent, that his Lordship could not spare any men from the force under his command.

The Commissioners found that, taking into account the quality of the labour, the current cleansing work for Balaklava and its neighbourhood, considering its resident population, and a daily influx of from 20,000 to 25,000 men, and large

numbers of animals, would require seventy-six men to do it thoroughly. For the other works, of a more permanent nature, such as the covering up of the graveyards marsh, &c., the number of men required would of course depend on the time within which the work must be done. In the prospect of the near approach of warm weather, it appeared that at least 293 men would be necessary, with suitable tools and means of transport.

There was at the time abundance of peat charcoal and lime at Balaklava, and there was a large bank of debris, suitable for covering the malarial surface of the marsh and graveyard within a few feet of its margin.

As soon as the work was completed, the intention of the Commissioners was to have recommended the Commander of the Forces to direct the men to be employed on other sanitary works connected with the army.

The estimate was sent to head-quarters on the 18th April, and on the morning of the 21st, Dr. Sutherland and Mr. Rawlinson had to deplore the loss of their zealous colleague, Dr. Gavin, who was accidentally wounded on the preceding evening, under very painful circumstances, and died in about eight hours afterwards.

Between the 17th April and the 2nd of May the total number of labourers that could be spared for sanitary works averaged only twenty-five men a-day, a number wholly inadequate for the current work at Balaklava. The larger number of men required by the estimate, for covering the marsh and graveyards, was never obtained.

At this period the supply of men and materials was irregular, as well as the direction of the work, because every officer was occupied with duties connected with the siege, and the Commission, in consequence, deemed it to be advisable, in order to realize the intentions of their instructions, to offer to aid in directing the works, provided the Commander of the Forces saw no objection thereto. They had an interview with Lord Raglan on the 26th April, and, at his Lordship's request, addressed a letter to him on the 27th, proposing several plans to answer the object. The one selected by his Lordship was to place the works directly under the Commission.

A letter was received by the Commissioners on the 1st of May, conveying his Lordship's decision, and requesting that Mr. Newlands should apply to General Simpson in writing whenever additional labour or materials were required. By this date, however, valuable time had been lost, and further delays would necessarily take place before the labour could be procured. The warm weather was rapidly approaching, and the Commissioners had the most serious apprehensions lest a severe outbreak of cholera should take place on board the transports, and the efficiency of this essential branch of the service be compromised. Whatever was now to be done required the utmost dispatch, and 500 labourers would scarcely have sufficed to do all that was necessary in the time. This number was asked from General Simpson on the 2nd May, with a request that as many labourers should be supplied at once as could be spared, and the remainder as soon as practicable. The day afterwards the average staff of men was raised to eighty, and no more were sent till the 30th, when the number was increased to 155, but by that date the time for which Mr. Newlands' services were placed at the disposal of the Commission had expired, and as he was urgently required at Liverpool, he was obliged to resign his appointment, and left the Crimea on the 7th June. The direction of the sanitary works, therefore, reverted to the military authorities, and the two inspectors who came with Mr. Newlands remained to superintend the men.

The extreme difficulty experienced by the military authorities in obtaining labour was the cause of the delay. There was no indisposition on their part to assist the Commissioners, and to give effect to their instructions.

Although the works had not been carried out with that decision which was requisite for protecting the public health in such an emergency, a good deal had been slowly accomplished by a careful direction and economizing of the labour in hand. The town had been cleansed and kept clean, and as soon as the more urgent cleansing operations had been completed, and peat charcoal used for deodorizing offensive matters, the inspectors were directed, on the 24th April, to detach as many as they could of the small staff of men at

their disposal, to cover over the worst of the graveyards.* A layer of peat charcoal was laid upon the graves, and eight to twelve inches of sandy ballast were placed above the charcoal. The work proceeded slowly, and after the surface had been gone over once it was found that the deodorizing substances used, but especially the sand, had acted so effectually in destroying the odour that it was unnecessary for the time to add to the depth of the covering. By this means an abominable and dangerous nuisance was in the end got rid of.

At the same period, Lieutenant-Colonel Harding began the construction of a temporary wooden quay across the top of the harbour, preparatory to filling up the shoal water there. While the graveyard was being covered, the men employed on it co-operated with those employed on the quay in filling up the end of the marsh nearest to Balaklava, and the nuisance from it was abated. The large exhaling surface of the marsh was never covered, for want of labour, neither was the Turkish burial-ground on the west side of the harbour, and both continued to generate malaria during the whole summer.

Additional latrines were erected, old unwholesome dwelling-houses were cleared away, and lime-washing was extensively used by order of the Commandant.

The inspectors, and the labourers under them, likewise applied peat charcoal and lime extensively to the margin of the harbour, to diminish, as far as practicable, the nuisance from the filth and animal matter that had been deposited there.

Two barges had, in the meantime, been provided, for removing filth and offal out to sea, and the deposit of manure along the margin of the port had been put a stop to. One of the barges was moored at the head of the harbour, and a notice was sent round by the Commandant, directing the people to deposit their refuse in it. These barges were towed out to sea, sometimes by boats and sometimes by a

* The following extract from Mr. Newlands' diary shows the dangerous state of the graveyards at this time:—"The stench from the uncovered graves frightful. No one can stand over them to work for an hour without becoming sick, and being attacked with diarrhoea. The inspectors have to procure wine and stimulants for the poor labourers hourly."

steam-tug; but partly from the state of the weather, partly from the boats being otherwise employed, it was not always possible to ensure regularity in the removal of refuse. To obviate this defect, as far as practicable, the inspectors were directed to cart away as much of the manure as they could, to a place at the head of the harbour, on the west side, and to burn it there.

The condition of the harbour itself underwent a gradual improvement, as the harbour police, organized by Rear-Admiral Boxer before the Commissioners went to the Crimea, became more practised in its work. It is true that the Commissioners had several times to make complaints of offal and dead animals having been thrown into the harbour, but these complaints met with immediate attention, and the nuisance was diminished for a time. The only effectual remedy for the evil was the construction of a slaughtering-place, and the prohibition of slaughtering on board ship, as had been recommended. There was no available ground for the purpose, and Admiral Boxer gave directions for the formation of a slaughtering wharf under the Castle Rock, by blasting, and laying down a temporary quay. Considerable progress was made in the work at the date when the Admiral fell a victim to the epidemic which then prevailed.

For reasons already stated, the sanitary precautions progressed slowly and irregularly, and the Commissioners had constantly to dread an outbreak of disease. A vigilant watch was kept up over the state of health of the population, especially on board ship. In the close, warm nights of early summer, the odours arising from the mass of decomposing organic substances, in contact with the salt water, along the shores of the harbour and at its head, were perceptible over the whole area of the town and harbour, and it was impossible not to feel alarm at the prospect of cholera, or some other epidemic appearing.

Early in May the temperature rose considerably, with a warm south-east wind. On the 10th, 11th, and 12th, there was heavy rain. On the 13th there was sunshine, with a hot, close, and damp state of the atmosphere, and cholera began to show itself in the camp before Sebastopol. There had

been a few cases before that date among new arrivals, and among men engaged in the trenches. About the same time, the disease first indicated its presence on board ship, in the harbour of Balaklava.

The earliest intimation of it which reached the Commissioners was in the form of complaints of danger to health from the old accumulations of filth along the water side. Inquiry was at once instituted, and it was found that diarrhœa, and one or two cases approaching in character to cholera, had appeared. The Commissioners immediately saw Admiral Boxer, and asked his aid in placing both ships and crews under medical inspection, with the view of adopting sanitary precautions on board, and bringing the diarrhœa under early treatment.

Admiral Boxer at once issued instructions for a more rigid exercise of the powers of the harbour police: he provided additional means of removing the refuse of the town and port out to sea; he issued orders to Her Majesty's ships that medical assistance should be rendered to any persons labouring under cholera or diarrhœa, and he ordered a general inspection to be made of all ships in port.

At our request, Mr. Walling, of Her Majesty's ship "Wasp," was directed to communicate with us, for the purpose of organizing the requisite inspection. At this period, Dr. Costello was employed, under Captain Heath, as medical officer of transports, but it was obvious that one medical officer was insufficient for the execution of the contemplated preventive measures. It was therefore arranged that the harbour should be divided into three districts, and that Mr. Walling, Dr. Nolloth, of Her Majesty's ship "Leander," and Dr. Costello, should undertake the duties, aided by two assistants. These gentlemen were instructed:—

To give medical aid to all applicants;

To examine the sanitary condition of all transports;

To enforce any measures of cleansing, disinfecting, or ventilation that might be requisite;

To inspect the crews, and to treat, on the spot, any persons affected with diarrhœa, cholera, or other zymotic disease;

To deposit medicines on board where requisite, and to warn all captains, officers, and crews, of the necessity of immediate attention to diarrhœa.

They were further requested to report to the Commissioners at regular intervals, and to point out any nuisances along shore, or in the harbour, that might occasion mischief on board ship.

The ship inspection was begun on the 19th May, and had to be continued for four months from that date. It was most efficiently done, and was of great importance to the public service.

By its means, numerous nuisances in the harbour arising from the offal of slaughtered animals and refuse surreptitiously thrown overboard, were discovered and removed. The state of the beach was represented to the authorities from time to time. Foul ships were cleansed, lime-washed, ventilated, and fumigated, and the harbour was thinned of ships as soon as there was an appearance of overcrowding.

Numerous cases of zymotic disease were discovered, and promptly put under medical treatment. The sanitary measures, beyond doubt, diminished the number of attacks, and the immediate treatment of diarrhœa cases arrested the development of cholera. The following table shows the cases brought under treatment, but it does not contain the whole number of premonitory cases :—

Cholera.	Choleraic Diarrhœa.	Diarrhœa.	Dysentery.	Fevers.
90	172	530	81	229

From inquiries made respecting the probable average numbers of seamen among whom these cases occurred, it appears likely that they exceeded 2,000 men.

Many of the fever cases were preceded by diarrhœa. Hardly any diarrhœa cases passed into cholera. The results of the cholera cases are not given in the returns, because whenever it was practicable to do so, these cases were sent

to hospital, and went from under the care of the visiting surgeon.

The following brief extracts, taken here and there from the journals of the surgeons, will show the conditions under which the disease prevailed:—

“Epidemic disease was found to prevail more or less extensively, according to the greater or less apparently insalubrious position of the ship or ships.”

“Particular ships appeared to suffer in proportion to the greater or less neglect of their cleanliness or ventilation.”

“Disease became more general where the men were dirty and more than usually closely packed together.”

“Sickness was greatest towards the top of the harbour, and this diminished as soon as such ships were removed either to the entrance or just outside the harbour.”

“The ‘Paramatta,’ where cholera and choleraic diarrhoea continued for several weeks, had a large quantity of soiled blankets on board.”

“The cattle-ships have proved to be always the most sickly.”

“Seamen, during the prevalence of an epidemic, should be dispersed as much as convenient throughout the ship,”

An affected ship is described as being:—

“Moored close to the beach on the eastern side of the harbour, and opposite to her are two pools of decomposing vegetable matter, bread, onions, and cucumbers, the stench from which is most powerful.”

“The heavy rains and great traffic have converted the eastern beach and road into a filthy puddle, and it is amongst the ships close to this beach that three-fourths of the cases of cholera have occurred in my division. Fever and dysentery are always prevalent in that quarter.”

“About a fortnight ago this ship was hauled further off the beach, and though only some fifteen yards, it is most astonishing the decrease in the number of sick.”

“Stench from the beach unbearable; the master of one of the vessels told me this morning that he looked upon it as the cause of his having lost four of his men from cholera.”

“The steamers employed in carrying cattle are the most unhealthy vessels in my district. The prevailing diseases on board them are intermittent, remittent, and continued fevers, diarrhoea and dysentery.”

“On board the ‘Paramatta,’ lying at the upper part of the harbour, found five cases of choleraic diarrhoea.”

“Sickness has been much more rife on the south-east than on the north-west side of the harbour, which latter is quite free from the many sources of vitiated air found on the opposite side.”

“Inspected the ‘Black Sea,’ having just landed mules. Her between decks contains a large quantity of animal excretions, and is generally insanitary. Found four cases of choleraic diarrhoea.”

“Examined ‘Kangaroo,’ found her in a very insanitary condition, having brought up 250 cattle. She had on board a large number of dead cattle in

different stages of decomposition, an immense quantity of dung, animal excretions, &c. Recommended to Captain Heath that she should land her live oxen as quickly as possible, and proceed out to sea to dispose of the dead bullocks immediately, and clean ship, using chloride of zinc, charcoal, white-washing, &c."

These extracts will give a general idea of the localizing conditions of the epidemic disease in the harbour. Many affected ships were found in a bad sanitary state, especially the small Levant traders. The cargoes of vegetables, fruit, hay, &c., brought by them were often decayed or partially rotten. The holds foul and the bilge water often offensive. The forecastles were not unfrequently crowded, filthy, and unwholesome.

In numbers of cases affected ships were found in good condition, except that they were moored close to the nuisances on shore. Sending such ships outside the harbour was a certain means of arresting disease. Lime-washing, cleansing, ventilation, &c., were also used with advantage. Referring to the precautionary measures adopted, Mr. Walling, of Her Majesty's ship "Wasp," who had the worst division of the harbour under his charge, says in his report:—

"During the winter and spring I have often looked with feelings of alarm to the approach of summer, and the effects of its scorching sun especially when examining the filthy beaches and the insanitary condition of the cattle-folds, slaughtering-places, and graveyards. The favourable way in which the summer has passed appears to me to be entirely due to the immediate institution by the Sanitary Commission on the first appearance of the epidemic of most active measures for its suppression."

The sanitary condition of ships engaged in the transport of animals deserves more attention than it has received. It never appeared to us to be recognized that animal health and life depend on the same conditions as human health and life. From neglect of this obvious principle a large number of valuable animals were continually being sacrificed during the siege of Sebastopol, and many of those landed alive at Balaklava were often in so diseased a state, even after a voyage of two or three days, that some of them died immediately on being landed; a large number sometimes died shortly after, and the flesh was often of a very inferior quality in those that were slaughtered for use. Excessive filth, want of fresh air, and deficiency of water and sometimes

of food, along with the careless manner in which the animals were hoisted on board, frequently by a rope passed round the horns, were the main causes of the loss. It is beyond a doubt, as proved by many of the horse-transport steamers, that the transport of animals can be effected without the accompaniment of these elements of suffering and destruction, and it is within the bounds of probability that the want of care not unfrequently evinced in these matters might have led to serious consequences to the public service.

Such was not unfrequently the condition of these cattle-ships that during the prevalence of the epidemic the Commissioners considered their presence in the harbour as hazardous to the public health. It was at first the custom to throw the dung overboard into the harbour, but when this practice was put a stop to, the ships were ordered to be cleansed on their outward voyage. During the epidemic this regulation was deemed to be insufficient, and the Commissioners therefore issued an instruction on June 14th that the fires on board should be banked up on all cattle-ships coming into harbour, the live stock discharged, and that immediately thereafter the vessel should proceed outside the harbour, to throw the dung overboard, cleanse decks, and wait for orders. This instruction was put in force at once.

The reports of the visiting surgeons show that, as the Commissioners had anticipated, the emanations from the margin of the harbour were the most powerful localizing causes of the pestilence. Most of the cholera cases, and nearly all of the fatal cases, occurred in ships moored close to it. The foul matter from which the emanations proceeded could not be removed, for it was imbedded below the surface, and any disturbance of it would have been dangerous. All that could be done was to use peat charcoal, or lime, to deodorize the mass, and to cover it with earth as far as the labour would admit of its being done. Although the smell was remedied to a certain extent by these means, the peculiar organic effluvia which appear to determine the action of the cholera poison on the human constitution, still exhaled into the air.

A somewhat remarkable illustration of this fact was afforded by the case of the steam-ship "Chester." This ship

had been in harbour several weeks, and was moored stern on to the shore. She was loaded with charcoal for the use of the army, which was being discharged by the crew. A lofty wall of bags of charcoal had been piled up within a short distance of her stern, and a good deal of charcoal dust had fallen all over the quay, so as effectually to deodorize the surface of the putrid matter of which the quay was at this point composed. The men were dusted over with charcoal from their work. There was no smell in the ship, and none from the quay close to it. If charcoal, as has been asserted, really had the power of absorbing or neutralizing the effluvia which predispose to epidemic disease, here was a case in which of all others the crew ought to have enjoyed immunity from cholera.

Nevertheless, on the 21st May a case of cholera occurred on board. On the 23rd and 24th there were five new cases. Of these six cases, five proved fatal with extreme rapidity. On the afternoon of the 24th the ship was removed from the influence of the local atmosphere of the harbour, by being sent a short distance outside into the open sea, after which a few cases of diarrhœa, all readily yielding to treatment, occurred among the crew, but there was no more cholera.

With regard to the removal of ships out of harbour, it may be stated that, practically, a change of place no more than sufficient to withdraw the vessel from the immediate atmosphere of the harbour, made all the difference between safety and danger, a very conclusive proof of the merely local conditions on which the outbreak of cholera depended. It was, in fact, simply a question as to whether the ship lay on the north or south side of the Castle Rock. If in the former position, and within the harbour atmosphere, her crew were in danger; if in the latter, and in the open sea air, they were comparatively safe.

Another ship, called the "Peace," also laden with charcoal, was moored within the harbour. She was a sickly ship, and had, moreover, two cases of cholera on board, both of which proved fatal.

The practical results of the measures enforced during this epidemic, in preventing the extension of cholera, confirmed the experience of former epidemics, and also justified the

opinions promulgated by the first General Board of Health, in their Reports on Quarantine, as to the neglect of sanitary precautions on board ship being attended by a liability to epidemic diseases, and as to the effect of a bad sanitary condition of seaports in localizing pestilences, both in seaport towns, and on board ship in harbour.

At the beginning of June the inspectors were directed to push forward the sanitary works specially connected with the margin of the harbour.* In compliance with the

* A few occasional extracts from the diaries of Mr. Newlands and the inspectors will show clearly the sanitary evils they had to deal with up to this period, and the progress made in carrying out the works :—

“1855. April 3, Tuesday.—We were enabled to commence operations in the village of Balaklava, having had forty-three labourers (including four umbashies or chiefs) placed at our disposal by the Town Adjutant, Mr. Deacon, and we received from the Storekeeper of the Royal Engineers ten wheelbarrows, twelve shovels, and twenty picks. We immediately set nine of the men to work in removing a quantity of timber that had been indiscriminately strewn over a piece of vacant land in Quay-lane, and situated at the back of the Commissary rum store, and which had been, and still is, the resort, as a privy, not only of the workmen employed in the various stores and shipping discharging on the quay, and also of the Turks, Greeks, and Maltese living in the immediate vicinity, but of thousands of people who daily come to the village to transact business. As might be expected in such a place, the surface is entirely covered with human ordure, in many places to the depth of several inches.

“We caused the wood to be piled at the entrance to the ground, and had a portion of it levelled. The other men were employed in levelling the ground, and in removing large quantities of filth and offensive matter, also in burying refuse and other garbage, which had been deposited in several places on the surface, at the back of the Naval Brigade magazine. This place had also been a stand for Commissary horses, and several tons (say forty) of manure and other filth had been permitted to accumulate on the margin of the stream flowing down the ravine from the Sanatorium. As some of the filth was dry, the inspectors set fire to it, and in some measure the smell emanating from it was remedied.

“April 4.—Thirty labourers were placed at our disposal by the Town Adjutant this morning, six of whom were employed at the ground in Quay-lane in finishing, levelling, and otherwise improving the place. Four loads of quicklime and ten bags of charcoal were freely distributed over the surface, and in deodorizing the filth, and the place was in a great measure improved. There are some Maltese living in a small room in this yard, and three were lying (on this day) ill of fever. The remainder of the labourers employed on the same place as yesterday with a very beneficial result, as the whole of the filth from where the houses stood had not only been entirely

instructions, large quantities of peat charcoal and lime were used for covering afresh the worst parts of the margin, and the construction of temporary quays was commenced with such materials as could be obtained on the spot.

removed, but the surface of the ground was in a measure levelled, so that no water or filth could remain on it to stagnate or become offensive."

"April 5.—Thirty labourers again at work in digging large holes for burying filth and organic matter. Others employed in covering over collections of filth on the hill-sides and on tent sites."

"April 6.—Thirty labourers were again given by the Town Adjutant, all of whom were employed during the forenoon in cleansing the margin of the harbour, near the Ordnance wharf, and in dragging the garbage and other filth that had accumulated there on to the shore (the smells emanating from which were most offensive and sickening). Six large holes were dug, and the filth buried, but, previous to covering over with soil and ashes, quicklime was freely used, and the locality, when the work was completed, presented a very different appearance and a purer atmosphere. During the afternoon, the labourers were employed in covering with lime and earth a large heap of manure near the ravine."

From the 10th to the afternoon of the 17th no labour was supplied for sanitary work, when twenty-three labourers were sent to the inspectors, who "were employed for the remainder of the afternoon at the margin of the harbour, between the cattle and ordnance wharfs, in cleansing and liming. We had the carcasses of two calves, and several bellies and other garbage buried, and used plenty of lime thereat. Afterwards we strewed a quantity of lime on heaps of filth and offensive matter in the yard of the Chaplain's house, and between it and the Quartermaster-General's office. We then had three barrows of lime and a quantity of charcoal thrown into the public latrine in Mount-street. Previous to so doing, it was very offensive, but after the process was completed, the stench was entirely removed. A latrine belonging to the General Hospital was similarly dealt with, and a dead mule was buried."

"April 23.—Twenty-five men employed on similar work to that of yesterday. In the afternoon some of them were employed in deodorizing the latrines at the General Hospital, at the back of the Guard-house, in Mount-street, and behind the Turk's Stores. Also the one at the Castle Hospital. This was attended with most beneficial results. We had also a quantity of lime carried to the head of the harbour, for the purpose of mixing with gravel, to cover some dead horses that had been buried a few inches below the surface of the ground."

"April 28.—Twenty-nine labourers employed to-day; twenty-three of them at the top of the harbour, and six finishing the pits of the latrines at the Turkish Hospital. The weather being now very hot in the middle of the day, very offensive smells arise from the graveyard at the top of the harbour, and many loud complaints are being made about it. In some instances the bodies have been laid on the surface, and then covered with earth, and as decomposition set in, it made its appearance on the surface of

Rubble stones and squared stones were collected from old walls and houses, and a line of quay was carried outside the decomposing filth, and between it and the water. A solid surface was thus gradually formed over the most dangerous places. The inspectors were also directed to put down

the ground, which is marshy. We have had to change the labourers from off the ground almost hourly every day, until a coat of gravel, about twelve inches deep, has been spread over the surface. This will form a portion of our work for many days to come. The gravel has to be carried on the labourers' shoulders, in baskets holding about a stone, in consequence of our not being able to get a sufficient number of carts or wheelbarrows.

" May 3.—Seventy-five men were employed this day, sixty-three at the top of the harbour and graveyard, and the remaining twelve, in filling up holes in the main road, where some stagnant water and filth had accumulated, near the wharf where the sick and wounded soldiers are taken on board the transports, and which smelt offensively.

For some days after this one hundred men] were employed on the same work.

" May 12.—The excessive rain having somewhat abated, we employed seventy-five men in various parts of the village in cleansing the streets and overground drains, and removing the filth that had accumulated in holes in various places.

" May 15.—Seventy-five men and ten carts employed in covering the graveyard at the head of the harbour, and in removing large quantities of stable manure from the yards in the town to burn it at the Turkish burial-ground for neutralizing the smells proceeding from it. The drivers refused to work in removing the filth, their health is visibly affected by the horrible exhalations from the graveyard.

" May 21.—Seventy-four labourers and ten carts employed at the graveyard at the head of the harbour, with the exception of six, who were employed in filling the dirt-boat.

" May 31.—150 men and seven carts employed at the graveyard at the top of the harbour.

" June 7.—150 men and seven carts engaged at the head of the harbour and graveyard, and in cleansing the margin of the harbour, and macadamizing the road near the water's edge on the east side.

" June 27.—100 labourers and three carts. Eighty were employed at the top of the harbour and graveyard, and twenty at the quay, until noon, when they were sent to Quay-street, to remove a number of old and filthy houses.

" June 30.—100 men and three carts at work at the same time and places as yesterday. On Thursday the Sappers and Miners having commenced to drive piles to form a quay, and to do away with the offensive smell of the sides, we rendered assistance by filling in with stone and gravel, and in a few days an excellent quay was formed, and the smells which had injured the health of the workmen were removed.

mooring-posts for the shipping, to prevent the quays being pulled down, and the filth turned up and exposed by the customary manner of anchoring to the beach.

The number of native labourers told off for sanitary works by the beginning of June had been raised to 150, with seven carts, and the requisite tools. Towards the end of the month the number was reduced to 100, and, during the month of July, the usual number was ninety-eight.

During June and July the workmen were superintended by the inspectors of the Commission, but the works were under the direction of the military authorities. The Commissioners kept a constant oversight on the proceedings, and communicated with the military authorities, or with the inspectors when it appeared necessary to do so.

The number of men employed affords no correct indication of the work done, for it was found in practice that six native labourers were required to do the same amount of work that one English labourer could have accomplished in the same time. As a general rule, it may be stated that, even in using a wheelbarrow, a native labourer hardly ever was able to wheel above a third or fourth part of a barrow load. There was, besides, a constant tendency to idling and waste of time, which it required the utmost vigilance on the part of the inspectors to prevent. On these accounts the work progressed slowly, notwithstanding the apparently effective force of men employed.

The deposit of stable manure and offal along the east side of the harbour was at length put a stop to by obviating the necessity for doing so. As much as could be taken out to sea was removed by the dirt barges, and the remainder of the stable manure was burned at the top of the harbour. The formation of temporary quays for covering the filth previously deposited, progressed as quickly as the labour and supply of materials would allow, and the sanitary state of the town continued to improve.

§ VI. SANITARY CONDITION OF THE CAMPS NEAR BALAKLAVA.

Immediately after the preliminary examinations at Balaklava were completed, and the necessary instructions

issued for the sanitary improvements, the Commissioners proceeded to examine in detail the various camps of the British army around Balaklava and before Sebastopol.

The camps were situated in two districts of country, the topographical and sanitary conditions of which differed. Those around Balaklava occupied the ridges, slopes, and valleys of the jurassic limestone and conglomerate. Those before Sebastopol were scattered over the eminences and flats of the tertiary limestone of the plateau.

The camps in the neighbourhood of Balaklava were those which first came under the notice of the Commissioners, because they presented the most obvious sanitary defects, at least with two or three exceptions. For topographical purposes these camps may be divided into three groups, namely, the camps on Marine Heights to the east of Balaklava; the camps on the slopes to the north-west of Balaklava harbour, and the Cavalry camps in the valley of Karani:—

1. The group of hills known as "Marine Heights," consists of highly inclined beds of conglomerate, dipping from east to west, and terminating abruptly on the east in a long narrow ridge running from south to north, and falling rapidly towards the north into the valley of Balaklava.

The highest point of the ridge is its south end, which overhangs the sea at an elevation of 1,227 feet above its level. On the east side of the ridge the ground is very steep and commands a road leading from the valleys east of the occupation to Balaklava. On the west side of the ridge the slope is more gentle, following that of the conglomerate beds, although the descent is still a steep one. About 600 feet below the crest of the ridge, on the west side, and resting on the conglomerate, is a hill of compact jurassic limestone, at the foot of which the town of Balaklava is situated.

Between the two formations there is an upland valley, the highest point of which at its southern extremity is about 580 feet above the sea level, from whence the valley falls gradually to the north, and opens into the valley or plain of Balaklava.

A line of entrenchments, beginning at the summit of Marine Heights, was carried down the ridge to the north,

following its curves, and passing in its course through a variety of ground from hard rock to soft clay soil. Within the entrenchments, and on the western side of the crest of the heights, there were two camps, that of the Rifles, on the very summit, and the camp of the Royal Marines, following the slope of the ridge towards the north.

The bed of the upland valley already mentioned is formed of retentive beds, on which in some places rests a superficial stratum of porous sandy loam and debris full of water. The opening of the valley on the north, was cut across by the line of intrenchments with *trous de loup* outside. At all times a considerable quantity of water escaped from the line of the works, and ran down the hill-side to the valley of Balaklava. Even after dry weather many of the *trous de loup* were three-parts filled with water, showing to what an extent the soil was charged with it. Close to the line of the intrenchments at this point were the camps of the 79th and 42nd Highlanders.

Following the slope of the limestone hill towards the head of Balaklava harbour, the 71st were encamped along a road on the hill-side. The site of the camp was on a bed of debris. At the foot of the slope, under the 72nd, were the huts and stables of the Royal Horse Artillery.

As regards the medical topography of this group of camps, the ground occupied by the Marines and Rifles was hard, dry, and naturally well drained, exposed to no special cause of malaria, but being on the boundary of sea and land, and having a considerable elevation, the camps were subject to rapid changes of temperature, high winds, and sea fogs. During the spring of 1855 the average range of the thermometer on the heights was about 20° Fahrenheit in twenty-four hours.

The camps were formed of tents, wooden huts, and stone huts. In most instances we found the ground had been well prepared before erecting them. Drains had been made for turning surface water from the sites of tents and huts; soft parts of the ground had been paved with rubble-stone, and the camps were clean. They were in a comparatively good sanitary condition, except that the huts were not sufficiently well-ventilated for the numbers they had to

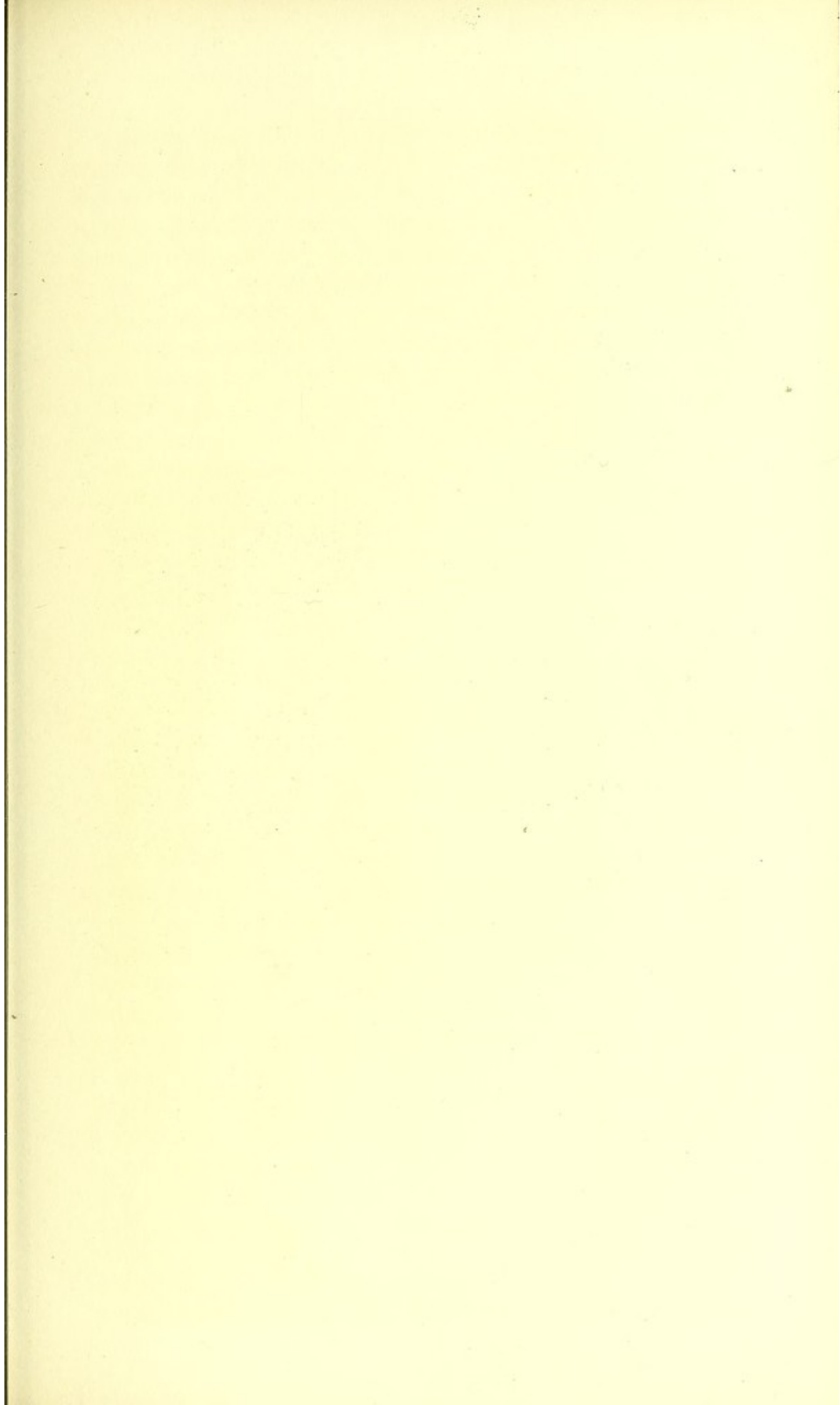
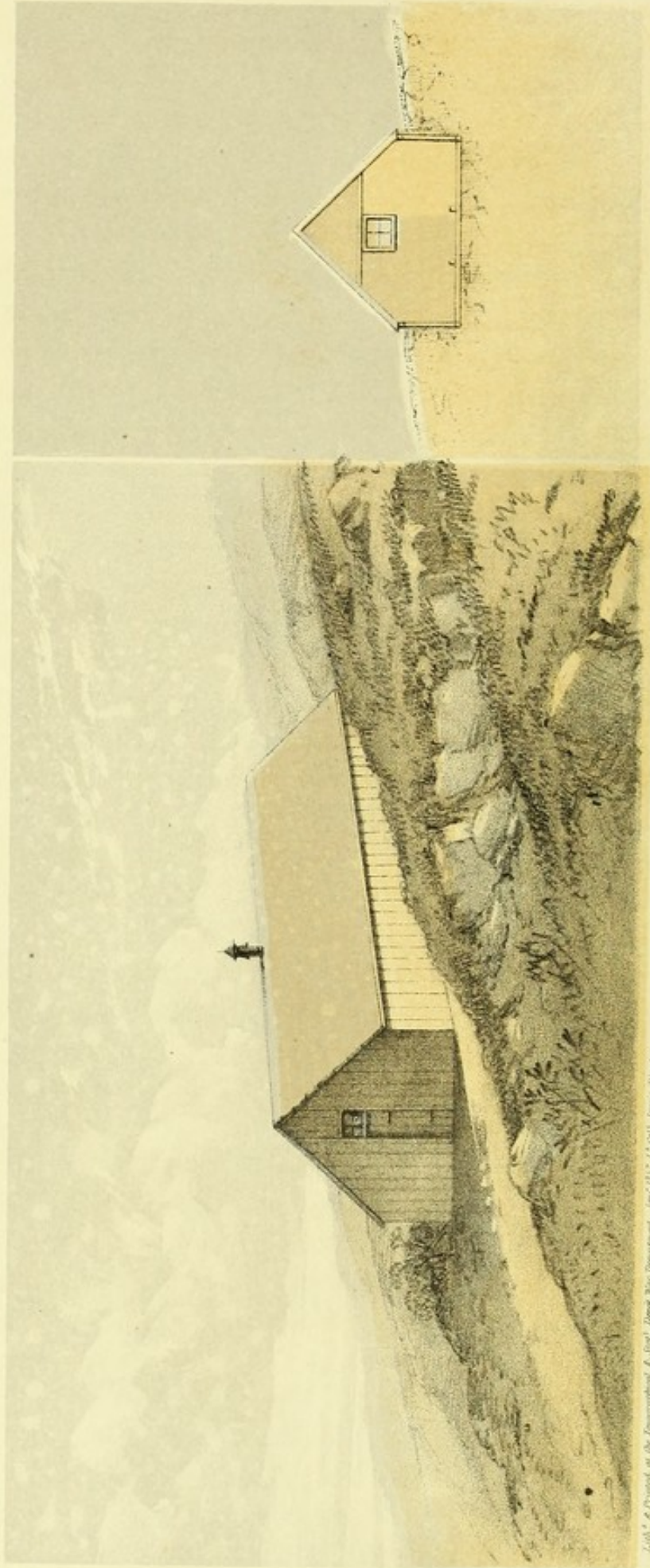


Fig. 1.



HUT IN HILL SIDE. HIGHLAND BRIGADE.

CROSS SECTION.

UPPER END.

Gift of the President to the Department of the Interior, U.S. Geol. Surv. Division.

accommodate. At the time of our inquiry we were informed by the medical officers, that the chief diseases, under which the men suffered in this lofty exposed situation were pulmonary complaints.

The next camp following the descent from Marine Heights was that of the 79th Highlanders.

Part of this regiment occupied a range of wooden huts and tents on the slope, immediately under the steep descent from Marine Heights, at an elevation of about 550 feet above the level of the sea. The ground was a porous sandy loam, with a considerable water shed above it. In preparing the ground, sites for huts had been dug out of the slope, and the earth was heaped up against their sides. The surface was not sufficiently drained, and the huts were not properly ventilated.

The remaining part of the 79th were, for special military reasons, encamped 100 feet lower down, where the ground was soft and wet. The ground sloped rapidly towards this part of the camp, and from the configuration of the surface, the drainage from Marine Heights above was concentrated in a hollow, within which a number of huts had been erected for the men more immediately engaged in the defence of the works, which passed close to the doors. A few of these lower huts were erected above the hollow, and with a good natural drainage.

The whole of the ground was wet, and traversed by superficial drains, and it had, moreover, been extensively turned up in constructing the works. In erecting the huts, the space cut out of the slope was just sufficient to hold the hut, and the earth was left in contact with the boarded sides for two or three feet in height. (*Fig. 1* shows this defect.)

The attention of the Commissioners was first specially directed to this part of the camp, by a representation from Sir Colin Campbell, that fever had been very prevalent among the troops occupying it. On the 13th April, 1855, the Commissioners met Sir Colin Campbell by appointment, and proceeded to make a careful examination into the circumstances.

It appeared, that shortly after the ground was occupied in the end of October 1854, zymotic diseases, chiefly diarrhoea, with a few cases of fever and cholera, occurred among

the men. From the week ending 31st October, until the date of our inquiry, 80 per cent. of the sickness in the regiment had been occasioned by zymotic diseases. Diarrhœa cases were most numerous until the week ending January 16, 1855, and there were comparatively few fever cases before that date. From the 16th January till the 18th April, the time when the measures recommended by the Sanitary Commission were taken, above 74 per cent. of the total sickness had been caused by fever. During the week ending April 11, out of 64 cases 60 were from fever. The type of fever was remittent, passing into the typhoid form, clearly marking the causation. At the time fever prevailed, the other forms of zymotic disease had nearly disappeared.

There had been some fever in the range of huts under Marine Heights; but the majority of the cases were confined to the huts on the wet ground, close to the works. There was little or no fever in tents in the vicinity.

In addition to the topographical defects already mentioned, we found the floors of the infected huts very damp; and on removing the boarding, the surface of the ground beneath was found covered with threads of fungi, and the atmosphere in the huts had the peculiar odour and dampness usually experienced on going into an underground cellar.

So wet was the subsoil, that water was found under one of the angles of a hut. The men slept on the boarding, hardly raised above the ground, and breathed the damp malarial atmosphere arising from it. The cubic contents of the huts were 3,645 feet, and allowing twenty-five men to a hut, the cubic space per man would be about 146 feet. The ventilation was insufficient; and under all the circumstances, the huts were overcrowded. (*Fig. 3* shows the usual internal arrangements of unventilated barrack huts.)

The Commissioners were of opinion, that nothing short of the removal of the men from the lower huts would put an effectual stop to the fever; but that the huts under Marine Heights admitted of being improved. There was nothing in the case essentially differing from the experience obtained elsewhere as to the effect of damp, unwholesome dwellings on health; like causes everywhere produce similar effects, and the Commissioners had no hesitation in expressing their

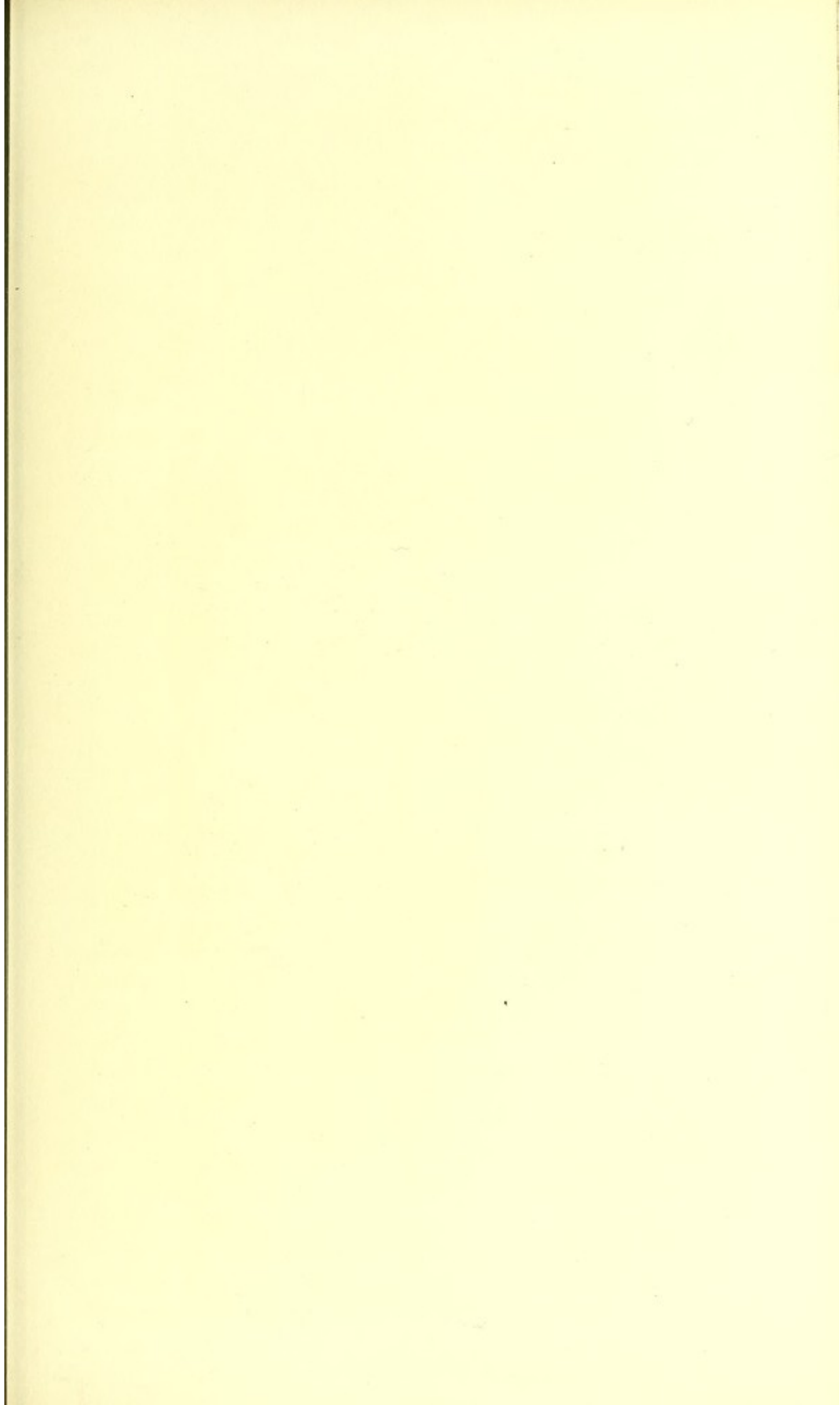
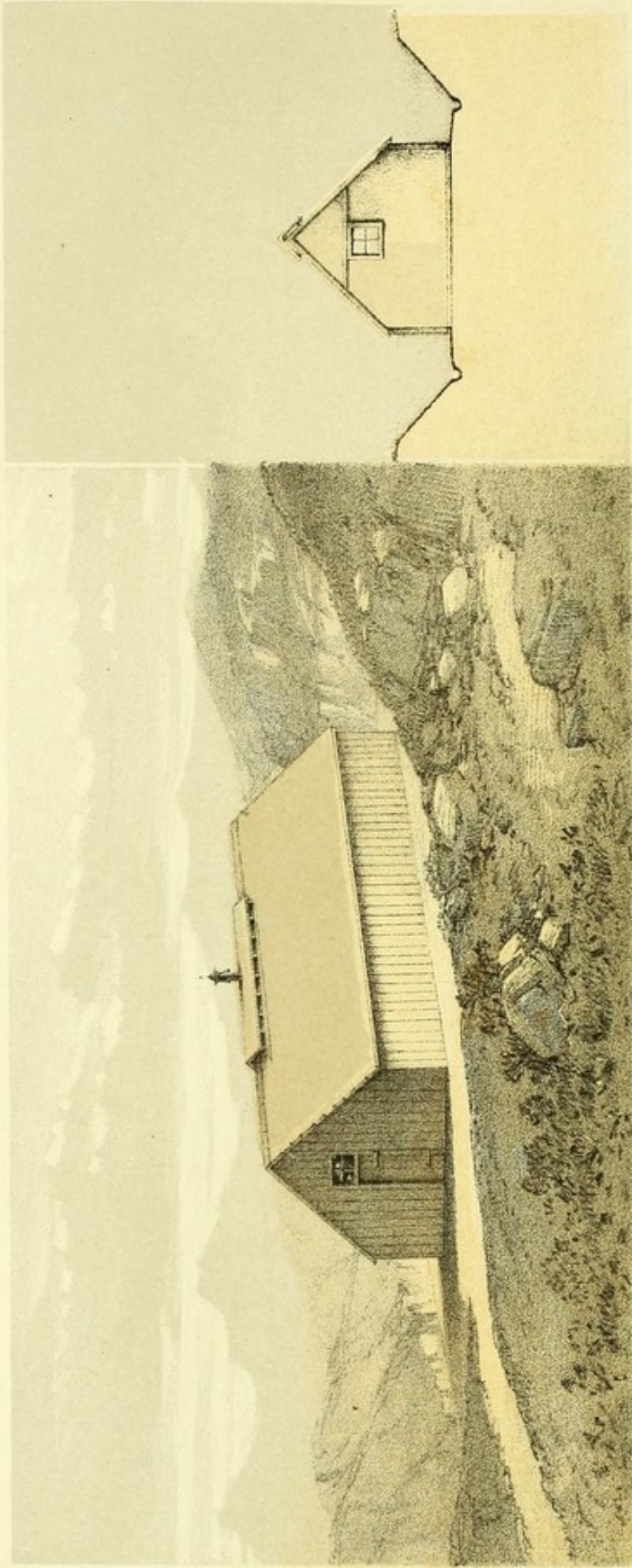


Fig. 2.



CROSS SECTION.

HUT CLEARED AND VENTILATED AT RIDGE.

Lull. A. Provided at the Department of Agriculture, U.S. Geol. Surv., Division.

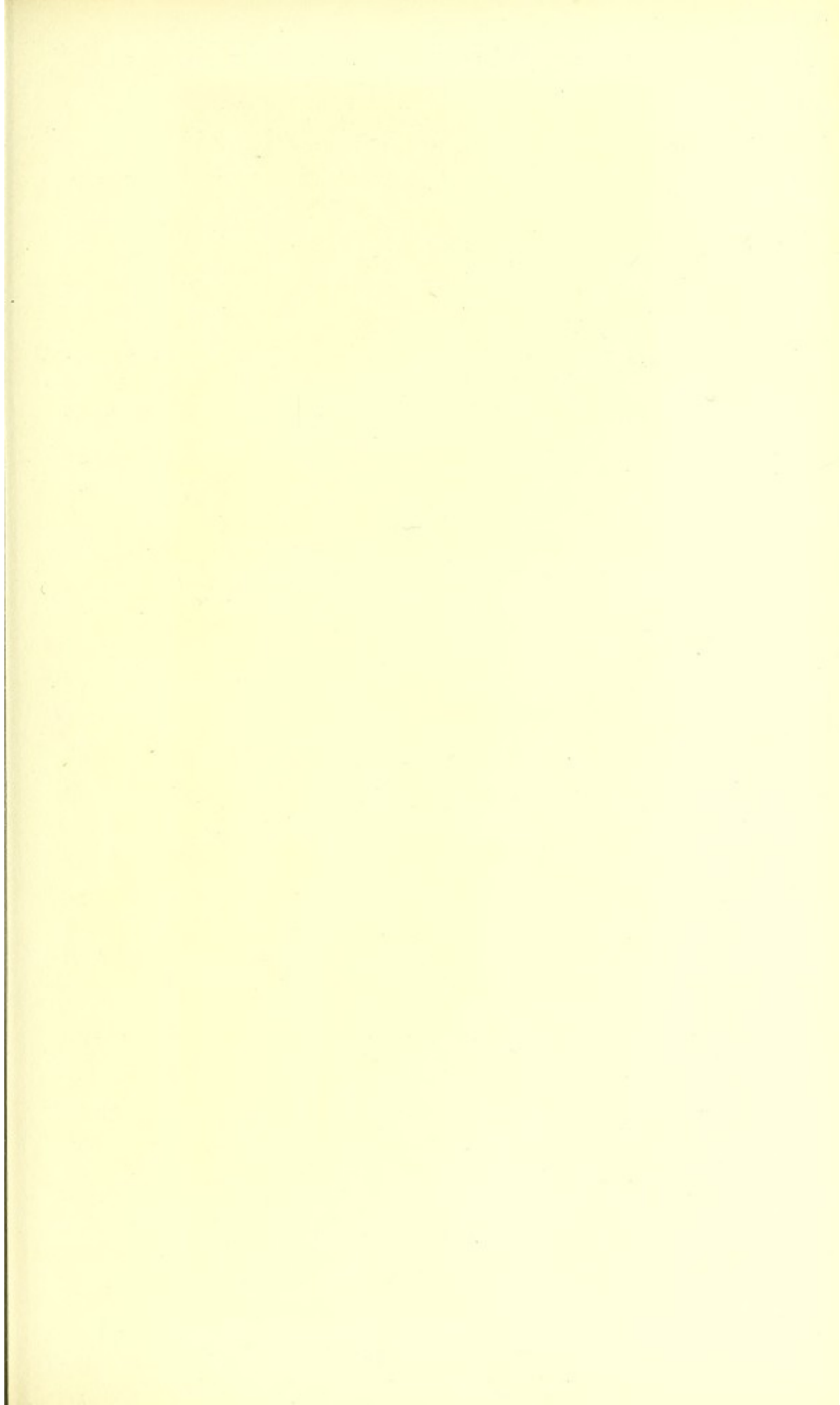
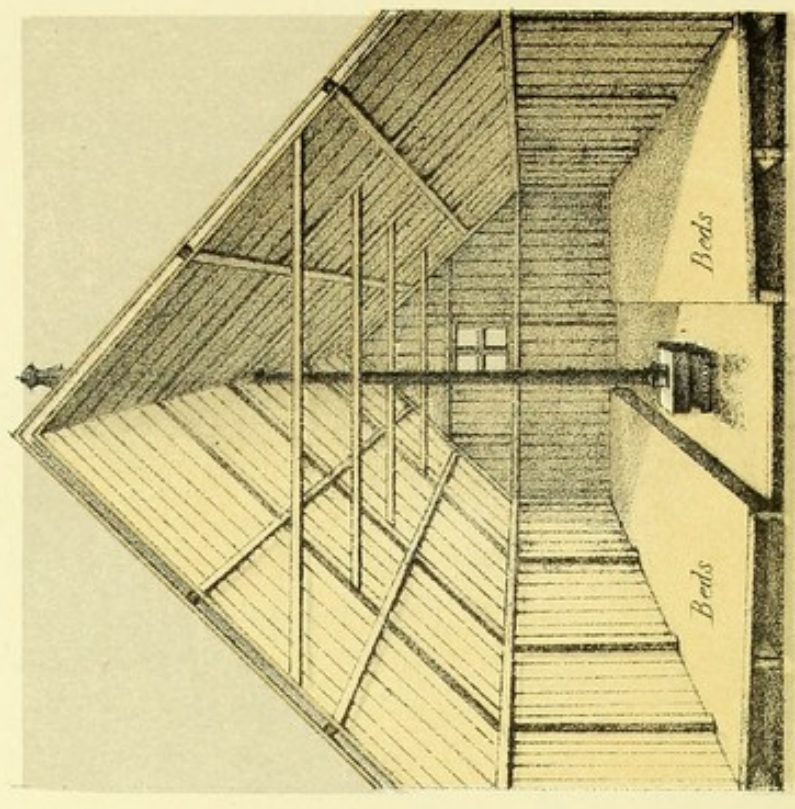
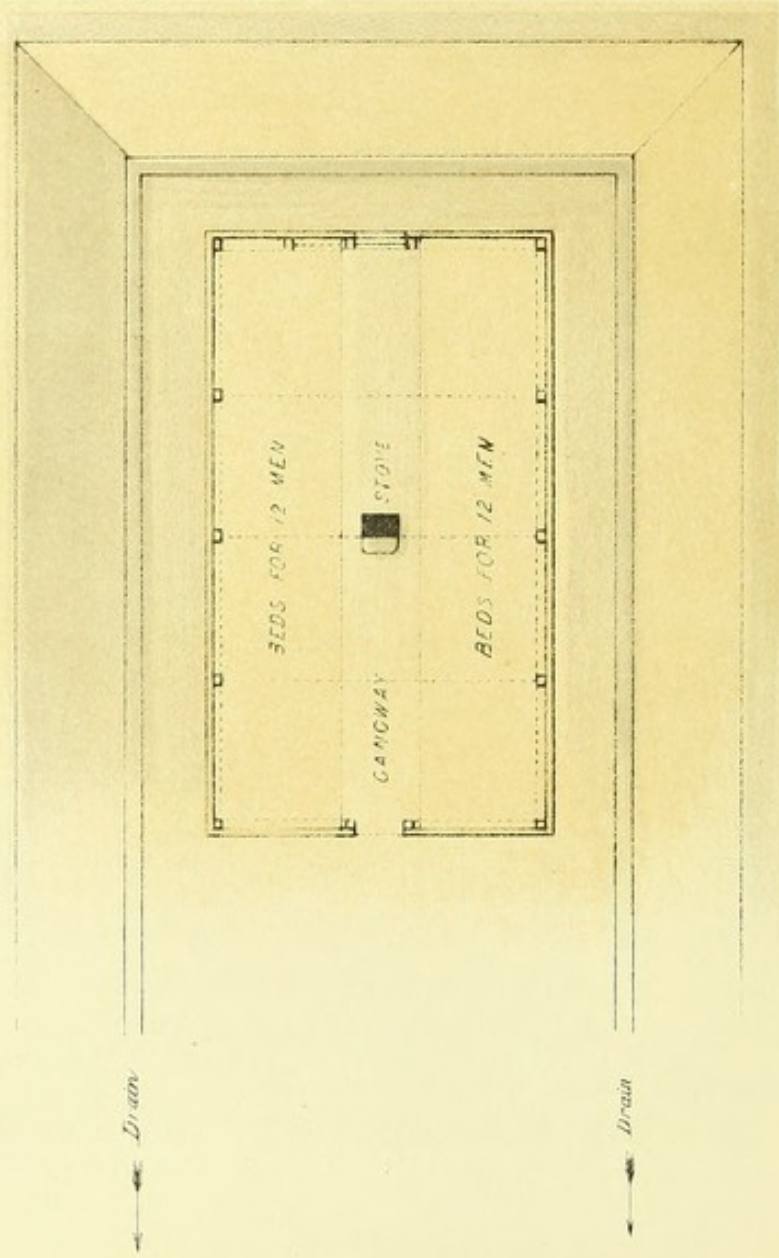


Fig 3.



INTERIOR SHEWING BED ARRANGEMENT.



79TH HUT CLEARED.

NOTE: A drawing of the Experimental & Staff Trench Works, 1861-62, is given in the Appendix.

opinion that if the entire brigade, consisting, as it did, of robust men in the prime of life, were made to occupy the lower huts in succession, a considerable proportion would be disabled from service in a very short time.

On the 14th April, the Commissioners recommended the Commander of the Forces either to remove the troops to better ground, or should the exigencies of the service render this proceeding impossible, that the ground occupied should be drained, the huts isolated by digging the earth away from the sides, and the site of each hut separately drained by a trench cut round the cleared space, and about a foot below the level of the floor; that the huts should be thoroughly ventilated by ridge and floor ventilation, and the number of men reduced in each. By comparing *Fig. 2* and the ground plan *Fig. 3* with *Fig. 1*, this manner of improving the drainage and ventilation will be readily understood.

These recommendations were immediately acceded to by Lord Raglan. All the huts on the better ground were improved in the manner pointed out, and those on the wet ground were vacated. A few tents were erected to receive the sick on the higher and drier ground.

The result of these measures was an immediate abatement of fever, hardly any new cases having appeared after the removal of the men. The improvement in the sick was equally striking.

It may be useful to mention here what remains of the history of these same huts, because it strongly illustrates the importance of selecting healthy sites for the physical efficiency of an army.

In consequence of the removal from them of the men of the 79th, the huts were only partially improved, but never sufficiently so to make any material difference in their sanitary condition. They were rather considered as unfit for occupation on account of their position. After the 79th left this ground, the 31st Regiment arrived at Balaklava, and took possession of the huts on the 25th May, 1855. Their strength on landing was 873. On the 1st June, a case of cholera occurred in the regiment. Its occupation of the huts was only for a temporary purpose, and on the 16th the regiment was removed to the front. Between the 1st and the 16th June, there were thirty-four

deaths from cholera, and a great number of diarrhœa cases. The company most severely affected occupied the bad huts. This company was removed higher up, and the disease abated. The regiment carried it with them to the front, and there were seventeen deaths there after their arrival.

The huts were again left in their original condition, and were occupied early in September by the Royal Artillery, four companies of which, in all about 500 men, disembarked at Balaklava on the 8th of the month and were marched up to Marine Heights.

Three of the companies were placed in the old huts of the 79th Regiment, and the fourth was encamped on dry, open ground, outside the lines. On the 7th October, cholera appeared among the men occupying the huts on the wet ground, and one death occurred. This was followed by six other deaths from cholera in the same huts, and diarrhœa was very prevalent among the men. Finding that the disease showed no disposition to leave the huts, the medical officer ordered all the affected huts, twelve in number, (the entire number in the hollow,) to be pulled down and re-erected at a higher level under Marine Heights. They were again reoccupied in their new position by the same men, after which one death from cholera occurred and the disease entirely disappeared.

The fourth company, which was encamped outside the lines, at a short distance from the affected huts, escaped the disease altogether.

On examining the ground after the huts were removed, it was found exuding water at every pore.

To return: the huts situated at a short distance from those in the wet ground, but having a sufficient natural drainage, were comparatively healthy, except from the effects of deficient ventilation. They were occupied at the time partly by the 79th, and partly by the 42nd. The camp of the 42nd was about 400 feet above the level of the sea, and had excellent means of drainage. Much of the water from the higher levels was indeed cut off from this site, and had its outlet through the ground occupied by the affected huts of the 79th. The lower end of the camp was thoroughly drained by a deep, natural water-course, which

passed through the camp. The part of the camp west of the water-course was situated on a bed of porous debris resting on the steep slope of the limestone hill.

Speaking generally, the sites for most of the huts had been prepared, the ground levelled, the earth cut away from the hill-side at the back of the hut, and thrown forwards so as to complete the platform on which the hut was erected, and thereby affording additional facilities for the natural drainage of the subsoil. Some of the huts required trenching and draining, and all of them required ventilation. The tent sites were tolerably good.

The huts of the 71st were erected in foundations dug out of debris. The steepness of the slope afforded them good means of natural drainage, but they had the serious defect that the earth rested against their sides, and they were not ventilated.

The camp of the Royal Artillery in the valley, under the 71st, was not well situated for health. Much of the drainage of the higher levels found its way into this valley. The huts had the usual defects, and there were large manure heaps belonging to the stables on the plain immediately below them, on a spot of ground where a number of dead animals had been buried. There was nuisance from these causes complained of as far up as the camp of the 71st.

These lower camps were exposed to malaria arising from the marshy ground at the head of the harbour, and from the lower part of the plain of Balaklava.

2. The second group of camps occupied a site on the north-west side of Balaklava Harbour. The steep rocky limestone hills which bound the harbour on the west side, terminate a little above the head of the harbour, and a wide gap, or rather a very steep ravine, divides the north end of this ridge, and separates it from a spur of conglomerate which juts out from the sea-coast mountain chain to form the south-eastern boundary of the valley of Karani. The ravine between the two formations is almost filled up by a huge highly-inclined bed of calcareous loamy debris, with underlying shaley beds. This debris, under the action of the weather and rains, has been deeply furrowed by a number of narrow secondary ravines, but where it rests on the con-

glomerate it presents a tolerably even but highly-inclined surface, rising rapidly towards the south-west. This ground forms a long, narrow, highly-inclined belt, the higher extremity of which is about 600 feet above the level of the sea. The Guards' camp was situated on this belt, and occupied about 300 feet in perpendicular height of it. The highest part of the camp was about 600 feet, and the lowest about 300 feet above the sea level. Somewhat lower down was the camp of the 3rd Buffs, and at the foot of the ravine, and between it and the head of the harbour, was the Land Transport camp.

All the inclinations from the Guards' camp were very steep, and the means of drainage ample. There was, moreover, no great extent of water-shed above the site. The soil, like that of the remainder of the district, became, under the influence of rain, a wet, tenacious, plastic clay, retaining the surface water in every hollow, and becoming in some parts almost impassable. The highest end of the ground was the best; it was stony, and partly covered with brushwood, amongst which the tents were pitched. There were tents and huts on the lower part of the ground, and most of them overhung the heads or edges of the ravines. It is very questionable if these damp shaley ravines are ever wholesome. There were similar ravines in other parts of the occupation. On going through them in different states of the weather, the air had always a peculiar faint unwholesome odour, very likely to affect the purity of the neighbouring atmosphere. The ravines leading down from the Guards' camp had this further disadvantage, that they opened at their lower end on the foul marsh extending from the head of Balaklava Harbour towards Kadikoi. Though the site upon the whole was not a very good one, considerable attention had been paid to the preparation and improvement of the camping-ground. In most instances the sites of huts had been insulated from the surrounding ground; in some instances the foundations of huts had been raised above the level. Trenches had been cut to carry off the surface water from many of the tents and huts, and the surface of the ground was clean. There were a number of instances, however, where the earth had been heaped up against the sides of the

huts and generally the huts had no proper means of ridge ventilation.

It will be seen that there were causes in this camp likely to have produced disease. Besides these, the Guards were at this time mostly employed on duty at Balaklava, and were exposed to its malaria, from which they probably suffered more than from any sanitary defects there may have been in their camp.

About the middle of June 1855, the Guards moved from this camp to the front, and were one of the most healthy brigades of the army.

The Land Transport camp was, in April 1855, situated at the lower end of the ravines descending from the Guards' camp close to the head of the harbour. Its topographical position was one of the worst in the whole occupation. There was a large number of animals picketed among the huts and tents; the ground was filthy; the whole neighbourhood was covered with filth by the Tartars employed in the camp, and in many places offal of slaughtered animals infected the air. At that period the men connected with the Land Transport Corps chiefly lived in tents, the huts being used as hospitals, and they were, as might have been expected, crowded with fever cases. This camp was, fortunately, removed from the site, as the organization of the corps went on.

3. The third group of camps near Balaklava were those of the Cavalry Division in the valley of Karani.

This valley is about two miles and a-half in length from its head to Kadikoi. It runs nearly from west to east, descending rapidly from its western or highest end, about 600 feet above the sea level, to 70 or 80 feet above the sea level at Kadikoi. The sides of the valley are formed by ridges of compact limestone, which are widest apart at its lower end, and they leave between them a tolerably flat bottom, inclined to the north. This space is about three-fourths of a mile long and one-fourth of a mile wide, and its height above the sea level may be taken at from 90 to 150 feet. On this area, and on the lower slopes of the south side of the valley, most of the Cavalry regiments were encamped. The camps were placed at the upper end of the ground. The

17th Lancers were encamped on a slope of the hill on the north side of the valley, immediately above Kadikoi, and the Royal Artillery were encamped below them, just in the opening of the valley. Higher up the valley, and at a point where it becomes very narrow, the 4th Dragoon Guards and the Royal Horse Artillery were camped. The 12th Lancers and 10th Hussars occupied a plateau of ground about 200 feet above the other Cavalry camps.

The valley was well calculated for winter protection, but the ground over most of the area was so bad, that it became almost an impassable clay swamp after heavy rain. The rainfall from all the heights to the west and south flows directly down into the bottom, which was then occupied by the cavalry, and its natural outlet is into a water-course running close under the hill on the north side of the valley; the water from all the south slopes of the valley, that was not carried off by evaporation, had thus to find its way across the ground occupied by the camps to reach the outlet stream.

Although the ground was not marshy, it still retained sufficient water to emit malaria in hot weather after rains. The sun's rays acted intensely on the narrow space occupied by the troops, and there was no free sweep of wind over it.

The topographical defects of the site would not of themselves account for the extent of sickness, especially of zymotic disease, then prevailing. As usual, the newly-arrived regiments suffered, especially from diarrhœa and cholera; but we are disposed to attribute a large part of the sickness to the sanitary defects of the camps, especially in the lower part of the valley, where numbers of men and animals were congregated on too confined a space for safety. This kind of surface overcrowding always gives rise to sickness, for it leads to the saturation of the ground with excretions of men and animals, so that after a time the area so occupied gives off emanations which predispose all who breathe them to zymotic diseases.

The necessities of the service, also, rendered it indispensable that the men should be near their horses, and hence the picketting grounds were distributed among the camps,

and they were thus placed too close to the quarters of the men. Such was certainly the case in most of the Cavalry camps in the valley of Karani.

There is no remedy for this but the most scrupulous attention to cleanliness; sweeping of the surface; frequent removal of the manure away from the camps; change of ground as frequently as possible, and scattering some deodorizing or disinfecting substance, such as quicklime or charcoal dust, over the vacated ground before it is re-occupied. The true purifying agents are those which nature furnishes—air, sun, rain, and the absorbing power of the soil. It is by making use of such remedies that the unwholesome emanations from saturated picketting grounds can be best got rid of.

The accumulation of stable manure was another obvious cause of atmospheric impurity, at the time we first examined these camps. The usual way of disposing of it was to collect the manure in long heaps within the circuit of the camp, and fire it, but this was generally done without due regard to the rapidity and perfection of the burning. The fired heaps therefore smouldered away, and not unfrequently the humid, fœtid smoke from them occasioned much nuisance and atmospheric impurity. During dry weather, and with proper care, the burning can be readily effected by opening up the heaps with a stable fork, so as to admit the air. By taking advantage of the weather, and using this simple precaution, many heaps in the camp were burned rapidly and with a large bright flame. This plan was adopted before the evacuation of the camp before Sebastopol. By the common method of burning, the most that can be expected is the covering of the unconsumed litter with a layer of charcoal, derived from the surface combustion, which to some extent deodorizes the mass below. The more perfect combustion by admitting air in the way described, or by throwing the manure on a bed of large stones to admit the air below it, is, however, far preferable.

The best method for disposing of the organic refuse of a fixed camp, including stable manure, is that used in the cantonments in India. A furnace, like a lime-kiln, is constructed, and thoroughly heated. The whole organic products

of the camp are collected by people set apart for this purpose, carried to the furnace regularly, and thrown in. In this way stable manure, bones, offal, &c., are consumed, and the saturation of the ground prevented. At first, the Commissioners were of opinion that it might be advantageous to construct similar furnaces in the Crimea, but they were deterred from recommending them, on account of the great difficulty of obtaining labour and materials for more urgent sanitary works. They found, besides, that the bulk of the manure from stables and picketting grounds could be sufficiently well burned, if due care were bestowed on it. During the spring of the present year, two furnaces were constructed at Scutari by Mr. Unsworth, surveyor to the Commission there, on the recommendation of Dr. Milroy, for burning the manure of the cavalry camp at Haidar Pascha, which had accumulated during the winter so as to occasion nuisance.

As a general principle, it appeared that at the period of our arrival in the Crimea, camps where there were animals yielded a greater amount of sickness than others. This was especially the case with the mule camps, which the native drivers kept in a very filthy state, and there was much fever in consequence.

During the early part of the warm season, from the beginning of May till the middle of July 1855, there was an excess of sickness among the Cavalry and Artillery over that in the Infantry, and the admissions from zymotic diseases to force in the Cavalry and Artillery exceeded somewhat those in the Infantry. The proportion of zymotic cases to the total diseases admitted during the same period in the Cavalry and Artillery also exceeded the proportion in the Infantry regiments.

A similar difference continued up to the period of the evacuation of the Crimea, and appeared to be mainly due to unwholesome conditions arising from the presence of animals.

During the cold season of 1854-55, there was a considerable number of carcasses of dead horses buried close to the Cavalry camps, which still gave rise to nuisance at the period of our inquiry.

The huts which had been erected for the men presented the usual sanitary defects. The foundations had not been

prepared or drained, and earth was raised against the walls. We had the floors taken up in several instances, and found the earth beneath, very damp and covered with fungus. The ventilation was also defective. Numerous cases of fever had occurred in these huts. It may be further stated, as indicating the causes of the fever, that one Cavalry regiment, most of which was under canvas, had little or no fever, and that in the huts of the Royal Horse Artillery, which had their sides properly isolated from the surrounding ground there were three cases of intermittent under treatment, out of a force of 230 men—a very small proportion at that date (May 5, 1855).

At the mouth of Karani valley, on the rising ground close to Kadikoi church, part of the Highland Brigade was at this time encamped. The ground itself was tolerably good, but the lower part of the valley of Balaklava in its vicinity was marshy.

§ VII. SANITARY CONDITION OF THE CAMP BEFORE SEBASTOPOL.

The general topography of the plateau before Sebastopol has been already described, and we shall now add a few details respecting the positions of the different camps.

The camp of the Guards, after its removal to the front, occupied an excellent site on one of the undulations of the ground, about 1,300 yards to the north-west of the edge of the plateau, and about 600 feet above the sea. The surface soil was the usual loam of the district, but it was mostly thin and underlaid by a calcareous sandy subsoil, which, in some places, came to the surface. The natural drainage was good, and the position a healthy one.

The 3rd and 4th Divisions, and part of the 1st Division, were camped on an elevated part of the plateau, to the north-west of the Guards. It was nearly surrounded by depressions and deep ravines affording ample facilities for surface drainage. The elevation of the ground varied from 500 to 650 feet above the sea level, the highest point being the summit of Cathcart's Hill. The whole area was exposed to the free sweep of the winds. The porous limestone strata come to the surface round the edges of the ravines, but most of the area is covered with a thin tenacious loam. In some

places occupied by hospitals and camps, the surface was more deeply covered with wet, retentive clay. These camps were not so healthy as others on the plateau, and when cholera first appeared in May 1855, it attacked them by preference. With the exceptions named, the positions of the camps were good.

The 2nd Division occupied part of the eastern slope of Cathcart's Hill, about 50 or 60 feet below its summit, and also a slope on the opposite side of the ravine intervening between Cathcart's Hill and the Woronzoff road. Much of the ground under Cathcart's Hill was not very good, especially the lowest portion of it, where the clay was deepest. The part towards the Woronzoff road was, generally speaking, better.

The Light Division was encamped on the north-east side of the Woronzoff road, and occupied two crests of rising ground, with the intervening slopes. Its natural means of drainage were good. The ground was partly rocky and stony, or covered to a greater or less depth with loam. The position was a healthy one, if we except the lowest points.

The camp of the Naval Brigade was situated on sloping ground facing the south, under the camp of the 3rd Division. It was well protected from cold winds during the winter and spring by the high ground immediately above it. The site was a tolerably good one for a winter camp, but below it there was a wet valley, which joined one of the ravines leading to marshy ground, at the head of the inner harbour of Sebastopol. We deemed it necessary to recommend the removal of this camp to higher ground.

The positions occupied by the different regiments, chiefly during the autumn and winter of 1855-56, are given on the map.

The site of the camp before Sebastopol, consisting, as it did, of summits and sides of ridges or heights, with intervening depressions ending in ravines, without any marshy ground in its immediate neighbourhood, and with ample means of natural drainage by the ravines, was, with limited exceptions, arising from the nature of the surface soil, as healthy a district as could have been found within the whole occupation, but it was, of course, exposed to those local and climatic conditions common to the country, which are known to give rise to periodic fevers at certain seasons.

Before communicating with his Excellency the Commander of the Forces, the Commissioners made several examinations of the camp, in different states of the weather, with special reference to the condition of the surface. Considering the pressing nature of the siege duties at that time, they found the camp remarkably clean, and the external sanitary arrangements, on the whole, well attended to. There was considerable difference in the condition of camps, which appeared to depend very much on the pains taken by the commanding officers and surgeons. Some were much better than others, and there were some regimental camps in regard to which it would have been difficult to have suggested improvements.

On closer examination, however, there were sanitary defects, likely to affect the health of the troops, observable in various parts of the camp. They were not general, but whenever and wherever they did occur, it was our duty to notice them. We next proceed to state what the defects were.

1. *Huts.* The huts most in use at the time of our arrival were known as "Portsmouth huts." These huts were 27 feet by 15 feet inside measure, and 6 feet high to the eaves, with a ridged roof rising to the height of 12 feet from the ground. Their cubic contents were 3,645 cubic feet, giving about 146 cubic feet per man for their usual occupants, 25 men. The boarding was single throughout. Some huts had boarded floors, but the majority of the barrack huts had a partial raised floor running along each side, on which the men slept, the space between the two strips of flooring being either paved with rough stones or made of earth. The roof was covered with felt, impervious to air. In some huts there was a swing window at each end under the ridge, and one door: in others, the window over the door would not open, although the window at the opposite end opened by sliding.

These huts had no independent means of ventilation, and when they were used for hospitals the thin boarding was not sufficient protection either from the cold or from the intense sun heat.

It was not unfrequently the custom, as already mentioned, respecting the huts of the 79th Regiment, to erect the huts without sufficient preparation of the ground. The

site was either undrained, or defectively drained; the floor of the hut was below the level of the surrounding surface, or the earth was piled a foot or eighteen inches against the sides, as shown in *Fig. 4*. The surface drainage in the vicinity of huts and tents was sometimes so defective that the camp was wet and muddy for days after rain. The ground under the huts and tents became damp from this cause, and endangered the health of the men from zymotic diseases, as already mentioned.

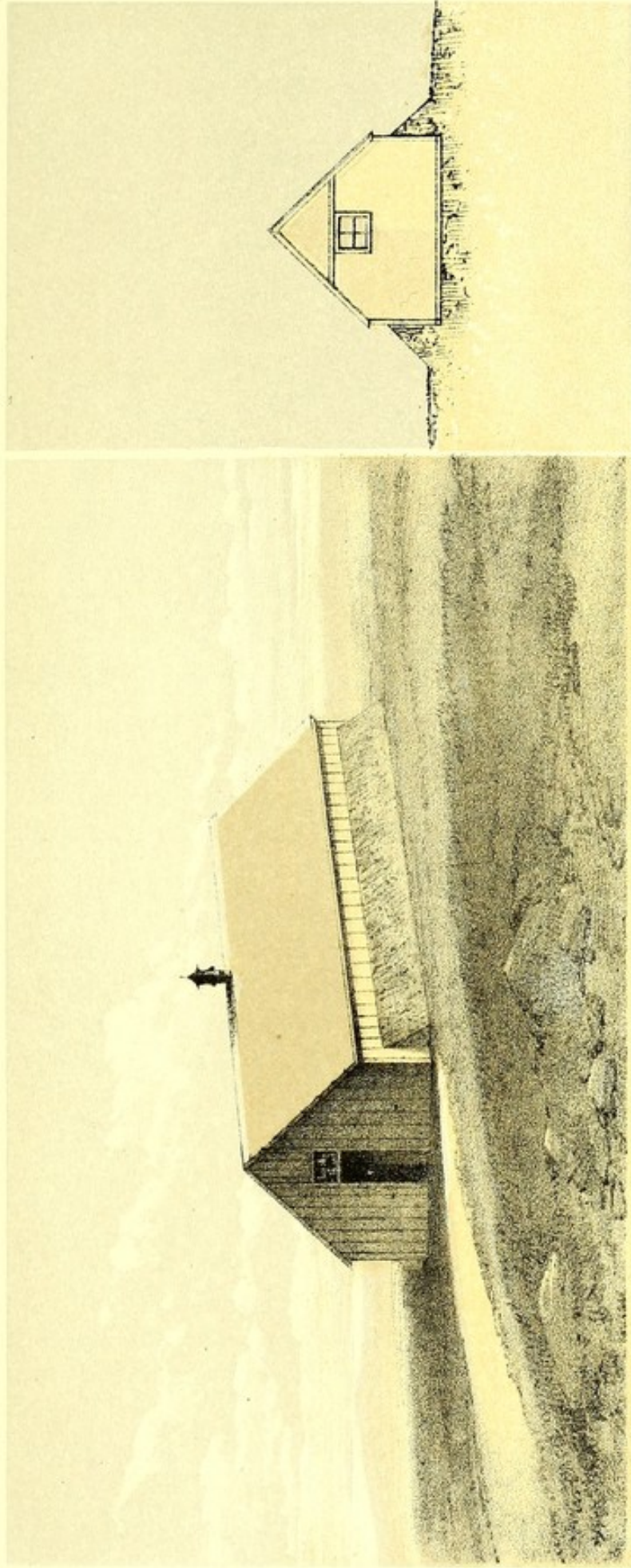
This damp condition of the subsoil is one of the most common local causes of disease for the removal of which engineering works are carried out in towns. It is an evil fraught with danger to health wherever it exists, and in fixed camps it is perhaps of more importance than in towns, because in towns a considerable part of the rainfall runs directly off the surface by the pavement, a means of drainage which does not exist in camps. Hence the necessity for isolating, preparing, and trenching the sites of huts and tents to facilitate the flow of surface water.

2. *Tents.* The space between tents was generally sufficient. In some cases it was more than in others, and there were instances of tents being too close together. In such cases the regiments were not among the most healthy in the camp.

The most obvious sanitary defect in the tents was their want of ventilation. An ordinary bell tent has about 512 cubic feet of capacity. It is usual on march for twelve to fifteen men to sleep under a bell tent, but in camp one-third of the number are on duty. The cubic space for each soldier would thus be from fifty-one to sixty-four cubic feet. The necessity of economizing transport, renders a considerable degree of overcrowding in tents inevitable; but the evils arising from this circumstance would be greatly mitigated by ventilation. The indispensable necessity of renewing the air is, indeed, recognized, for there are a few small openings for this purpose near the apex of the tent, but they are of too small a size to be of use.

We had occasion to examine the ventilation during the outbreak of cholera in May 1855, and were struck on entering the tents by the foulness of the atmosphere. This led to inquiry, and we found the men were perfectly aware

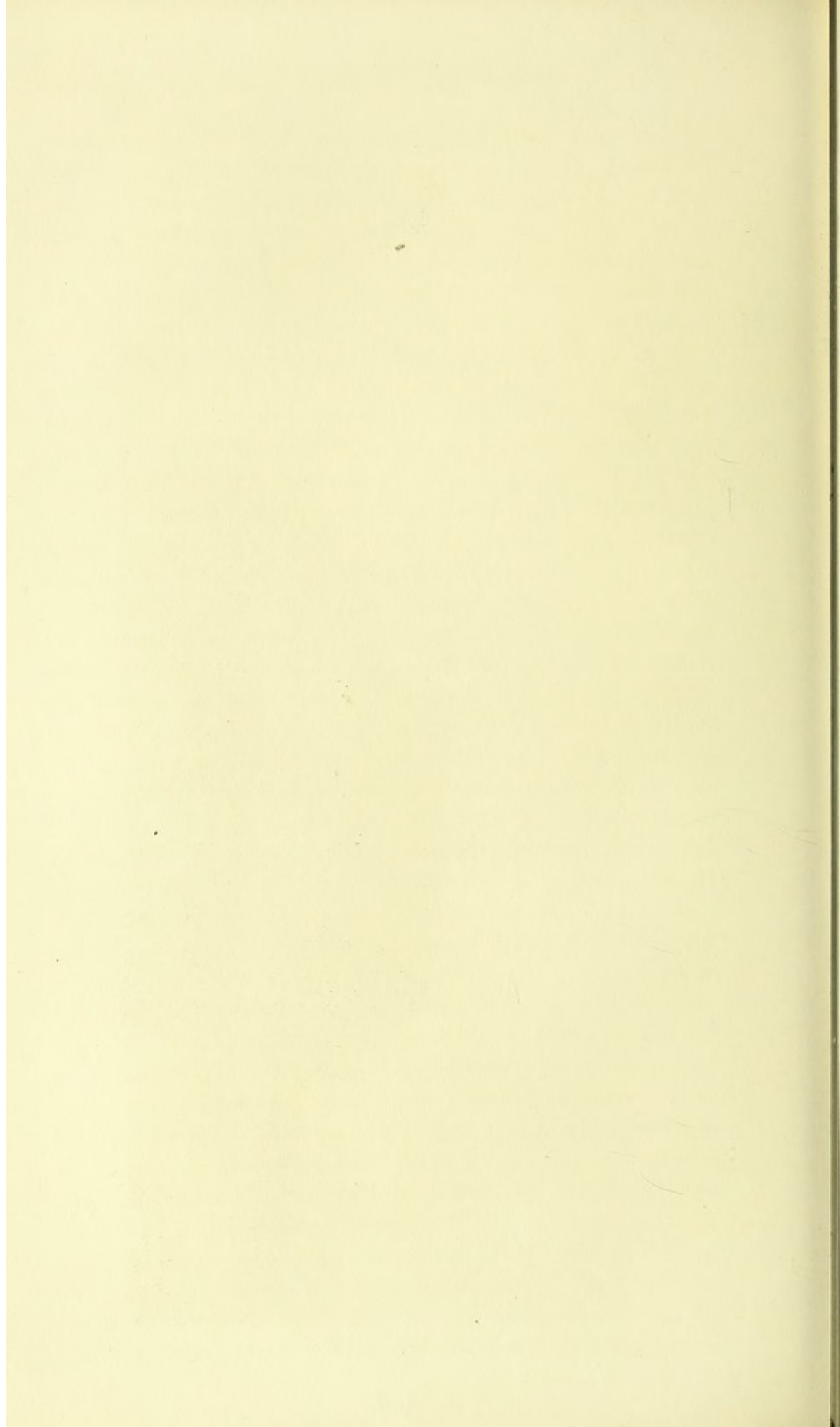
Fig. 4.



HUT BANKED UP ON LEVEL GROUND.

CROSS SECTION.

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of the defect, and complained of it themselves, especially in the morning. It may be laid down as an axiom, that an atmosphere in this condition cannot be breathed during sleep, night after night, without risk to health. At the same date we found instances of sick being treated under bell tents, and in going into one of these, we saw pans of peat charcoal on the floor, and were told by the surgeon that were it not for the use of charcoal for absorbing the emanations from the sick, the air of the tent would have been unbearable—a very sufficient proof of the necessity for a better ventilation.

Fresh earth also absorbs animal effluvia, and it is highly probable that the surface covered by a tent absorbs a certain amount from the foul air inside for a time; and this may account for the fact that tents become unhealthy, unless the ground is changed, probably on account of the saturation of the earth. It also accounts for the faint, sickly, unwholesome odour observed after the removal of camps, when the ground is exposed to the action of the sun and air, but which is not experienced to the same extent while the tents are standing. This peculiar odour was especially observed to last for days on camping ground vacated by the Allies after the conclusion of peace, and the smell was at times so strong as to resemble that proceeding from imperfectly buried carcases of animals.

To remove as far as practicable the evils of overcrowding, it appears indispensably necessary to improve the ventilation of tents.

In so far as regards the saturation of the earth, the great and obvious remedy in stationary camps, like that before Sebastopol, is to strike the tents and remove them to a fresh surface, even at a short distance off. On one occasion, early in May 1855, while recommending this verbally, we were informed that the supply of tents was deficient, and that it was impossible to strike the tents we pointed out, as they were too much decayed to admit of removal.

In pitching tents it was a common practice to dig a circular pit, eighteen inches or two or more feet deep, and to pitch the tent over it. Very often no adequate provision was made to turn aside the surface water, and we have

seen tent pits filled with water to the level of the ground in consequence. It has been stated to us that charcoal fuel has been used to warm these excavated tents, and with fatal results, from the carbonic acid having filled the pit to the surface, just as if it had been water, and causing asphyxia in persons sleeping with their heads below the level of the ground.

3. *Latrines.* All the British camps were supplied with excavated latrines, except those of the natives. The latrines were too wide, and not deep enough. They exposed too extensive an exhaling surface, were kept too long open, and were not regularly deodorized.

4. *Burial of Carcasses of Animals.* At the time of our first examination of the camp, there were very few unburied animals to be seen within the British portion, but in a number of localities we found carcasses imperfectly buried, and giving off emanations which infected the air to some distance. It appeared to have been the usual practice to dig a shallow pit, not sufficiently deep to contain the carcase, to drag the carcase into it, and to throw earth over it. Sometimes the carcase was left on the surface, and merely covered with earth, in either case producing nuisance.

5. *Slaughtering-places.* The slaughtering-places belonging to the divisions were generally kept in good condition, and the offal buried in a satisfactory manner. During numerous examinations we seldom detected any smell from them, except immediately on the area, and after moist hot weather. There was a large depository of offal belonging to the French Commissariat between the British head-quarters and the 3rd Division, which we had to report to the Commander of the Forces, on account of nuisance proceeding from it.

6. *British Burial-grounds.* The dead of the British army and navy during the siege of Sebastopol were interred in 66 burial-grounds, scattered over the occupation, from the advanced trenches before the Redan on the west, to beyond Kamara on the east, and from the heights of Inkermann to Cossack Bay. The larger burial-grounds on the plateau were generally situated in advance of the army, on the slopes of ravines leading down towards Sebastopol, but there were many smaller grounds containing a few graves,

scattered over the space occupied by the different divisions of the army. When first used, most of these grounds were at a sufficient distance from the camp, but as the positions were advanced, some of the grounds were included within its circuit, and others were formed on any vacant space of ground at a sufficient distance from the tents and huts of the regiments.

Except at Inkermann and the Redan, those who died in hospital, or were killed in the trenches, were buried in single graves, with four or five feet of earth over the corpse, according to the Army Regulations. We had frequent opportunities of observing the manner of burial, and on every such occasion the interments were conducted with care and decency. The good taste and feeling displayed by the soldiers in the laying out and decoration of the different regimental cemeteries can never be forgotten by those who witnessed it.

On one occasion complaint was made to the Commission of graves being too shallow in the burial-ground near Kadikoi, and on another, a ground too close to some huts was complained of as emitting offensive smells; but with these exceptions there was every reason to be satisfied with the practice of burial in the camp. The case of the burial-grounds at the head of Balaklava harbour, which was an exceptional one, has been already referred to.

7. *Manure Heaps.* There were stables and picketting grounds in various parts of the camp before Sebastopol, which were at the date of our examination kept in tolerably good condition. The manure was swept up, and on the whole well burned.

The most influential sanitary defects at this period were those connected with the huts and tents. The former were the more important, and were remediable, but the exigencies of the service at that time rendered it impossible to remove the tents to fresh ground, except in special cases.

In pointing out the remedies, we considered it to be most advisable to recommend improvements we found already in operation in some part or other of the camp, on the very obvious principle that what had been done successfully in one regiment might be readily done in another. This course

was always taken, and where we found that something further required to be done, we endeavoured as far as possible to limit such requirements to what was barely necessary. We usually pointed out the defects and suggested improvements on the spot, sometimes accompanying the recommendations with rough sketches for the guidance of the workmen. By the middle of May the whole camp had been examined, and on the 17th of the month a brief statement was drawn up and sent to Lord Raglan, containing all the points more immediately requiring notice, which we had observed, some here, some there, over the entire area of the camp, with the necessary remedies.

The following were the sanitary improvements recommended for huts during the warm season, whether used as barracks or hospitals:—

1. The site of each hut to be cleared for a space of not less than four feet around and beyond the lines of outer boarding.

Fig. 5 shows the hut, *Fig. 4*, cleared of earth and ventilated as recommended.

2. The whole space actually occupied by the hut to be isolated by drainage at least twelve inches from the shallowest part of such drain, which drain must in all cases be formed round the extreme limits of the site cleared.

3. Over the whole inner space of each hut charcoal should be laid, to the extent of half an inch in thickness, before the boards are nailed down.

4. The surface drainage of the side-long ground should be intercepted, and carried off by proper channels.

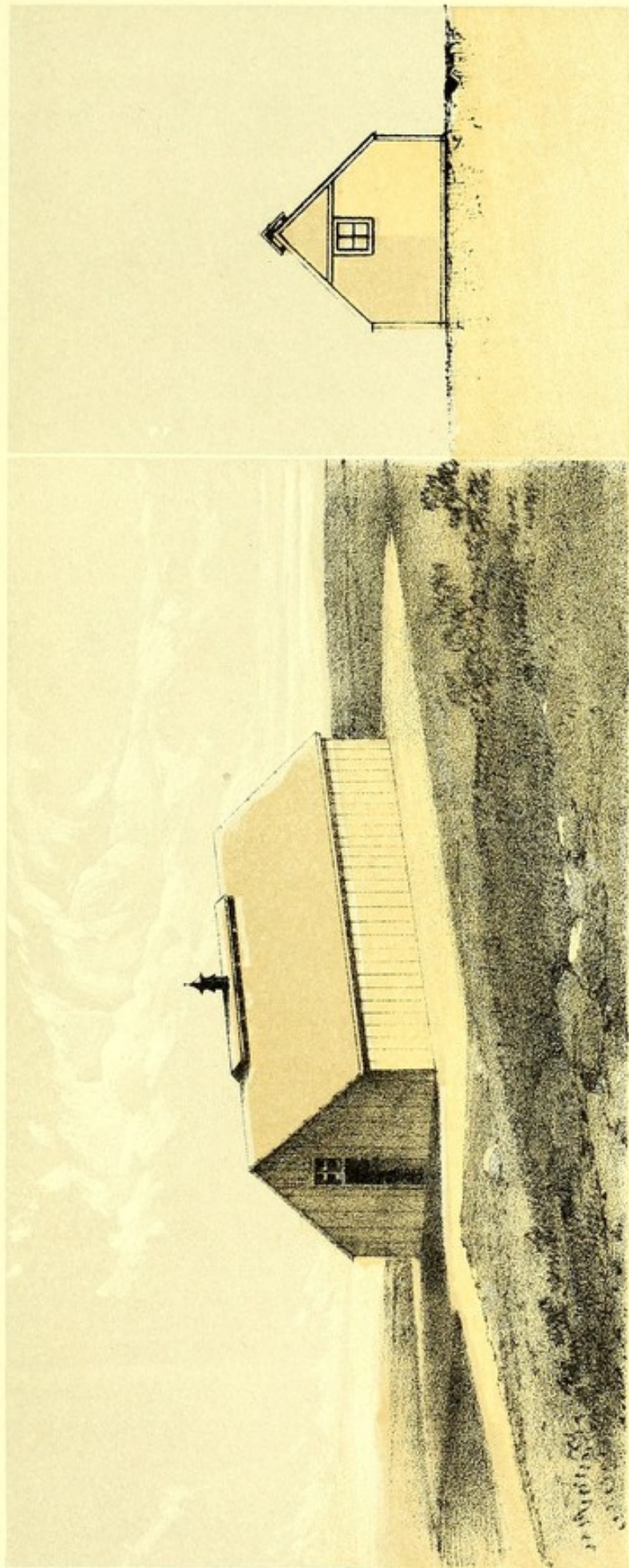
5. In all huts to be hereafter built, the foundation timbers to be laid upon dry material, rubble walls, gravel, or concrete. If practicable, the external space cleared round the hut should be formed with gravel, or paved.

6. Perflation beneath the floor should be provided for.

7. To secure each hut to the site in exposed situations, holding down bolts or timbers should be inserted in the rock or earth, as the case may be. The angle uprights of the huts should be spiked or bolted to these.

8. Ridge, end and side ventilation to be provided. The ridge ventilation to be obtained by clearing a space on either side of the ridge-piece, and covering the opening by

Fig. 5.



HUT CLEANED, ALL ROUND AND VENTILATED.

CROSS SECTION.

Gift of the Trustees of the Smithsonian Institution, Washington, D.C. 1887. Photo by the Smithsonian Institution.

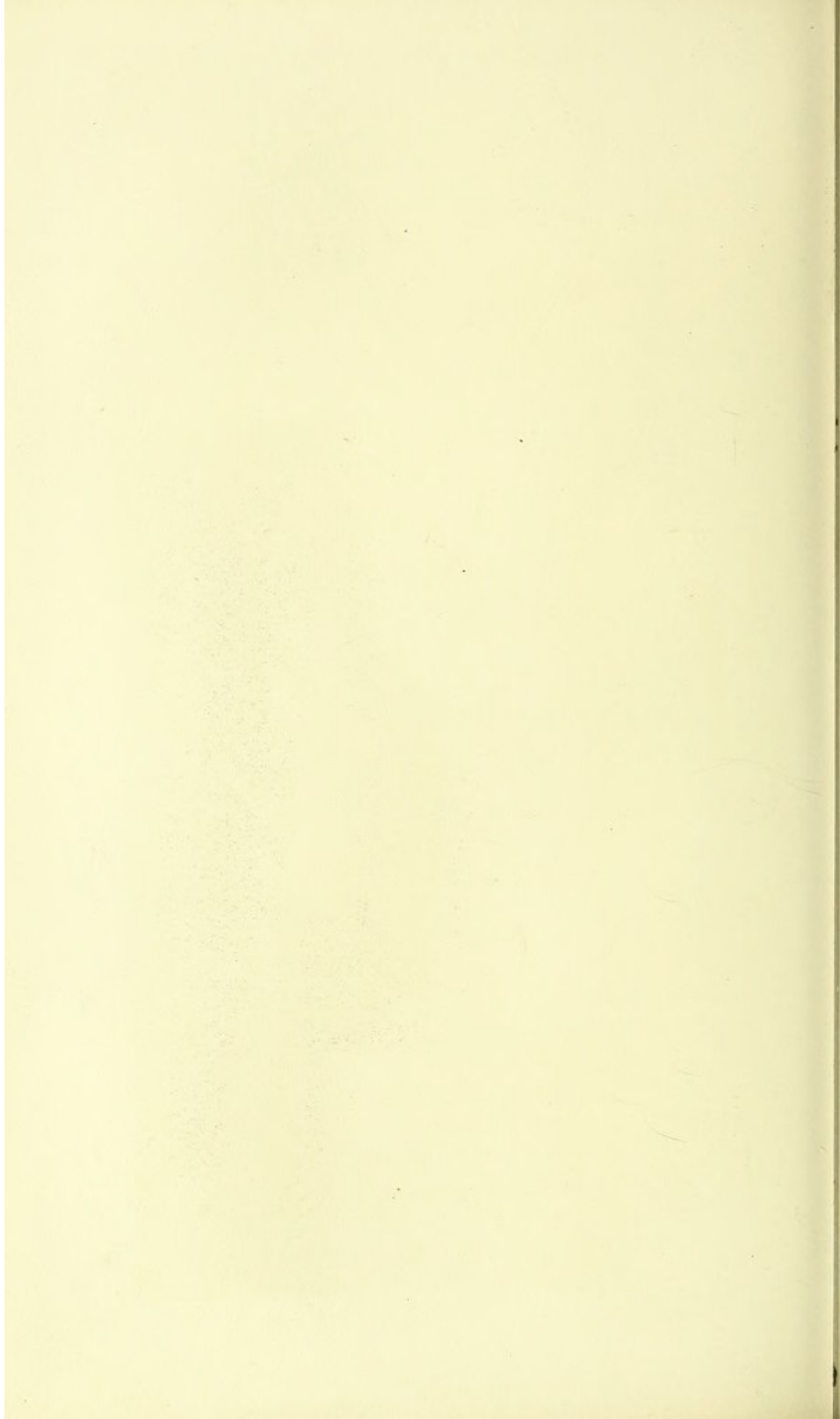
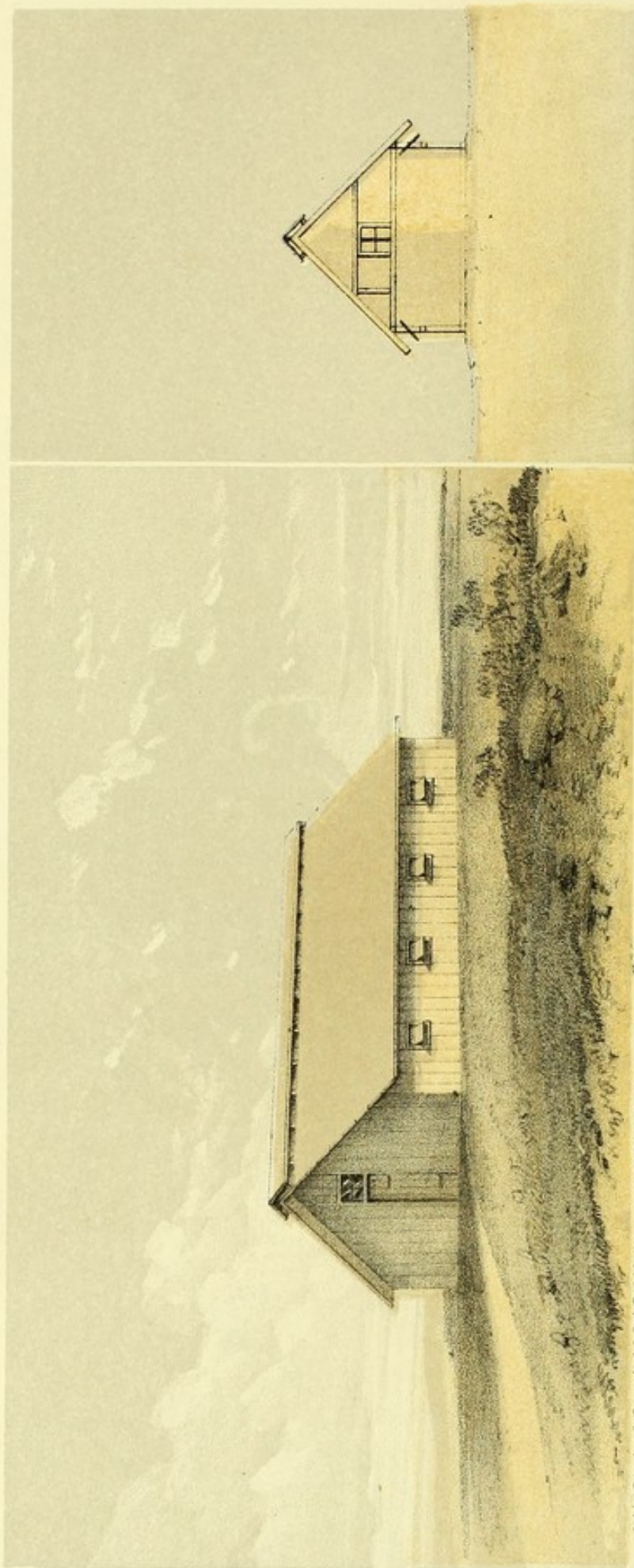


Fig. 6.



Each is provided in the Appendix, p. 100. * Same size as Appendix, Jan. 1857, p. 100. * Same size as Appendix.*

HUTS AS THEY SHOULD BE. RIDGE VENTILATED AND PROJECTING EAVES.

CROSS SECTION.

a second board, as had been done at the Castle Hospital. Side spaces to be opened in the walls of the huts, and protected by hinged or sliding shutters, of which there were examples in the Second Division.

9. To obviate the necessity usually alleged for banking up huts with earth outside, a practice most injurious to health, the huts to be lined inside about three feet in height from the floor, to prevent the wind blowing on the heads of the men. In hospital huts external seats to be provided for convalescents.

10. All huts to be lime-washed externally.

11. Should fever or cholera occur, the numbers in each hut to be reduced, and if the surrounding subsoil be wet, the site should, if possible, be changed.

12. Projecting eaves-boards would reduce the temperature within the huts during hot sunshine.

Fig. 6 shows the full ridge ventilation, and projecting eaves recommended for huts, as they should be.

The hospital huts which were at the time being erected for the Naval Brigade above Cossack Bay, according to the recommendations of the Commission, presented all the necessary improvements, and were recommended as examples.

Existing huts in various parts of the camp were also being improved, the labour for which had been found by commanding officers of regiments.

On the same date on which the suggestions for improving the huts were drawn up, other general recommendations, to be put in force wherever and whenever it might be necessary to do so, were also transmitted to Lord Raglan. They were all required in some part or other of the camp, but such cases were exceptional. The cases, however did exist, and to that extent the health of the army was liable to suffer, and it was part of our duty to deal with them.

We recommended:—

1. That all those parts of the camp where dead animals or offal have been buried, be examined from time to time, and wherever any offensive odour is perceptible, or wherever any animal remains are exposed, a quantity of charcoal be strewed over the whole surface, and an additional foot or more of earth be placed over such remains.

2. That all dead animals or offal be buried immediately to such depth that three feet of earth, at the least, intervene between the upper surface of the decomposing matter and the level of the ground. In every case, before the earth is filled in, a quantity of charcoal to be thrown over the animal or offal. That all interments take place as far as practicable outside the camp, and at as great a distance from the camp as possible, and that no grave be less than four and a-half feet deep.

3. We gave our entire approval to the destruction by fire of all refuse matters that could be so disposed of.

4. During summer, latrines should not be made larger than required for a fortnight's use. That when first dug, a quantity of charcoal should be thrown on the bottom of the latrine, and every day such camp refuse as could not be destroyed by fire to be thrown into the latrine, and peat charcoal thrown over the whole, and then a few inches of earth. This process to be repeated day by day until the matter thrown in reached within two feet of the surface, after which some charcoal was to be put over it, and the earth filled in a little above the level of the ground. No new latrine to be dug near any source of water for the camp.

5. Those parts of the camp where animals are picketed to be kept constantly cleansed, and the dung and refuse removed and burned. It would be very advisable to change the ground for a week occasionally, to allow the air and sunshine to free the ground from exhalations. In any case where there are noxious smells, charcoal or quicklime may be advantageously used for removing the effluvia.

6. It would be very advantageous to strike the tents, and to remove them to a short distance from the ground they occupy, so as to leave it exposed to air and sunshine. After removal, a small quantity of slaked quicklime thrown on the spot where the tent stood would aid materially in preparing the ground for returning to it. We further advised that, in cases where cholera or other epidemic disease prevailed, an additional supply of tents should, if possible, be served out to affected regiments, to enable the number of men in each tent to be reduced.

In making these recommendations, we expressed our opinion that the camp sanitary police should be vigilantly

exercised, and that it would be very desirable that similar precautions should be adopted in the other camps of the allies, so as to preserve the atmosphere of the whole camp in as pure a state as the circumstances of the siege might render possible.

Had it been practicable to obtain the large number of men required for the speedy execution of the sanitary works at Balaklava already mentioned, it was the intention of the Commissioners to have recommended that part of these men should, after the completion of the works, be organized for camp sanitary service, and they further intended to have placed their sanitary inspectors at the disposal of the military authorities for the purpose, as they had done at Scutari.

There were natives already employed in keeping the camps clean, but the small number of labourers at Balaklava required the constant attention of the inspectors in order that the works there might progress, and they could not be spared for the camp. The Commissioners therefore themselves kept up a continual oversight of all parts of the camp, and this was done day by day, unless personal sickness interfered to prevent it. Inquiries were at the same time made of the medical officers as to the health of the troops, and abstracts of the weekly medical states were made up.

It has been already stated that cholera appeared in the army early in May 1855. Immediately on being informed of the occurrence Dr. Sutherland met Dr. Hall and examined the affected camps. The disease showed itself first among men engaged in the trenches, near a place where there was an offensive burial-ground belonging to the Russians, and it attacked by preference new arrivals and intemperate men. The camps before Sebastopol which were first affected were those of the 48th, the Royals, the 3rd Buffs, and the Royal Artillery. The disease made very little progress until after three days of heavy rain followed by a hot sun.

The ground occupied by the affected camps was wet clay which, after the rain, had been worked into a puddle. In some of the affected tents the ground was wet and the men slept upon it. That never-failing source of danger when epidemic disease is present, overcrowding, especially in the

tents, was an obvious evil, and in every instance the ventilation of the tents was deficient. There were one or two offensive latrines to windward of affected camps, and the water used was muddy from causes already mentioned. There was a good deal of diarrhœa among the troops at the time. As the disease progressed its attacks appeared to conform to the usual epidemic laws, and the localizing conditions to be much the same as those observed elsewhere, aggravated by the higher temperature. Removal of affected regiments to fresh ground at times put an arrest on it, but at other times it was not so successful.

After having completed the inquiry, Dr. Sutherland, with the concurrence of Mr. Rawlinson, addressed two communications to Dr. Hall on the 16th May, in one of which the removal of affected camps to better ground, the diminution of overcrowding, by serving out a larger supply of tents to affected regiments, and examination, deodorizing, and covering up of all old latrines and other offensive matters within half a mile of affected tents was recommended.

In the other communication it was pointed out that the existing means of discovering and treating diarrhœa cases were insufficient, and that it was necessary to take steps for discovering the disease at the very commencement, either by an inspection of the troops, by setting a watch over the latrines, or by any method consistent with the rules of the service whereby the malady might be promptly discovered, and the medical treatment carried to the patient without waiting for his applying for it.

During all the recent epidemics of cholera the beneficial results of similar inspections for the discovery and treatment of the earlier stages of cholera have been fully experienced, both in civil life and in the army. The worst cases are precisely those in which the sick are least likely to apply for medical aid, and hence the necessity for seeking them out and treating them on the spot. There are few fatal cases of cholera in which disease has not been neglected in its early and curable stages, and application for medical relief put off till it was too late to be of service. To this general rule the experience of the army, is itself no exception.

While we were occupied with the sanitary inquiries con-

nected with the camps, we at the same time carried out similar inquiries into the condition of the hospitals, and we next proceed to state the sanitary defects we discovered in them, and the remedies which were applied.

§ VIII.—MILITARY AND NAVAL HOSPITALS IN THE CRIMEA.

At the beginning of April 1855, there were three general hospitals belonging to the British army in the Crimea, namely, the General and Castle Hospitals at Balaklava, and the General Hospital in the 3rd Division. On the 3rd May the Commission was applied to by Dr. Hall to examine a site for a fourth General Hospital which he had selected near the monastery of San Georgeo, and of which we entirely approved.

This hospital was immediately commenced and extended as occasion required.

Besides the General Hospitals, there were the Regimental Hospitals situated in various parts of the camp. There was a hospital belonging to the Royal Marines under Marine Heights, and the sick and wounded of the Naval Brigade were at that time received on board Her Majesty's ship "Diamond," lying at the head of Balaklava harbour.

With the exception of Kadikoi Church, which was used as a hospital for the Guards, the *General Hospital* at Balaklava was the only establishment built of stone. It had been a Russian military school, and consisted of two divisions, the front one containing large lofty airy wards, well isolated from the ground. The other portion was behind and consisted of a range of smaller apartments built against the slope of the hill, and having windows only on one side. This part was unhealthy, and fever had originated in it.

These two buildings formed two sides of a parallelogram, and were situated on the eastern side of the harbour. The area was completed by two other ranges of buildings, used as stores and offices for the hospital.

Besides the wards in the stone building there were twelve or thirteen Portsmouth huts erected in rows on the sloping ground above the harbour, also used as wards for the sick.

The whole establishment was situated on a sloping bank of ballast under the rocks at the north end of the town of Balaklava. It was subsequently discovered that part of the back range of wards had been erected on the site of an old graveyard.

The main objection to this hospital was its position. Anywhere else it might have been a good hospital, but being exposed to malaria and other injurious emanations, arising from the bad sanitary condition of the neighbourhood, it was not an establishment where the highest results of medical or surgical treatment were likely to have been realized.

The front part of the building had windows on both sides; and at the time of our inspection a plank had been removed from the wooden ceiling of each ward to admit of free passage upwards of the ventilation into a space under the roof, from which it could escape by existing openings into the external atmosphere.

The inner walls of the wards were repeatedly lime-washed and were clean. From having windows only on one side, the wards in the back portion of the building had no thorough draft, but the ventilation had been materially improved through the ceiling in the same manner as in the front part of the hospital. This portion was also kept clean by lime-washing.

We found the ventilation in the huts deficient, but it was subsequently improved by louvred openings in the roof of each hut.

The outside of the entire establishment was lime-washed and always looked clean.

The chief removable sanitary defect in this hospital was the condition of the latrines, the worst of which was filled up at our request. Fever had originated in two of the hospital sheds nearest this latrine. A proposal was subsequently made for removing to a distance the whole filth of the hospital, to which we gave our approval.

Complaints were occasionally made that stable manure and other refuse was allowed to accumulate among the huts in the vicinity of the hospital, but on representing this to the Commandant Lieutenant-Colonel Harding, or by

calling the intention of our own inspectors to the complaint it was immediately attended to.

The water for the General Hospital was obtained from a fine well almost under it, at the edge of the harbour.

From its situation this hospital had to receive not only soldiers as patients but a large number of natives employed in the neighbourhood, and also sailors from the transport service. Sometimes the sick of these latter classes constituted the majority of the inmates. At other times invalid soldiers, sent down from the front, were left in the hospital to recruit before being put on board ship for the Bosphorus.

From these various circumstances the number of inmates was sometimes larger than the hospital could well accommodate, while at other times there was cubic space to spare. So far as the army was concerned, the hospital was better suited for a transit hospital than as a place for the recovery of sick, and latterly it was almost exclusively used for that purpose.

Its sanitary condition, except in the points already mentioned, was as satisfactory as could have been expected, and the Commissioners deemed it sufficient to inspect it from time to time, in case anything should arise requiring their notice.

The *Castle Hospital* was situated on one of the finest natural positions that could have been selected for such a purpose. It occupied the whole of a long narrow ridge running nearly east and west, and joining the Castle Rock with Marine Heights. The ridge immediately overhangs the sea at a height of about 320 feet, and is isolated on the land side by the Castle ravine which cuts it off from the adjacent higher ground.

The natural means of drainage were all that could have been desired, and the esplanade towards the sea was always dry, even after heavy rains. The hospital at the time of our arrival in the Crimea consisted of a number of Portsmouth huts arranged side by side with the ends facing the sea. Several other huts on a model called the "Chester hut," were also being erected. Eventually the

whole ridge was occupied by thirty-one huts, all or nearly all of which were used either for hospitals or stores.

Other two large hospital huts were erected on platforms cut out of the hill slope on the north side of the ravine.

Water was obtained from an old well in the ravine, supplied, in all probability, by a pipe conducting the water from springs on the side of Marine Heights, and besides this source, the stream running down the ravine afforded water, but of a less pure quality. These springs had their origin on the water-shed of Marine Heights, but as this was only of a limited area, the supply would naturally diminish or fall short after a long continuance of dry weather. The porous deposits, however, from whence it proceeded, contained a large quantity of water, which could easily have been uncovered and conducted to supplement the deficiency.

The Portsmouth huts of the Castle Hospital were constructed on the usual model, namely a door opening directly into the external air, a window at either end, three-quarter inch boarding for the sides and roofs, boarded floors, the roof covered with felt, and the cubic contents about 4,000 feet.

The two most obvious defects in these huts for hospital requirements were—1st. The absence of independent means of ventilation; and 2nd. The thinness of the sides and roof, which could not afford sufficient protection from the heat of the sun.

The Chester huts were much better. They were longer and more roomy, and the sides were double, planking being nailed over each side of the uprights, so as to leave a space between. Each hut had a range of swing windows of rough plate glass on either side over the beds, and also an external porch, with a separate apartment for the attendant.

The Commissioners found that by taking advantage of this construction, these huts could be further improved, and rendered very suitable for hospital wards.

All that was required was to raise the ridge pieces so as to have ventilation along the ridge of each hut: to make a few openings in the lowest plank on the outside boarding to admit the air between the outside boarding and the

inner lining, and to have a clear passage upwards for the air entering by these openings, between the outer and inner planking of the sides and roof up to the ridge ventilation where it would be discharged. By this means the interior of each hut would be preserved always thoroughly ventilated, and a current of air kept up between the outer boards and the lining, so as to prevent the heating effects of the sun's rays on the outside from affecting the temperature of the air within the hut. Dr. Jephson, the medical officer in charge of the Castle Hospital, took great pains to make these huts and their ventilation as perfect as possible.

The excellent character of the position of this hospital rendered very little preparation of the ground necessary, except for the two huts on the north side of the ravine, where we found that after the huts had been erected, the earth had been filled in behind them, and rested for several feet against the sides.

The latrines for the hospital were situated in the ravine at a considerable distance from most of the huts.

Few Hospitals can show more favourable results than were exhibited by this establishment. It was primarily intended for the treatment of wounded men. Amongst this class of patients the mortality at the commencement of the year 1856, had been under three per cent. of the admissions. A number of sick had been from time to time admitted along with the wounded, and the mortality from sick and wounded together did not exceed three and a quarter per cent. of the admissions.

Judged by its results, this hospital must be considered as one of the most healthy of which we have records.

The General Hospital at San Georgeo was formed of a square of huts, similar to the Chester hut. It was situated upon a nearly level piece of ground not far from the top of the great ravine, and about 500 feet above the level of the sea. The ground consisted of stratified limestone, thinly covered with a layer of light loam. The site was well isolated and drained by trenching, and each hut was also drained.

The sides and roof of the huts were double, and the ridge pieces were raised so as to insure ventilation, and to allow the air to escape from the space between the side and

lining. Each hut was fastened down at the angles by holding down timbers. There was a porch at each end, and a row of swing windows of rough plate glass on either side.

There was one large hut belonging to this hospital constructed of corrugated iron, which from its conducting power for heat is a bad material for the purpose, whether used for walls or roofs. It is sure to become overheated by the sun's rays in summer, and to be cold in winter, and is at all times subject to those sudden variations of temperature between day and night which are so injurious to the sick in many cases.

The water supply for the establishment was obtained from wells belonging to the Monastery Farm at a short distance off.

The site naturally was a good one, and there were no local sources of malaria, excepting what might have arisen from a large cattle-yard belonging to the French Commissariat, about a quarter of a mile away. The chief cases sent to the Monastery Hospital were convalescent and ophthalmia cases, from regiments in the front.

The General Hospital in the 3rd Division, at the time of our first examination of it at the end of April 1855, consisted of a number of Portsmouth huts, ranged in parallel lines, situated behind the 3rd Division, and surrounded by the huts and tents of several regiments. The space it occupied was considerably raised above the general level of that part of the plateau, and it had ample means of natural drainage. Unfortunately, however, the ground consisted of a deep tenacious clay, hardly admitting of improvement by drainage, and becoming a complete swamp after rain. The huts were too close together, and were too nearly encroached on by regimental camps. They were undrained. They had earth raised against their sides, and were imperfectly ventilated. Considered as a whole, this hospital was, therefore, less favourably situated than the other General Hospitals.

Had it been possible at the time to have removed the whole to better ground, it would have been the best course to have taken. Otherwise the only thing to do was to improve it as much as was practicable, and to use it only on necessity.

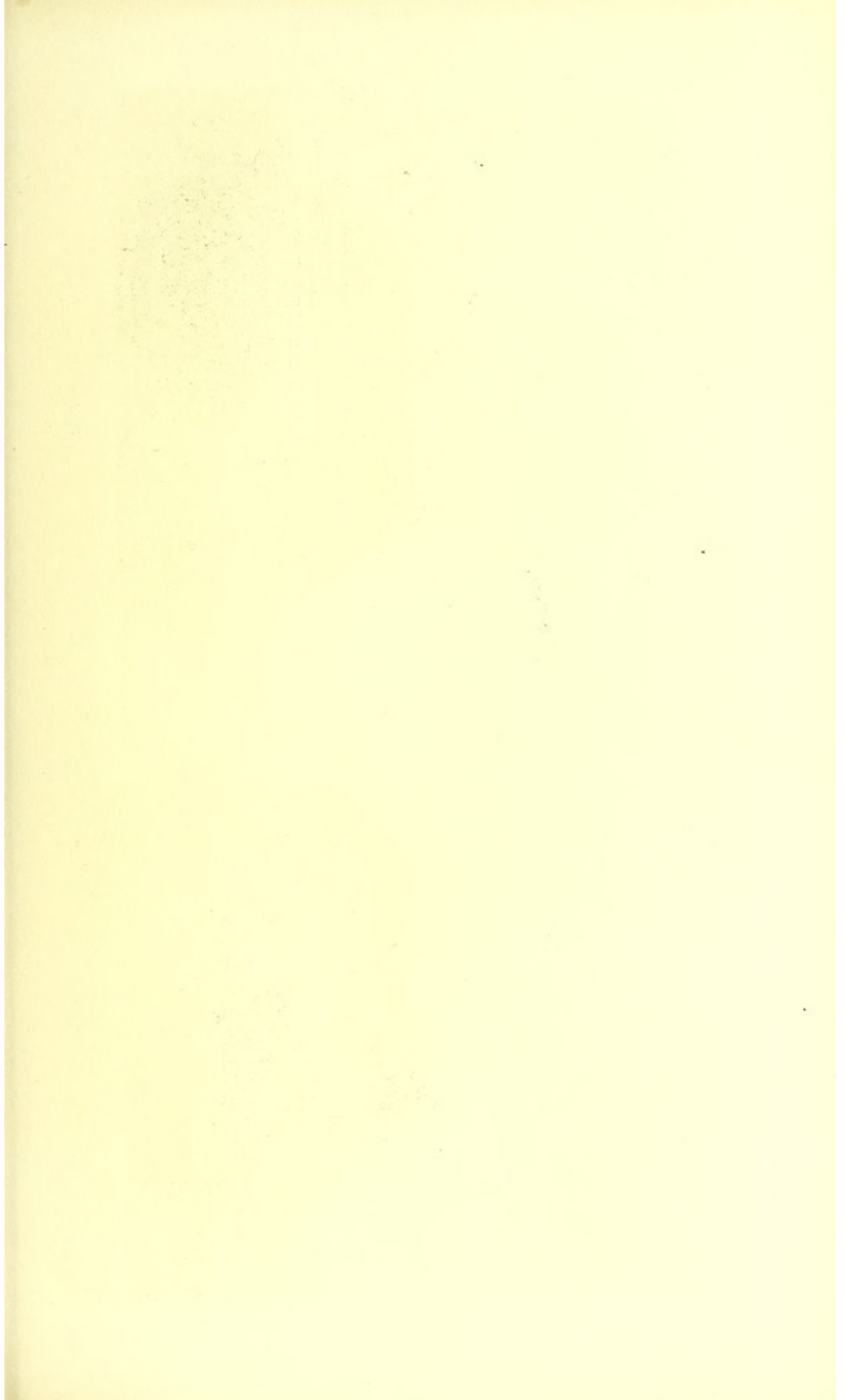


Fig. 7.



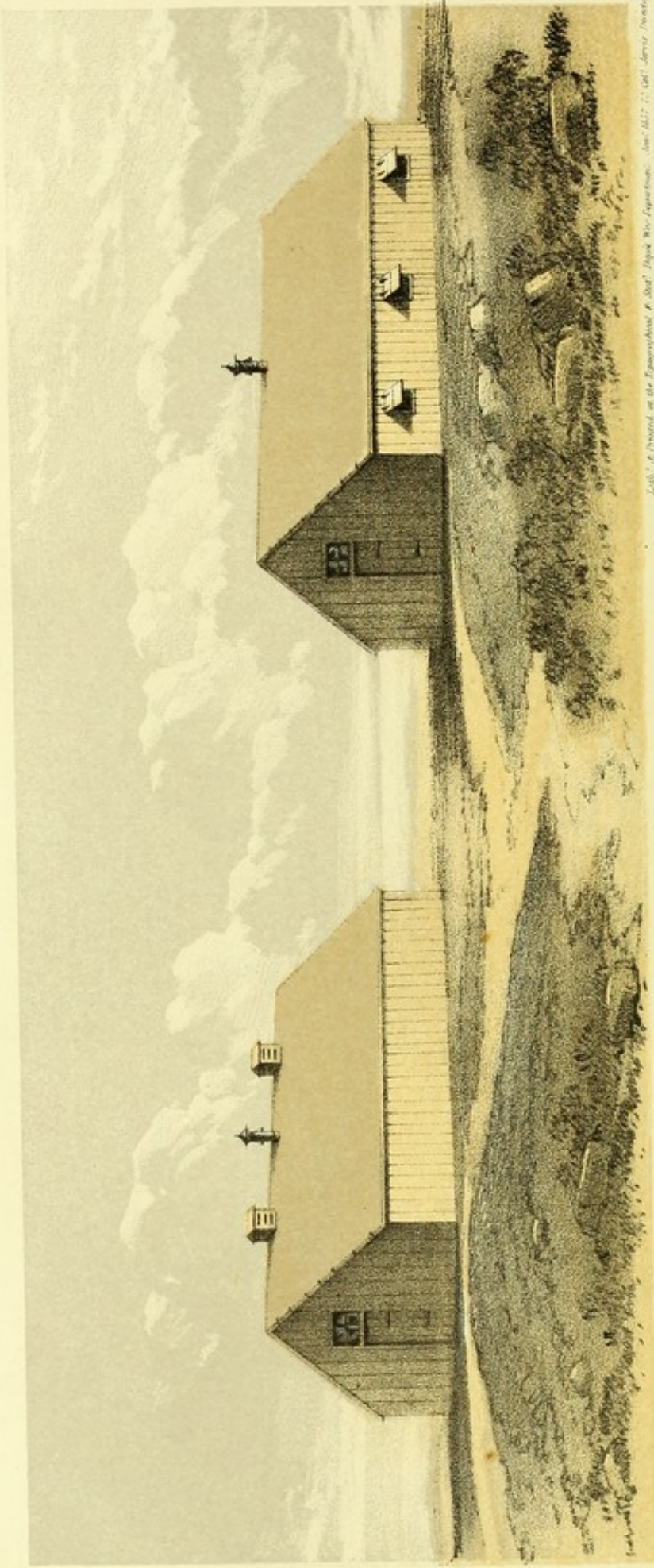
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2ND DIVISION. END VENTILATION BY HOLES.

4TH DIVISION. END-VENTILATION BY TRIANGULAR SPACE.



Fig. 8.



Lab. 1. 2. Printed at the Epigraphical & Steel-Plate Works, Argentina. Jan. 1887. U.S. Geol. Surv. Division.

LIGHT DIVISION HUT. LOUVERS IN RIDGE FOR VENTILATION.

3RD DIVISION HUT. SIDE VENTILATION.

The huts were gradually otherwise appropriated, and very few sick remained in the Hospital after the commencement of 1856.

The Regimental Hospitals were formed for the most part of two or three Portsmouth huts, generally placed among the tents and huts of the regiments. In a few instances hospital marquees were in use. The site of each hospital was of course determined by the position of the regiment. The ground was sometimes porous and good, at other times it was clay. In the majority of instances the medical officers had had the drainage of the huts improved to a greater or less extent. There were instances, however, in which no such improvements had been carried into effect.

The walls of all the regimental hospital huts were single, and they had the usual arrangement of one door and two windows. In most instances we found that the medical officers had remedied the defects in the ventilation to a greater or less extent.

One method of doing this was by drilling a few inch or inch and a half augur-holes through the wood in the triangular space between the ridge of the hut and the top of the window at each end of the hut, and placing a projecting board above the holes to keep the rain from driving in (*Fig. 7*). In other instances a triangular opening was cut at each end, in the same position, and protected in a similar manner (*Fig. 7*): or the upper board under the eaves on each side of the hut had been hung on hinges to admit of its being opened or shut. Sometimes two or three vertical slits, with sliding covers, were cut on each side of the hut, these slits being occasionally protected by a wooden penthouse (*Fig. 8*).

A freer ventilation was obtained by cutting out large square windows, generally two on each side, with wooden shutters instead of glass.

All these methods, however, were more or less defective, because they did not make sufficient provision for the escape of the heated foul air from under the roof.

The best method of accomplishing this latter object which we found in use was in some of the hospitals of the Light Division, in which a square opening was cut in the middle of the roof at the ridge, and covered by a louvred

turret (this is shown in *Fig. 8*). In some cases no provision had been made for ventilating the hospital huts.

Generally speaking, the huts were more or less isolated from the surrounding ground, but not unfrequently earth was heaped up against their sides, and there was consequently no protection for the subsoil from damp.

Sometimes the floor was boarded all over, but generally only the sides where the beds were, and the passage between the two rows of beds was either rammed hard and covered with a thin layer of lime, or it was paved with rough stones.

The roofs of the huts were generally covered with felt.

Admitting exceptions, of which there were some, the regimental hospitals, from the care bestowed on them by the medical officers, were in a good sanitary condition, and, with the occasional application of limewash, outside and in, they were preserved as clean and healthy as their defective structure admitted. They were apt to become overheated on account of the thinness of the walls, but this defect could be partially remedied by a more perfect roof ventilation, although the radiation from the heated wood still remained.

In pitching hospital marquees, the usual way was to dig a trench round the site, and the bedsteads were generally placed on the ground. Sometimes the interior was boarded over, when boards could be obtained, and it was astonishing to mark the difference produced on the aspect of the interior by this addition.

The best example of a marquee hospital was that belonging to the Guards, after they went to the front, in June 1855. It laying it out, a considerable area of porous sandy soil, on a good elevation, was selected. It was trenched round to ensure dryness, and the marquees were arranged in two parallel lines, at a distance from each other—a marquee in one line being opposite the interval between two marquees on the other, an arrangement admitting of a free circulation of air. The interior of nearly all of the marquees was boarded, the boards being generally laid on joisting. The usual method of ventilation in marquees is by opening or raising the sides; but this can hardly be said to be suffi-

cient, even in favourable weather, and still less is it so when from rain or high wind the sides cannot be opened. Even in fine weather it was remarked that the air under the roof of the marquee was hot and stagnant, although the sides were open, because there was no provision for its escape above. What is really wanted to render the ventilation sufficient is to make large and properly-protected apertures round the top of each pole. Were this done, a marquee would be rendered far more suitable for a field hospital than it is at present.

The whole question of ventilation, as regards field hospitals, is one of great importance. The limited means of transport admit only of a small amount of hospital accommodation being carried with an army, but it happens that a deficiency of cubic space can be, to a large extent, supplemented by free ventilation; and hence, so far as the rapid recovery of the sick and wounded is concerned, well-ventilated field hospitals answer the same purpose better than it would be fulfilled by a much larger amount of ill-ventilated cubic space.

To ventilate a field hospital well, is, in other words, to save transport.

Even with all the advantages possessed by a stationary camp like that before Sebastopol, backed by so large an amount of sea transport, the actual cubic space which could be set apart for the sick was very much less than in the hospitals on the Bosphorus. Each Portsmouth hut had from twelve to fourteen beds, which would give about 300 cubic feet of space per man. The hospital marquees generally accommodate from twelve to fifteen beds, and give about 250 cubic feet per man. It very generally happened, however, that from the improving health of the army, a considerable proportion of beds were left unoccupied, and the cubic space for each patient was, thus, much greater than the amount specified. Where a similar advantage does not exist, the only way of meeting the defect is by carefully attending to the ventilation, and ensuring its amplexness according to the state of the weather and season, by the most scrupulous attention to cleanliness, both within and without the hospitals, and by seeing that there are no latrines, dung heaps, dead animals,

or other nuisances in such a position as to affect injuriously the purity of the air in the vicinity. These precautions, which are at all times necessary to be observed, are the more so when the necessities of the case require the sick to be limited to a small amount of cubic space. Permanent and independent means of ventilation are particularly required at night, when the doors and windows are closed.

The Royal Marine Hospital was situated on the western slope of Marine Heights, about 500 feet above the sea, and at the upper end of the Castle ravine. It consisted of several wooden huts erected on a platform cut out of the slope, the huts being so placed that part of the ground rose several feet against the sides, and the earth was further heaped up, so that, in reality, the huts were partially buried. There were no surface drains, and no independent ventilation. The floors of the huts were damp, and had the hospital been occupied while these defects existed, it would have been decidedly injurious to the sick.

The attention of the Commissioners having been called to the condition of the hospital, they addressed a representation on the subject to the Commander of the Forces, on the 25th April, 1855, recommending that the huts should be isolated from the surrounding ground, the site drained, trenches cut to carry off surface drainage, and each hut ventilated at the ridge. Sketches representing the improvements required were at the same time sent to the Commander of the Forces, who approved of the changes, and directed their execution.

These sketches were intended, also, to exhibit the chief sanitary defects which we found in the barrack and hospital huts, and the manner of remedying them:

The object was, first, to cut off the surface drainage from the site by means of catchwater drains; next, to isolate the hut entirely from the earth, which should never touch its sides, by leaving a clear space all round, about four feet wide, to allow the air to circulate freely, and to cut off damp from the boards; and, lastly, to drain the site of the hut by a trench carried round the cleared space, about a foot below the foundation of each hut, and by sloping the earth from the foundation to the drain.

The sketches, also, showed the manner of introducing ridge ventilation, as recommended by the Commissioners.

There was still one desideratum in all the huts, which could only be supplied in those about to be erected, and that was a means of effectually protecting the air in the interior from the damp of the subsoil. The way in which we had this done will be presently mentioned.

At the date when the recommendations for improving the Royal Marine Hospital was made, there was no hospital ashore for the sick and wounded of the Naval Brigade, who were, at the time, received and treated on board Her Majesty's ship "Diamond," the main deck of which had been given up for the purpose.

To enable this to be done, the crew of the "Diamond," consisting of about 200 men, were sent to sleep on the lower deck, and the whole sick accommodation which was obtained in this way was sufficient for no more than twenty-four patients, without crowding.

We considered this arrangement, in the then sanitary state of the port of Balaklava, at the upper end of which the "Diamond" was lying, as alike compromising the health of the crew and the recovery of the sick, in which opinion we were sustained both by Captain Hamilton and by Dr. Smart, who had charge of the sick. At the same time, a number of transports were being fitted out in the harbour to be used as floating hospitals, so that it became necessary to consider the whole subject.

We examined the hospital arrangements on board the ships "Orient," "Poitiers," "St. Hilda," "Clifton," and "William Jackson." We found them generally good, and sufficient for conveying sick to a distance, but we were decidedly of opinion that, in the existing condition of the port, no ship could be used there as a hospital with safety. We accordingly stated this opinion to the Commander of the Forces on the 19th April, and recommended, in so far as the sick and wounded of the Naval Brigade were concerned, that hospital huts should be erected on sites we had examined on the high land above Cossack Bay, which presented many obvious advantages for this purpose. The step was the more pressing as two cases of cholera had already appeared on board the "Diamond."

The huts were immediately granted. We explained to the ship carpenter the plan to be adopted in their erection, and went, from time to time, to examine the progress of the work.

The ground was cleared, levelled, and drained. A foundation of large rough stones picked off the adjacent surface, about a foot high, was formed, and the timbers and flooring of the hut laid on these stones (as shown in *Fig. 9*). By this simple means, the air was allowed to circulate freely under the hut, and all risk of damp was removed.

The sides and roof of each hut were double, and a current of air was allowed to pass upwards in the space between the outer boarding and the inner lining, in the manner already mentioned. As the result of this arrangement the temperature was the same inside the hut as it was outside in the shade.

Ridge ventilation was introduced, and the external air was admitted a little above the level of the floor by simply raising the lower edge of one of the boards a little outwards, and one of the inner boards a little inwards, to permit air to enter. *Fig. 10* shows these provisions for ventilating the interior of the hospital, and carrying off the hot air from the walls.

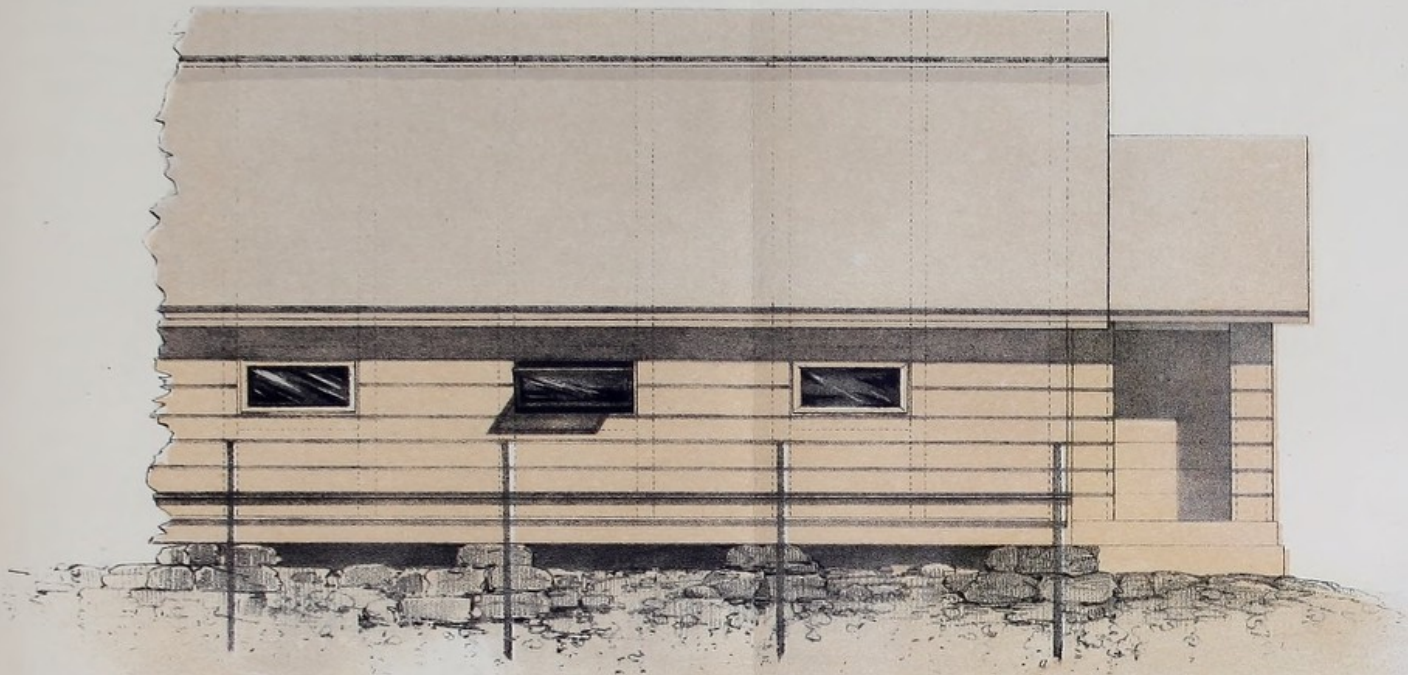
A covered porch was erected over the door at each end of the hut, and projecting eaves were carried over on the sunny side to afford shelter to convalescents, and additional protection from the sun's rays.

Each hut had the usual swing plate-glass windows, along either side. Dr. Smart bestowed great attention in having the construction and internal fittings of the huts completed in a proper manner.

The result of the arrangements were highly satisfactory, and, as already mentioned, these hospital huts were indicated by us as models for other huts to be erected in the camp. The materials used were all at hand, and very little more labour was required in putting up the huts in a healthy manner than was expended on those of the usual construction.

The General Hospital at San Georgeo afforded another good embodiment of sanitary precautions similar to those advised for the Naval Brigade Hospital, and whenever it was examined the air within was cool, fresh, and wholesome.

Fig. 9.



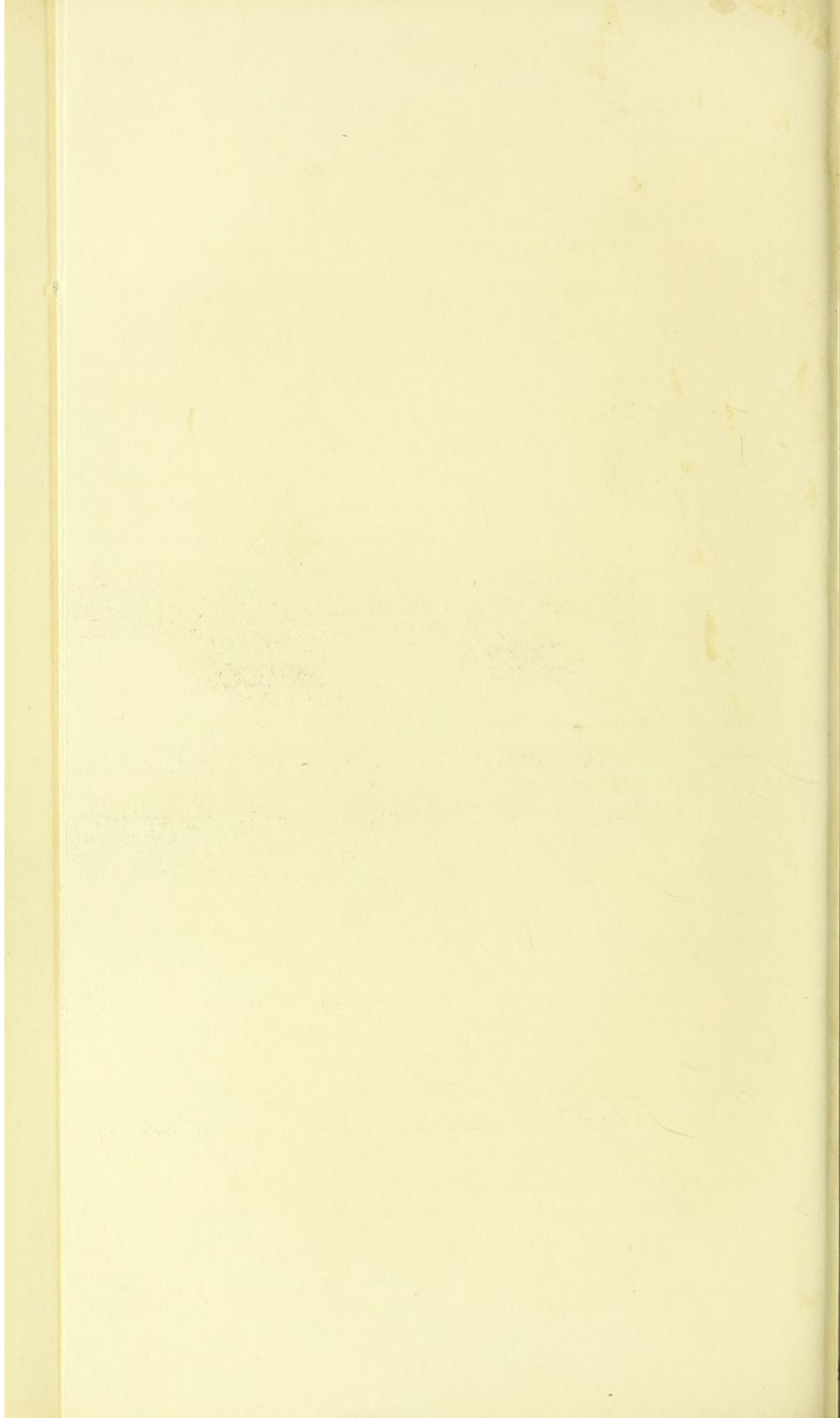
1884. Printed at the Topographical & Staff Dept. War Department. Ser. 1857. 47. 1st. Series. Division.

NAVAL BRIGADE HOSPITAL HUT—COSSACK BAY

SIDE ELEVATION

Scale.





The improvements recommended in the drainage, isolation, and ventilation of existing hospital huts, were carried out where they were required, and lime-washing, both inside and out, was diligently practised.

In connection with the subject of the Army Hospitals, we may state that soon after the arrival of the Commissioners at Balaklava, they received a request from Lord Raglan, asking them to examine the peninsula of Sinope as a site for a hospital.

The bad sanitary condition of Balaklava, and the necessity of completing the inspections, and forwarding the works there and in camp, prevented us complying with Lord Raglan's request until the end of May, but on the 30th of the month we sailed from Balaklava for Sinope. The anchorage at Sinope was carefully examined, and found to be good, and jetties for landing the sick could easily have been constructed.

There were no buildings in the town of Sinope itself which could have been rendered available for a hospital, but there were several excellent sites on the peninsula. The mass of the peninsula consists chiefly of igneous and tertiary rocks, the natural drainage is sufficient, there are no marshes, or local sources of malaria, and the sea almost surrounds the lofty table-land of which it is composed. It is, perhaps, the most healthy site along the north coast of Asia Minor; fevers were stated to be unknown, and invalids come from the neighbouring districts to recover their health. The supplies were abundant, except in the matter of vegetables. The water was good, but limited in quantity, and a sufficient amount could not be obtained for a hospital of any large size, without incurring considerable cost for engineering works.

This was the main objection to Sinope, which, in other respects, was as good a place for a large hospital as could have been desired.

The Commissioners returned to Balaklava on the 8th June, on the 10th Mr. Rawlinson was wounded at the front and sailed for England on the 21st, where, subsequently to his arrival, he continued to act as Commissioner, and to give his aid, especially in the works required for the more permanent improvements at the hospitals on the Bosphorus.

Dr. Sutherland went at the same time to Constantinople, and made an inspection of the hospitals there, returning to Balaklava on the 14th July, 1855.

§ IX. PROGRESS OF THE SANITARY WORKS IN THE CRIMEA.

About the middle of July, the services of the two inspectors, Messrs. Freeney and Aynsley, were urgently required in Liverpool, and they gave notice of the fact to Dr. Sutherland, on his return.

An inquiry was therefore made to ascertain the extent to which the recommendations and instructions for the sanitary improvement of the town of Balaklava, contained in the communication addressed to the Commander of the forces on the 11th April, had been carried out. On the 16th July, the state of the works was as follows:—

1. The British burial-ground at the head of the harbour had been deodorized and covered with gravel and earth, under the superintendence of the inspectors.

2. All old collections of offensive matter had been deodorized and efficiently covered; and such refuse as could be most easily disposed of by burning had been so destroyed.

3. Four additional latrines had been erected—three of them by the inspectors, and they were all kept deodorized by charcoal, lime, and earth.*

4. An efficient cleansing staff was in full operation for keeping the town clean.

5. There were two barges more or less in use for removing filth out to sea.

6. The lime-washing of houses, and levelling the sites of those pulled down, had been completed.

7. The shoal water at the upper end of the harbour had been filled up in the way recommended, on the side nearest the town, and the work was progressing.

* It may here be stated that, for such purposes, charcoal powder was found to lose its deodorizing quality when wetted. Lime acted best when wet. Sand or dry earth, in larger quantity, were found to be very efficacious. Perhaps the best deodorizing compound was one used by the inspectors in all their works. It consisted of one part of peat charcoal, one part of quicklime, and four parts of sand or gravel.

8. Nearly the whole of the worst part of the east side of the harbour had been temporarily quayed, about two-thirds having been done under the inspectors, with materials found in the village. The margin of the harbour which had been formed with filth, dead animals, and offal, had been covered with lime, charcoal, and earth, and temporary quays carried outside of it, so as to have a depth of from three to six feet of water.

9. Covered channels, for draining surface water into the harbour, had been formed by the Royal Engineers.

10. The streets had been named by the Commandant.

The works still remaining to be done were—covering the marsh; covering the Turkish burial-ground; the completion of the slaughtering-place, begun by the late Rear-Admiral Boxer; and covering over the water-stream running down the Castle ravine.

It will be seen that a considerable extent of work had been done, and contemporaneously with it the health of the town had improved.

The results obtained by the use of deodorizing substances were certainly not satisfactory, at least so far as concerns the public health. They diminished the odour, but disease did not decrease in a corresponding ratio. The Commissioners are decidedly of opinion that these substances should never be trusted to for protecting health, if it be possible to remove nuisances at once and to a distance. Burial of putrid refuse to a sufficient depth, when removal is impossible, or when the substance cannot be destroyed by fire, is a safer expedient than merely removing its smell by charcoal, or by any other deodorizing agent scattered over its surface. Smell is indeed the natural index of danger, and removal or destruction of the offensive matter is the remedy. There is reason to fear that after the smell is removed the danger remains. The use of earth or sand in bulk mixed with charcoal and lime, as already mentioned, is unquestionably a better expedient than trusting to charcoal alone.

Another work, which had been the substance of previous communications with the Commander of the Forces, had not at this time been carried out, namely, the construction of a proper brow or jetty for the more easy shipment of sick and wounded for Scutari.

At the beginning of April 1855, the sick transports were generally moored at the lower end of the harbour, which at that period was very full of shipping. There was a jetty or wharf at the upper end of the harbour, nearly under the General Hospital, called the "Sick Wharf," to which the sick were brought from the front in ambulances. There was a small office on the wharf for the officer in charge of the embarkation, and accommodation was provided close to it for giving the sick such refreshment as they might require after the journey and before going on board.

The ambulances brought down two classes of sick, those who could sit up and those who required to be kept in a recumbent position. The former class was accommodated in an open part of the ambulance waggon. The latter were laid on stretchers inside, which were so arranged that the sick could be drawn out on the stretchers, and carried to the boats without change of position. At a later period a convenient form of mule ambulance (*cacolet*) was introduced, each mule carrying two sick, one on either side, in a sitting or recumbent posture, as was required.

The sick wharf was nearly on the same level as the side of the boat into which the sick were placed. The boat was drawn up alongside; the sick on stretchers were deposited in the middle, and those who were able to sit up, at the two ends. The ambulance generally drew up within a few yards of the water side.

During the many opportunities we had of seeing the sick placed in the boats, it was always done with great care. After the sick were taken on board, the boat was rowed out into the harbour, and down the middle between the rows of shipping for a distance of perhaps 450 yards and brought up alongside the ladder of the "sick ship." This ladder was like an ordinary steep stair, the outer side being protected by a rope rail. The sick who were able to do so either walked up the ladder by themselves or with a little assistance. Those on stretchers were lifted on board by a simple contrivance, consisting of a rope with four ends, each end having a loop. The four loops were placed in the four projecting handles of the stretcher, which was then hoisted on board by means of a pulley, and kept in a horizontal position. Arrived on

board, the stretcher was carried below by two men, and the patient transferred to a swing cot.

It appeared to the Commission that this method of shipping the sick was rather too complicated and fatiguing. It involved two changes of posture where one would have done, and the whole process might, as it appeared, be at once simplified by bringing the ambulances down to the shore under the stern of the "sick ship," and by having a brow constructed by which the sick might be carried directly on board.

After conferring with Major Mackenzie, Acting Quartermaster-General, and Dr. Anderson, principal medical officer at Balaklava, as to the practicability of the change, the Commissioners communicated with the Commander of the Forces, and advised its being carried out. His Excellency authorized the construction of the works on the 21st April, 1855, but the pressure of the siege operations prevented their being executed at the time.

It may be well to state that the average shipments of sick during the months of May, June, and July 1855, were 337 per week. In August, September, and October, the weekly average was 380. During November and December 1855, and January 1856, the weekly average fell to 164, and during the ensuing three months the weekly average was 113. During the whole period the Commissioners had every reason to be satisfied with the careful and considerate manner with which the duty of embarking the sick was performed by the officer in charge.

The proposed jetty for shipping the sick was constructed at the sick wharf towards the end of the year 1855.

In consequence of the notice of leaving the Crimea given by the inspectors, Dr. Sutherland made application to the Commander of the Forces for two competent persons to succeed them in their work, and the appointments were made forthwith. Mr. Newlands had already returned to England on the 7th June, having visited the hospitals on the Bosphorus on his way home, where he found that the system of cleansing which had been organized, was being efficiently carried out. All three inspectors left the East on the 28th July, and from the date of their departure the Sanitary

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 effected, 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 carcasses 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 Tchernaiia, 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 Kadikoi. 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 perfusion 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-pu-trid 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 carcasses 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 carcasses 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.

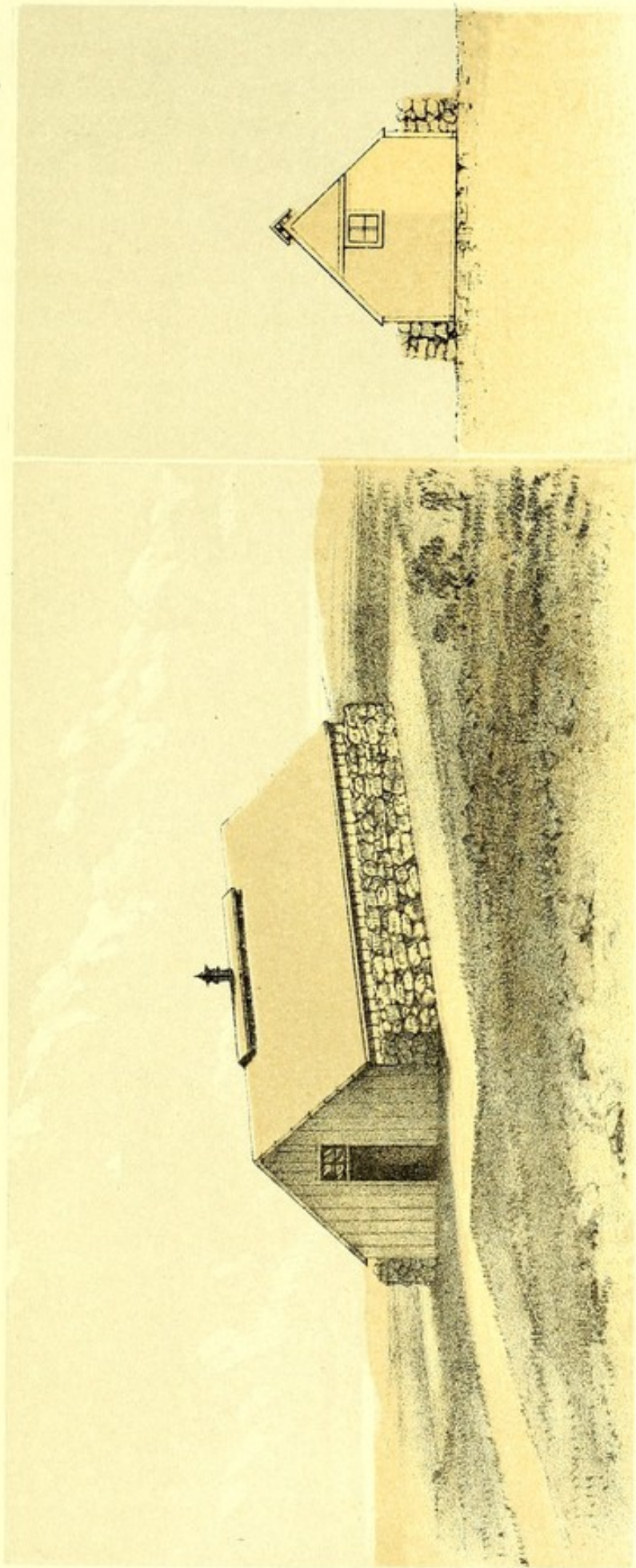
The hospital latrines were generally placed at a proper distance, and suitably protected from exposure.

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.



HUT BUILT ROUND WITH STONE.

CROSS SECTION.

Fig. 11. A. Project of the Department of Public Works, San Francisco, Jan. 1887. L. G. & J. W. Architects.



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 imbued 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 $2\frac{1}{2}$ per cent. of the force. The percentage of zymotic diseases fell to $28\frac{1}{2}$ 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 campaign 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 huttet 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 huttet 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. McPherson, 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, in 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 backyards; 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:—

				<i>s.</i>	<i>d.</i>
Meat.—	1 $\frac{1}{4}$ lbs. fresh	.. ..	at 7 $\frac{1}{2}$ d. per lb.	0	9 $\frac{1}{4}$
	Or 1 lb. salt meat	.. ..	10 $\frac{1}{2}$ d. „	0	10 $\frac{1}{2}$
Bread.—	1 $\frac{1}{2}$ lbs. fresh	.. ..	4d. „	0	6
	Or 1 lb. biscuit	.. ..	3 $\frac{1}{2}$ d. „	0	3 $\frac{1}{2}$
Groceries.—	1 oz. coffee	.. ..	10 $\frac{1}{2}$ d. „	0	0 $\frac{3}{4}$
	Or 1 oz. tea	.. ..	1s. 6 $\frac{1}{2}$ d. „	0	1 $\frac{1}{4}$
	Or 1 oz. cocoa	.. ..	4d. „	0	0 $\frac{1}{4}$
	Or 2 oz. sugar	.. ..	28s. per cwt.	0	0 $\frac{3}{8}$
	Or 2 oz. rice	.. ..	28s. „	0	0 $\frac{1}{2}$
	$\frac{1}{2}$ gill rum	.. ..	4s. 2d. per gall.	0	0 $\frac{3}{4}$
[	1 oz. lime juice	.. ..	2s. 4d. „	0	1 $\frac{1}{4}$
	$\frac{1}{4}$ oz. pepper	} between 8 men or less		0	0 $\frac{2}{100}$
	$\frac{1}{2}$ oz. salt				
	$\frac{1}{2}$ tallow candle	in summer to 12 men,	at 7 $\frac{1}{2}$ d. per lb.	0	0 $\frac{1}{2}$
	2 do. do.	in winter do.	do.	0	1
Fuel.—	4 $\frac{1}{2}$ lbs. wood	at 7s. 6d. per chechic	of 516 lbs.	0	0 $\frac{3}{4}$
	Or 2 $\frac{1}{4}$ lbs. coal	at 60s. per ton	.. ..	0	0 $\frac{3}{4}$
	Or 1 $\frac{1}{2}$ lbs charcoal	at 10s. per 100 okes	=281 lbs.	0	0 $\frac{3}{4}$
Extra Issues.—	2 pints rum	} for every 25 men, to take with lime-juice.			
	1 lb. sugar				

Preserved vegetables (the ration being marked in squares) and fresh vegetables, the ration of which is 1 $\frac{1}{2}$ lbs. potatoes and $\frac{1}{4}$ lb. 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 hygiene 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 headquarters 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 carcasses 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 carcasses 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 quick-lime, 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 carcasses 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

vicinity. All buildings situated in low, confined, or malarial positions, or where the wet ground cannot be easily drained, or where there is a damp relaxing local atmosphere, likely to depress the vital powers, should be avoided if possible.

III.

The sanitary condition of the neighbourhood in which the building is situated should be carefully examined to ascertain whether there be any decaying organic matter, such as dungheaps, unburied carcasses of animals, offal, filth, or foul water lying on the surface; open ditches containing offensive matter, graveyards, &c.

All nuisances should be immediately removed to a distance, or buried or burned, as the case may be. The surface should be levelled, paved, and channelled where necessary, and kept scrupulously clean; offensive open ditches should be cleansed and covered over, and any graveyard emitting offensive effluvia should have fresh earth, with lime or charcoal thrown over it.

No interment should take place at a less distance than 200 yards from a hospital. No more than one body should be buried in a grave, and no grave should be less than five feet deep.

IV.

It is especially necessary to examine most carefully the state of the sewerage and drainage. However spacious and suitable any building may appear for a hospital or barrack, when viewed externally and superficially, it may, nevertheless, have the elements of disease concealed beneath it to such an extent as to render it little better than a pest-house in certain conditions of the weather and directions of the wind.

Sewers or drains built of rough rubble stone, with a square section, or without proper attention to fall, or too large for the volume of water they have to convey, are liable to accumulate foul deposits, and generate poisonous gases. If on examination deposits be actually found within sewers, it is quite certain that such sewers may at any time become dangerous to the health of the building, especially if they

pass under or near any inhabited apartment, so that the air of the room become infected with the exhalations escaping through their sides. Deaths from fever and cholera occurred within the Barrack Hospital at Scutari directly traceable to this cause.

Still more dangerous do sewers become when there is a direct communication between them and the interior of the buildings by means of untrapped privies or sinks. In this way the air becomes tainted to a much greater degree, and may, alone or in combination with other sanitary defects, give rise to disastrous consequences.

To prevent similar occurrences, it is indispensably necessary before putting either troops or sick into such a building to cleanse thoroughly the whole drainage, to provide a suitable apparatus with water for flushing the sewers to prevent accumulations in them, to trap the outfall of the sewer to prevent the wind or sea, as the case may be, from driving foul air inside the building, and to provide ventilating openings for sewers in such positions that the effluvia cannot reach the interior of the building.

It may be necessary to destroy and relay sewers with a better form and inclination. The section should be as nearly oval as the materials at hand will admit.

Wherever earthenware pipes of sufficient sectional area can be obtained, they form the best and safest drainage for buildings.

The experience of the civil hospitals at Renkioi and Smyrna, and of the Naval Hospital at Therapia, and also the partial experience in the Barrack Hospital at Scutari, all go to show that it is not only possible but highly advantageous for the salubrity of any military hospital to substitute pan closets for any arrangement whatever of open privies, and that with ordinary care on the part of the attendants these closets act perfectly.

Wherever practicable, water-closets should be under a separate roof, and in all cases they should have a ventilation distinct and independent of that of the building. Box latrines with flushing apparatus may be used with advantage for barracks. They save water, but they require daily attention and to be used with care.

V.

The actual state of the ventilation, and also the capabilities of ventilation of every building about to be occupied as a hospital or barrack should be carefully examined.

It may be laid down as a principle that any building in which a number of people, whether sick or healthy, are to be congregated together for any length of time, should never depend for its ventilation solely on doors and windows.

Doors and windows may be placed in wrong positions for ventilation. They are liable to be opened and closed irregularly. They may be, and generally are, closed during the night, when ventilation is more necessary for hospitals and barracks than it is during the day.

Whenever there is a want of freshness in the air of a ward or barrack-room, it may be laid down as an axiom that there is danger to health, and no means of ventilation ought to be deemed sufficient that does not remove this.

In carrying out an independent ventilation of a ward or barrack-room, it is of primary importance to afford free exit for the warm foul atmosphere as near as possible to the ceiling of the wards. Ventilating openings of sufficient size, whether through the walls into the external air, or by ventilating tubes through the ceilings and roof, as was practised with great benefit at Scutari and Kulali, are well adapted for the purpose.

The size of the openings must depend on the number of inmates, and they should be considerably larger for a barrack-room than for a sick-ward, on account of the larger number of inmates in the former.

While providing an exit for the impure air, it is necessary to have means of admitting fresh air. This can be most readily done in most instances through the windows, by removing a sufficient number of panes of glass, or by making openings through the wall near the level of the floor. In most cases, it is necessary to modify the current of air, especially in sick wards, by introducing into the openings for admitting fresh air panes of perforated zinc or of wire gauze, if obtainable, or by narrow overlapping louvre boards, which can be readily made of any wood found on the spot, or by nailing over the apertures pieces of open

canvas, gauze, or bunting. All such ventilating arrangements to be effectual require attention and modification according to the weather, and the sensible state of the atmosphere within the ward or barrack-room.

Whenever the condition of the weather and climate admit of it, a free perflation of the whole building by opening the windows or doors or both, is most desirable, but it does not obviate the necessity for the other permanent arrangements already mentioned.

VI.

The cubic contents of every room or place where the sick are to be received, or which it is intended to use for a barrack-room, should be ascertained, but the number of inmates should not be apportioned solely on the basis of the cubic contents.

Wards or rooms may be very lofty, but if the cubic space be above the beds, and the beds be placed too close together, on the assumption that there is cubic space enough, the sick may still suffer from all the evils of overcrowding. In like manner a lofty apartment used as a barrack-room may be overcrowded if the men sleep too closely packed together on the floor.

In large stone buildings taken possession of for hospital purposes, beds should never be placed nearer each other than six feet measured from centre to centre, and the cubic space allowed for each patient should never be less than 1,000 cubic feet.

The amount of cubic space required for healthy men in stone buildings depends on the climate and season, and above all, on the presence or absence of an epidemic constitution of the air, indicated by a tendency to zymotic diseases. A smaller amount of cubic space may be allowed in a colder than in a warmer climate, and in winter than in summer. It is unsafe, even with good ventilation, and in a temperate climate, to allow less than 500 cubic feet for an adult man in health, and more than this should be allowed in epidemic seasons. Cholera broke out among the troops in the Barrack Hospital when the allowance was between 250 and 350 cubic feet per man. Of

course if the atmosphere be polluted with emanations from foul sewers or by defective ventilation, a small amount of cubic space is far more likely to predispose to disease than if these additional elements were not present.

The only safe rule in practice is to attend strictly to cleanliness within and without the buildings, to correct defects in the sewerage, drainage, and ventilation, and to spread the troops as much as the accommodation will allow.

It is safer to camp out or to bivouac troops than to overcrowd. Overcrowding of barracks and defective ventilation are only other terms expressive of disease among the men and danger to the efficiency of the force.

During epidemic seasons especially, either one or other, or both of these conditions conjoined, will almost infallibly lead to immediate loss, and during ordinary seasons the loss is merely procrastinated and spread over a longer time.

Should cholera break out under the conditions mentioned, the troops should be immediately removed from the building and put under medical inspection, for the discovery and treatment of premonitory diarrhœa. Camping out in a dry, healthy position, and spreading the troops over a wide area is the best remedy.

It is hazardous to quarter troops in obviously unwholesome localities, or in houses already overcrowded with inhabitants. Regiments, even while on march, when quartered on filthy, overcrowded towns or villages, especially during epidemic seasons, have, from the mere circumstance of additional overcrowding, become affected with fever and cholera, and have left them in nearly every town and village through which they have passed.

VII.

The walls and ceilings of all apartments are liable to become saturated with organic matter, absorbed from emanations proceeding from the bodies and breath of persons inhabiting the room. This is one of the most ordinary consequences of filth, overcrowding, and bad ventilation, and it is a common predisposing cause of epidemic diseases.

Hence before any buildings are occupied, either for hospi-

tals or barracks, the walls and ceilings of the apartments should be scraped, thoroughly cleansed, and then washed with a sufficient number of coats of fresh quicklime wash to make them thoroughly white, and the process should be frequently repeated. This simple proceeding has in numerous instances been found to arrest the progress of zymotic maladies, when nothing else appeared to be of use. The materials and tools required are easily obtained, and almost any labourer can be instructed to do the work effectually.

VIII.

It is hardly necessary to specify that everything likely to give off injurious emanations in sick wards, whether it be the excreta of patients, foul linen, the remains of food, &c., should be immediately removed outside the walls of a hospital.

IX.

Ships, unless specially fitted up, and moored in healthy positions, are not adapted for hospital purposes, and should not be used either for sick or convalescents, if suitable accommodation can be obtained on shore.

PRACTICAL CONCLUSIONS RESPECTING BALAKLAVA.

I.

That the bad sanitary condition of the town and harbour of Balaklava and their vicinity, when the Commissioners arrived in the Crimea, was the cause of much sickness in the town, on board ship, in the neighbouring camps, and among the soldiers employed on fatigue duty in the town and neighbourhood. That the local causes of disease then existing were essentially the same as those which have been observe to predispose to epidemic and pestilential diseases elsewhere, and would have led to similar results at home under an equally high temperature.

II.

The most important of these causes were :—

Nuisances, defective cleansing, defective state of the surface, allowing foul water to remain upon it.

Filthy and overcrowded houses.

The horrible state of the eastern margin of the harbour, from the accumulations of organic matter proceeding from dead carcases, offal, stable manure, and other filth close to or under the water line.

Emanations from the putrid marsh and graveyards at the head of the harbour.

Dampness of the subsoil from defective drainage.

It is requisite to point out, besides these existing evils, another that might have been of grave import, namely, the polluted state of one of the principal water sources of the town and shipping. Had there not been a sufficient supply obtainable, independently of this stream, unwholesome water might have aggravated the severity of the cholera.

III.

To prevent and remove these evils, it is necessary, on taking military possession of a town, especially if troops are to be barracked in it for any length of time, and above all, if it is to be made the basis of operations, at once to organize a sanitary police to attend to the health of the town.

The duties of such a police should be clearly defined and vigilantly exercised, and should be as follows:—

IV.

1. To make a thorough sanitary examination of the whole town and neighbourhood, and to report thereon.

2. To proceed immediately to organize measures for a thorough cleansing, and removal of nuisances. All offensive matters should be transported to a safe distance from the outskirts of the town, or be burned, if inflammable, or buried, if removal be impossible or dangerous.

3. To provide for the daily cleansing of all streets, alleys, courts, open spaces, backyards, stables, cattle sheds, &c., and for the safe disposal of refuse in the way pointed out.

4. In places where the surface of the streets or roads is in so defective a state as to accumulate foul water, and to interfere with surface cleansing, the defects should be

repaired, and proper channels formed for carrying off surface water.

5. Under certain circumstances, it may be necessary to cleanse foul ditches. Care should be taken, in all such cleansing operations, not to throw the mud extensively over the surface, so as to expose a large surface to the action of the sun, and the work should be suspended during the heat of the day. Quicklime, charcoal, or fresh earth may be advantageously used for covering the mud.

6. All buildings to be occupied by troops, or as hospitals, should be dealt with as already mentioned.

7. All wells and sources of water should be carefully examined and guarded, to prevent accidental or intentional pollution, or waste.

8. Wet, unwholesome ground, may be rendered less injurious by trenching or by covering it with fresh earth.

Besides these measures additional precautions are requisite to prevent the evils resulting from the occupation itself.

9. A sufficiency of latrines should be provided, and regulations laid down for their management.

10. Stable manure from the additional number of horses, should be daily removed and burned.

11. Carcasses of dead animals and the offal of slaughtering-places, should be daily removed and buried.

12. The dead should be interred away from the living.

13. Refuse charcoal dust, where obtainable, may be used with advantage for deodorizing latrines and filth which it would not be safe to remove. Sand or fresh earth answer the same purpose, but in larger quantity. Quicklime prevents decomposition. Burning stable litter over them also deodorizes foul unwholesome surfaces.

14. Deodorizing agents should never be used as *substitutes* for the *removal* of decaying organic matters to a distance, or for their destruction by fire.

V.

As regards transport ships, the experience at Balaklava has proved :—

That crews of transports may become liable to sickness and mortality, especially during epidemic seasons, from an infected state of the atmosphere of seaports, even although the vessels themselves be in a good sanitary condition.

That, in such cases, removal of the affected vessel outside the port into the open sea, and out of the infected atmosphere, is the readiest means of arresting sickness on board.

That especial care should be taken to keep cattle and horse transports in a good sanitary state, by cleansing and ventilation, and further to preserve the animals in good condition, by making proper arrangements for embarking and disembarking them without injury, and for securing forage and water during the voyage and on landing.

That when epidemic diseases appear on board ship in seaports, a medical sanitary inspection should be made of all ships in port, to ensure the adoption of proper measures of cleansing, ventilation, and lime-washing on board, and for the purpose of bringing all attacks of prevailing epidemic diseases, especially of cholera, under treatment in their earlier stages.

That the true method of protecting seaport towns and ships frequenting them, from pestilential diseases, is not by quarantine regulations against vessels arriving from suspected countries, but by sanitary works and measures for removing those causes of disease on shore as well as on shipboard, which determine the localization of pestilence. Quarantine regulations, had they been enforced in the East while the cholera prevailed, would have occasioned serious injury to the service, by interfering with the supplies, without affording the required protection.

That in seaports in military occupation, a water sanitary police should co-operate with the sanitary police of the town, to prevent dead animals, offal, refuse of food, manure, &c., being thrown into the water of the harbour, and to make arrangements for the removal and safe disposal of all such matters from on board ship, either out at sea, or on shore.

PRACTICAL CONCLUSIONS RESPECTING THE CAMP.

I.

That by far the greater part of the disease and mortality existing in the camp, when the Commission arrived in the Crimea, was due to zymotic maladies, such as cholera, fever, diarrhœa, and dysentery.

That besides the effects of topographical and climatic peculiarities connected with the occupation, and making allowance for the predisposing influence of other conditions, to which the troops had been exposed, the prevalence of zymotic maladies was obviously connected with local favouring causes essentially the same in kind as those observed in civil life, especially in rural districts, namely:—

Damp.

Impure Air.

(Although in a minor degree) Impure Water.

II.

Attacks of zymotic disease were observed to be connected with the three following sources of dampness:—

A wet subsoil; a retentive surface soil; confined locality.

1. Of these three conditions, *a wet subsoil* occasioned the largest proportional amount of sickness.

The experience of the 79th Regiment, and that of the 31st and Royal Artillery, who were successively camped on the same ground, below Marine Heights, proves that one of the worst sites for a camp is that in which a thin bed of porous material rests upon an impervious bed beneath, which retains the water, and keeps the subsoil charged with it, while the surface may afford little or no indication of the fact.

Dangerous sites of this kind were often marked by a greener or more vigorous vegetation than that of the surrounding district, or by water-springs coming to the surface, or by evening fogs settling over them sooner than over the adjacent country.

Before selecting positions for camps in unknown ground, it would be very advisable to dig trial holes a few feet deep, to ascertain what is the condition of the subsoil drainage, and not to risk the health of the men in camping on ground in which these trial holes show the presence of water near the surface.

Should it be necessary, for military reasons, to hold a position on a wet subsoil, the whole should, if practicable, be thoroughly drained by deep trenches, and if there be a hillside or water-shed above the ground, the surface water from it should be turned aside from the site by deep, catchwater drains, as was done with the camp of the Highland Division at Kamara.

If the position be such that deep trenching and draining cannot be carried out, it is in the highest degree probable that if held for any length of time, it will be at a considerable sacrifice of the force.

2. *The retentive character of clay surface soils*, and the difficulty of draining such soils, render it advisable to avoid them as camping-grounds, when it is possible to do so.

Wet clay soils keep the air near the ground damp and cold, and they affect the atmosphere of tents and huts in a similar manner. There was sufficient proof of their injurious effects on the health of troops in the Crimea.

Where such soils must be occupied, for military reasons, the defects in the natural drainage should be remedied, as far as practicable, by trenching the ground, and by trenching the site of every hut and tent separately, connecting the hut and tent drains with the larger trenches. In this way, not only are the sites and the vicinity of the huts and tents kept comparatively dry, but the surface water is more readily removed, the exhalations from the damp soil diminished, and the air purified. The experience of the army in the Crimea showed the very beneficial effects of this surface drainage and trenching on the health of the troops.

3. *Dampness of the air, arising from the nature of the locality*, proceeds from the topographical peculiarities of the ground preventing a free circulation of the air, and the atmosphere becoming stagnant, and charged with moisture

and emanations from the ground. The valley of Karani above Kadikoi afforded an illustration of this, in certain states of the weather.

It was observed in other parts of the seat of the war in the East, that damp white mists, settling in valleys or hollows occupied by troops, had been the precursors of epidemic diseases, especially of cholera. All valleys are at times exposed to similar occurrences, especially such as contain stagnant lakes. An unhealthy and stagnant state of the air is sometimes increased by brushwood or trees.

There is often no escape from epidemic sickness occurring among troops from the occupation of such positions; they should, therefore, be avoided or abandoned.

III.

The evils resulting from these local causes of dampness were not unfrequently aggravated by the manner of pitching tents and erecting huts. Want of due preparation of the ground and defective drainage of the site, often led to a damp state of the air within huts and tents, and induced a tendency to fevers.

Deep trenching round the tent-site, as already mentioned, is the best remedy, and in the case of huts, the site should be isolated from the surrounding ground, and the area to be occupied by the hut, drained by a trench dug round it at least a foot below the level of the floor.

If it be not practicable to drain the subsoil, and if the position must be held, adequate provision should be made with any materials at hand for raising the beds of the men above the ground.

Huts should never be banked up with earth against the wood. The experience in the Crimea has shown that it is a dangerous practice, for it used to be a common cause of fevers. An interior lining, even of old newspaper, affords a much better, and at the same time a perfectly safe protection from drafts.

The flooring of huts should be occasionally raised, the surface of the ground below cleansed, and quicklime and charcoal strewed over it.

For hospital huts, an interior lining of boards, or building

a rough rubble stone wall outside, as was done in many of the regimental hospitals, affords the requisite protection from weather, and from sun heat.

IV.

The camp before Sebastopol was, generally, remarkably clean when first visited; but there were in certain situations sources of atmospheric impurity from putrescent organic effluvia, likely to influence injuriously the health of the troops. The chief of these were:—

Picketting-grounds, and manure heaps.

One or two slaughtering-places, and latterly the large cattle depôt and slaughtering-place at Kadikoi.

The graveyards and putrid marsh near Balaklava.

Latrines kept too long open, and exposing too large a surface.

When an army can shift its ground at will, danger to health from similar evils can always be avoided by doing so.

When, on the other hand, an army is tied to its position for a length of time, the camp becomes a town, and is subject to all the sanitary defects of towns, as these existed before the introduction of the first great step that was taken for improving the public health, namely, the introduction of paving.

Picketting of horses saturates the ground they occupy with organic matter. In like manner accumulations of manure, if allowed to remain, saturate the ground they cover. Filth of any kind is washed into the ground by the rains, or trodden into it by the steps of men and animals, and must necessarily give off impure emanations under the joint action of sun heat and moisture.

To avoid the injurious consequences likely to arise from these circumstances, it is indispensably necessary to observe the most scrupulous cleanliness over the whole surface and vicinity of a camp. All refuse should be at once swept up, and removed to a distance. None should ever be allowed to accumulate within, or in the immediate vicinity of a camp.

Bones and refuse of food can be most easily disposed of by burial.

Stable litter and all inflammable refuse should be carefully burned. The usual method of forming heaps of litter and firing it is imperfect. Before being fired, it should always be opened up, to admit the air to dry it, and to expedite the combustion. Manure heaps burn with difficulty if left on the ground for any length of time before they are fired.

Carcases of animals and offal should be buried to a sufficient depth below the surface. Three feet is enough under ordinary circumstances. Refuse charcoal dust thrown over tainted ground will assist in deodorizing it, or, if that be not obtainable, the burning of stable litter on the spot will furnish sufficient charcoal for the purpose.

Latrines should be made narrow and deep; a quantity of earth should be thrown into them each day, until they are filled within two feet of the surface, after which the latrine should be filled up and another dug.

When an army requires to occupy the same surface of ground for years, it would be unsafe to bury the refuse in the ground, because eventually the soil would become saturated with organic matter and dangerous to health.

In such a case the construction of furnaces to consume every organic product of the camp, is by far the best and safest proceeding. Speedy collection, removal, and destruction by fire of all such refuse matters obviates any risk of danger from them.

V.

Atmospheric impurities arising from overcrowding and defective ventilation of tents and huts, were a frequent predisposing cause of zymotic disease.

Were it practicable in warfare to diminish materially the number of men sleeping in tents, it would be advisable to do so.

But considering the limited transport at the command of an army in the field, the injurious consequences of overcrowding may, to a considerable extent, be obviated by a free ventilation of huts, and by improving the construction of tents and marquees, by introducing effectual means of ventilation round the top of the poles.

In the case of huts, ridge ventilation is the most efficient.

Lime-washing huts inside, especially hospital huts, purifies the air; lime-washing of huts outside protects them, to a certain extent, from the intense sun's rays and keeps them cooler within.

The usual practice of striking tents and shifting ground is an excellent means of avoiding the effects of saturation of the earth by emanations proceeding from the breath and bodies of the men.

VI.

The condition in which the water was drawn for use in the camp was likely, especially during the prevalence of cholera, to aggravate the severity of the disease, although not to a great degree.

It is always desirable that water for drinking and cooking purposes should be as nearly as possible destitute of colour, taste, or smell. Anything that interferes with these three natural tests is more or less injurious to health; but marsh water, however apparently pure, is not wholesome.

All engineering works for supplying camps with water should comprehend:—

The selection of the purest obtainable source.

The delivering the water for use as pure as it is at its source.

If it be necessary to pound the water, the tanks should be covered.

Water should, if practicable at all, never be drawn by dipping, if it be rendered muddy in the act of being so drawn.

If a source of water of sufficient purity be not obtainable, the water should be filtered. A filter may be made with sorted gravel, clean sand, and charcoal.

Every trough for supplying horses should have a separate inlet and overflow.

GENERAL CONCLUSIONS FROM THE WHOLE EXPERIENCE.

I.

That as scurvy, and the forms of disease connected with it almost disappeared from the army under the influence

of improved diet, clothing, &c., so, in like manner, zymotic diseases, the destructive effects of which mainly depend on breathing a humid, tainted atmosphere, declined on the carrying out of suitable sanitary works and measures.

II.

That men just arrived in a new country are especially liable to suffer from prevailing zymotic maladies. That any given number of reinforcements will not compensate to the service for the loss of the same number of the original force from these diseases, and hence the necessity for effective sanitary precautions is doubly imperative, whether as regards the abatement of local favouring conditions, or the discovery and immediate treatment of the premonitory stages.

III.

As the result of their whole experience, the Commissioners beg to express their opinion, that, inasmuch as the neglect of military hygiène, whether as regards the soldier personally, or the sanitary condition of camps, barracks, and hospitals, has hitherto, in all countries, climates, and seasons, been the cause of the largest amount of loss in armies, the whole subject, closely connected as it is with the physical efficiency of Her Majesty's forces, demands in future a practical development commensurate with its importance to the public service.

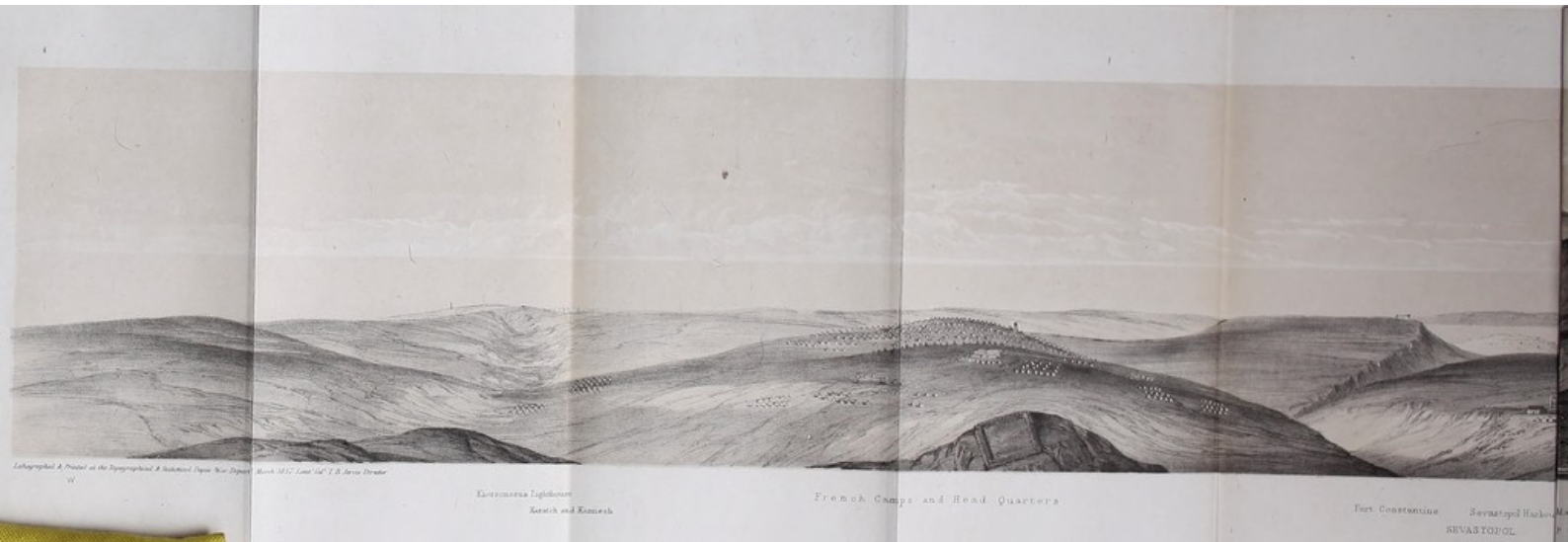
We have the honour to be,
My Lord,
Your Lordship's humble and obedient Servants,

JOHN SUTHERLAND,
ROBERT RAWLINSON,
GAVIN MILROY.

The Right Hon.

LORD PANMURE, G.C.B., &c.,
Minister at War.

December 1st, 1856.

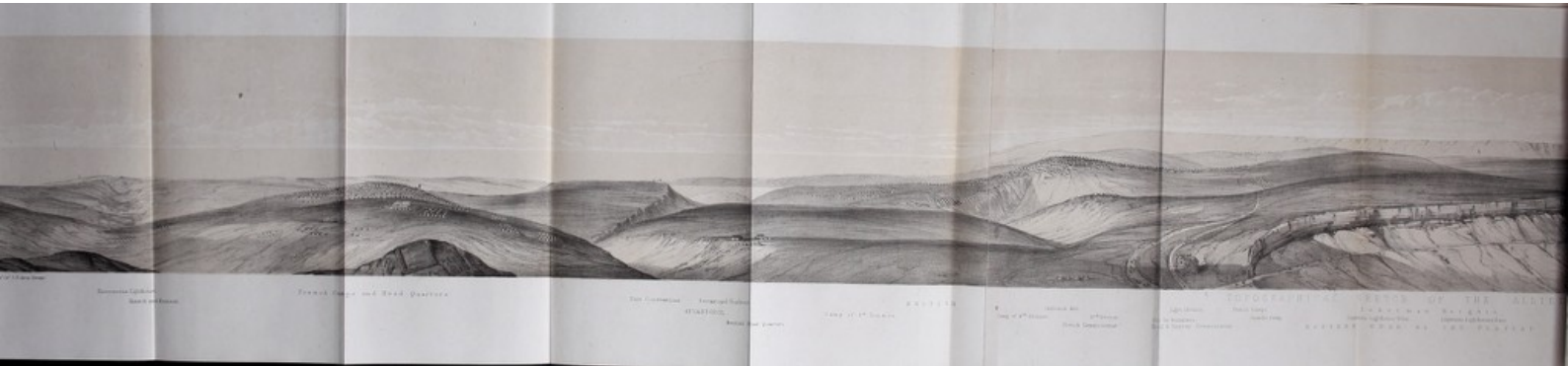


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Eleonora's Light-house
Ketch and Ketch

French Camps and Head Quarters

Fort Constantine Sevastopol Harbour
SEVASTOPOL



Section 1

Section 2

Section 3

Section 4

Section 5

Section 6

Section 1

Section 2

Section 3

Section 4

Section 5

Section 6



SECTION BEFORE THE GREAT WALL
Great Wall of China
WEST OF THE GREAT WALL
THE GREAT WALL OF CHINA

Section of Great Wall
Walls of Beijing with Great Wall

Section of Great Wall
Walls of Beijing with Great Wall
WALLS OF BEIJING
Walls of Beijing with Great Wall

Section of Great Wall
Walls of Beijing with Great Wall
WALLS OF BEIJING
Walls of Beijing with Great Wall



Summit of Table Top
Ridge of Baldy with Forested Gorge
A.M.P.

Saddle Mountain
Baldy Mountain
Cape Horn
TABLE OF MOUNTAINS

Baldy Mountain
Cape Horn
TABLE OF MOUNTAINS
Laid Down by Army Topo Corps
Baltimore
1848

TABLE OF MOUNTAINS
Laid Down by Army Topo Corps
Baltimore
1848

Cape Horn
TABLE OF MOUNTAINS

Cape Horn
TABLE OF MOUNTAINS
A.M.P.

APPENDIX.

No. I.

NOTE on the TOPOGRAPHY and GEOLOGY of the Allied Occupation. By DR. SUTHERLAND.

THAT portion of the allied occupation within which Her Majesty's forces were stationed, is about sixteen miles in length, measured from Cape Chersonese to Kamara, and nine miles in breadth from Cape San Georgeo to the cliffs of Inkermann. It covers an area of about ninety square miles.

The country presents certain striking topographical peculiarities, depending on the remarkable geological character of this part of the Crimea.

The lowest point of land within the occupation is Cape Chersonese, which shelves away into the sea. From this cape the coast follows a south-east direction as far as Cape San Georgeo, for about seven miles. It rises very gradually out of the sea, presenting a vertical section of nearly horizontal beds of whitish and yellowish tertiary limestone. The coast rises higher and higher as it approaches the cape, and at that point attains an altitude of upwards of five hundred feet above the level of the sea. A little to the west of the cape, masses of dark-coloured volcanic rocks underlie the tertiary beds, and form the great bulk of the cape itself, and also of the nearly vertical escarpment of the small bay lying immediately to the east of Cape San Georgeo, under the Monastery.

The tertiary beds overlie these rocks as far as the great ravine to the east of the Monastery. The underlying volcanic rocks consist of basalt, amygdaloid, serpentine, and porphyry, with associated minerals, laterite, zeolite, sulphur, &c. Several singular needles of these igneous rocks rise out of the sea along the margin of the bay. One of them, consisting of a pyramid of basalt, gives a marked character to Cape San Georgeo, and is about two-thirds of the altitude of the cape itself. A considerable extent of the outer surface of the igneous rocks is covered with the debris of the tertiary cliffs

above, which becomes detached after rains, and falls into the sea in landslips, one of which occurred during the winter of 1855-56.

The great ravine already mentioned divides, by a rent nearly 600 feet in vertical depth, the stratified tertiary limestone of the plateau from another formation extending from this point to Balaklava, and far to the eastward.

About midway down the ravine, and thence to the bottom, are natural sections of schists, containing selenite and lignite, some specimens of which resemble charcoal. The amygdaloid also crops out through the schists, and is found near the summit of the ravine.

The eastern side of the ravine is formed by an enormous overhanging precipice of reddish limestone, belonging to the jurassic series, full of fractures, and from which huge masses have from time to time detached themselves, and lie piled on the slopes of the ravine below. Underneath this great cliff, which is above 600 feet high towards the sea, are beds of reddish conglomerate of different degrees of fineness and hardness, gradually wasting away so as to leave a long deep hollow undermining the cliff, which has toppled forwards, and is partially separated by a deep rent from the mass of the sea-coast line. The schists underlie these beds of conglomerate.

The coast to the east of the ravine of San Georgeo consists of precipices of the same reddish compact limestone, rising directly out of the sea to the height of from 800 feet to 1,000 feet. Following this line of cliff to the eastward, we find that, a little to the west of the entrance to Balaklava harbour, the cliff is interrupted by a ravine, and rises again into a remarkably characteristic tooth-shaped summit, 608 feet high, also of jurassic limestone.

The coast line of mountain-ridge is at this point broken across by a deep sigmoid fissure, forming the entrance to the harbour of Balaklava. On the west side of the entrance, the rock sinks almost perpendicularly into the water, and on the east side the entrance is bounded by a singular conical hill, 469 feet high, on the summit and side of which are the ruins of the old Genoese Castle of Balaklava. The western slope of this hill consists of masses of the same compact reddish limestone, and the bulk of the hill itself is formed of detached fragments of the same rock, or rather of a brecciated form of it, resting on highly-inclined beds of conglomerate, dipping towards the west. The hill presents, towards the sea, a vertical, or rather overhanging cliff, built up of boulder-like masses of limestone of all sizes, from that of pebbles up to huge fragments of from fifteen to twenty feet in diameter, arranged in regular beds, the smaller below and the larger

above. These beds dip towards the west, and lie parallel with the upper surface of the conglomerate on which they have been deposited.

The conglomerate, after sloping upwards to the east from underneath this mass of fragments, forms an almost horizontal ridge, about 250 yards in length from west to east, with highly inclined sides, falling on the south into the sea, and on the north towards a ravine separating the castle rock from the hills, at the foot of which Balaklava is situated. This ridge is about 320 feet above the sea, and on it was constructed the Castle Hospital, which occupied its whole length.

East of the ridge the conglomerate rises, by a very steep ascent, to the height of 1,227 feet, forming another lofty narrow ridge, presenting its end to the sea, and known as "Marine Heights," from its having been occupied by an encampment of marines. To the east of the heights, and 180 feet below their summit, is another ridge of conglomerate, connecting Marine Heights with the mountains above Kamara. Under this ridge the ground begins to fall gradually towards the sea, instead of being precipitous; and the slopes form the commencement of that richly-wooded and beautiful ground falling from the camp of the Royals down towards the waters of the Bay of Balaklava, and joining towards the east the conglomerates and jurassic limestones, which projected for several miles at right angles towards the south, terminate in the huge precipices of Cape Aia, the highest point of which, opposite Laspi, is upwards of 2,000 feet above the level of the sea.

The coast-line extending from Cape Chersonese to this point affords a longitudinal section of the British portion of the allied occupation. It consists of two quite distinct and well-marked portions, the boundary-line between which commences at the great ravine of San Georgeo.

A line drawn from this ravine towards the north-east, curving a little eastward, and ending on the north-eastern angle of the Heights of Inkermann, eight miles distant, divides from each other two districts of country, the topographical and geological characters of which are very different.

The country to the west of this line is about sixty square miles in area, and is the plateau which was occupied by the camp before Sebastopol. The country to the east of the line includes the valleys of Balaklava and the Tchernaiia, with their branches, and the sea-coast mountain ridges on which several of the British camps were located.

The ground which was occupied by that portion of the allied army more immediately engaged in the siege opera-

tions, is bounded on the east by a steep escarpment, which presents sections of horizontal beds of light-coloured porous fossiliferous limestone, resting on a steep talus sloping down to the valleys of Balaklava and the Tchernaiia. The ground along this eastern margin of the plateau is from 700 to 800 feet above the level of the sea. It rests on the sea-coast mountain ridge at its southern extremity, and dips into the waters of the Tchernaiia on the north.

From this latter point, the north side of the plateau is bounded by the nearly vertical precipices of Inkermann, immediately under which flows the Tchernaiia, and also by the inner harbour of Sebastopol, as far as Quarantine Bay, from whence to Cape Chersonese the northern boundary is completed by the sea.

From Cape Chersonese to the ravine of San Georgeo, the south-west boundary is formed by the sea-coast precipices, as already mentioned.

The plateau before Sebastopol is thus of a triangular shape, and has the sea on two sides of it.

Very little of the surface is flat. It is, on the contrary, undulating, and consists of slopes and low hills, and of valleys, the general course of which is towards the north-west. As these valleys approach the harbour of Sebastopol and the sea-coast line, they sink rapidly, the ground of the plateau retaining its level, or sinking more slowly than the valleys. The result is that the shallow superficial depressions gradually become deep, narrow ravines, enclosed by vertical precipices, between which the brooks draining the plateau escape into the harbour or sea.

Several of these ravines end in deep creeks, and it is of importance to remark that the ground at the head of these creeks is generally marshy, and is saturated with a mixture of salt and fresh water.

The mass of the plateau, as shown by sections all round it, consists of porous stratified tertiary limestone, rich in fossils, underlaid, on the Inkermann side, by nummulitic limestone, affording an easily worked white building stone, above which, on the slopes of the hills, are loose deposits full of nummulites.

The rock comes to the surface on the edges of the plateau and ravines, but on the slopes and bottoms of the depressions and valleys it is covered to a greater or less depth, but seldom exceeding two or three feet, with light loam, at times approaching, in consistency, to clay.

In dry weather this loam produces a light dust, easily carried about by the wind, but after continuous rain it passes into a very plastic and adhesive clay, sometimes so strong as

to draw off horses' shoes. The clay also occurs in considerable patches, even on the higher points occupied by the British troops.

The surface of the plateau is more or less covered with loose fragments of limestone, which appears to form the common rubble building stone of the country.

The soil, over a considerable extent of the area, is too thin to admit of cultivation, and yields only a scanty herbage, but wherever the soil was deep enough, it had been formerly laid out in farms and vineyards.

There is little or no brushwood on the plateau, except at Inkermann Heights, which were formerly covered, to some extent, with dwarfed oak, but it was uprooted for fuel during the siege.

The eastern part of the allied occupation is very different in character from that of the plateau before Sebastopol.

It may be described as a narrow mountain ridge, rising precipitously to the height of from 800 to 1,500 feet out of the sea, with lateral spurs, mostly covered with brushwood to their summits, and forming a number of lateral valleys, all debouching into the valleys of Balaklava and the Tchernaiia. These mountain ridges, with their spurs, consist of compact, reddish limestone, of the jurassic series, sparing in fossils, having the conglomerate underlying it, and in some places merely capping the conglomerate.

These limestones differ in structure from those of the plateau in that they are not porous; they are deeply fissured, and present appearances of stratification, although their general characteristic is that of massiveness.

On the slopes of the hill sides, and in the valleys, there rest considerable beds of debris of various formation. Sometimes it is clay, at others sandy loam, in other cases the debris is formed by the disintegration of the conglomerate, or of the compact limestone, which has a tendency to weather into polygonal fragments of different sizes, by the wasting away either of the more easily destroyed portion of the rock, or of a calcareous matrix in which the harder fragments were imbedded. The limestone, not unfrequently resembles breccia, and fine specimens of this rock are met with.

One of the longest of the secondary valleys, near Balaklava, is the valley of Karani, running nearly parallel with the sea-coast line, and extending from the ridge at San Georgeo to the village of Kadikoi, where it unites with the valley or basin of Balaklava. The village of Karani, at the head of the valley, is about 600 feet above the sea. This was the only lateral valley debouching into the Balaklava basin, which was occupied by the British troops. Both sides

of it are formed by steep hills of jurassic limestone, between which the narrow valley descends rapidly towards the east, as it were by steps, so that when seen from the east it appears to recede not gradually, but by successive and distinct rises.

The slopes on the south side of the valley, from Karani downwards, were all covered with brushwood. Those on the north side are of almost bare rock, powerfully reflecting the sun's rays. The lower part of the southern slope, and the bottom of the valley, are covered with the same loamy clay found on the plateau. The valley of Karani is drained by a little brook running close to its north side, and joining a water-course which empties itself into the head of the harbour of Balaklava. The length of the valley from Karani to Kadikoi is a little more than two miles.

The valley, or rather basin of Balaklava, extends from the Col at the edge of the plateau, eastward as far as the high ground on which the church of Kamara stands. It is inclosed on the south by the sea-side mountain range, and on the north by a long ridge about 400 feet in height, surmounted by a chain of redoubts, at the early part of the seige operations, but which was latterly occupied by French troops. This ridge divides the valley of Balaklava from that of the Tchernaiia.

The extreme length of the basin, from east to west, is about four and a-half miles, and its breadth, from the head of Balaklava harbour to the crest of the ridge above mentioned, is about two miles.

The total drainage area, including the mountain slopes and lateral valleys, is not less than eighteen or twenty square miles. All the valleys on the Balaklava side of the ridge constitute part of an inclosed inland basin, the only outlet for the waters of which is into the harbour of Balaklava. The ridge is chiefly formed of grey schists, sections of which can be traced in the defensive works under the Col, and also in the redoubts and cuttings of the ridge. Low, rounded elevations of porous, chalky limestone, rise above the bottom of the basin at two or three points. On the crest of the ridge, at its eastern end, are a number of large erratic blocks of granite lying on the surface.

Similar schists are found in one or two of the lateral valleys, where, becoming disintegrated, they form immense masses of sandy debris, mixed with loam, on which one or two of the camps were situated.

The mountains bounding the south side of the Balaklava basin, east of Kadikoi, consist of conglomerate, capped by masses of jurassic limestone; and the lower slopes are formed chiefly of decomposed schists, especially towards Kamara.

At the east end of the valley is an insulated hill, called Canrobert's Hill. The south side consists of conglomerate, on which rests a mass of compact, greyish limestone, forming the north side of the hill. To the east of the ridge where Kamara church stands, the ground falls rapidly to a stream of water, which rushes through a deep gorge from the valley of Varnoutka to join the Tchernaiia. The mountains on each side of the gorge consist of jurassic limestone, rising to the height of 1,500 feet above the level of the sea. A branch of this valley runs southward towards the sea, ascending in its course to the ridge already mentioned as connecting the mountain group to the east of Balaklava with the precipices of Cape Aia. The bottom of this valley is formed of large masses of brown-coloured schists and loam, which extend through the ridge to the sea shore. On the west side of the valley, on the steep mountain slope, were placed the winter camps of the Highland Division in 1855-56.

All the valleys of this district are covered with brushwood, dwarf oak, elm, and a few trees of larger growth. The subsoil generally consists of loam and loamy clay, with the exception of a few spots here and there, similar to those occupied by the Highland Division, where the ground was formed of mixed sand, gravel, and loam.

The soil in the valley of Balaklava itself varies at different points. The lower levels, especially in the neighbourhood of the town, and about Kadikoi, consist of deep, tenacious clay. In other places, the clay is mixed with sand, and there are some spots where the sand comes to the surface. Similar varieties in the surface soil exist in some of the lateral valleys, and also on the mountain sides in the vicinity.

The observed effects of these varieties of surface and soil on this portion of the occupation is, that in cases where the rock is exposed, the rainfall flows rapidly over it into the valleys and accumulates there, flooding the surface after heavy rains, or saturating the soil with water. In other instances, the water is retained for a longer or shorter period in the masses of porous debris on the hill sides, and drains away more gradually, to saturate the ground in the lower levels.

There is no distinct stream in the valley of Balaklava; but there are several watercourses supplied by springs, some of them having only a small quantity of water at ordinary times, and others being nearly dry except after heavy rains.

Many portions of the surface of the valley are so charged with water that it can be readily found by digging down two

or three feet. A large extent of wet surface has often been exposed to the action of the intense sun heat, by the wallowing of buffaloes in parts of the valley where no signs of water were previously visible.

The defective state of the natural drainage was also shown by the greatly increased quantity of water which flowed into the harbour of Balaklava after the deep trenching executed for the roads and railway in the neighbourhood of Kadikoi was completed.

The entire basin of Balaklava used to be covered with rich vegetation and flowers; and a considerable extent of the area was occupied with farms and vineyards.

To the north of the ridge, forming the northern margin of the basin, lies the valley of the Tchernaiia. From the crest of the ridge the ground falls gradually to the foot of a chain of hills called "Fedoukine Heights," which rise rapidly to an elevation of 500 feet above the sea level. From their summits there is a rapid descent to the level of the Tchernaiia. The valley through which the river flows is broad and tolerably flat. The bottom is formed chiefly of marl mixed with pebbles and chalky debris, and the bed of the river, which is only a few yards wide, is scooped out of the debris to a depth of from four to six feet. Most of the ground is perfectly firm in ordinary states of the weather, but as the river approaches the head of Sebastopol harbour the ground becomes a marsh.

Fedoukine Heights consist of loose chalk with flints mixed with thin layers of the same material.

The northern boundary of the valley of the Tchernaiia is formed by Mackenzie's Heights, a long, almost horizontal ridge of precipices of chalk, rising to the height of about 1,000 feet above the level of the sea, and resting on a steep talus extending from one end of the ridge to the other.

The greatest distance from the river to the foot of the heights is about three miles. The intervening space is mostly filled up with chalk hills, having flints in tabular beds running through them. The rainfall on those hills crops out at some distance from the top, and can be traced wetting the chalk along their sides.

The greatest breadth of the Tchernaiia valley, measured from its southern boundary ridge to the foot of Mackenzie's Heights, is about six miles, and the length of the wider part below Tchorgoun is about five and a quarter miles to Inkermann Castle, where the precipices of the plateau approach those of Inkermann, and between them lies the marsh at the mouth of the river.

The whole of the valley is covered with grass and flowers, and there are no trees except in the marsh. The chalk hills and valleys at the foot of Mackenzie's Heights, and the slope of the talus are covered with brushwood.

A little below the village of Tchorgoun, in the higher and narrower part of the valley, there is marshy ground; but at a considerable distance from any of the British positions. Close to this village the waters of the Tchernaiia are partially diverted into a canal, carried at a higher level than the river, along the foot of Fedoukine Heights on their north side, and round the Inkermann end of the plateau to Sebastopol docks. This canal, and the river itself, yielded an abundant and excellent supply of water for the French and Sardinian troops.

Lying to the eastward of the district we have been describing, and beyond the mountain range to the east of the Highland Camps at Kamara, are two inclosed basins, which were occupied by French troops, and where some British troops were at one time stationed.

These are the valleys of Varnoutka and Baidar; their conjoined drainage area is about 150 square miles, and their lower portions are between 800 and 900 feet above the level of the sea. The slopes of the sea-side mountain range, which compose their southern boundary rise from 1,000 to 1,400 feet above their lower levels. The slopes are formed of conglomerates and jurassic limestones, with schists underlying them, and the slopes are covered with forest trees. There are steep mountain ridges all round, which discharge their waters into the basins, and there is no outlet except through two deep rents in the mountain chains, by which the waters escape into the Tchernaiia. The valley of Baidar is at certain seasons filled with fog, which escapes by a gap in the mountain chain near Laspi, and falls like a cataract towards the sea. The positions in the lower part of these basins were not healthy.

The town of Balaklava occupies a somewhat singular situation. The harbour, as already stated, is formed by a cleft through the sea-coast mountain chain, affording, as in the other basins of the district, the only outlet for the waters of the valley of Balaklava, so that if this narrow rent had never taken place, the whole valley, with its lateral branches, would have been a lake. As seen from the sea, there is no appearance either of town or harbour, and it is only after turning the point of the Castle Rock, through the narrow entrance, that the position of the town becomes visible. Once inside the harbour, it has the appearance of a small lake, inclosed on the east, south, and west, by rocky hills

sloping rapidly into its waters, and only open on the north by a gap in the hills, through which a part of the plain, with its northern boundary ridge, and the eastern edge of the plateau before Sebastopol rising above it, are visible.

The town is situated on the east side of the harbour, on a bank of debris resting on a steep hill-slope receiving the surface water from the high ground above it. Where the hills open towards the north, they leave a space of ground between them, which has been formed chiefly by the gradual filling up of the harbour at its north end. It is flat and marshy, and during the earlier part of the occupation, the surface was to some extent covered with shallow pools of fresh and salt water.

The confined position of the town, the marshy ground, and the great extent of bare, rocky surface, from which the sun's rays are reflected, would indicate unfavourable conditions as to health; but there was a good deal of movement in the air generally, through the rocky gap from the bay outside, up the harbour to the valley beyond.

The topographical peculiarities of the allied occupation, and the influence likely to be exerted by the positions on the health of the troops, will be more readily comprehended by referring to the annexed topographical sketches which were taken from a lofty hill above the Col on the eastern margin of the plateau. These sketches include the whole ground occupied by Her Majesty's forces, except the valley beyond Kamara, where the Highland Division was encamped during the winter of 1855-56.

The geology of the Crimea has attracted the attention of scientific men since the time of Pallas and Clarke, but the most accurate account of it is contained in the work of M. Dubois de Montpereux, and in the geological part of Demidoff's work, written by M. Huôt.

The following summary, with the map, gives the details, as extended from personal observation within the area occupied by the allied forces; but there are some questions of interest in the striking geological features of the country, which require further elucidation.

The geological series, from above downwards, includes the following formations:—1. The Newer Tertiary, or steppe limestone. 2. Volcanic cinders and ashes. 3. The Older Tertiary. 4. Nummulitic limestone. 5. White chalk and greensand. 6. Neocomien. 7. Jurassic limestone. 8. Conglomerates. 9. Schists. 10. Erupted volcanic rocks.

1. *The newer tertiary limestone* forms the superficial stratification of the plateau before Sebastopol, and also the higher levels of the country to the north and north-east of

Sebastopol harbour. The siege works were principally excavated in it. This limestone affords good rubble building stone, and also an inferior road material.

2. Immediately under the upper tertiary beds at San Georgeo is a bed of volcanic ashes containing shells, which can be traced from the great ravine of San Georgeo along the sea coast to Cape Chersonese, and thence round the inlets of Sebastopol harbour to Karabelnaia.

3. Older tertiary beds underlie the volcanic ashes in the cliffs of San Georgeo. They come to the surface at Karabelnaia, and form the Heights of Inkermann, as also the hills bounding the north side of Sebastopol harbour.

4. The nummulitic limestone forms the hill-slopes and cliffs of Inkermann, in the ravines of which it has been extensively quarried for building stone. The hill-slopes above the quarries are covered with loose nummulites. The formation again appears in the hills at the head of Sebastopol harbour, extending from thence to the north-east of the line of Mackenzie's Heights.

5. The white chalk begins, on the west, at the ruins of Inkermann, where it is mixed with green particles and upper greensand fossils. It forms the line of cliffs and talus of Mackenzie's Heights: also the bed of the lower valley of the Tchernaiia, and occupies the area between the slopes of Mackenzie's Heights and the ridge which separates that valley from the basin of Balaklava. It extends eastward along the base of the heights, and fills up the space between them and the jurassic limestone group east of Tchorgoun, rising into round-backed lofty hills. It forms also the line of hills south of the Tchernaiia, known as "Fedoukine Heights."

6. Neocomien beds appear under the chalk near Tchorgoun, and extend along the western side of Schula valley towards Aitodar.

7. Jurassic limestone appears on the west, in the great cliff at the ravine of San Georgeo. It forms the sea coast cliffs and mountain chains to the eastward, and also the mountain groups between the valley of Tchorgoun and the Baidar and Varnoutka basins. The rock is much altered, dislocated, stratified, hard and compact, often fissured, and the fissures filled with indurated red clay. Not unfrequently it caps the conglomerate.

8. Conglomerates of different degrees of fineness occur from the ravine of San Georgeo to Baidar valley. Fine grained beds of conglomerate, apparently altered by heat, underlie the jurassic cliff at San Georgeo. Immediately to the north-east of the cliff the formation reappears, and forms part of a chain of hills closing the upper end of the valley

of Karani. The hill on the south side of the entrance to the valley above the bazaar at Kadikoi also consists of the same formation. Marine Heights and the hills to the east are wholly or partially formed of conglomerate, as are also the southern and western slopes of the Varnoutka basin. Part of the mass of Cape Aia consists of the same rock.

9. *Schists*, apparently belonging to the Lias, underlie the conglomerate beds in the ravine of San Georgeo. They reappear on the south and eastern sides of the basin of Balaklava, under the Col, and in the ridge separating Balaklava basin from the valley of the Tchernaiia. They are found in large masses in the valleys to the east of Kamara, from whence they extend southwards to the sea shore. They occur in the basins of Varnoutka and Baidar, and in the undercliff below Laspi.

10. *Erupted volcanic rocks* form the vast picturesque masses of Cape San Georgeo. They underlie the upper and lower tertiaries there, and they protrude themselves at intervals among the jurassic limestones and schists along the south coast of the Crimea to the eastward.

No. II.

NOTES ON FOOD AND DRINK, CANTEENS, &c.

By DR. MILROY.

Food and Drink.

The supplies were, and had been for many months, abundant. Fresh meat was served out three or four times a week, and vegetables, fresh and preserved, were liberally supplied. A pound and a-half of soft bread, or a pound of biscuit, was the daily allowance to each man. The former was always eaten; much of the biscuit was not, and was thrown away. The ration of salt meat, too, was often not consumed; the fresh always was. There was, however, at all times no small waste, from the heads, feet, &c., of the slaughtered animals not being used.

Two ounces of rice, and the same quantity of sugar, with one ounce of coffee, or a quarter of an ounce of tea, were also served out daily to each soldier; pepper and salt as required. Cocoa had been occasionally tried, but the men did not relish it, seemingly from the insufficient allowance of sugar, although it is so much liked on board ship.

The articles of food most missed by the soldier were flour and peas. Both are very nutritious, and afford means at the same time of varying the constant recurrence of broth and boiled meat for dinner. It was the opinion of the medical officers generally that they would advantageously form part of the soldier's mess. They are easy of transport. Cheese also was always much in request. Many of the men remarked that it served to check looseness of the bowels, and they bought it largely at the canteens. It is certainly a most useful article of food, and well suited for the field and on the march.

The almost entire disappearance of scurvy from our army, during the last twelve months of the occupation, while it continued to exist in other parts of the allied camp, affords a convincing proof how much some forms of disease, which have often been most destructive to armies, may be prevented by attention to one set of hygienic requirements.

The daily allowance of spirits to each man was one gill. Generally speaking, the men got it *neat*. The first half-gill ration was often served out the first thing in the morning. Young recruits, just arrived, would now and then refuse their ration for a time, but they soon overcame their aversion, and took it as readily as others. The habit is too easily acquired. Even the Turks, and other natives in the Land Transport Corps sometimes drank their allowance, for it was served out to them also. Generally, however, they sold it to the British part of the force, to the no small injury of the latter.

In consequence of the increased amount of intemperance after the cessation of the siege, from the greater facilities of purchasing spirituous liquors in the camp, the attention of the Commander-in-chief was formally drawn to the subject. A board of officers was convened, and, upon their recommendation, the daily allowance of rum was reduced to one-half, while that of sugar was correspondingly increased.

Cooking.

The usual arrangement was that two men were told off from each company, the one as cook and the other as his assistant. The cook acted for a week; then the assistant took the duty, and another man was appointed to assist him; and so on. Each soldier had thus in his turn a fortnight at the work. The cook was relieved from ordinary regimental duty, but not the assistant.

In the Cavalry, one kitchen generally served for a squadron, or two troops; two men acted as cooks, and there were two others to fetch water and hew the wood, &c.

One of the camp-kettles in common use served for preparing the food of seven or eight men. The larger ones, known as the Flanders-kettle and which will cook for twelve or fifteen men, were seldom seen, except among the Artillery, who can attach them on the march to the gun-carriages.

The mode and appliances of cooking varied not a little in different parts of the camp. Sometimes the fuel was merely laid across a few stones on the ground, and a fire lighted and kept burning, as it best might be, in the open air. At other times, the ground was scarped down a few feet, or a low wall of stones put up as a screen, and then a row of holes scooped out to receive the kettles. This was more frequently seen in the French, and also in the Turkish camps, than in our own. The Turks, who are adepts in simple cooking, had made, in some of their camping-grounds on the road to Baidar, small ovens of stone and dab for cooking their food.

In most of the regimental camps, however, something of a rude kitchen had been contrived, either by digging a pit and covering it over, or building it with rough stones and mud. Each company had sometimes its own cooking-place; while in other cases there was but one for every two or four companies, or a still larger one served for the whole regiment.

Besides the ordinary camp-kettles which had been served out, the men had very generally got hold of some larger utensils which they found much more convenient. This was usually a powder-case;—it cooked the rations of forty men or more. The Naval Brigade had some large kettles or boilers, extemporised from iron tar or paint barrels, by cutting them in half and fitting handles and wooden covers to them. The fuel went much further; and the cooking was both easier and better than when there were a number of small kettles to be attended to. With a little management, too, a quantity of warm food was more easily kept ready for the men on their return from the trenches or other exposed service. It was, of course, always a great advantage when the tea and coffee were not prepared in the same vessels which had just been used for cooking the meat rations; yet this was, on the whole, not very frequently the case.

In addition to the above contrivances an American or some other form of stove, the gift of the commanding officer or of friends at home, was met with in most of the regimental kitchens. The object of them all was to economise fuel and facilitate cooking for a number at a time.

Some commanding officers continued to the last to prefer the ordinary camp-kettle for their men to any larger

utensil, on the ground that the former being so much more easily carried on the march, it is best to accustom the soldier to the use of what is served out to him. The men themselves greatly preferred the larger vessels, as the various shifts and expedients they had recourse to clearly showed.

After the 9th of September, when the work in the trenches ceased, and the troops began shortly afterwards to make preparations for the winter, a great improvement took place in almost all the cooking-places. Throughout the whole summer the hospital kitchens had been, on the whole, kept by the medical officers in a most creditable condition. Now many of the regimental kitchens also became extremely neat and convenient; while others—and this, too, sometimes in their immediate contiguity—continued to be dark, dirty, and stifling with smoke.

The large iron boilers, which were brought up from the barracks and other buildings in the Karabelnaia district of Sebastopol, contributed much to the comfort of the troops* during the winter of 1855—6, as well as to the saving of fuel and consequently of transport labour. Each boiler would cook the rations of from sixty to eighty men. The men themselves remarked that the fuel, which before was required for a company, would now often do for the whole regiment. This was the case when the boilers were properly set in stone work, so as to have a small fire-place underneath. At the side of the boiler, an old powder case, or a preserved vegetable canister, was sometimes fixed in, and served as a cooking oven.

In some of the camps, large ovens were constructed, and a considerable quantity of bread was baked, to be either served out in the rations, or sold to the troops.

The Army Works Corps were generally supplied with cooking-stoves, provided with a boiler and a large pot, the one for preparing the tea or coffee, and the other for the meat rations.

Canteens.

Almost every regiment had its own canteen; occasionally there was but one between two regiments, and in a few instances there were two in a regiment, one for the men, and the other for the officers. The canteen was very generally kept by some of the foreign suttlers that followed the army, Italian, Greek or Levantine. The commanding officers of some regiments however—the Scots Fusilier

* M. Soyer, who had done so much to improve the cooking establishments in the hospitals, &c., at Scutari, and who was then in the camp, gave many useful suggestions for improving the cooking of the soldier.

Guards for example—would not give their permission to that class of people in their camp, and required that the canteen should be in the charge of a man belonging to the regiment. When this was the case, it was directly under the management of some of the officers, who took upon themselves the trouble of providing the stores, &c. The canteen of the 47th regiment was upon this plan, and the men paid less, and were better served in consequence. The Grenadier Guards had their own “battalion stores” under the charge of a serjeant of the regiment, The articles were purchased in Balaklava by one of the officers.

The prices usually charged in the ordinary canteens, were:—

	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>
Bottled porter or ale	1	8	to	2 0
Draught beer, per quart	1	0	„	1 8
Tenedos, or other Greek wine, per bottle	1	6	„	2 0
Flour, per lb.	0	8	„	1 0
Cheese per lb.	2	0		
Butter per lb.	1	8	„	2 0

The liquid measures were generally much under the English standard, so that the actual charges were often much higher than the above prices indicate. In most canteens, spirituous liquors were not allowed to be sold, except per bottle; in a few, however, they were openly retailed at 6*d.* per glass.

In the canteens which were under the more immediate direction of the officers, the prices charged were considerably less than the above, and the quality of the articles, of course, more to be depended on.

It was the universal opinion that the whole canteen system in the field might be altered with advantage, and that better articles, at a much lower price, might be put within the reach of the soldier, by arrangements between the different departments of the public service itself.

Clothing.

Although the troops had been abundantly provided with woollen clothing to wear next the skin, and they were, moreover required by a General Order to do so, many of the men neglected this important preservative of health, until the cold weather began to set in. This neglect had been over and over again observed to be followed by sudden attacks of diarrhœa among the men, when they were at night in the trenches, or on other duty, exposed to the great alterations of temperature so frequent in the Crimea. It was chiefly among the young soldiers who had recently arrived, and who were from other causes the most liable to such disorders, that the neglect was found to exist. The

old campaigners, and all the officers without exception, wore flannel throughout the year. In some regiments, the surgeons took the useful precaution of occasionally inspecting all the men, to ascertain that they wore their woollen skin clothing, and many attacks of illness were doubtless thus prevented.

The medical officers generally were also of opinion, that the waterproof capes and jackets supplied to the troops tended very materially to preserve the health, as well as to increase the comfort, of the men. During the hot weather, the light fatigue jackets had been found most acceptable and useful.

No. III.

NOTES ON SHIPS OF WAR. BY DR. MILROY.

In consequence of the very fatal outbreak of malignant cholera in the fleets at Varna in the preceding year, when general alarm was occasioned in the land and sea forces of the allies, and the expedition to the Crimea was thereby considerably delayed, the Lords of the Admiralty considered it advisable in the summer of 1855 to put the Commission in communication with the Admiral in command and with the principal medical officer of the Black Sea fleet, in the event of epidemic sickness again prevailing in the squadron.

On the occasion referred to, the "Britannia," carrying the flag of Vice-Admiral Dundas, had been visited with extraordinary severity. Between one-half and two-thirds of the crew were smitten with the pestilence in its milder and more severe forms. Of 229 attacked with developed cholera, no fewer than 139 perished, or about 13 per cent. of the entire crew (1,040 in number). Nearly the whole of this dreadful mortality took place within four or five days. There was no death among the officers.

Other ships of the fleet, chiefly line-of-battle ships, suffered much at the same time, but none to the extent of the "Britannia."

The circumstances which had occasioned the excessive virulence of the disease on board the Admiral's ship appear to have been these. She arrived at Varna at the end of July, her crew at the time in excellent health, and the ship thoroughly clean throughout. Diarrhoea began to occur

immediately afterwards, and increased from day to day with occasional attacks of cholera, which had made its appearance both on shore and among the shipping. It was, therefore, thought advisable to put to sea in the hope of getting rid of the sickness, by leaving the anchorage near the shore. For the first day, the change seemed to do good; but from the following night, when it was found necessary to close the lower deck ports, things rapidly became worse, and next morning the dreadful attack commenced. The men seemed to have been poisoned by the impure air they had breathed during the night. The violence of the disease continued for the next four days, until the ship returned to Varna, and the whole crew were transferred to other vessels. From that moment, it rapidly subsided and ceased, without being communicated or doing any injury whatever to those on board these vessels. A more striking example of the deadly effects of impure air in an epidemic season, and of the all but infallible means of arresting the evil, cannot be imagined.

A minute inspection of the "Royal Albert" was made by Dr. Milroy, in company with Dr. Brien the principal medical officer, and subsequently of the "Queen," with Dr. Deas, Inspector-General of the fleet. Especial attention was paid to the arrangements on board ships of war, which are generally believed to have most influence in predisposing the crew to attacks of epidemic diseases, and in rendering these attacks formidable. The foremost of these is the amount of accommodation between decks for the men at night. In line-of-battle ships, the lower gun deck is reserved for this purpose; in two-deckers, the marines as well as the seamen sleep there, but in three-deckers, the marines and boys occupy the fore part of the middle deck. From 600 to 800 men, according to the strength of the crew, are thus usually berthed on the lower or main deck. By the relief of watches every four hours, there may never be more than one-half these numbers in their hammocks at one time; but nevertheless the whole have to sleep on that deck from night to morning. The state of the atmosphere must depend on the efficiency of the means for ventilation, by which the breathed air can be removed and fresh air introduced. When all the ports are open, there is of course free perfation, and the hatchways over head serve for the escape of the heated impure air; but when the ports are closed, the only means of admitting fresh air is by the hatchways, with or without the aid of windsails, so that the same openings serve the double purpose of entrance and escape. The close and offensive state of the between-decks of a ship of war, within two or three hours after the men have turned into their ham-

mocks during the first watch, proves how quickly the atmosphere becomes tainted; and the evil of course becomes worse afterwards. Sir William Burnett, the late Director-General of the Medical Department of the Navy, has observed, in reference to the causes of the great mortality on board the "Britannia," "It will thus be seen that the whole ship's company were, during the greater part of the night, so situated that they could not help breathing an atmosphere which was not only well nigh exhausted of all its vital support, but poisoned by the effete products of respiration and by the other emanations which escape from the living body, whether in health or disease."

The immunity of the officers upon that occasion was doubtless owing chiefly to their having a larger amount of breathing space allowed them.

On board the "Royal Albert," and in other screw line-of-battle ships, most of the officers have their cabins on the orlop deck, where all the midshipmen and mates also sleep. This arrangement, introduced of late years, must serve to render the atmosphere in the main deck still more impure; the heated breathed air from the orlop deck passes into it. The officers' cabins are apt to become quite stifling when the scuttles are shut, more especially when the furnaces are lighted.

The accommodation for the sick in screw ships, as in the "Royal Albert," is, in several respects, inferior to that on board sailing ships of the same class. The sick-bay is much smaller, occupying only one side of the upper deck forward instead of its entire breadth. It is not nearly so well ventilated, and does not admit of being so well ventilated. It is, moreover, exposed to contamination of atmosphere from the faulty arrangements of the water-closets, which have been adopted in the new ships. By the closet of the sick-bay being placed forward in the ship's eyes, and its shoot communicating with the large shoot from the men's latrine in the head, offensive effluvia are continually being driven back into the hospital, to the disgust of the patients and attendants. This nuisance is much complained of by the medical officers. It is, moreover, made worse by the midshipmen's closet in the recently constructed ships being put immediately outside the bulk-head of the sick-bay, instead of being at a distance from it on the middle deck as in other vessels. On going into the sick-bay in the "Royal Albert," the noxious exhalations from this closet were very perceptible.

In some new ships the stock-pen, too, has been brought so much more forward than it used formerly to be, that it is in direct proximity to the sick-bay. There is less

freedom of circulation of air around it, and the effluvia from the live stock are proportionately more offensive.

The latrine accommodation for the crews of ships of war appears to be quite insufficient at all times. In some epidemic seasons, this defect must be not merely inconvenient but positively injurious.

The experience of our Black Sea fleet in 1854 afforded another instance of what is from time to time occurring in the navy—an extraordinary amount of sickness and death on board some ships in epidemic seasons. On almost every such occasion, the overcrowding of the men, and the defective ventilation of the between-decks at night appear to have been the chief predisposing and aggravating causes. A foul state of the hold may have been sometimes present at the same time; but so much attention is paid in the present day to thorough cleanliness of every part of a ship of war, that this source of mischief is comparatively rare.

That the ventilation of the between-decks and of the cabins is capable of being greatly bettered by sufficiently simple means cannot be doubted. Still it is very questionable whether by any means it can be made so perfect as to render the air at night as pure as is desirable, or even safe in certain seasons, while the crew continue to be crowded together on one deck, and that deck the lower one. At least one-half of the best sleeping space in a ship of war is, in ordinary circumstances, left unoccupied. It is only made available when there is much sickness on board, and then it is used as part of the sick-bay. There appears to be no other reason for its non-occupation at other times but the practice hitherto of the service. Free space and pure air are, however, as necessary for the prevention of disease as for its mitigation and arrest.

The changes in the accommodation for the well and sick, adopted of late in the new screw line-of-battle ships, have had the effect of diminishing the amount of space, without any concomitant improvement in the ventilation of the decks. This point requires the more notice, as the heat on board a steamer is of course greater than in an ordinary sailing ship, and the atmosphere is liable to become more oppressive. Many of the most fatal outbreaks of pestilence in the navy of recent years have occurred in steamers.

Several troop-ships and transports in Balaklava harbour were inspected by the Commission.

No. IV.

ABSTRACT of the DIARIES of JAMES NEWLANDS, Esq., Civil Engineer, and of MR. JAMES WILSON, Inspector of Nuisances, relative to the Cleansing and Scavenging operations carried out at the Scutari Hospitals, from March 8, to July 7, 1856.

March 1855.

6th.—Mr. Newlands reached Constantinople in company with the Sanitary Commissioners.

10th.—Messrs. Freeney, Aynsley and Wilson, the three Inspectors of Nuisances attached to the Sanitary Commission, arrived at Constantinople this day.

From the 8th to the 15th, Mr. Newlands rendered such assistance to the Commissioners as was required. Scavenging operations were commenced at the several hospitals on the Bosphorus, and Mr. Wilson being installed at Scutari, and his own work being completed at Constantinople, Mr. Newlands received instructions from the Commission to proceed along with Messrs. Freeney and Aynsley, the two other Inspectors of Nuisances, to the Crimea; they embarked on board the steam transport "Brandon," and left Constantinople for Balaklava the same afternoon.

The cleansing operations at Scutari were commenced as soon as the necessary men and materials were obtained. Flushing cisterns for cleansing the sewers at the Barrack and General Hospitals had to be erected, and a little delay took place in consequence.

A gang of native labourers having been placed by Lord William Paulet under the direction of Mr. Wilson, they were daily employed in sweeping every part of the neighbourhood of the hospital buildings, and streets in their vicinity. The main sewers were opened and cleansed, and were afterwards flushed twice and sometimes three times a-day, and the privies were regularly examined, cleansed daily, and deodorized with peat charcoal.

A place of deposit was selected for the filth and rubbish, which was each day collected and carried by labourers to the appointed place.

The flushing of the sewers at the hospitals absorbed much of the labour at Mr. Wilson's disposal, as the water used for the purpose had mostly to be carried up from the Bosphorus to the hospital; the supply there not being abundant enough to be used for flushing.

Mr. Wilson inspected cleansing operations at the hospital at Kulali, as well as at those at Scutari, once or twice a-week; taking care that the cleansing operations at Kulali, which were done by the purveyor's men, were being properly carried out.

In the same way, cleansing at the Palace Hospital was, from the 14th of April, 1855, done by men acting under the orders of the Purveyor there, Mr. Wilson frequently inspecting the work. The following is an abstract of the diary:—

WEEKLY ABSTRACT OF MR. WILSON'S DIARIES.

Week ending March 24.

Thirteen men, on an average, employed in cleansing the surface of the ground in the vicinity of the Barrack Hospital and at Kulali, in removing the refuse, burying animals, &c. During the week there were collected and removed from the vicinity of the Barrack Hospital 202 hand-carts or baskets full of filth, rubbish, and offensive matter. Two tons of filth were removed at Kulali. The carcasses of 15 dogs and 2 horses were buried and the sewers of the Barrack Hospital were flushed three times.

Week ending March 31st.

The cleansing operations were extended to the General Hospital and Palace Hospital this week. The number of men employed was 20 on the average. The ground about both Hospitals, and that portion of the village nearest the Barrack Hospital was swept clean. A large sewer within the barrack square was opened, by order of the Commissioners, and 42 hand-carts of filth removed from it. The sewers connected with the privies were opened and cleansed, and 26 hand-carts of filth removed from them. A sewer at the General Hospital was also opened, and cleansed, and 14 hand-carts of filth were removed from it. Water was carried to the flushing tanks, and the sewers at the Barrack Hospital were flushed 19 times in the course of the week. The total filth and refuse removed from the vicinity of Barrack, General, and Palace Hospitals during this week, was 354 hand-carts or baskets full, and the carcasses of 7 dead animals were buried. Peat charcoal was used in the cleansing operations.

Week ending April 7th.

The ground about the Barrack, General, and Palace Hospitals was swept as usual, also part of the village of Scutari; an offensive sewer at the Barrack Hospital was cleansed. The average number of men employed during the week was 25. There were 297 hand-carts or baskets full of filth removed. Water was carried to the flushing tanks, and the sewers and privies at the Barrack Hospital were flushed 21 times. Peat charcoal was used to deodorize the privies. The hospital at Kulali was inspected. Peat charcoal was used for deodorizing the privies. The ground round the hospital was cleansed and the privies flushed.

Week ending April 14th.

The average number of men employed this week was 20. The ground about the hospitals was swept as usual, and 215 hand-carts or baskets full of filth were removed. Water was carried to the flushing tanks, and the sewers at the Barrack Hospital were flushed 19 times during the week. The carcasses of 2 horses, a cow, and 4 dogs, were buried.

Week ending April 21st.

Several large foul sewers were opened at the Barrack Hospital by order of the Commissioners; peat charcoal was applied to deodorize their contents, and above 100 hand-carts of filth were removed from them. The ground around all the hospitals was cleansed. The filth and refuse collected and removed during the week, amounted to 417 hand-carts or baskets full. Water was carried to the flushing tanks, and the sewers and privies at the Barrack Hospital were flushed out 24 times. Peat charcoal was applied to the privies every day. A dead horse was buried. The average number of men employed during the week was 26.

Similar cleansing works were carried out during the two succeeding weeks.

Week ending May 12th.

An average of 24 men employed during this week. The cleansing operations at all the hospitals inspected as usual. There were 284 hand-carts or baskets of filth removed from the vicinity of the Barrack and General Hospitals. Water was carried, and the sewers at the Barrack Hospital flushed out 23 times. The privy drains were also flushed by the aid of the fire engine, several tons of water being used for the purpose.

Similar cleansing works were carried out during the week ending the 19th.

Week ending May 26th.

The usual cleansing operations were carried out at the Barrack and General Hospitals, and the other hospitals, which are cleansed by the purveyor's men, were inspected, and found in a satisfactory condition. An average of 25 men were employed during the week, in sweeping, removing filth, and carrying water to the flushing tanks. The sewers and privies at the Barrack Hospital were flushed out 24 times, and 329 hand-carts or baskets of filth were swept up and removed. A dead buffalo was also buried. The privies were deodorized with peat charcoal.

Week ending June 2nd.

There were 25 men employed on cleansing at the Barrack and General Hospitals during the week. The hospitals at Haidar Pascha and Kulali inspected as usual, and found to be clean. There were 335 hand-carts or baskets full of filth swept up and removed from the vicinity of the Barrack and General Hospitals. Water was carried to the flushing tanks at the Barrack Hospital, and the sewers were flushed 23 times during this week. The flushing tanks for cleaning the sewers at the General Hospital were completed at the end of this week, and the sewers were flushed out twice.

Week ending June 9th.

The external cleansing of the hospitals at Haidar Pascha and Kulali was inspected and found to be well done. Cleansing operations carried on at the Barrack and General Hospitals by a daily average of 22 men, and 295 hand-carts of filth and rubbish swept

up and removed. Water carried to the flushing tanks at the Barrack and General Hospitals, the sewers and privies of both hospitals were flushed out 40 times during the week. Two dead horses buried.

During this week Mr. Newlands, on his return from the Crimea, examined carefully the state of the cleansing works under Mr. Wilson's inspection, and had every reason to be satisfied with their efficiency. He reported the hospitals, externally, to be in a very different condition than they were in when first visited by the Sanitary Commissioners.

Week ending June 16th.

There were 26 men employed on cleansing operations at the Barrack and General Hospitals, 405 hand-carts and baskets of refuse were swept up and removed. Water carried for flushing the sewers, and those of the Barrack and General Hospitals flushed out 20 times each, in the course of the week. The other hospitals were also inspected.

Week ending June 23rd.

All the hospitals visited as usual, the cleansing operations inspected and found satisfactory. There were 23 men employed during this week at the Barrack and General Hospitals, in sweeping, removing filth and rubbish, and in carrying water to the flushing tanks. The sewers and privies at the Barrack and General Hospitals were flushed out 24 times each, and 380 hand-carts of rubbish and filth swept up and removed.

Week ending June 30th.

The average number of men employed this week in cleansing and carrying water at the General and Barrack Hospitals was 20. The ground in the vicinity of both hospitals cleansed as usual, and 348 hand-carts of refuse removed. There were 48 flushing operations carried out at the sewers and privies of both hospitals, and one dead horse buried. The other hospitals were visited and found to be clean.

Week ending July 7th.

The usual cleansing operations were carried out with 21 men. The ground in the vicinity of the Barrack and General Hospitals, and also around the new depôt huts was cleansed, and 354 hand-carts of refuse removed. Water was carried to the flushing tanks of both hospitals and the privies and sewers of each hospital were flushed out 24 times in the course of the week, making 48 flushing operations. The other hospitals were inspected as usual, and found to be clean.

The same cleansing operations were continued until Mr. Wilson left Scutari.

No. V.

ABSTRACT OF DIARY OF JAMES NEWLANDS, ESQ., and MESSRS. FREENEY and AYSLEY, relative to Cleansing Operations carried out at Balaklava.

March 1855.

19th.—Having reached Balaklava the previous evening, Mr. Newlands proceeded to Head-Quarters, and had the honour of an interview with Lord Raglan. His Lordship gave orders that every facility should be afforded for the necessary examinations at Balaklava.

20th.—During this and the two following days, a minute examination was made of the harbour, the village of Balaklava, and its precincts.

On the east side of the harbour, the shore was covered with putrid filth; in creeks formed by the jetties on that side, floating carcasses, parts of slaughtered animals, and many bellies were seen in a putrid condition.

Statistics were obtained of the slaughtering on board vessels in the harbour, which at that time was crowded, and it was found that not less than eighty sheep were slaughtered daily on board ship, and the blood and offal thrown into the harbour. It was impossible even to approximate to the number of fowls killed daily, the entrails of which were also thrown overboard into the harbour.

The berthing place for newly arrived transports being chiefly in the neighbourhood of the Ordnance Wharf, caused an accumulation of many of the above-named nuisances, in the creeks between the Ordnance and Cattle Wharves, and between the ships lying there. The transport ship "Brandon," on board of which the Inspectors lived on their first arrival at Balaklava, was rendered unwholesome by fœtid exhalations from the water around the vessel.

On the north or upper part of the harbour, the water was found to shoal, and the whole of its margin to be a compost of decaying animal and vegetable matter, emitting a most offensive stench. Part of the continuation of the low land opening into the plain of Balaklava, which is swampy ground, was found to have been converted into a burial-ground, smelling most offensively. The west side of the harbour, having a steep shore, was almost free from nuisance, except at Cossack Bay, where several carcasses were floating.

From the absence of proper latrines in the village, it was found that in the lower part of the ruins of the Genoese Castle on the slope of the hill itself, and in almost every place in Balaklava which was screened from observation, there were accumulations of ordure.

The bed of the stream at the south-east of the harbour was also in a most filthy condition, and the whole neighbourhood of this locality was covered with parts of slaughtered animals, with manure and with garbage of other kinds. In the midst of this filth, a considerable population was living in tents.

An uneven piece of ground at the rear of the Naval Brigade Magazine, and another between that and the Commissary-General's office, used as a station for transport mules and drivers, was in a filthy condition.

From a want of names to the streets, it is not easy to indicate, precisely, the locality of nuisances that were observed; but one may be particularized, as its virulent nature called for the most prompt remedy; it was at the back of the rum stores, where, on the site of a dismantled house, and in the yard belonging to it, human ordure covered the ground to a depth of some inches, a small apartment in this yard was inhabited.

On this day the thermometer indicated 70 in the shade, and towards evening the bad smells in and over the valley were sickening.

During the whole day the village of Balaklava was crowded with baggage animals and their drivers, and with persons from the camp coming and going.

23rd.—Dr. Gavin having reached Balaklava the previous evening, Mr. Newlands, showed him the various localities demanding attention, and laid before him memoranda of suggestions as to the way of dealing with the evils in question.

24th.—Mr. Newlands went with Dr. Gavin to Head-Quarters, had an interview with Field-Marshal Lord Raglan, and stated to his Lordship that to carry out the proposed cleansing operations, 50 such men as the railway navigators would be required.

26th.—Occupied in drawing up report on the cleansing measures for Balaklava, and in making copies of the same.

27th.—Major Mackenzie, Assistant Quartermaster-General, was to-day enabled to grant two huts for the use of the Inspectors, much inconvenience having been felt whilst living on board ship, for want of some place on shore to which messages and communications could be sent.

A requisition made upon the authorities for men and tools; but as none could be obtained either on this, or the two following days, the Inspectors were reduced to comparative inactivity.

30th.—Went this morning by appointment to Lieutenant-Colonel Harding's, the Commandant of Balaklava, and had 41 men told off for use. Marched the men to the office of the Royal Engineers, but found, that as no order had been given for tools, none could be obtained; the labourers were, in consequence, discharged.

At 9 o'clock inspected the harbour in company with Rear-Admiral Boxer, and fixed on a site for a slaughtering-wharf, and on one for embarking the sick.

31st.—Made a further inspection of the village and harbour of Balaklava.

April.

2nd.—A requisition for tools upon the officer commanding the Engineers having been obtained, Mr. Newlands was enabled to set to work the men placed at his disposal, under the superintendence of the two Inspectors, Messrs. Aynsley and Freeney.

3rd.—Accompanied Dr. Gavin this morning to inspect a portion of the cavalry camp near Kadikoi.

Forty-three labourers, 10 wheelbarrows, 12 shovels, and 20 picks, having been granted to day, the Inspectors were directed to employ them as follows:—

Nine of the men to remove and pile up a quantity of timber lying scattered over a piece of vacant ground behind the Commissariat rum store, and to begin levelling the ground. The surface of this ground was covered with human ordure, in many places to a depth of several inches, the place being, at this date, the resort of workmen employed in the various stores, of sailors from the shipping lying off the adjacent quay, of the natives living in the vicinity, and also of many of the soldiers coming daily to Balaklava from the front.

The other labourers were employed in removing and burying large quantities of offensive matter at the back of the Naval Brigade Magazine, and in levelling the ground so cleansed. This place had been used as a stand for Commissariat ponies, and about 40 tons of manure and filth had been allowed to collect on the margin of the stream which flows from the Castle ravine past the Brigade Magazine. Some portions of this refuse being dry, the Inspector had it set on fire, and thus got rid of part of it, and in some measure lessened the bad smell proceeding from the remainder.

4th.—Continued general inspection.

Thirty labourers having been granted this morning, 6 of them were employed on the ground behind the rum store in finishing the levelling, and in otherwise improving the place. Four loads of quicklime, and two bags of charcoal were also distributed on the surfaces.

Some Maltese were living in this yard, three of whom were at the time lying ill with fever.

The remaining 24 labourers were employed behind the Naval Brigade Magazine, and with very beneficial results. The whole of the horse dung and manure was removed, and the surface of the ground sufficiently levelled to prevent any water or liquid refuse from stagnating and becoming offensive.

5th.—Went this morning with Admiral Boxer to select a dirt barge to be employed in conveying to sea the refuse from the ships and the village. A boat having been fixed on for the purpose, Admiral Boxer undertook to have a new deck put upon it.

Thirty labourers were again put at the disposal of the Commission. They were employed on the ground near the Naval Brigade Magazine, as a number of tents had formerly been pitched in this neighbourhood, when the ground was a good deal broken up and uneven.

The old sites that had been cleared for the tents, being to some extent sheltered by the earth thrown up round them, had become places of deposit for all kinds of filth by the men at the Cattle Pier, the Commissariat drivers and others.

These deposits, the Inspectors now proceeded to have covered over with earth and gravel, and the ground so levelled as to prevent any such accumulations in future.

During the forenoon, six of the labourers were employed in removing the filth, from that portion of the old Castle which was lowest down the hill, and also from the various hollows along the stream flowing down the Castle ravine. Two large holes were then dug, and the filth placed therein, a quantity of old mortar (to a depth of 5 or 6 inches) from the ruins, and then earth being

thrown over the animal matter. A dead horse found lying on the hill side at the back of the Naval Brigade Magazine was also buried.

6th.—Went on board the steam ship “Severn” to see Dr. Sutherland and Mr. Rawlinson, who had arrived from Constantinople, and afterwards proceeded with them to inspect the work in hand.

Thirty labourers having been granted this morning, they were employed by the Inspectors during the forenoon in cleansing the margin of the harbour near the Ordnance Wharf—this being the berthing place for the largest class of transport steamers—and in dragging the garbage and other filth that had collected in the shoal water on to the shore. The smell from this offal was most offensive and sickening. Six large holes were then dug, and the filth buried, quicklime being freely scattered over it, before it was finally covered with ashes and earth.

In the afternoon the men were employed in covering with lime and earth the remains of a large heap of manure near the Castle ravine, a portion of which had been burnt, under the direction of the Inspectors, on the 3rd instant.

7th.—To-day 30 men were assigned, all of whom were employed in cleansing the bed of the Castle ravine stream for about 50 yards of its course, being the space between where it issues from the ravine, and where it falls into the harbour. The whole of the filth and garbage that had accumulated in the stream was removed and buried, and the margin of the harbour, where the bellies of slaughtered animals and other refuse was floating, was dragged, and the offal so collected was buried. The margin of the harbour and stream for about ten yards was likewise covered 6 inches deep with lime and fresh earth. The water of the stream, which had previously flowed in an indiscriminate manner over the whole space between the ravine and the harbour, so that foot passengers could hardly cross it, was confined to a channel about 2 feet in width, by 6 inches in depth, and a sufficient fall given it, so that any refuse which may hereafter accumulate can be easily removed.

The crew of the steamer “Tonning,” lying off the Cattle Pier, laden with sheep and bullocks for the Commissariat, were throwing large quantities of manure into the harbour. From 5 to 8 tons of manure were thus disposed of. The Inspectors called the attention of the harbour police to the circumstances.

8th.—Engaged in drawing up some extended proposals for improving the sanitary condition of Balaklava, and the vicinity.

Thirty men were handed to the Inspectors, who employed them on the same work as the preceding day; but towards afternoon the weather was so unfavourable, that nothing could be done after 3 o'clock.

9th.—Completed the proposals commenced yesterday. The weather stormy and wet; no outdoor work could be proceeded with.

10th.—On the Inspectors attending at the usual hour and place for parading the labourers, they were informed by the non-commissioned officer in charge, that some of the natives were sick, that others had been sent to the front, and that the few who remained were required by the Town Adjutant.

The Inspectors therefore made a minute inspection throughout Balaklava.

11th.—Mr. Newlands was with the Commission to consider his report and proposals.

The military authorities were again unable this morning to grant any labourers for the work of the Sanitary Commission.

12th.—Attended at a meeting of the Sanitary Commission, on the subject of a communication to be presented to Field-Marshal Lord Raglan, on the state of Balaklava and the harbour.

No work was done to-day, as the military authorities continued to be unable to supply the requisite labour.

The Inspectors being, therefore, unemployed, they again made a thorough examination of the village and harbour, both of which were found to be in a very filthy state.

No improvement had been made in the condition of the houses or ground, facing the quay, the surface being very dirty, more especially near the railway saw-mills and the charcoal stores. The ground, which had been cleansed and deodorized by the Inspectors on the 4th instant, was becoming foul again, as it continued to be the resort of the natives and others living, or working, in the immediate neighbourhood.

The margin of the harbour, opposite the then quarters of the Gendarmerie Impériale, and near the Ordnance Wharf, was likewise in a filthy state, with garbage floating on the surface of the water. In front of the Naval Brigade Magazine there was a quantity of offal, and there was more near the Cattle Pier; on the margin of the harbour, where the Castle ravine stream enters it, there were also several bellies floating, and the carcass of a dead sheep, and behind the Naval Brigade Magazine a dead mule had been lying some days unburied.

In the yard attached to the Commandant's house a latrine was in a very offensive state.

The railway labourers had erected a latrine for their own use at the back of five huts in their occupation, and sunk a soil pit about ten feet deep.

Behind the Police Office, at the side of the road leading to the Castle Hospital, there was a hole sunk in the rock, and used as a soil pit. The smell from it was most offensive. Within a few feet of this hole there was a tent pitched in the occupation of men in the employment of the Commissariat.

A latrine for soldiers had been made in Mount Street, and two others for officers not far from it. The public latrine was offensive, and stood in need of an application of charcoal, or lime and earth. Near the General Hospital there was another latrine, and an offensive smell from it was perceptible at the upper end of the village.

13th.—Attended at a meeting of the Sanitary Commission, and inspected the native mule camp. Also wrote a letter on the withdrawal of the men who had been previously at work, and a report as to the dirt barges.

The Inspectors having attended at the Town Adjutant's Office were informed that he had only 23 men at his disposal, and that they were required by him.

The Inspectors, therefore, continued their inspection of the village and harbour, and found several bellies and other garbage floating about. During the day there was a very offensive smell near the Ordnance Wharf, and also, towards sunset, from the upper end of the harbour and graveyard. The dead mule, behind the Naval Brigade Magazine, alluded to in yesterday's diary, was still unburied.

14th.—This morning drew up a statement of the manner in which the Inspectors had been employed since their arrival in the Crimea.

The Inspectors, on attending at the Town Adjutant's, were told that there were only 25 labourers available for work, and that none could be spared for the service of the Sanitary Commission.

15th.—Having been consulted by Admiral Boxer as to the duties of the Harbour Police, Mr. Newlands drew up the necessary document and rode up with it to the hut of the Sanitary Commission.

There were no labourers available this morning.

16th.—Went on board the "Australia" to procure a supply of peat charcoal.

The Inspectors, continuing still to be without any labour, inspected the cattle slaughtering-place at the head of the harbour, near the lime kiln, found it in a most filthy state.

17th.—Attended this morning at the Town Adjutant's Quarters at 6 o'clock, expecting that men would be assigned, but ascertained that none would be available until after 12 o'clock, when 23 labourers would be told off for sanitary work.

Nine days had elapsed since the Sanitary Commission last had any labourers granted them.

Having instructed Mr. Freeney to be ready to receive the men, proceeded to make an inspection of the harbour and village. Afterwards attended a meeting of the Commission, and furnished them with an estimate of the number of men and materials required to carry out the necessary cleansing operations.

Twenty-three labourers being handed over to the Inspectors after dinner, they employed them on the margin of the harbour between the Ordnance and Cattle Wharves, in cleansing and liming. The carcasses of two calves, several bellies and other garbage were buried, lime being plentifully strewn over them.

The Inspectors next had a quantity of lime strewn over the heaps of filth in the yard in front of the church, and the Chaplain's Quarters, and over similar accumulations lying between the last-named house and that of the Quartermaster-General's Department.

Three barrows of lime and a quantity of charcoal were likewise thrown into the public latrine in Mount Street, and similar quantities into a latrine in front of the General Hospital huts. These places, both of which were previously very offensive, were greatly improved by the above application.

The dead mule that had been lying at the back of the Naval Brigade Magazine was also buried to-day, lime being thrown over the carcass before it was entirely covered with gravel and earth.

18th.—Mr. Newlands confined to his hut by fever.

Twenty-two labourers were handed over to the Inspectors, who

employed them at the yard behind the Commissary-General's in removing a large quantity of filth that had been allowed to accumulate, and in levelling and liming the surface of the ground. A heap of manure near the old Greek Church was also limed, and the sloping ground, in front of some tents occupied by soldiers attached to the Commissariat, was likewise cleansed and lime strewn over the surface, a quantity of stagnant water collected here, had been very offensive for some days preceding. The Inspectors next caused the latrine in the yard of the Commissariat Office to be deodorized with lime and charcoal, and a dead bullock (that had died after being landed) to be towed out to sea and there sunk.

During the day a fatigue party of the Guards employed in pulling down the yard walls in front of the English Church, and of the houses intervening between it and the Quartermaster-General's, these walls having hitherto served as screens for the deposit of refuse and filth. This work had been begun by Tartar labourers before they were transferred to the Inspectors of the Sanitary Commission, and was finally completed by soldiers. Later on in the day, the Guards' fatigue party employed at the wharf at the upper end of the harbour.

19th.—Attended a Commission meeting respecting the report to Field-Marshal Lord Raglan, on men and materials required to carry out cleansing operations; 24 labourers came to work, but not until a late hour. They were again employed at the yard behind the Commissary-General's Quarters in covering over the filth with about a foot of earth, and in otherwise improving the condition of the place.

Eight of the Tartar labourers were employed in cleansing an old surface drain at the Commissariat Wood Yard, and in filling up with earth and gravel a number of holes in front of the same place, in which stagnant and putrid water had collected and become so offensive, that the storekeepers complained of being made sick and obliged to leave their duty in consequence.

20th.—Engaged in an inspection of the vicinity of the Castle Hospital, the condition of which was found much improved; and in preparing a report on the works in progress.

Twenty-three of the labourers were at work under the inspectors, eight of them at the yard behind the Commissary-General's quarters, and the remainder at the Commissariat Wood Yard, making an underground drain to convey refuse water from the yard of the Commandant's Quarters, and in otherwise improving the surface and filling up holes on the quay. A dead mule from near the French Commissariat Yard, was towed out and sunk at sea, the French Authorities objecting to its being buried near their store.

21st.—Twenty-four labourers employed during the day in levelling the surface and covering over filth at the yard behind the Commissary-General's, and in cleansing the margin of the harbour.

22nd.—Twenty-two labourers at work at the yard behind the Commissary-General's, and in cleansing the bed of the stream flowing down the Castle ravine.

23rd.—Went to the camp of the Highland Brigade along with Dr. Sutherland and Mr. Rawlinson.

Twenty-five labourers employed on work similar to that of yesterday. In the afternoon a portion of them were directed to deodorize the latrines at the General Hospital, and the Main Guard, in Mount Street, and at the quarters occupied by the Turkish labourers, and also the one at the Castle Hospital. The Inspectors also had a quantity of lime carried to the head of the harbour, to mix with gravel intended for the more effectual covering of some dead horses, whose carcasses had been buried only a few inches below the surface.

24th.—This morning inspected the present state of the whole of the village and harbour of Balaklava, and the precincts of the Castle Hospital. Afterwards proceeded to Head-Quarters with the Commissioners for an interview with Field-Marshal Lord Raglan, but found that his Lordship was engaged.

Returned to Balaklava, and directed the Inspectors to employ the men in covering over the graves at the head of the harbour.

The nineteen labourers assigned to the Commission to-day, were employed at the head of the harbour, in covering the dead bodies and those places where stagnant water and filth had collected, the latter being from twelve to eighteen inches in depth. Whilst thus engaged, a body of Tartar labourers, under the direction of a non-commissioned officer, were employed in driving piles at the head of the harbour, and the Inspectors of the Commission were enabled to assist in this work, by ordering their men to fill in the water space behind the piles with earth and gravel.

25th.—Accompanied the Commissioners to Head-Quarters by appointment, and proceeded thence with them, and Colonel the Honourable A. Gordon, to inspect the camp and the regimental hospitals.

Twenty-three men employed this day by the Inspectors on the same work as yesterday, the Eupatorian labourers continuing their work of pile-driving and embanking. The latter men, who were acting under the military authorities, are much stronger and more active than the men assigned to the Sanitary Commission Inspectors.

Fatigue parties of soldiers continued to be employed on the roads near the village, and on the quay near the Railway Yard.

26th.—Engaged in drawing up statements, to be presented to Field-Marshal Lord Raglan, as to the mode of carrying on the future sanitary and cleansing operations.

Twenty-five men assigned to the Commission were employed under the superintendence of the two Inspectors, at the head of the harbour in covering over the surface of the old burial ground, a dead horse, lying near the lime kiln, was likewise buried, lime and charcoal being thrown into the pit along with it.

27th.—Went with Dr. Sutherland and Mr. Rawlinson, to the camp of the Highland Brigade.

Twenty-seven labourers were at work to-day under the Inspectors, of whom 15 were employed at the head of the harbour, the remaining 12 being engaged in digging two latrine pits at the Native Hospital Huts above the Mule Camp outside the village, and in cleansing the surface of the ground around the huts.

28th.—Twenty-nine labourers employed to-day under the superintendence of the Inspectors of the Commission, for finishing the latrine pits begun yesterday at the Native Hospital, and the remainder at work at the head of the harbour covering the graves and levelling the ground.

The weather very warm, and complaints begun to be made about the offensive smells from the ground at the head of the harbour, which was wet and marshy, one side being bounded by the road which connected Balaklava with the front, and along which the whole traffic of the army was conducted.

This marshy space had served as the burial-ground for the men at or near Balaklava during the winter of 1854-55, the bodies in many instances being merely laid on the surface, and then earth heaped over them.

The warm weather now hastened decomposition, and the effect of this was sometimes visible on the top of the grave mounds, the stench being so great, that the labourers on the ground had to be changed every hour, until the surface had been covered with a coating of gravel about twelve inches deep.

To cover the whole ground effectually, was a work of some duration, considering the quantity and quality of the labour assigned. A great part of the labour consisted in carrying the gravel to cover the graveyard from the opposite side of the railway and main road, which bounded it, the gravel having to be carried on the men's shoulders in small baskets, that would not hold above a stones weight of material, there not being a sufficient supply of either carts or wheelbarrows.

29th.—Made an inspection of the village, and of the ground at the foot of the Castle ravine.

Twenty-nine men at work to-day, under the Inspectors at the graveyard at the head of the harbour.

30th. Twenty-five men at work to-day under the superintendence of the two Inspectors, covering the graveyard at the head of the harbour, lime and charcoal being used with the gravel where necessary.

May.

1st.—A letter was this day received by the Commission, stating that Field-Marshal Lord Raglan had acceded to a proposal made by the Commissioners relative to carrying on the cleansing and other sanitary works.

Twenty-six labourers were employed to-day at the same work as that on which they have for some time past been engaged.

2nd.—Mr. Newlands, in compliance with the orders of Field-Marshal Lord Raglan, this day made a requisition on General Simpson, the chief of the Staff, for—

500 Men,
40 Horses and Carts,
250 Spades,
250 Picks,
50 Wheelbarrows.

32 labourers were set to work on the graveyard at the head of the harbour, in addition to 75 others who were made over later on in

the day; but this supply of 107 men was lessened by the subtraction of 25, who were taken away by the Town Adjutant, Lieutenant Deacon, he having received orders to send them up to Head-Quarters.

After having waited some days the following articles were this day granted to Mr. Newlands:—

15 Wheelbarrows,
30 Pickaxes,
20 Shovels,
20 Spades.

Lime and charcoal continued to be used in different parts of the village, as well as at the graveyard.

3rd.—The embarkation of the Highland troops for Kertch to-day, somewhat interfered with the works. Labourers very inefficient, six natives being either unable or unwilling to do as much as one Englishman.

Seventy-five men at work under the Inspector, 63 at the graveyard at the head of the harbour, and 12 filling up hollows in the road near the Sick Wharf, beside the Royal Engineer's Office, stagnant water, which smelt offensively, having collected in the holes in the road.

4th.—In company with Lieutenant-Colonel Harding, the Commandant, inspected sites for proposed buffalo pond; the earth excavated to be used in the covering of the graveyard.

Seventy-three men at work to-day, covering the graveyard, and spreading lime and charcoal where necessary; also in removing manure and refuse from the yards and houses in the village, especially from stables.

5th.—An idea of the very inefficient labour at the disposal of the Inspectors, may be gathered from the fact, that it took 12 natives two entire days to dig two pits, each 10 feet long, $3\frac{1}{2}$ feet wide, and 8 feet deep.

Seventy-two men were at work at the head of the harbour, covering the English graveyard, and scattering lime over some parts of Turkish burial-ground near the lime kiln. The Director of the the Land Transport Corps having made over some carts to the Sanitary Commission, a portion of the men had to be employed as drivers.

6th.—One hundred labourers at work to-day at the head of the harbour, and in driving carts carrying gravel and ballast.

7th.—Though the works proceed very slowly, a perceptible improvement visible in the state of the ground at the head of the harbour, the smell much diminished.

8th.—A minute inspection of the harbour and its approaches was this day made, every little inlet being entered and examined. A great amount of filth, and many paunches and bellies were found floating about.

9th.—One hundred labourers at work to-day under the Inspectors on the graveyard at the head of the harbour.

10th.—Heavy rain during the whole day put a stop to all out-of-door operations. Furnished the Commission with a copy of his report on Balaklava of April 7th.

11th.—The heavy rain continuing, all out-of-door work at a stand, the native labourers refusing to turn out, in spite of every exertion used to make them.

The roads again converted into sloughs, there being no provision for the water escaping, so that they became mud streams. In some places, the walls built to retain the ground next the harbour gave way during the wet weather. From the same cause the work done at the graveyard has been damaged.

12th.—Seventy-five men made over this morning, and employed in clearing the channels all along the flooded quays.

At Kadikoi the mud was as deep as in winter. The smell from the graves yet uncovered very offensive, but there was none perceptible in that portion of the ground which had gravel spread over it.

13th.—Ninety-six men having been made over, were directed by the Inspectors to continue the same work as yesterday, and to drain away any water that had settled on the covered or on the uncovered portions of the graveyard.

14th.—Ten carts were issued this morning, but found them, as Colonel M'Murdo had stated, not at all adapted for the work. Ninety-six labourers handed over, were employed in covering part of the graveyard where the stench is the worst. Some of the men were also employed in removing the accumulations of litter from the village to the hill side to be there burned.

Twenty men of the number assigned in the morning withdrawn during the day for some special service.

The quays along the harbour having been formed with the filth and manure from the village, began about this time to emit an intolerable stench. Decaying animal matter at the Ordnance Wharf, also, having become very offensive, Rear-Admiral Boxer requested to give instructions for its removal.

15th.—Seventy-five men (30 of them for only a portion of the day) and 10 carts told off this morning, and employed in covering the graveyard, and in removing the stable and other manure from the yards and quarters in the village to the hill side near the lime kiln and Turkish burial-ground, this spot chosen both for its convenience, and because the ashes of the manure, when burnt, may be used to deodorize the graves at the Turkish burial-ground.

The stench from the uncovered part of the graveyard at the head of the harbour, extremely bad. Any one working over the graves for an hour became sick and affected by diarrhœa, so that the Irish drivers of the carts granted to the Commission, refused to work, and the Inspectors were obliged to give the other labourers stimulants at hourly intervals.

16th.—Mr. Newlands drew up a report on the state of the works at Balaklava, for the Commission. A letter addressed to Mr. Beattie, C.E., requesting him to take the manure from the railway stables in trucks, as the carts cannot get near them. There was an outbreak of cholera to-day at the mule camp outside the village. Seventy-five labourers and 7 carts were made over to the Commission, and employed at the graveyard at the upper end of the harbour, and in carting lime and charcoal to it.

17th.—Seventy-five men and 9 carts having been made over to day, were employed under the supervision of the Inspectors, on the same work as yesterday and the days preceding.

18th.—The smell from the harbour very bad to-day, and the slaughtering-wharf, recommended to be made, was still incomplete.

Seventy-five men and 10 carts were at work under the Inspectors at the graveyard at the head of the harbour.

The dirt barge furnished by Rear-Admiral Boxer, was this day moored at a convenient spot in the harbour, to receive the refuse from the village and from the shipping.

19th.—Seventy-four men and 10 carts were made over to the Commission to-day. Twelve of the men directed to take the dirt barge out to sea and empty it, and afterwards to deodorize the latrine at the back of the main guard. The remainder of the men engaged on the same work as on the preceding days.

20th.—Seventy-five labourers and 9 carts at work as on the preceding days.

21st.—A large quantity of manure under the old camp of the 71st Regiment was burned.

Inspected the quays, along with Mr. Rawlinson, and found that the work there going on more satisfactorily; the men under the Commandant's orders being engaged in pulling down the old houses on the west side of the railway, and making good the ground along the quays, with the materials so obtained. No provision was, however, made for drainage.

During the inspection to-day, it was noticed that the harbour, south of the Ordnance Wharf, was much cleaner than it had yet been, and that the quays were less encumbered with filth. Seventy-four labourers and 10 carts were employed as heretofore, with the exception of six men engaged in filling the dirt barge.

22nd.—Seventy-five labourers engaged at the head of the harbour, but no carts could be obtained, as they were all needed to assist in the transport of stores and baggage for the men going on the expedition to Kertch.

24th.—Seventy-three labourers at work at the head of the harbour, as heretofore, and Lieutenant-Colonel Harding placed 2 mule carts at the disposal of the Inspectors, but most of the gravel had to be wheeled from the bed to the graveyard in barrows, or else carried in small baskets on the men's shoulders, at a great loss of time and labour.

25th.—Seventy-three workmen, with 3 carts granted by Lieutenant-Colonel Harding, the Commandant, were employed at the head of the harbour.

26th.—The same number of men and carts were at work to-day at the same place.

27th.—Seventy-five men and 3 carts at work to-day, but nothing could be done after 11 o'clock in consequence of the heavy rain.

28th.—Seventy-five men at work to-day, all of whom were engaged in sweeping and cleansing the town, and in opening the channels after the heavy rain of yesterday.

The heavy rain of Sunday was found to have washed away portions of the gravel from the graveyard, and to have become stagnant in some parts of it. Where this was the case, the heat of the sun acting on the moisture, and on the animal matter below the surface, produced a stench almost intolerable. Seventy-three men and 10 carts were made over to the Inspectors, who employed a portion of the labour in cutting surface channels through the graveyard, to carry off the stagnant water into the adjoining water-course, as well as the formation of the ground would permit.

30th.—One hundred and fifty labourers and 8 carts (the latter not assigned till 10^o o'clock A.M.), were this day granted, and employed under the superintendence of the Inspectors, in covering the graveyard at the head of the harbour with a second coating of gravel, a quantity of lime and charcoal being used along with it.

31st.—One hundred and fifty labourers and 7 carts employed on the same work as yesterday.

June.

1st.—One hundred and fifty labourers and 7 carts again at work until noon, when, in consequence of the excessive heat, and in accordance with orders recently issued, the men returned to their camp until 4 P.M. After this hour the labourers were engaged, under the Inspectors, in removing filth from the margin of the harbour, and in general cleansing.

2nd.—One hundred and fifty labourers and 7 carts employed in the same work as yesterday up to mid-day. After 4 o'clock they were engaged in cleansing the margin of the east side of the harbour.

3rd.—One hundred and fifty-six labourers and 7 carts again employed on the same work as yesterday.

4th.—One hundred and fifty labourers and 7 carts at work at the graveyard, and scraping and cleansing the roads.

5th.—One hundred and fifty labourers and 7 carts at work at the graveyard, and filling up a number of holes near the Turkish burial-ground, where stagnant water had collected; also in removing a quantity of filth from the Commissariat yard.

6th.—One hundred and fifty men and 7 carts at the same work as yesterday, and also manure burning.

7th.—Mr. Newlands left Balaklava this day on board the "Hydaspes," steam transport on his return home to England.

One hundred and fifty men and 7 carts were employed on the same work as yesterday during the forenoon, and afterwards in cleansing the margin of the harbour, and macadamizing the road along the east side of the harbour.

8th.—One hundred and fifty labourers and 7 carts were employed on the same work as yesterday.

9th.—One hundred and fifty labourers and 7 carts again similarly employed.

10th.—One hundred and fifty labourers and 7 carts again employed at the graveyard, and in cleansing the margin of the harbour.

11th.—One hundred and twenty labourers and 7 carts at work at the graveyard, and 30 in the removal of filth from the margin of the harbour near the Ordnance Wharf.

12th.—The same number of men and carts as yesterday at work at the graveyard, and near the Ordnance Wharf.

13th.—One hundred and seventeen men and 7 carts at work at the graveyard, and 33 near the Ordnance Wharf.

As the water shoaled very much all along the margin of the harbour, south of the Ordnance Wharf, and as the greatest part of the disembarkations, and many of the shipments of sick take place there, the Inspectors were directed by the Commission to make a loose stone quay wall outside the filth, and thus give a depth of from two to three feet of water.

14th.—One hundred and fifty men and 7 carts at work, most of them at the head of the harbour, a few engaged in pulling down the lime store near the house occupied by the French Gendarmerie.

15th.—A festival day among the natives, and none of them therefore at work.

The Inspectors, in the course of their examination to-day of the village and harbour, detected a very offensive smell, proceeding from a number of dead bullocks, whose carcasses had floated under the rocks at the Castle Hospital. The circumstance reported to the Commission.

16th.—One hundred and fifty men and 7 carts at work, most of them at the graveyard, and in quaying the margin of the harbour, the remainder engaged in covering with lime and charcoal, the native graves on the hill side behind the new Greek Church.

17th.—One hundred and fifty men and 7 carts at work, 120 at the same work as yesterday, and 30 in pulling down some old and filthy houses in which fever cases had occurred.

18th.—One hundred and fifty men and 7 carts on the same work as before, and in filling up with lime and earth unwholesome ground opposite the Commissariat Stores.

19th.—One hundred and fifty men and 7 carts at work as before.

20th.—One hundred men and 7 carts at work to-day. The reduction in the number of labourers was owing to a number of Tartars having left Balaklava.

21st to 23rd.—One hundred labourers and 7 carts, were each day employed on the same work as heretofore. On the 23rd, a quantity of lime carted to various places along the margin of the harbour, for the purpose of deodorizing.

24th.—The whole of the labourers at the disposal of the Inspectors were employed in cleansing the roads, and in opening out the water-courses that had become choked up during the thunderstorm of last night, and the heavy rain of this morning.

25th.—The labourers were employed in various parts of the village on work similar to that of yesterday.

26th.—Seventy labourers and 3 carts employed at the graveyard and the head of the harbour, and 30 men engaged at the margin

of the harbour, south of the Ordnance Wharf, until 12 o'clock, when all the labourers were taken away to cleanse the roads and break stones.

27th.—Eighty labourers and 3 carts employed at the graveyard and the head of the harbour, and 20 near the Ordnance Wharf as yesterday. At noon the men were directed to remove a number of old and filthy houses, and to continue the repairing and cleansing of the quay.

28th, 29th, and 30th.—During these three days, the workmen were employed as follows:—

Seventy-five men and 3 carts at the upper end of the harbour, and 25 at the quay near the Ordnance Wharf until noon; the whole of the men and carts in the afternoon working at the repair of the quay.

On the last of these days the Sappers began to drive piles at the upper end of the quay, nearly opposite the Royal Engineer Yard, preparatory to forming a better and more permanent wharf in deeper water. The Inspectors assisted in this work, by directing their labourers to fill in stone and gravel at the back of the piles.

July.

1st to 4th.—The two Inspectors, having the same supply of men and carts, continued to employ them on the same work as during the last few days, with the exception of 6 men, who were told off to sink a latrine pit at the back of the main guard.

5th to 13th.—During this period, the Inspectors had, each day, at their disposal 98 labourers and 4 carts, who were employed as heretofore at the head of the harbour, near the Ordnance Wharf, and on the quays.

On the 5th instant another latrine pit was dug near the Ordnance Wharf.

14th to 20th.—During this period the same number of men and carts continued to be placed at the disposal of the Inspectors, who employed them in the same works as heretofore.

On the 14th instant, a third latrine pit was dug at the foot of the Castle ravine, for the use of the men on duty in this part of Balaklava.

21st.—The same number of men and carts were employed till noon on the same works. They were then directed by the Inspectors to thoroughly cleanse the margin of the harbour, from one end of it to the other, of every kind of filth perceptible.

22nd.—The same number of men and carts were employed in the same places as yesterday and the days preceding; 10 of the men engaged in burying the carcasses of 6 bullocks and 1 horse, found lying dead near the bazaar at Kadikoi.

23rd.—The Inspectors, Messrs. Freeney and Aynsley, being required in England, left Balaklava this day.

No. VI.

ABSTRACT of JOURNALS of M. WALLING, Esq., Surgeon, Her Majesty's Ship "Wasp;" EDM. NOLLOTH, Esq., M.D., Her Majesty's Ship "Leander," and T. M. COSTELLO, Esq., Surgeon, R.N., relating to the Sanitary and Medical Visitation and Inspection of Transport Ships in Balaklava Harbour, between May 22, and September 19, 1855, during the prevalence of Asiatic Cholera.

M. WALLING, Esq., Surgeon, H.M.S. "WASP."

May.

22nd.—Conferred with Sanitary Commissioners respecting the sanitary condition of the ships in harbour and their crews, and as to the sanitary measures to be adopted, in consequence of having received an order to that effect from Rear-Admiral Boxer.

Examined 20 vessels situated in the upper part of the western side of the harbour. Left directions on board each for the better observance of sanitary precautions. Represented to Admiral Boxer the necessity for removing certain small (Italian) vessels anchored on the west side of Cossack Bay, out of the harbour, as they were throwing overboard decayed fruits, &c., which all floated into the harbour.

23rd.—Visited all the vessels situated on the lower part of the western side of the harbour. Met with several unimportant cases. Advised the masters as to cleanliness, whitewashing, ventilation, the use of chloride of zinc, pumping the ship out, and where to apply when in want of medical assistance. Also what remedies to use in case of necessity or on the appearance of cholera. Received an order from Admiral Boxer to act in conjunction with the Sanitary Commissioners.

24th.—At 6 A.M. visited the "Bella Leandra," (a Sardinian barque). Found a seaman who was attacked, at 2 A.M., with cholera, in a state of collapse. Directed the necessary remedies. Returned at 9 A.M., and found the patient better. Ordered everything to be cleared out of the fore-castle, and the fore-castle to be cleansed and whitewashed. Ship to be frequently pumped, and chloride of zinc to be used. Directed suitable remedies for the patient, but they were not sent for, and the man died at one P.M. Body to be immediately taken out to sea.

This ship was not clean. Her cargo consisted of salt beef, pork, hay, &c. Two other men are ailing, apparently from slight febrile attacks.

Cholera appeared on board the "Chester." Ordered out of harbour.

Visited the "Medora," "Mary Ann," and "Paramatta," on board of the latter of which there was a man suffering from slight purging. "John Bowes," "Iron Age," and "Melbourne"; also

many small Turkish, Maltese, and Italian vessels, attending to cases met with, and directing sanitary precautions for all.

Directed Admiral Boxer's attention to the filthy condition of Ordnance Wharf, near which the "Chester" had been lying when cholera appeared on board.

25th.—Visited the "Bella Leandra." No further appearance of cholera. The two sick men improving. Directed further measures of cleanliness. Ordered powdered charcoal to be thrown about among the cargo where there was any injurious smell perceived. Visited cases of purging on board the "Medora" and "Paramatta." Visited the following vessels, and also several trading ships:—"Lady Russel," "Othello," "Lilly Dale," "Amity," and directed the requisite sanitary precautions.

26th.—Visited the "Bella Leandra," and found the sanitary precautions nearly completed, as directed. The two sick men improving. Met with a case of mild fever in the "Faith," and another on board the "Paramatta." Inspected the "John Bull," "Zebra," "Bruiser," "Abundance," "Sir J. Easthope," "Imperial," "Faith," "Lion," (captain sick with fever,) "Cheshire," "Canadian," "Clyde," &c. Most of these ships were in a satisfactory sanitary condition, and any improvements that were found requisite were made. The "Imperial" had been carrying cattle, and was far from clean in any part. Like all cattle ships, she had boards nailed loosely down to the deck, under which animal excrements accumulate, and cannot be dislodged except by tearing up the boards each time.

27th.—Had a conference with Dr. Nolloth and Dr. Costello, with a view to dividing the ships in the harbour into three parts for the convenience of visitation. Visited fever cases on board the "Faith," "Paramatta," and "Bella Leandra." Examined some small Greek vessels.

28th.—Increase of fever. Represented the state of the beach to Admiral Boxer. Visited the following ships:—

"Faith;" the two cases of fever improving.

"Paramatta;" one case of diarrhœa and one of fever.

"Bella Leandra;" cases improving.

"Columba;" captain ill of fever.

"Isabella Blyth," and "Pursuit;" ordered lime-washing, &c., for both.

"Ann and Isabella;" several slight cases.

"Isabella;" ordered sanitary precautions to be taken.

29th.—Communicated with the Sanitary Commissioners respecting the condition of the eastern beach of the harbour, the cattle-folds, and slaughtering-place.

Visited the fever cases and found them improving. Fever appears of a mild type. Its onset frequently resembles cholera, being preceded by purging.

Inspected the "Elizabeth Nicholson," "Iron Age," on board which were two cases of fever. The "Imperial," which had two cases of fever and one of diarrhœa.

30th.—Visited "Candia," on board which a man died of diarrhœa last night. Inspected the eastern side of the beach. Visiting the following ships:—

“Paramatta,” which had three cases of fever; “Imperial,” two cases choleraic fever; “Iron Age,” one case choleraic fever; “Isabella,” one case of choleraic fever; “Jarrow,” one case of fever; “Regina,” one case of diarrhœa; “Columba,” one case of fever. Directed all the other cases to be sent on board the “Wasp,” to be treated when able to attend.

31st.—At 9 A.M., visited the “Edina,” and found a case of cholera on board. Visited the other cases, also the “Ariel,” where there were two cases of choleraic fever. The “Gomelza,” a case of fever. Visited also the “Pursuit,” “Jane Elizabeth,” “Eva,” “Defender,” “Charles Richard,” “Challenger,” “Jarrow,” and suggested any sanitary precautions that appeared requisite.

June.

1st.—Called to “Columba” at 5 A.M., to see the nephew of Admiral Boxer, who had been seized with cholera. He died at half-past 12.

The master of the “Isabella Ann” was attacked with cholera at 2 A.M.; was seen at 4 A.M., and died at 3½ P.M. Visited the following vessels:—

“Sir John Easthope,” one case of fever; “Imperial,” one case of fever; “Jarrow,” one case of choleraic fever; “Regina,” one case of diarrhœa; “Isabella Blyth,” three cases of fever, and one of diarrhœa; “Columba,” one case of fever; “Walmer Castle,” one case of fever. Much filth of all sorts collected among the inner tier of ships.

2nd. The new cases visited to-day occurred on board the following ships:—“Walmer Castle,” one case of choleraic diarrhœa; “Billow Queen,” one case choleraic diarrhœa; “Sir G. Pollock,” one case choleraic fever; “Isabella Blyth,” two cases of fever; “Phœnix,” three cases of choleraic diarrhœa; “Challenger,” one case diarrhœa; “Pursuit,” one fever case; “Odin,” one of diarrhœa.

Represented to Admiral Boxer the necessity for sending the “Isabella Blyth,” out of the harbour, as she has had already seven cases on board. Ordered to anchor outside.

3rd.—The following new cases were visited:—

“Gomelza,” one case cholera; “Imperial,” one case diarrhœa; “Jarrow,” one diarrhœa, and one case cholera—this vessel has several men sick; “Sir G. Pollock,” one case cholera; “Isabella Blyth,” one case cholera; “Gutmansthal,” one case cholera; “Columba,” one case diarrhœa; “Walmer Castle,” one case diarrhœa; “Challenger,” two cases fever; “Pegasus,” one case fever; “Odin,” one case fever; “Young England,” one case diarrhœa. All the cholera cases had suffered from previous diarrhœa. Six of the affected ships were recommended for removal out of harbour.

At 10 P.M. visited the “Corfu;” a case of cholera had occurred, which was sent to hospital.

4th.—Visited “Young England,” one case fever, and “Alcides,” one case diarrhœa; “Wasp,” one case cholera; “Jarrow,” master attacked with fever; “Progress,” one case of cholera and one of fever; “Snowdon,” one case of fever; “Columba,” two new cases of fever; “Challenger,” one case of fever. All fever cases were preceded by choleraic symptoms.

"Belgravia," one case fever. Observed a larger quantity than usual of offal, filth, &c., amongst the closely packed shipping, where I also found most disease.

The "Gomelza" and "Isabella Blythe" (two cases fever) sent out to sea.

5th.—Called to the "Alcides" at 5 A.M., and found a man with all the symptoms of cholera. Inspected fore-castle, and found it dirty and ill-ventilated. Ordered it to be immediately cleared out, and chloride of zinc used, then to be whitewashed, and the bow port to be knocked out.

Visited all the old cases.

"Young England," one case diarrhœa; "Charles Richards" and "Walmer Castle," one new case of fever on board each. Recommended the removal of several sickly ships out of harbour.

6th.—Summoned at 4.30 A.M. on board the "Peace." Found the master ill of cholera, who died at 7 P.M.

Called to "Troubadour," at 5 A.M., a case of cholera had been attacked through the night—said to have had no previous diarrhœa. Found three new cases of diarrhœa, and one case of fever on board the "Charles Richards" and "Sir G. Pollock;" and four diarrhœa cases on board the "Gomelza," "Othello," and "Jane Elizabeth."

All fever cases are still more or less complicated with vomiting, purging, &c.

Many ships sent outside the harbour.

Fever, diarrhœa, and cholera increasing. Most of the fatal cases occur in ships moored close to the eastern beach.

7th.—Visited "Charles Richards;" found one case of cholera, and one case of diarrhœa; found a case of cholera on board the "Princess Royal;" also a case of cholera on board the "Jane Elizabeth;" and another on board the "Quartus;" found three cases of diarrhœa, and one of fever on board the "Lord Warden," "Imperial," and "Sir John Easthope;" called at 10 P.M. on board the "Holyrood," where three men had been attacked with diarrhœa, one of which was choleraic.

8th.—Another case of diarrhœa on board the "Charles Richards." Cholera appears on the decline, which appears to be mainly due to the removal of so large a number of vessels out of the harbour, and the liberation from among the ships of a large quantity of offal and filth which has been carried out to sea by the north-east winds. Drunkenness has a marked effect in predisposing to attacks of cholera. Existing cases of disease were visited and found improving. A cholera case on board the "Charles Richards;" another on board the "Tonka;" and a new case of diarrhœa on board the "Holyrood;" a case of diarrhœa on board the "Union," which ended in cholera, and one case of fever on board the "Chevalier."

9th.—Visited the "Princess Royal," one cholera case on board; visited the "Cochrane," which has brought 180 mules from Messina. Her lower deck contains an immense quantity of dung, &c., the stench from which, and from the bilges pervades the whole ship. The captain sent one case of cholera to hospital at 10 A.M., a second occurred at 5 P.M. I reported this ship for removal from the harbour until she be well cleansed, ventilated, and whitewashed, and disinfec-

ting fluid used. The men had suffered from previous diarrhœa. The following new cases occurred:—“Walmer Castle,” one diarrhœa; “Cochrane,” one diarrhœa; “Union,” the master has severe diarrhœa, which will probably terminate in cholera.

10th.—The “Cochrane,” sent outside the harbour last night, has some new cases of diarrhœa on board to-day.

Visited all the old cases.

11th.—Examined the “Kangaroo,” and found her in a very insanitary condition. She had brought 250 cattle, and had on board a large number of dead cattle in different stages of decomposition, and an immense quantity of dung, animal excretions, &c.

The stench was horrible, and pervaded every part of the ship. Recommended that she should land her live oxen, and proceed to sea to bury the dead bullocks immediately, and clean ship, using chloride of zinc, charcoal, whitewashing, &c.

One case of choleraic diarrhœa on board the “Pursuit;” and a case of cholera has occurred on board the “Quartus.”

There were new cases on board the the following vessels:—

“Jane Elizabeth,” one case of cholera; “Holyrood,” three cases diarrhœa; “Othello,” one choleraic diarrhœa; “Faith,” two cases diarrhœa; “Imperial,” “Sir J. Pollock,” and “Union,” four cases choleraic diarrhœa.

12th.—“Union,” chief engineer attacked with cholera this morning. She is a clean ship, but the probability of her being a sickly ship induced me to advise her removal out of harbour.

Four new cases of diarrhœa on board the “Jane Elizabeth,” “Odin,” and “Imperial.”

13th.—Inspected the “Black Sea” which had just landed mules. Her between decks contains a large quantity of animal excretions, and she is in an unwholesome condition. Found four cases of choleraic diarrhœa on board which probably would have run into cholera, if the ship remained in her present state and position.

Advised her leaving the harbour, to clean.

Found two cases of remittent fever on board the “William Oldham,” both of which had commenced with purging, &c. Also a case of fever and a case of diarrhœa on board the “Holyrood.” Visited all ships where there were cases of sickness.

14th.—“Walmer Castle,” two new cases of choleraic diarrhœa or fever. One new case of diarrhœa on board the “William Oldham.” “Troubadour,” one new fever case. Inspected “Kangaroo,” and found satisfactory progress being made in the sanitary measures recommended. Eastern side of the beach still in a most unsatisfactory state, especially above the vegetable wharf.

15th.—Was attacked with vomiting and purging during the night. The master of Her Majesty’s ship “Wasp” was attacked in the same manner. Mr. Cooke, Assistant Surgeon, visited the shipping having sick on board. The following new cases occurred, “Mary Ann,” one case fever. “Faith,” one case diarrhœa. “Peace,” one case diarrhœa.

16th.—Mr. Cooke again inspected the ships, and reported four new cases of diarrhœa on board the “Volunteer,” “Faith,” and “Abundance,” and one new fever case on board the “Walmer Castle.”

17th.—Visited ships where the cases required it, and inspected a number of ships of which the sanitary condition was good.

18th.—I have not seen anything like a case of cholera since the 12th instant, yet cases of diarrhœa, frequently choleraic, occur daily, and which, if neglected, would probably run into cholera. I think it fortunate that early and active measures have been adopted to check the late visitation of cholera. Almost every individual is suffering from the excessive heat, and has derangement of the stomach and bowels, dyspepsia, &c. Visited the sick on board ship. A new case of fever, and one of diarrhœa occurred on board the "Faith." There was a case of diarrhœa on board the "Volunteer," and a case of fever on board the "Walmer Castle." Inspected a number of ships, and suggested the requisite sanitary precautions.

19th.—Visited the "Hannibal" which had brought mules from Genoa. Found a quantity of dung on the sand ballast, which I ordered to be removed, and a quantity of charcoal to be thrown over the ballast. Pointed out where ventilation and lime-washing were required. She had a crew of 11 men, but no sick. Visited the "Joseph Sheppard," apparently a very clean ship. Suggested ventilation, &c. Found one case of choleraic diarrhœa, and one case of apparently mild fever. Visited all ships where the sick required it.

20th.—Visited ships as usual. Found "Walmer Castle" very sickly, all more or less complaining. Six men were suffering from febrile diarrhœa. The master of the "Edina" suffering from severe choleraic diarrhœa.

21st.—Visited ships. The choleraic case on board the "Edina" has put on dysenteric symptoms. A new case of fever on board the "Walmer Castle." Another on board the "Peace," and a third on board the "Phœnix." A case of choleraic diarrhœa on board the "Peace," and two cases of diarrhœa on board the "Princess Royal" and "Phœnix."

22nd.—An immense number of slight bowel complaints, almost every person complaining more or less. The following new cases were met with:—"Edina," two choleraic diarrhœa; "Walmer Castle" two cases of fever with purging; "Joseph Sheppard," two cases choleraic diarrhœa.

23rd.—Many of the cases of diarrhœa under treatment have taken a dysenteric form. Some are severe. Two new cases of diarrhœa occurred on board the "Pursuit" and "Abundance."

24th.—Two new cases of dysentery on board the "Pursuit." Diarrhœa cases have a dysenteric rather than a choleraic form.

25th.—Fever and dysentery are now the prevailing types of diseases. A case of choleraic diarrhœa occurred on board the "Edina," and two cases of diarrhœa on board the "Snowdon" and "Zealous." Dysenteric cases very uncontrollable by treatment.

26th.—A thunder storm on the 23rd had damaged the quays and increased the impurity of the atmosphere by stirring up and exposing the filth. The following new cases were met with: one cholera on board the "Peace;" one cholera on board the "Simoom;" one choleraic diarrhœa on board the "Walmer Castle;" one choleraic fever on board the "Union," and one fever case on board the "Sir G. Pollock."

27th.—Both cholera cases seen yesterday have died. Two cases of fever have occurred on board the "Oscar," and three cases of diarrhœa on board the "Princess Royal," "Walmer Castle," and "Vigilant." The "Peace," on board of which there have been two fatal cases of cholera, is a charcoal ship, and has still many tons on board. She has also been a sickly ship, which shows pretty clearly how little power charcoal possesses as a disinfectant.

28th.—A case of cholera on board the "Edina," which has been a very sickly ship; "Faith" (brig), two diarrhœa cases. I directed the fore-castle of this ship to be whitewashed, and the place ventilated by removing the bow ports. Four new cases of diarrhœa and one of fever on board the "Pursuit," "Edina," "Simoom," and "Oscar."

29th.—Dysenteric cases intractable. A case of fever and another of diarrhœa occurred on board the "Alster."

30th.—Two new cases to-day; one choleraic diarrhœa on board the "Ocean Queen," and one diarrhœa on board the "Young England."

July.

1st.—Visited the ships where the sick required it, and also several ships lately arrived in harbour, to inquire into their condition, and to direct sanitary arrangements. Two new cases of diarrhœa were found on board the "Alcides" and "Walmer Castle."

2nd.—The following new cases occurred to-day: "Simoom," two diarrhœa cases; "Walmer Castle," one choleraic diarrhœa and two diarrhœa; three cases of diarrhœa on board the "Pekin," "Princess Royal," and "Peace," and one fever on board the "Young England." The "Walmer Castle" is an exceedingly sickly ship. New cases of diarrhœa and mild fever occur every day amongst her officers and men. The cause is obviously the unwholesome state of the eastern beach, close to which she has been moored for several months.

3rd.—The harbour is becoming again filled with shipping. Two new cases of diarrhœa occurred on board the "Queen," and one case of fever on board the "Richard Ingram."

4th.—Cholera in my division appears to be kept under. I have not met with a case since the 26th ult., and cases of dysentery do not increase, yet there are a large number of men under treatment. The following new cases have occurred to-day:—"One case of choleraic diarrhœa on board the "Sapphire" yacht, one fever on board the "Walmer Castle," and six cases of diarrhœa on board the "Pursuit," "Alcides," "Queen," "Ocean Queen," and "Walmer Castle."

5th.—Called on board the "Faith" this morning; found a large number of sick and ailing. She arrived yesterday from Constantinople. The following new cases were placed under treatment:—Four cases of diarrhœa, one of fever, and one of dysentery, on board the "Faith," "Sir G. Pollock," "Abundance," and "Peace."

6th to 9th.—Six new cases of diarrhœa, one of which was choleraic, and six cases of fever, were put under treatment on board the "Walmer Castle," "Faith," "Sir G. Pollock," "Oscar," "Riverdale," and one case of diarrhœa at the Naval Depôt.

10th.—Cholera appears to be quite kept under, and dysentery does not seem to increase. Diarrhœa has, in some cases, run into

dysentery, which is very severe and uncontrollable, especially when the patient has suffered from the same disease in India. One new case of diarrhœa occurred on board the "Pekin."

11th.—On going my daily round among the ships to-day, I found the harbour, especially the upper part of it, very full of vessels, and an immense increase in the quantity of floating debris, such as dead animals, offal, &c., among the shipping, the stench from which was very offensive. Called the attention of the harbour police to this. One new case of cholera occurred on board the "Hetton," and three new cases of diarrhœa on board the "Catherine," "Walmer Castle," and "John Baynon." The "Hetton" is moored close to the beach, on the eastern side of the harbour, and opposite her are two pools of decomposing vegetable matter, bread, onions, and cucumbers, the stench from which is most powerful.

12th.—Visited all ships where the sick required it. Four new cases of fever, and two of diarrhœa, were seen on board the "John Bull," "Margaret Elizabeth," "Peace," "Walmer Castle," and "Anne Baker." One of the fever cases had strong symptoms of cholera.

13th.—The offensive pools on the beach, which were reported on the 11th, have been filled up. Much offal floating amongst the shipping. Directed the harbour police to see to its removal. Two new cases of fever, and one of diarrhœa, on board the "John Bull," "Alcides," and "Witch."

14th and 15th.—Visited the ships, as usual, which had sick on board; also several Sardinian vessels, and directed the necessary sanitary measures. There is one new case of fever, and one of diarrhœa on board the "Hetton" and "Zealous."

16th.—A case of cholera occurred on board the "Dolphin;" three cases of fever and one of diarrhœa occurred on board the "Rosario," "Alcides," and "Queen." The cholera case had symptoms resembling those of fever.

17th.—Two cases of cholera occurred on board ship within the last twenty-four hours. One of these cases occurred on board the "Pursuit," in a man who had convalesced from dysentery. The second case took place on board the "Prompt." There have been six new cases of diarrhœa and one of fever on board the "Imperial," "Columba," "Faith," "Diadem," "Sir G. Pollock," and "Alcides."

18th.—Five new diarrhœa cases, and three cases of fever, were met with on board the "Imperial," "Columba," "Sir G. Pollock," "Zealous," "Georgiana," "Helen," "Faith," and "John Baynon."

19th to 22nd.—A case of cholera occurred on board the "Walmer Castle" on the 20th. There were nine new cases of diarrhœa, one of dysentery, and five of fever on board the "Columba," "Zealous," "Diadem," "Walmer Castle," "Pursuit," a Belgian brig, "Alcides," "Alster," and "Hetton." The "Walmer Castle" has improved greatly in health since she was drawn about fifteen yards further away from the filthy beach. The sick on board ship have been attended, and newly-arrived vessels have been inspected, and the necessary sanitary measures recommended.

23rd.—The "Walmer Castle" having been a sickly ship, I have

been anxious to find out the reason, as the ship appeared to be clean and sweet, chloride of zinc having been freely used for deodorizing. On cleansing out the ship's hold lately, a quantity of decomposing salt provisions was found, the stench from which was very bad. Three new cases of diarrhœa, and one of fever, were met with on board the Belgian brig, "Riverdale," "Walmer Castle," and "Pursuit."

24th to 26th.—Visited all ships having sick on board. Many cases of fever of a low type continue under treatment, and occur daily in those ships close to the eastern beach. The weather hot, oppressive, and most debilitating, with frequent heavy showers. There has been one case of choleraic diarrhœa on board the "Riverdale," and ten new cases of diarrhœa, and two of fever, on board the "Witch," "Eagle," "Zealous," "Walmer Castle," "Anne Baker," "Alcides," "Columba," "Diadem," "Georgiana," and "Peace."

27th to 31st.—The following new cases have occurred:—One case of choleraic diarrhœa on board the "Zealous," and ten cases of diarrhœa, ten cases of dysentery, and four of fever, have occurred on board the "Anne Baker," "Walmer Castle," "Riverdale," "John Baynon," "Zealous," "Eagle," "Columba," "Elizabeth," "Sir G. Pollock," "Diadem," "Peace," "Pursuit," "Defender," and "Rosario." The sick were all visited as usual, and several small trading vessels, with decomposing grain and vegetables on board, were visited, and the requisite sanitary measures ordered. The heavy rains and great traffic have converted the entire beach and road into a filthy puddle. It is amongst the ships close to this beach that three-fourths of the cases of cholera in my division have occurred. Fever and dysentery are always prevalent in that quarter.

August.

1st.—In consequence of the heavy rain, the eastern side of the harbour is deep in very offensive mud. There has been a case of cholera on board the "Isabella Blythe," and a case of dysentery on board the "Pudgona."

2nd.—The hot sun acts powerfully on the eastern beach after the rain. There are two new cases of cholera, one on board the "Margaret Elizabeth," and the other on board the "Candid." There is a case of diarrhœa and one of dysentery, also on board the "Margaret Elizabeth." The ship is pretty clean; but is moored close to the grain wharf. The "Candid" is lying off the Ordnance Wharf, and has just landed a large cargo of Cavalry horses; the horse-boats smell strongly of animal excretions. There is a new case of dysentery, also, on board the "Swift."

3rd.—Visited the ships as usual. A new case of cholera on board the "Diadem," lying off the Grain Wharf. There has been a new case of diarrhœa on board the "Walmer Castle."

4th.—Three cases of fever, three of dysentery, and one of diarrhœa, have occurred on board the "Margaret Elizabeth," "Queen of the Dark," "Pudgona," "Usworth," and "Dido."

5th.—There has been a new case of cholera on board the "Zealous," and one of fever on board the "John Bull;" one case of dysentery on board the "Priscilla," and one of fever on board the

“Alcides.” The part of the harbour where these vessels are lying is very full of ships; and I observed large quantities of garbage floating amongst them to-day.

6th.—The crowded state of the harbour, and the moist condition of the beach, under the action of a powerful sun, have led to a considerable increase of fresh cases to-day. There has been a new case of cholera on board the “John Baynon,” and another on board the “Riverdale.” There have been four new cases of diarrhœa, three of dysentery, and two of fever on board the “Old England,” “Robert Ingram,” “Usworth,” “Haulbowline,” “Arab,” and “Sir G. Pollock;” I was obliged to send a cholera case to hospital, as the vessel had to put to sea. I have not done this before for some time, as nearly all the cases died, though generally sent in the early stage, I suppose from loss of time, or the change and fatigue during the transport.

7th.—There have been five new cases of diarrhœa, one of dysentery, and three of fever, on board the “Defender,” “John Bull,” “Robert Ingram,” “Francis Beckly,” “Faith,” “Riverdale,” “Recruit,” and “Pursuit.”

8th.—A case of cholera occurred on board Her Majesty’s ship “Wasp,” a case of choleraic diarrhœa on board the “Zealous,” and one of diarrhœa on board the “John Bull.”

9th.—A case of cholera occurred on board the “Riverdale,” another on board the “Queen Victoria,” and a case of diarrhœa on board the “Queen.”

10th, 11th, and 12th.—On these days there were four cases of choleraic diarrhœa, three cases of diarrhœa, four cases of dysentery, and two cases of fever, on board the “Georgiana,” “Walmer Castle,” “Zealous,” “Sir G. Pollock,” “Mary Young,” “Riverdale,” “Old England,” “Antagonist,” “Elizabeth,” and “Pursuit.” The master of one of the vessels told me, that he looked upon the unwholesome state of the beach, as the cause of his having lost four of his men from cholera.

13th and 14th.—There have been four new cases of fever, two of diarrhœa, and one of dysentery, on board the “John Bull,” “Georgiana,” “Sir G. Pollock” and “Pelham.”

15th and 16th.—A case of cholera occurred on board the “Bucephalus.” Three cases of diarrhœa, three of dysentery, and one of fever, took place on board the “Sir G. Pollock,” “Ulrica,” “Alcides,” “Elizabeth,” “Ellen,” and “Queen.”

17th.—A case of cholera occurred on board Her Majesty’s ship “Wasp.” Six new cases of diarrhœa, and one case of fever were met with on board the “Volunteer,” “Georgiana,” “John Bull,” “Finchley,” “Ellen,” and “Zealous.”

18th.—Visited ships, and attended to all cases as usual, which still continue numerous, although new cases appear to be becoming much less frequent. A case of cholera has occurred on board the “Riverdale,” the patient positively denies having had any previous diarrhœa.

19th. Three cases of diarrhœa occurred in the “Baraguay d’Hilliers,” “Francis Barret,” and “Riverdale.”

20th, 21st, and 22nd.—Three cases of cholera occurred on board Her Majesty's ship "Wasp." All the men attacked were employed in a harbour-boat. They were much exposed to the sun, and had great facilities for procuring liquor. All recovered except one. There have been four new cases of diarrhœa, one of dysentery, and one of fever, on board the "Mary Young," "Alcides," "Robert Ingram," "Priscilla," "Georgiana," and "Stephen Huntley."

23rd to 28th.—Ships visited as usual. The harbour-master has promised to limit the number of ships in my division, and to leave a passage between them for ventilation. The weather has improved, and the eastern beach is dry. The number of new cases has fallen off considerably. During these five days, there were only two new cases of diarrhœa, two of dysentery, and there were also seven cases of fever on board the "Panama," "John Bull," "Irene," "Jane Anson," "Priscilla," "Raleigh," "Lady A. Lambton," "Ulrica," "Haulbowline," "Sarina," "Helen," "Chapin," "Mary Young," and "Rose."

29th to 31st.—Sick visited on board ship as usual, and recently arrived vessels inspected, and the requisite sanitary measures ordered. The following new cases have occurred. Five cases of diarrhœa, three of dysentery, and four cases of fever on board the "Irene," "Zealous," "John Bull," "Panama," "Sabrina," "Priscilla," "Hannibal" and "Aid."

September.

1st to 19th.—During this interval, the health of the harbour rapidly improved, and the inspection was finally discontinued on the representation of the Sanitary Commission, on the last of these days. There was no more cholera, there were only six cases of diarrhœa, three of dysentery, and six cases of fever on board the "Georgiana," "Retriever," "Raleigh," "Aid," "Bucephalus," "Mary Gibson," "Hannibal," "Daring," "Alice Walton," and "Poitiers." A number of cases of remittent fever have occurred during the last two or three weeks on board Her Majesty's ship "Wasp," caused, I fear, by the gradual accumulation and exposure of a large surface of mud at the top of the harbour. The "Wasp" is the nearest ship, and lies broadside on to it.

On shortly reviewing the past period, it may appear that epidemic cholera has been prevalent, and often fatal, especially in the locality to which I was attached, yet I consider the way in which the disease was kept under, and the smaller comparative mortality than might have been reasonably expected, to be a subject of congratulation. During the winter and spring, I have often looked forward with feelings of alarm to the approach of summer, and the effects of its scorching sun, especially when examining the filthy beaches, the unwholesome condition of cattle-folds, slaughtering-places, and graveyards, in the latter of which might have been seen, every day during winter, several bodies placed in one shallow grave, and but scantily covered with earth. The favourable way in which the summer has passed, appears to me to be entirely due to the exertions of the Sanitary Commissioners who, on the first appearance of the epidemic, in May, immediately instituted the most active measures for its suppression. This was done by directing Admiral Boxer's attention to

the necessity for every ship in the harbour being visited by competent medical officers, to ascertain the actual amount of disease in the harbour, to institute sanitary measures, and to leave directions with the masters, in the event of bowel complaints occurring on board their vessels.

The ships were afterwards divided into three divisions, and a medical officer appointed to each, who made a daily ship-to-ship visitation, attended to all cases that occurred, saw that all sanitary measures of cleansing, ventilation, &c., were carried out, and that early attention was paid to bowel complaints. These measures were very efficient, in spite of the continued unwholesome condition of the eastern beach and other places, near which most of the fatal cases occurred. It is to be lamented, that a good corps of at least 300 labourers, for filling-up and improving the surface, was not provided, in order that these important measures might have been completed early in May, instead of permitting the surface to remain in so unhealthy a state.

It would be a measure of some importance in the management of a closely crowded harbour, to have a convenient place established where any master of a ship could apply for proper remedies for any prevailing epidemic, for it is seldom that the most suitable medicines are to be found in the chests of merchant ships. It has often happened to me, on being called to a case of cholera, perhaps in a state of collapse, to find that generally castor-oil, often rhubarb, and sometimes salts and senna, had been given to the patient. It would be advisable to include some such provision in the harbour regulations.

EDWARD NOLLOTH, ESQ., M.D., Surgeon, H.M.S. "LEANDER."

May.

19th.—In consequence of an order received from Admiral Boxer I proceeded to examine the ships on the south-east side of the harbour, between the entrance of the harbour and the Ordnance Wharf. On this date I found no cholera or other disease of any importance. One of the principal measures suggested for maintaining a healthy condition of the crews, was to keep as few ships as possible in the harbour.

27th.—Made arrangements with Messrs. Walling and Costello, as to the division of the shipping which each of us was to take under our charge. It was agreed that I should have charge of the north-west side of the harbour.

28th.—Visited the "Medora," and found two cases of diarrhœa on board. This ship was lately purchased for a coal depôt, and is as clean as could be expected.

On board the "Daring" found the master suffering from diarrhœa, and one case of intermittent fever.

Called to the "Koh-i-noor," with ordnance stores aboard, to a case of cholera, which died in the course of the night.

29th.—Inspected the "Rose Gasparin," (Austrian), laden with barley and hay. Ship clean, but the berths confined, and the ham-

mocks hanging up. Ordered them to be removed during the day. Boarded also two small Italian vessels with chopped straw, &c. Found them quite clean and the crews healthy. Inspected a Turkish brig, and found her healthy; also the "Messenger," clean and healthy. These vessels were lying in Leander Bay. Inspected the "Ariel," "Æolo," (Greek), "Forth," "Helena," "Neapolitan," "Junius," "Imperiale," (Austrian), "Surinam," on board of which I discovered two cases of diarrhœa; "Sorti," (Maltese), which had one case of diarrhœa, "Paulina," (Austrian), "Ethernus," (Servian Danube), on board which there were two fever cases, an Austrian vessel in which there was one case of intermittent fever, and found two cases of diarrhœa on board the "Orion." All of these ships were perfectly clean.

30th.—Visited all the sick on board ship. Inspected the following vessels, "Tempe," (Neapolitan), "Armadigge," (Austrian), "Trovatore," (Maltese), "Sylvan," "Teresa Hanna," (Austrian), "Circassian," "Nova Pietà," (Neapolitan), "Fannia," (Turkish), "Aurora," (Austrian), "Elizabetta," (Neapolitan). Found on board these ships three cases of diarrhœa and two cases of fever. Inspected, also, eight or ten Turkish large boats, and found them quite clean and the crews healthy.

31st.—Visited the vessels on board of which there were sick. Inspected the "Koh-i-noor," on board of which there were two cases of diarrhœa; also the "Duna," "Maria di Porto," (Austrian), and "Staatzrath von Rock," (Mecklenburg); also the "Talavera," with ordnance stores and some horses on board. There were several cases of choleraic diarrhœa on board, and the ship did not look very clean.

June.

1st.—Reported to the Admiral that the north-western side of the harbour is in a satisfactory condition, a small quantity of offal only having been occasionally seen, and the border of the harbour being free from offal or filth of any kind. Visited the ships with sick on board, and found all progressing favourably.

Visited the "Paramatta," lying at the upper part of the harbour, and found five cases of choleraic diarrhœa. She is being loaded with dirty blankets, linen, &c., to take to Malta to be washed. Spoke to the Admiral to send her to sea as soon as possible. Inspected the "Bella Leandra," (Sardinian), "Lillydale," "Giuseppe Secondo," (Austrian), "Prince Oscar Frederick," (Norwegian), and "Staatzrath von Rock." Two cases of diarrhœa on board these vessels. There was a case of cholera on board the "Gutmansthal" in the afternoon.

2nd.—Visited the ships with sick on board, and found them all going on favourably. Eight cases of diarrhœa and four of intermittent fever under treatment.

3rd.—Visited a case of cholera on board the "Duna," and another of choleraic diarrhœa on board the "Paramatta;" a case of cholera occurred on board the "Elizabetta," (Neapolitan), and another case of cholera on board the "Corfu." There was also another fresh case of diarrhœa on board the "Lillydale." Visited the ships with sick on board.

4th.—Inspected the "Koh-i-Noor," and found several cases of

choleraic diarrhœa. The "Duna" is ordered to sea. A severe case of choleraic diarrhœa was found on board the "San Nicolai;" there was also a case of fever on board the "Diana."

Admiral Boxer was seized with cholera to-day on board the "Jason," outside the harbour; he had had diarrhœa the previous day. A case of cholera occurred on board the "Edward."

5th.—Admiral Boxer died at 12:30 A.M.. Case of cholera on board the "San Nicolai." Visited the vessels with sick on board, also several newly-arrived Austrian ships. A new case of diarrhœa on board the "Pigeon."

6th.—A case of cholera on board the "Koh-i-Noor." Another case of cholera on board the "Lillydale;" also a case of continued fever on board an Austrian ship. Visited all other sick cases.

7th.—Several fresh cases of diarrhœa on board the "Lillydale," and one case of cholera. "City of London," one case of cholera. Health improving.

8th.—Visited sick ships. "Æolo," two cases slight fever. A good many ships gone outside the harbour within the last two or three days. A new case of cholera occurred on board the "Cochrane," and there was a fatal case of cholera on board the "Talavera" (there is a surgeon on board), there are several severe cases of choleraic diarrhœa on board this vessel. She is not clean. I inspected the holds and berths, and requested that they might be whitewashed.

10th.—At 4 A.M., went two miles outside the harbour to visit the mate of the "Challenger," and found him ill with cholera. Three cases of diarrhœa on board the "Osmanli." Visited sick in other ships. Another case of cholera occurred on board the "City of London," (cattle-ship), and at midnight a case of cholera occurred on board the "Rambler."

11th.—At 6 A.M., a very sudden and bad case of cholera occurred on board the "Nova Pieta." All the cases of diarrhœa, fourteen in number, on board the other ships are doing well. There are four slight fever cases of the intermittent type under treatment.

12th.—Visited the "Sally." There was one case of cholera, and five cases of choleraic diarrhœa on board. Other cases also visited.

13th.—The following new cases were visited to day—"Surinam," one case of fever (remittent), "Messenger," two fresh cases of diarrhœa, "Lillydale," one fever case, "Union," one fever case.

14th.—Three fresh cases of diarrhœa occurred on board the "Lillydale." One fresh case of diarrhœa and one of fever on board the "Messenger." A new case of fever also occurred on board the "Rambler." Other cases attended.

15th to 16th.—Health of the harbour better. There were between these dates, twenty-two new cases of diarrhœa and one of fever on board the ships "Surinam," "Æolo," "Odin," "Queen Victoria," "Orient," "Koh-i-Noor," "Maria di Porto." One case of cholera occurred on board the "Rose Gasparin," on the 24th.

27th to 30th.—A case of choleraic diarrhœa on board the "Aurora" passed into cholera, and two fresh cases of choleraic diarrhœa occurred on board the same vessel. A case of fever, and five cases of diarrhœa occurred on board the "Gibraltar," which had just arrived with

horses and mules from Sinope. Eleven cases of diarrhœa and two cases of fever had likewise taken place on board the "Silvum," "Orient," "Odin," "Magnet," "Rose Gasparin," "Lillydale," and "Koh-i-Noor." All other cases of sickness on board ship were attended to.

July.

1st.—A case of cholera, and one fresh case of diarrhœa, occurred on board the "Rose Gasparin." Nine new cases of diarrhœa took place on board the "Odin," "Gibraltar," "Lillydale," "Orient," and "Koh-i-Noor."

2nd to 7th.—No new case of cholera. All sick attended to as usual, and the diarrhœa less severe in character. There have been fifteen new cases of diarrhœa, two cases of dysentery, and two of fever on board the "Koh-i-Noor," "Odin," "Dover," with horses on board, "Mary Ann," with troops, "Rose Gasparin," "Pekin," "Orient," "Gibraltar," and "Lillydale." The "Odin" has gone out of harbour.

8th to 18th.—During this interval there were two fresh cases of cholera, eight cases of diarrhœa, one of dysentery, and ten of fever, on board the "Pekin," "Prediola," "Civility," "Caduceus," and "Charity." The two cholera cases occurred on board the "Pekin," which was in a dirty state, and was directed to be cleaned, white-washed, and to have chloride of zinc applied.

From the 18th July till the ship visitation was finally discontinued, on the 19th September, there were treated three new cases of cholera, sixty-six cases of choleraic diarrhœa, nine of diarrhœa, nine of dysentery, and twenty-three cases of fever. During the time the cholera prevailed in the harbour, there were about 300 cases of diarrhœa on board Her Majesty's ship "Leander," which was stationed at the south-east angle of the harbour all the time.

Dr. Nolloth makes the following remarks on the results of the medical inspection of the shipping in the north-west division of the harbour.

About the 2nd June, epidemic disease in the form of intermittent and remittent fever, cholera, choleraic diarrhœa, and dysentery, made its appearance.

The suggestions made to the masters of ships were always willingly attended to, and, where practicable, carried into effect.

As far as my experience will allow me to judge, epidemic disease was found to prevail, more or less extensively, according to the greater or less apparently insalubrious position of the ship or ships. Thus, sickness has been much more rife on the south-east than on the north-west side of the harbour, which latter is quite free from the many sources of vitiation found on the opposite side.

Particular ships appeared to suffer in proportion to the greater or less neglect of their cleanliness or ventilation.

Disease, whether fever or diarrhœa, when it once made its appearance, became more general where the men were dirty, and more than usually packed together. In some instances, dirty clothes and linen, &c., had been allowed to accumulate in the bunks.

On the north-west side, the sickness was greatest in ships towards the top of the harbour, and diminished as soon as such ships were removed either to the entrance or just outside the harbour.

In some instances, the nature of the cargo seemed to exert considerable influence in the production of disease. The "Paramatta," on board of which cholera and choleraic diarrhœa continued for several weeks, had a large quantity of soiled blankets, &c., on board for conveyance to Malta. Another affected ship, the "Pekin," was a dirty and damp coal ship. Two other affected ships were loaded with patent fuel. Fever and choleraic diarrhœa were very prevalent in small vessels which had hay, chopped straw, and barley on board, and where the air was strongly impregnated with the scent of these articles.

When disease once got into a ship (English at least) where no spirituous liquors were allowed, the general health of the crews seemed to be much improved when those stimulants were prescribed. The "Paramatta," "Koh-i-noor," "Lillydale," and "Pekin," &c., were instances of this.

The cattle-ships have proved to be always the most sickly. The "Charity," one of these, had ten cases of low fever, contracted apparently, however, at Sinope, where the disease was prevalent.

It seems to be a matter of great importance, that seamen, during the prevalence of an epidemic, should be as much dispersed throughout the ship as convenient, so as to be enabled to breathe an atmosphere already vitiated, as little further contaminated by human breath as possible.

T. M. COSTELLO, Esq., Surgeon, R.N.

May.

24th.—I have this day arranged with Dr. Nolloth, Surgeon of Her Majesty's ship "Leander," and Mr. Walling, Surgeon of Her Majesty's ship "Wasp," to undertake for my share of the labour the medical charge of all the transports and private vessels lying on the south-eastern shore of the harbour, and extending from the Railway store to Castle Point, at the entrance of it.

The first step I took was to make a ship visitation, to ascertain whether they were clean, to suggest that where the crews lived be whitewashed, to cause wind-sails to be hoisted, to recommend the employment in the holds (more especially where the bilge water had an offensive smell) of the various deodorants in their possession, whether Sir William Burnett's solution of chloride of zinc, or Crewe's disinfectant fluid, to apply for medical assistance early in cases of diarrhœa, and, finally, to point out what measures to adopt in case of cholera till medical assistance could be procured.

For the week previous to the appearance of the epidemic, diarrhœa was more prevalent than usual. Between the 21st and 24th May six cases of cholera occurred: of the six cases, five happened on board of the steam transport "Chester," laden with charcoal, and lying close to the Ordnance Wharf, where animal and vegetable decomposition is always going on, and where a most offensive smell, more particularly during the night, is observable. The accommodation for the crew was better than is usually to be found in vessels of her class; the water was good and ship clean. I immediately caused the apartment occupied by the men to be cleaned and whitewashed, wind-sails to be

hoisted, the sufferers to be sent to the Military General Hospital, and at my recommendation, the Principal Agent for Transports sent her to anchor in the bay. No fresh case of cholera occurred subsequently, but there were five cases of diarrhœa, which readily yielded to ordinary treatment. Four of the five cases of cholera terminated fatally I have since learnt.

The other case of cholera occurred on the 23rd of May, on board the transport "Clifton," laden with a quantity of shot and shell, lying in the tier under the Castle, in a man who had been employed previously on boat service, and who had spent much of the time close to the wharves at the north-western end of the harbour. This case terminated fatally.

25th.—Fifteen cases of diarrhœa under treatment to-day. No case of cholera in my district. Visited the "Sir John Easthope," "Mary Anne," "Royal Victoria," "Cumberland," "Nymph," "Belgravia," "Clifton," "Edward," "Earl of Shaftesbury," "Stephen Huntly," and "Alster."

26th.—One case of cholera occurred on board the "Alipone," horse transport, lying close to the Ordnance Wharf. Ordered the place where the men slept to be whitewashed, the between decks to be scrubbed and whitewashed, wind-sails to be hoisted, and the ship to be pumped out.

There are, in addition, two cases of diarrhœa, and one of intermittent fever.

Recommended to Captain Heath that as few vessels as possible be kept in the harbour, and likewise pointed out to him what a prolific source of disease existed while dead animals were floating about the harbour.

27th.—A little in excess of the average number of sick, owing to the increase of diarrhœa and febrile complaints. No fresh case of cholera in my district.

The masters of transports generally are very ready to carry out all sanitary suggestions. Six fresh cases of diarrhœa.

28th.—One case of cholera occurred on board the "Gomelza," a transport, laden with chopped straw, and lying close to the Vegetable Wharf, where the stench from the decomposition of onions is so offensive, that it invariably produces nausea in my own person. There was premonitory diarrhœa, for which the man neglected to take any remedy. The ship was clean, the water good and provisions wholesome. Ordered the men's accommodation to be whitewashed, a solution of chloride of zinc to be sprinkled on it, cloths saturated with it to be suspended from the beams, and some poured into the hold. Three fresh cases of diarrhœa.

29th.—One case of cholera occurred on board the "Edward," transport, laden with bread and pork, and lying in the tier under the Castle. The ship is clean and free from any offensive smell. This man ultimately recovered. Four cases of choleraic diarrhœa on board of the "John Bowes," steamer, lying close to the Ordnance Wharf; and two cases of choleraic diarrhœa in the "Lion," cattle steamer, lying also close to the Ordnance Wharf.

30th.—One case of cholera on board of the "Lion," at the

Ordnance Wharf. The master reports to me, that the smell from the shore at night is sometimes almost insupportable.

June.

1st and 2nd.—On neither of these days did any cases of cholera occur in my district. Some cases of fever in the steamers employed carrying cattle. Hitherto these vessels were prohibited from throwing overboard (it being contrary to the harbour regulations) the dung, &c., which remained after the cattle were landed, but as sometimes considerable delay occurred in the coaling of these ships, it followed that the crews were exposed during this period to the effluvia from these accumulations.

The rule at present observed, is for these vessels, immediately they land their cargoes, which occupies generally from one to three or four days, to proceed out of harbour, and there throw overboard all dung, &c., clean the between decks, and then return to harbour and coal if they require any. A manifest improvement in the health of the crews results from this sanitary measure. There are but few of these ships in which intermittent fever does not exist.

3rd.—One case of cholera in the hired vessel "Persagno," lying off the railway saw-mill, amidst a crowd of shipping, where the entrails of animals killed on board ship lie floating about in a state of decomposition. The "Belgravia," transport, lying near the last named vessel, has six cases of diarrhœa, two of continued fever, and one of scurvy. Some others of the crew have a scorbutic taint. The accommodation on board this ship is commodious, dry, and well ventilated. I have recommended a daily issue of 1lb. of potatoes, and 4oz. of lime-juice to the men with a scorbutic taint, and 1 oz. of lime juice three times a week to the remainder of the men.

4th.—Admiral Boxer was seized with cholera this morning, on board of the steam transport "Jason," at anchor in the bay, whither he had removed at my suggestion on the 1st; he at that time having been suffering from diarrhœa. His case terminated fatally twenty-three hours after the seizure. A fatal case had happened in the vessel he had been previously living on board of.

5th.—Two cases of cholera in the "Isabella Blythe," hired vessel, laden with grain, lying close to the beach near the railway saw-mill. I mainly refer these cases to the unhealthy locality where the ship lies. Many of the cases of diarrhœa under my treatment, present a choleraic type to-day.

6th.—A good many ships have been sent out of harbour, and offensive matters floating about that have hitherto escaped observation are now easily seen, and are being removed. Seven fresh cases of diarrhœa.

7th.—Scorbutic cases on board "Belgravia" decidedly improved under the use of the potatoes and lime-juice. A marked amendment also in the cases of diarrhœa on board her.

8th.—Two cases of cholera to-day; one on board of "City of London," which terminated fatally. This man was moribund when I was called to see him, and I learned that he had laboured for some days under premonitory diarrhœa. The other case occurred on board of

the hired vessel "Tonka," lying abreast of the Commissary-General's house. The place in which the men are berthed on board of this ship is very confined, the external air having access only through a small square hatch on the upper deck. Two cases of choleraic diarrhœa on board of the cattle steamer "Lion." Three cases of fever under treatment progressing favourably.

9th.—Two cases of cholera to-day; one on board of the "New Pelton" steamer, laden with rum, and lying close to the beach in front of the commissariat stores, where some barley is lying in a state of fermentation. The ship is clean and sweet, but the smell from the shore is highly offensive. There are likewise three cases of diarrhœa, two of them choleraic. Upon my suggestion, this vessel was sent out of harbour at once, to lie in the bay. The other case of cholera was on board of the "Cochrane" horse transport. He was in a state of collapse when I saw him, and died shortly after being removed to hospital. There are two cases of choleraic diarrhœa on board the French brig "Actif," lying close to the railway saw-mill, where offensive smells always exist.

10th.—Visited "Sultana," "Wallace," "Daring," "Cumberland," "Lion," "Earl of Shaftesbury," "Edward," "Star of the South," "Gauntlett," "Kangaroo," "City of London," and "Royal Victoria." Two cases of cholera to-day; one on board the "City of London," lying close to the beach, and to the northward of the Ordnance Wharf, and the other on board the "Royal Victoria" cattle steamer, lying at the Cattle Wharf. The latter vessel has very bad accommodation for her crew, and on my suggestion the after-steerage is to be occupied by all men unfit for duty. Three of her crew are suffering from diarrhœa, and one from intermittent fever. "Kangaroo," cattle steamer has three cases of diarrhœa, and one of fever. "Sultana" has three cases of diarrhœa.

11th.—Four cases of diarrhœa on board the "Protomelia;" one case of cholera on board the "City of London," lying in the same locality as indicated yesterday; one case of diarrhœa on board the "Snowdown" steamer, lying at the Ordnance Wharf.

12th.—Four cases of diarrhœa on board the "Mary Gibson," lying in the tier under the Castle; five cases of diarrhœa on board the "Gauntlett." Both ships are very clean, but the crews are much exposed to the sun in performing ship's duties. In all instances where cholera appears in a ship, I order whitewashing, the employment of whatever deodorants they possess, and the most efficient means of ventilation.

13th.—One case of cholera on board the "Cumberland" cattle steamer, lying at the Cattle Wharf. She has, in addition, three cases of diarrhœa, one of continued, and one of intermittent fever.

14th.—One case of cholera to-day on board the "Gauntlett," laden with ammunition, and lying close under the Castle, where there is an accumulation of feculent matter. The subject of it is an old man, and the case terminated fatally. Visited "Gauntlett," "Snowdown," "Vigilant," "Cumberland," "Royal Victoria," "Edward," "Mary Gibson," "Earl of Shaftesbury," and "Star of the South." Two cases of diarrhœa on board the "Cumberland" cattle steamer. There is at all times a most unpleasant ammoniacal

odour in the cattle steamers, from the urine of the animals saturating the ballast, or whatever lies at the bottom of the vessel. I have recommended water being poured in, and then discharged, but it does not remove the odour.

15th.—“Phoenix,” one case of dysentery and two of diarrhœa; “Dinapore,” three cases of diarrhœa. The cases of diarrhœa on board the “Gauntlett” are improving, as likewise those on board the “Edward.” Sent a case of continued fever to hospital from the the “Royal Victoria” cattle steamer.

16th.—One case of cholera occurred on board the “Levant,” which I sent to hospital; one case of diarrhœa on board the “Eliza;” and three in the “Snowdown” steamer, lying at the Ordnance Wharf.

17th and 18th.—A considerable reduction in the number of cases under treatment, but referable, in some measure, to the diminution of the number of vessels in my district. No new cases;—discharged to duty many of the diarrhœa cases.

19th.—The cases of diarrhœa on board the “Earl of Shaftesbury,” “Star of the South,” “Edward,” and “Protomelia,” are slightly improved. There is very little animal matter floating about in my district; and I have urged upon the masters of transports to cause the men who kill sheep, &c., on board their ships, to remove the entrails, &c., without the harbour.

20th.—No new cases to-day.

21st.—One fatal case of cholera occurred on board the steamer “Gibraltar,” lying on the northern shore; “Kangaroo,” cattle steamer, two cases of dysentery.

22nd.—Two cases of cholera to-day. One on board the steamer “Rajah,” lying in the crowded tier under the Castle. The accommodation for the crew on board of this ship is very confined, owing to the large number of men she carries. The other case occurred in the foreign ship “Odin,” where the men live in a place to which air has access only by means of a small hatch. There are two cases of diarrhœa in the “Prompt,” one case of fever and three of diarrhœa in the “Cumberland” cattle steamer.

23rd.—Visited “Star of the South” “Prompt,” “Kangaroo,” “Gauntlett,” “Earl of Shaftesbury,” and “Oscar.” Three cases of diarrhœa in the “Oscar,” four in the “Kangaroo,” and one in the “Gauntlett.” Enjoined the masters to a strict attention to cleanliness and ventilation.

24th.—No cases of cholera.

25th.—“Royal Victoria” cattle steamer, three cases of diarrhœa, and one of intermittent fever. No other cases to-day. The cases of diarrhœa which occur in the stationary ships are almost confined to the boat’s crews, who spend much of their time on the beach, and who have, therefore, facilities for committing excesses in drinking which those on board do not, fortunately, enjoy.

26th.—Two cases of cholera to-day; one the master of the “Black Boy” steamer, lying in the bay, and recently returned from Malta, whither she had gone with a cargo of winter clothing that had been used by the army. He had premonitory diarrhœa of many days’ standing, which he neglected. The case terminated fatally. The

other case occurred on board of the "Cormorant," horse steam transport, just arrived, and lying near the sawmill. The case terminated fatally. There are, likewise, three cases of undeveloped fever in this vessel.

27th.—One case of cholera on board the "Phoenix," and three cases of diarrhœa; two cases of choleraic diarrhœa in the steamer "Hollander," laden with ammunition, and lying under the Castle. The accommodation for the crew is very crowded, and I have suggested that some of them should sleep on deck, under an awning, and likewise a better observance of cleanliness where the men are berthed. Four fresh cases of diarrhœa on board the "Edward," one case of fever in the Spanish steamer "Calabria," horse transport, lying at anchor on the northern shore.

28th.—One case of diarrhœa on board the "Zealous," and one of dysentery in the "Earl of Shaftesbury."

29th.—No fresh cases to-day; remaining ones progressing favourably.

30th.—One case of dysentery and one case of diarrhœa on board the "Kangaroo" cattle steamer. Harbour much cleaner of offal than I have observed it to be hitherto. When it was more crowded, offensive matters floating about escaped the notice of those whose province it was to tow them out to sea.

July.

1st.—Marked improvement in the sanitary condition of my district; no new cases to-day.

2nd.—Two cases of diarrhœa on board the "Louisa," one of them with choleraic symptoms. No other fresh cases.

3rd.—Two cases of diarrhœa in "Metropolitan" steamer.

4th.—The choleraic type which many of the cases of diarrhœa presented, has disappeared, and they yield to one or other of the usual remedies.

5th.—One case of diarrhœa in the "Albatross." The two cases of diarrhœa formerly reported in the "Hollander" steamer have assumed a dysenteric type, and appropriate treatment has been adopted.

6th.—Five cases of diarrhœa on board the steamer "Oscar," and one of fever. No cases of cholera, that I can hear of, in the harbour. The greater cleanliness observed, and the thinning of the shipping, has, I believe, contributed to [this improvement in the health of the crews of the transports.

7th and 8th.—No fresh cases of any description.

9th.—Two cases of diarrhœa in the "Albatross," one in the "Dinapore," and one in the "Lion." Sanitary state of my district satisfactory.

10th.—One case of dysentery in the "Caroline," cattle-steamer. No new cholera cases to-day. Visited a large number of ships, and enjoined a continuance of those sanitary observances hitherto in use, and which are being attended with such satisfactory results.

11th.—One case of diarrhœa in the "Mary Eleanor," two in the "Helen," and two in the "Prompt." There is no urgent symptom in either case.

12th.—Two cases of diarrhœa in the “Prince of Wales” steamer, just arrived from England with ammunition and clothing. One of the cases of diarrhœa presents some choleraic complications which I have not observed for many days. The ship is clean, and the water good. I regret much to see the harbour filling again, leading, as it does, to the presence of offal, &c., between the ships, the crowded state of which, preventing the authorities from tracing the offenders, and of discovering even, in all instances, the nuisances.

13th.—Two cases of choleraic diarrhœa in the “Rajah” steamer, and one in the “Wide Awake.” Cases on board “Prince of Wales” much improved.

14th.—Two cases of diarrhœa in the “Cumberland.” The steamers employed carrying cattle, are the most unhealthy vessels in my district. The prevailing diseases on board of them are intermittent, remittent, and continued fever, diarrhœa, and dysentery. They are seldom in harbour more than a few days, say from two to seven days. There is at all times a pungent ammoniacal odour in them, from everything in the lower hold being saturated with the urine from the animals, and which no washing, or pumping out of the hold entirely removes. Zinc is used plentifully in these ships.

15th.—I was this day requested to inspect the steamer “Emperor,” recently arrived from Alexandretta, with horses. This ship is clean, considering she has so recently discharged her cargo. The accommodation for the crew is spacious and well ventilated, the water is good, and fresh provisions have been issued for many days. While at Alexandretta, three cases of intermittent fever occurred, and no new cases occurred till some few days after her arrival in the harbour of Balaklava. She was seven days on the passage. There are now twelve cases, five being intermittent and seven remittent. Instead of sending this vessel for another cargo of horses to some ports near at hand, I recommended her being sent to Malta in the place of some other vessel intended for that destination, which has been acted upon.

16th.—One case of dysentery on board the “Baraguay d’Hilliers,” and one on board the “Ormelié.” No cases of cholera have occurred in my district since the 27th of June.

17th.—Two cases of diarrhœa on board the “Wide Awake.”

18th.—One case of choleric on board the “Carl Henrich.” No fresh cases to-day.

19th.—One mild case of fever on board the “Walmer Castle.” This ship is kept clean; but I learn that her crew have been very sickly. She has been lying in harbour for many months, close to the Engineer’s Store.

20th.—One case of diarrhœa on board the “Mandarin,” and three cases on board the “Ayrshire.”

21st.—One case of diarrhœa on board the “Amelia.”

22nd.—Two cases of diarrhœa on board the “Cormorant,” and one in the “John Bull.”

23rd.—No cases of cholera have occurred in my district since the 27th June, a period of twenty-six days.

Total number of cases of cholera, thirty-two; of whom six re-

covered, twenty died, and six whose fate I have not learned. I am unable to give the total number of cases of diarrhœa and fever, as the vessels in which many of them occur, are suddenly ordered to sea, and I thus lose sight of them for a time. In conclusion, I have to observe, that much benefit has resulted from the sanitary measures adopted in the harbour since the invasion of cholera.

From this period, weekly returns of sick on board ship were made out by Mr. Costello, from which it appears that during the week ending July 2, five cases of cholera, forty-one of diarrhœa, four of dysentery, and ten of fever were under treatment.

During the week ending the 16th July, there were twenty-nine cases of diarrhœa, seven of dysentery, and fourteen of fever under treatment; and for the week ending the 23rd, thirty-five cases of diarrhœa, four of dysentery, and seventeen of fever were treated. There was a new case of cholera, in the course of the following week ending July 30th. There were also twenty new cases of diarrhœa, three of dysentery, and three of fever.

During the next three weeks ending August 19th, there were about sixty new cases of diarrhœa, eight of dysentery, and twenty-eight of fever; and during the week ending the 19th, there were two new cases of cholera, which were the last that occurred in this division of the harbour.

The other forms of zymotic disease, still continued however, and between the 19th of August and the 19th September, when the ship inspection ceased, there were seventy-one new cases of diarrhœa, twenty-six of dysentery, and twenty-seven of fever brought under treatment.

No. VII.

ABSTRACT of STATEMENT of WORKS executed at Scutari under MR. HUGH UNSWORTH, Surveyor to the Sanitary Commission, and Abstract of the Labour employed thereon from November 11, 1855, to May 12, 1856.

November 1855.

Mr. Unsworth, having reached Constantinople from England on the 11th November, commenced operations on the 17th, and ascertained the probable yield of water from the wells at Haidar Pascha. Levels were then taken to ascertain the gradients of the drainage proposed to be laid down, and the whole of the works and buildings at Haidar Pascha were inspected in company with Dr. Sutherland and Major Gordon, R.E. From the 20th to the end of the month, the Engineer was engaged in the preparation of a detailed plan showing the proposed drainage works at Haidar Pascha, and of a report upon the contemplated sanitary improvements, in accordance with general instructions he had received from Mr. Raw-

linson before leaving England. The report having been submitted to Major Gordon, who made his written comments thereon, was finally laid before Dr. Sutherland, and sent by him to Major-General Storks for approval.

December.

On the 6th December, the sailing transport, "Mary Ann," arrived at Scutari, bringing out thirty-four workmen of the Army Works Corps, masons, bricklayers, carpenters, blacksmiths, fitters, and labourers, and a selected cargo of materials for the proposed improvements to be executed under the Sanitary Commission.

Various obstacles prevented the discharge of the "Mary Anne" till towards the end of the month. During the end of December and the commencement of January, there were employed in this duty:—

Workmen	26 days
Soldiers on fatigue . . .	36 „
Native Labourers . . .	139 „
Arabas	51 „

The first work on which the carpenters, who had come out by the "Mary Anne," were employed, was that of building the required hut accommodation for the workmen.

As a large cavalry camp was being formed at Haidar Pascha, and the roads were in an extremely defective state, the Surveyor commenced the construction of the roads, at the request of Major-General Storks; and during the latter portion of December, he was enabled to bare the rock, to obtain the necessary materials for the new road at Haidar Pascha, to work and cart stone from the quarry to Haidar Pascha, and to form 130 lineal yards of footpath.

The labour engaged was as follows:—

Soldiers on fatigue . . .	554 days
Arabas	6 „
Donkeys	70 „

Before commencing the road, it was necessary to drain the ground, for the double purpose of improving the sanitary condition of the area to be occupied by the camp, and for protecting the roads. Accordingly, 730 lineal yards were laid with three and four-inch tile drains, brushwood and broken stones being filled in above.

January 1856.

The work of road-making was rapidly proceeded with during the month of January, 1,320 superficial yards having been formed, and covered with ballast nine inches thick, and with broken stones four inches thick. On this work, and in the carting of materials from the cemetery and the sea beach to Haidar Pascha, the following men and materials were employed:—

Workmen	156 days
Soldiers on fatigue . . .	1,264 „
Native Labourers . . .	7 „
Mule Carts	204 „
Donkies	74 „

It was found necessary to build a sea wall, six feet high, at the

point where the sewerage was to be discharged; and during January, in preparing the foundation and cutting stone for the wall, there were engaged:—

Masons and Workmen	49 days
Native Labourers	82 „

The first of the new sewers commenced was one of 15-inch earthenware circular drain-pipes; the cutting of the trench for this sewer, during January, occupied:—

Workmen	82 days
Native Labourers	271 „

The road near the harem and the Palace Hospital being flooded and impassable in wet weather, it was determined to make an open water-course, 120 yards long, to carry off the superfluous water, and drain the road.

The labour employed at this point, during January, amounted to:—

Workmen	24 days
Soldiers on fatigue	22 „
Turks	6 „

The carriage of stoneware pipes from the quay, after being landed from the “Mary Anne” to the Palace and Barrack Hospital, was effected by:—

Workmen	12 days
Native Labourers	51 „
Soldiers on fatigue	43 „
Mule Carts and Arabas	29 „

The carpenters and four masons of the Army Works Corps continued to be employed in preparing the requisite hut accommodation for the men, and in putting up workshops for their use at Haidar Pascha.

At the Barrack Hospital, the Surveyor prepared a plan, and made out an estimate of the works and water supply, to guard against the chances of fire at the hospital and barrack buildings.

February.

The construction of the roads at Haidar Pascha was continued during February, when 1,080 superficial square yards were prepared, and covered with broken stone, four inches thick. The ground was thorough drained with four-inch tiles; 280 yards of footpath were also formed and metalled. These works, and the procuring and carting of the broken stones, and other necessary materials, employed the following labour, &c.:—

Workmen	73 days
Soldiers on fatigue	847 „
Native Labourers	30 „
Mule Carts	155 „

The following drainage works were executed this month:—

Cutting trench, and laying 520 lineal yards of 15-inch pipe, from five to eight feet deep, building three man-holes, each three feet six inches diameter, with stone invert, one having a metal, and the other two wooden covers.

Cutting trench, and laying 110 yards of 12-inch pipe, from four to five feet deep, with two man-holes, at the Barrack Hospital.

Laying 340 yards of 6-inch drain pipe at Albert Row, and fixing one gully, two man-holes, and twelve stench-traps to receive the refuse waters from the huts, also conveying into the new sewer, the refuse water formerly discharged into the valley between Albert Row and Victoria Barracks.

The works above described were executed by:—

Workmen	99 days
Native Labourers	485 „

Dressing stone for man-holes, and building thirty yards of sea wall, six feet high, with coping, dressed stone invert, and a cover at the mouth of the sewer, the apron being twelve feet long and eight feet wide, employed the following labour and carriage:—

Masons and Bricksetters	69 days
Native Labourers	33 „
Mule Carts	4 „

Additional watering troughs being needed for the cavalry horses at Scutari, the requisite quantity were constructed by:—

Carpenters	15 days
Masons	2 „
Soldiers on fatigue	8 „

Some of the private quarters at the Barrack Hospital were provided with soil-pans and flushing cisterns, and connected with the drain at Albert Row.

Six soil-pans were also fixed at the south-west angle of the Barrack Hospital, with a supply of water from the Turkish cistern.

Four soil-pans, three kitchen-sinks, three stench-traps, a flushing-cistern, and eighty yards of 6-inch pipe-drain, were placed at the huts of the workmen.

The labour employed on all of the above alterations and new constructions during the month of February was as follows:—

Carpenters	108 days
Native Carpenters	33 „
Bricksetters of the Commission	37 „
Fitters	22 „
Labourers	34 „

March.

Draining and forming roads at and near the hospitals continued during March. About 900 lineal yards of surface drains were laid in places where the ground was impassable for either man or horse. 480 square yards of new road were completed and covered with broken stone, four inches thick. The footpath was continued at Haidar Pasha, and about 1,300 yards of the old road near the harem of the Palace Hospital were covered with broken stones.

The execution of the above, together with getting and breaking stone, and the carriage of the same, occupied the following labour, and carts:—

Workmen	22 days
Soldiers on fatigue	520 „
Native labourers	177 „
Mule carts	130 „

The drainage works were also continued, and a 9-inch pipe sewer laid, 320 yards in length, and four feet deep, with two man-holes. An old Turkish drain was taken up, the refuse deodorized, fresh earth filled in, and the place flagged over.

There were employed on the above during the month :—

Workmen	32 days
Bricksetters	10 „
Masons	4 „
Native Labourers	282 „

The privy accommodation at Haidar Pascha and at the Barrack Hospital, was extensively rearranged during this month. At the former an old latrine was provided with proper flushing apparatus, and accommodation for ten men at a time.

At the Barrack Hospital thirty-six soil-pans, with new seat boards, and six urinals (all with flushing cisterns, and 6-inch vertical soil pipes discharging into a horizontal 9-inch pipe sewer), were put up in the north-east angle of the building. The floors of the closets and urinals were laid with flags, gutters formed in the floor to take away the surface water; down pipes and stench-traps, being also provided.

To supply the soil-pans and urinals a flushing cistern, capable of holding 2,000 gallons, was constructed and put up, with pipes and valves complete. A pump and pipes were also attached for the purpose of supplying the cistern with water, and fourteen new and fourteen old doors were put on to the closets and urinals.

The labour engaged on the above works during the month of March, was as follows :—

Carpenters	188 days
Masons,	47 „
Bricksetters	75 „
Fitters	17 „
Labourers	71 „
Native Labourers	93 „

On the sea-wall at the outlet of the sewerage, and in the constructing of a man-hole and inspection shaft for the 9-inch sewer, the following workmen were engaged :—

Masons	33 days
Bricksetters	15 „
Labourers	8 „
Native Labourers	49 „

The sailing transport “Alceste,” having arrived in the Bosphorus with a supply of deals for the works under Mr. Unsworth’s charge, the following men were employed in discharging her :—

Workmen	14 days
Turkish Labourers	25 „

In assorting drain pipes for use, there were engaged :—

Native Labourers	43 days
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and in pitting horse dung, which had accumulated from the Cavalry Barracks in such quantities as to become a nuisance:—

Military Prisoners 38 days

April.

During the month of April, the greater part of the labour at the disposal of the Sanitary Commission was employed in replacing the Turkish privies at the Barrack Hospital with soil-pans, with the requisite fittings and connections to afford them a good and plentiful supply of water. Two additional latrines were also constructed with provisions for cleansing the soil-boxes with the hose of the fire-engine, this means of flushing having been tried and found to answer very well.

The labour employed on the above work during April was as under:—

Carpenters	367 days
Bricklayers	190 „
Masons	169 „
Fitters	31 „
Labourers and Navvies	90 „
Native Labourers	155 „

The drainage work consisted of cutting a trench for, and laying 280 lineal yards of 9-inch pipe, and of cutting, laying, and filling in of about 700 lineal yards of surface drains, the materials employed for the latter being bushes, broken stones, and earth.

The men employed were:—

Carpenter	1 days
Navvies	101 „
Native Labourers	309 „

The construction of man-holes for the drains employed:—

Carpenters	13 days
Bricksetters	11 „
Masons	9 „
Native Labourers	6 „

There being nuisance from the stable manure, and difficulty being experienced in burning it in heaps, it was determined to construct one or more furnaces with the view of consuming the manure more speedily and effectually.

The construction of the furnaces, and the burning of the manure occupied the following labour during the month of April:—

Bricksetters	28 days
Carpenters	22 „
Masons	4 „
Navvies	71 „
Native Labourers	114 „

May.

In consequence of the news of the peace, the works of the hospitals were suspended early in the month.

From the 1st to the 12th, the works in progress consisted of laying a further length of 9-inch pipe at Haidar Pascha on which there were engaged:—

Navvies	36 days
Native Labourers	27 „

The construction of furnaces, and manure burning, engaged:—

Bricksetters	31 days
Carpenters	10 „
Navvies	31 „
Native Labourers	6 „

The construction of the water-closets at the Barrack Hospital occupied the following amount of labour:—

Carpenters	63 days
Masons	23 „
Plasterers	7 „
Bricksetters	6 „
Fitters	2 „
Navvies and Labourers	14 „

No. VIII.

REPORT on the Sanitary Condition of the ROYAL NAVAL BRIGADE, before Sebastopol, in the Winter of 1854-55. By WILLIAM R. E. SMART, M.D., late Surgeon to the Royal Naval Brigade Hospital, Balaklava.

As the Royal Naval Brigade, whilst serving in the Crimea through the severity and privations of the winter 1854-55, possessed an unquestionably better sanitary condition, and showed a much less amount of mortality by the same types of disease, than the main body of the army, of which it was an integral part, it has been suggested that those facts in its history that seemed to influence the general health of the seamen may contain some useful teachings towards the amelioration of the causes of disease that exist or are generated among men long stationed in camps.

The information collected in this paper is derived partly from casual notes made by myself during the period in question, and partly from such intelligence as I have been able to amass from officers and men who served with the Brigade through the siege of Sebastopol.

To present the data so as to facilitate the arrival at definite conclusions, they are arranged under several heads:—

I.—The predisponents to health or to disease affecting the seamen, previous to their disembarkation.

II.—The comparative frequency, in each month, of those diseases peculiar to the situation, and the mortality attending them, the only standard of which, that I am able to render, as one complete in itself, is from the list of men sent to my charge for hospital treatment.

III.—The nature of the clothing and diet provided for the Brigade, the amount of labour performed, and the degree of exposure undergone by the seamen. And—

IV.—Deductions from the data thus arranged, of those circumstances that may be reasonably advanced as most conducive to superiority of sanitary condition.

On the first head it is to be noted that as the army embarked at Varna in the last week of August, and the fleet sailed from Baljik on the 6th of September, the seamen continued to enjoy a diet of fresh meat and vegetables a week later than the soldiers.

At the time of sailing, the cholera had become extinct in the ships of war, but it was introduced into some of the transports among the troops, and continued to display cases among the regiments throughout the voyage to the Crimea.

The army landed at Old Fort on the 14th of September. It fought the battle of the Alma on the 20th of that month, underwent unaccustomed exposure and fatigue up to the 2nd of October, which was the date of disembarkation of the Naval Brigade.

During this eventful period, the seamen were enjoying the shelter and the regularity of diet of their ships, and were, for the most part, performing their ordinary duties.

On the landing of the Brigade at Balaklava, it was at once supplied with tents, which was an advantage not yet possessed by the troops.

From these preliminaries of the campaign, it is evident that the Royal Naval Brigade commenced the winter campaign under far more favourable circumstances than the regiments with which it was allied, and was, consequently, in a much better condition to withstand the first impulse of the morbid causes generated on the camp.

In short, the seamen had been victualled on fresh meat and vegetables to a later date than the troops. They remained sixteen days later under their ordinary circumstances, undergoing no unusual fatigue or exposure, enjoying uniformity of diet, regularity of meals, and a plentiful supply of wholesome water; and as soon as they landed they obtained camp shelter.

Advantages like these, operating towards the end of autumn, must have exerted a very important influence on the sanitary state of the Brigade, or on the phenomena of disease developed in it during the ensuing winter months.

I shall now attempt to trace out, under the 2nd head, "The

Extent of Disease and Mortality," adopting as my principal source of information the monthly returns of the hospital under my charge, believing them to be a fair criterion, as they embrace all cases of severity necessitating removal from the camp, excepting, however, such as were so rapid in their changes as to prohibit an attempt at removal.

In the following table, then—

The "Number of Cases of each Camp Disease, and the Mortality in Hospital," are abstracted from the several monthly returns sent into office.

The "Mortality in the Camp" itself is derived from two sources; from the "Diamond's" Complete-book, while the Brigade was borne on her Supernumerary List; and subsequently to that, from information afforded me by Dr. Jenkins, who had charge of the camp.

The "Mortality enumerated amongst Men sent from this to their own Ships," includes every case that ever came to the knowledge of Dr. Jenkins or myself, in answer to inquiries diligently made.

The "Total Mortality from Disease" among men belonging to the Royal Naval Brigade, compiled from these sources, is as correct, and as complete as I can render it. It shows "the ratio of mortality to mean strength," but not "that of mortality to disease," as I have not at my disposal the monthly camp returns, from which alone the "total disease" can be ascertained. Therefore this table professes to give the mortality in the Brigade, and the cases sent for hospital treatment, without including the cases cured on the camp.

"The mean Strength of the Brigade" was maintained by drafts of men from ships, to fill up vacancies by death, wounds, sickness, or defaulture; and thus a greater number of men were exposed to the morbid causes extant in the camp than is indicated by the mean ratio of strength shown in the table. The information concerning victualling is the most accurate to be obtained from the "Diamond's" log, for the time the Royal Naval Brigade was borne on her books; and I am much indebted to Mr. Browne, paymaster of the Brigade, for references kindly made to his accounts for the particulars of later date.

For many valuable hints concerning the arrangement of duties in the camp, and the affairs of the seamen in battery, I have to thank Mr. Duigan, who served in the trenches several months as surgeon of the Brigade.

ROYAL NAVAL BRIGADE.—Winter of 1854-55.

Mortality from Camp Diseases.—Returns of ditto received for Hospital treatment.—Abstract of Fresh Victualling, &c.

1854-55.	Fevers.			Diseases of Digestive Organs.							Death from ditto.	Scurvy.	Rheumatism.	Frost-bite.	Total cases sent for Hospital treatment.	Total deaths in Hospital.	Victualling—Anti-Scorbutics.													
	Continued.	Periodic.	Deaths from ditto.	Collapsed Cholera.	Choleraic Diarrhoea.	Deaths from ditto.	Diarrhoea.	Dysentery.	Deaths from ditto.	Jaundice.							Phthisis.	Mean strength of Brigade.	Fresh meat supplied.	Fresh Vegetables supplied.	Lime-juice.	Oranges supplied.								
October ..	13	..	..	14	9	4	45	49	..	7	..	1,200	3,500	300	1	4	142	4	1,200	3,500	300	1	4	1,200	3,500	300	1	4
November ..	7	16	1	4	..	..	73	50	..	..	..	1,250	5,000	3,000	4	1	176	1	1,250	5,000	3,000	4	1	1,250	5,000	3,000	4	1
December ..	10	9	1	4	..	2	15	2	..	1	..	1,346	11,040	18,800	4	3	46	3	1,346	11,040	18,800	4	3	1,346	11,040	18,800	4	3		
January ..	6	3	..	..	..	..	12	9	1	..	..	1,256	6,222	7,300	5	1	46	1	1,256	6,222	7,300	5	1	1,256	6,222	7,300	5	1
February ..	1	..	..	..	..	..	2	2	2	..	..	1,030	1,433	1,446	17	2	6	2	1,030	1,433	1,446	17	2	1,030	1,433	1,446	17	2
March ..	1	..	..	..	..	..	..	..	2	2	..	1,023	3,488	3,818	10	..	5	..	1,023	3,488	3,818	10	..	1,023	3,488	3,818	10	..
April ..	..	..	..	1	..	1	..	..	..	..	1	1,333	3,930	6,357	..	2	2	2	1,333	3,930	6,357	..	2	1,333	3,930	6,357	..	2
Totals in Hospital ..	38	28	2	23	9	7	147	112	3	10	1	1,202	34,673	44,021	51	13	423	13	1,202	34,673	44,021	51	13	1,202	34,673	44,021	51	13		
Deaths in Hospital	2	7	..	3	1
" on board their own ships	2	4
" in the Camp	4	16	..	1
Total Deaths from disease between 2nd October and 30th April	8	23	..	8	1

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In this table there are some remarkable features.

Fevers were of the continued type in October, while the men were undergoing fatigue under a hot sun. In November, when the rains had set in, the prevailing type was the remittent or endemic; and after a prolonged continuance of wet, with increasing privation, and coldness of weather, the remittent fevers assumed typhoid symptoms, with complications either of pneumonia or of dysentery.

Bowel Diseases.—Choleraic disease presented its highest intensity in October, when the men were first brought into relation with the morbid causes existing among the troops. It maintained intensity to the end of December, and then declined; but its cognate and milder ally, serous diarrhœa, was not absent through the winter months. The dysenteric or inflammatory form became pathologically more severe, although numerically less frequent, after November. This increase of intensity in individual cases was owing to the introduction of the scorbutic cachexy, that greatly modified the bowel diseases, by implanting a tendency to ulceration of the mucous surface, especially of the large intestine.

Scorbutic Disease commenced in November. Its first indications were pains of the limbs, mostly of the lower extremities, and aggravated diarrhœa, often lienteric, which required, in its treatment, that regard should be had to the scorbutic taint of the system.

The cases classified "Scurvy," are here restricted to those which presented lesions of the capillary vessels, and some disintegration of the soft solids on the external surface.

As I apprehend that some of the cases classed "Rheumatism," in the early part of the winter, may have been of the scorbutic cachexy in its milder manifestations, the entries for that disease are shown in the table.

This should, however, be borne in mind, that the entries for rheumatism underwent an almost unaccountable decrease in December, cotemporaneously with the supply of warm clothing; while scurvy, in the restricted sense defined above, did not disappear until after January, subsequently to a distribution of succulent fruits, in addition to a fuller allowance of lime-juice.

Tubercular Disease.—The almost entire absence of this cachexy, is equally remarkable with the inordinate predominance of other forms of disease.

Amid so great privation and exposure, it would be natural to expect, that unsuspected hereditary predisposition would develop itself into tubercular disease of the lungs or glandular system; but from these maladies there has been, on the contrary, a remarkable exemption. During the winter months there was no case of phthisis dismissed from the brigade. In March and May there was one in each month.

At first sight, this immunity would seem to foreshow a very healthy climate, one, at all events, not propitious to the development of "tuberculosis;" this conclusion cannot, however, be accepted without further experience of Crimean winters.

Some importance attaches to this, that when causes productive of generic diseases, especially those of epidemic or of endemic origin, or of those that expend their morbid impulse on any particular set of organs are predominant, then other sets of organs possess a certain

amount of immunity from diseased actions that ordinarily develop themselves in their tissues.

Death of a part from its being frozen, termed *Gelatio*, was unseen in the Naval Brigade; the only case admitted into hospital did not go beyond the degree of "chilblain," in which, although severe, the part was restored to its natural function without loss of continuity. It occurred in the person of a negro.

This very remarkable exemption of a large body of men from the destructive effects of low temperature, that was producing great suffering among other corps encamped around them, appears to me to afford strong presumptive evidence of a higher grade of constitutional power belonging to each individual, to resist depressing causes. It will be seen too, as we proceed, that the seaman owed his safety, in this particular, mainly to his having to undergo a minor degree of exposure, while unsubjected to extreme want of suitable clothing. And with especial reference to this point, it may be remarked, that it was often observed while these things were occurring, that the seamen of the Brigade contrived a variety of coverings of sailcloth, or tarpaulin, lined with blanket, for the protection of their legs and feet. It is very probable also that sailors, who are much accustomed on board ship to go barefooted, and to stand thus in water when assisting in "cleaning decks," possess from this habitual exposure unusually strong arterial power in their extremities, and are, on that account, somewhat fortified against impressions of cold that would be locally mortal to those who have minor powers of endurance.

The table makes it very evident, that the forms of disease prevalent in October and November, declined greatly in December and January, and disappeared almost in February.

This decrease of disease was undoubtedly, in a great measure, the consequence of an improvement in diet, in which the most marked advance was made in December, when the seamen received also an adequate supply of warm clothing. The larger issue of antiscorbutics in January must have contributed greatly to the same beneficial result. The former mitigated the effects of exposure, and the latter eradicated the scorbutic taint. But an important element in the constitution of the Brigade itself, already hinted at, contributed more than any other circumstance, in my opinion, to keep up the general standard of health of the Brigade, and to produce in particular this early amelioration; it is this:—

The mean strength of the Brigade was sustained by draughts of men from the fleet, whose stamina had not been lowered by camp life. Of those men who had landed in October, there was, in addition to the constantly occurring casualties, a very large dismissal in December and January, of parts of the crews of Her Majesty's ships "Britannia," "Trafalgar," "Vengeance," "Bellerophon," "Retribution," and "Arethusa," that were about to return to England.

By this withdrawal, the effective force of the Brigade was half renewed, as at least 600 men who had gone through the worst part of the winter were replaced by others who came on the scene possessing undebilitated constitutions, to derive all the benefit of the experience of camp life gained by those of their shipmates already stationed there.

I have no data in figures to guide me, but I conceive that by this constant infusion of new men into the Brigade, the mean strength of 1,200 was made up by not less than 2,000 individuals. This is an all-important feature in contrasting the sanitary condition of the Brigade with that of any purely military body in co-operation with it.

The ratio of Mortality to Mean Strength is surprisingly small, even with all these allowances, as it is found not to have exceeded $3\frac{1}{2}$ per cent. for the winter period of seven months, or $5\frac{1}{2}$ per cent. per annum.

With reference to the cases of *death on board their own ships* inserted at the foot of the table, it may be necessary to explain, that owing to the limited accommodation afforded by the "Diamond," as hospital-ship, it became necessary, whenever overcrowding of her maindeck was apprehended, to send away to their own ships at Kazatch, or in the Bosphorus, such men as had recovered so far as to admit of removal without apparent risk or danger.

The selection of cases for removal devolved on myself, and was often performed under the pressure of circumstances; and it may have occurred that there were occasional relapses among cases thus sent away; nor is it to be wondered at that some of them may have proved more adverse than was calculated on previously to removal. Notwithstanding which, I have not heard of more than six fatal cases having occurred, and these are appended to the table as having "died on board their own ships." Making, then, the fullest allowance for such casualties, the inference may be fairly drawn from the experience of this hospital-ship, that the diseases of the Naval Brigade, in the winter of 1854-5, were not essentially of a very fatal character; and that under ordinary means of treatment, combined with proper shelter and appropriate food, the mortality was moderate.

In detailing the facts connected with the third point, viz., in estimation of the comparative influence of the circumstances usually regarded as the "exciting causes" of the diseases that prevailed through the camp, the following order will be adhered to:—

- 1st. The Victualling,
- 2nd. The Clothing, and
- 3rd. The Duties of the Seamen.

The facts concerning the victualling shall be arranged under the heads of:—

- Quality and Quantity of Food issued;
- Regularity of Supply, as dependent on Conveyance;
- Arrangements of Messing in Force in the Camp;
- Means and Modes of Cooking;
- Supply of Fuel.

Quality and Quantity of food issued.—After departure from Baljik, in Bulgaria, a month elapsed without any issue of fresh meat, and through October and November the supply was very small, and does not appear to have exceeded three days in each month. In December a larger quantity, probably amounting to nine days' rations with vegetables, was supplied; but from the 6th of September to the

1st of January, the total daily allowances of *fresh meat, with or without vegetables*, do not appear, as far as I can ascertain, to have exceeded fifteen. After the 1st of January, the quantity decreased from what it had been in December; but this was the less felt, as the system was then commenced of allowing the seamen their savings-money, as on board ship, on provisions not issued to them; through which alteration they obtained the means of making purchases for their messes. *Salted meats* were drawn in the usual quantity of 1 lb. per man, in beef or pork, on alternate days. *Biscuit* was always issued in ample quantities. *Flour or peas* were not issued at any time; but in lieu of them, an additional quantity of bread was given, $\frac{1}{2}$ lb. in place of the allowance of flour, and a $\frac{1}{4}$ lb. in that of pease, on alternate days. *Rice* was issued in small quantities about the middle of November; but this supply had ceased early in December. *Cocoa* was not given earlier than January, and up to that time the men had received a double allowance of tea. *Rum*. On first landing the allowance was increased to $1\frac{1}{2}$ gills; but towards the end of November the system was adopted of giving that quantity to those men only who were going to the trenches, while those remaining in the camp, received one gill.

Lime-juice and other Antiscorbutics.—In the early part of the campaign, the quantities issued were small. The earliest supply that I can find record of is on the 27th of October, when 288 lbs. or six days' rations, and again on the 5th of November, when 144 lbs., or three days' rations, were sent from the "Diamond" to the camp.

I do not find that any further supply was available until January, but in February and in March there were ample quantities of it.

Oranges and lemons, in quantities sufficient for the use of the sick, were received in December; and, in January, a more liberal importation admitted of a moderate, though general distribution in the camp, kept up though a period of eight weeks.

The Victualling of the Brigade was always distinct from that of the army, the supplies being, at first, drawn from Her Majesty's ship "Diamond," and then from its own Naval Brigade Commissariat at Balaklava.

Regularity of supply as dependent on Conveyance.—From an early date the Brigade was never absolutely without mules, but the number allowed was inadequate to the exigency; so that, during the winter months, it became necessary to perform the duty by parties of men.

In the wet season of the winter, when the roads were at their worst, it was found impracticable to obtain a sufficiency by means of the parties that could be sent from the camp to Balaklava. The daily supply was dependent on the quantities brought up each day, and I am credibly informed that it sometimes happened, in November and December, the night-relief of the trenches was delayed in the camp waiting the arrival of their rations, but was never compelled to leave the camp without them.

On account of the extreme difficulty of supplying the camp by the efforts of parties sent from it, 300 fresh men, sent from the "Queen," and "London," in the Bosphorus, to join the Brigade,

who arrived at Balaklava about Christmas, were detached to do this duty on a new plan.

They had their home through several weeks on board ships at Balaklava, from which place they made a daily journey to the camp, conveying the supplies of provisions, &c.

But as soon as the weather improved, and the roads became more passable, this party shifted from the ship to the camp.

By this very excellent arrangement, the worst of the evils arising from deficiency of food were obviated from an early period of the winter, the irregularities and deficiencies of supply being thus limited on November and the early part of December.

It is worthy of notice, that the seamen stationed in the batteries around Balaklava did not leave their ships until after the attack of the 24th of October. They suffered very much less in the winter months than the main body of the Brigade did, which must have been greatly owing to their proximity to the stores at Balaklava.

As the spring advanced, no difficulty was found in gradually storing a reserve of provisions in the camp, so that when the batteries were open, the duty of bringing up supplies from Balaklava was suspended.

Early in April, the Land Transport Corps relieved the Brigade entirely of this duty.

Formation of Messes among the Seamen.—The original arrangement was, that the men dwelling in each tent should form a distinct mess. There were, at first, as many as eighteen in each tent, but they became gradually less crowded, by obtaining a larger number of tents.

The office of cook of the mess was taken by each man in turn. The cook's duty was to draw the rations of his mess from the steward, to provide fuel, and to cook the food for his messmates. He was excused from every other duty, and had to rise an hour earlier, so as to prepare breakfast for the party going to the trenches.

Another arrangement was afterwards carried into effect among the men of the "Queen," "London," and "Rodney," who, being provided with large extemporised camp-kettles, that would contain fifty rations in each, a cook and two mates from each ship's company were allotted permanently to this duty; by which arrangement, uniformity of diet was established; and as the men of each tent had no longer to provide for their own cooking, there was a great economy of the working hands.

Those ships' companies unprovided with these camp-kettles, adhered to the plan first instituted.

Means and Modes of Cooking.—It may be said that with seamen the normal mode of cooking their rations is by boiling them; the limited resources of ships' galleys will admit only of the sailor's enjoying a roast or baked meal as a luxury not frequently within his reach. This being the range of his ordinary habits, it follows that, when in possession of a stew-pot and fuel, he has all the appliances to enable him to meet the ordinary demands of his appetite.

Some ships' companies, on leaving their ships in October, were allowed to take with them the portable furnace and boilers supplied for the service of the boats; but these being small, were found very

inadequate to cooking for so many, and were soon worn out by constant use.

During the first week of October, the encampment of the Brigade lay outside the town of Balaklava, and the seamen then took care to provide themselves as well as they could, by purchase or otherwise, as many pots and kettles as they could procure from the townspeople. The utensils thus obtained being comparatively small, they only partially supplied a great deficiency.

In December, there were sent from some ships, for the use of their own men, large camp-kettles, or boilers, made from iron, tar or paint barrels, by cutting them in halves, and fixing on them iron-looped handles and wooden covers. This was a simple contrivance, but it proved a most efficient adaptation of means abundantly at disposal.

Possessing these contrivances for cooking, and having such good arrangements for messing authorised by their officers, it is improbable that the seamen suffered from any irregularity of meals, or from the use of uncooked food; or that men leaving the camp on duty, or returning to it, were unsupplied with some warm refreshment; and it would appear that what was so well arranged, was equally well carried out in practice.

The men going to the batteries took with them their rations for the time they were to be absent from the camp; and having hearths and cooking-places constructed in convenient corners, they cooked their food in the batteries; and from the *savoir faire* of the sailor's character, it may be assumed that he rarely went without a warm meal of some sort during his turn of duty, whether that fell by day or night.

The Supply of Fuel throughout the winter was entirely dependent on the exertions of the men in digging roots, which were very difficult to be procured when snow covered the ground.

In February, there commenced an issue of coal from the stores at Balaklava, but the difficulty of conveying so weighty an article on the shoulders of men, sufficed to limit the advantage of this supply, up to the time when the Land Transport Corps was sufficiently organized to undertake the carrying duties of the camp.

This concludes all I have to offer concerning the victualling of the Brigade; and, in the next place, I shall state all that is known to me with reference to the clothing of the seamen belonging to it.

The Quantities of Clothing and Slops, with reference to the original equipment and subsequent supplies, as affording protection from the wet and cold, and sudden changes of temperature, so very frequent in the Crimea, must have formed an essential item in the safeguard of health during the winter season. The anticipated shortness of the absence from their ships, and the continued fine weather through the month of October, did not seem to demand any provision of clothing beyond that for their actual wants at the time, and therefore no increase was made to the quantity to which they were restricted on leaving their ships—viz., to the suit on their persons, with one pilot-coat and a blanket.

Early in November this quantity was found insufficient for their protection and comfort, and the men began then to procure, as they

best could, more clothing from their ships. These being at anchor off the Katscha river, there were no means of proceeding on board them, even if the urgent affairs of the camp had then permitted; and as obtaining the wished-for supplies was left to each man's intelligence and personal exertions, to get the articles he wanted sent to him by steamers proceeding from the fleet to Balaklava, it is very probable that a partial and insufficient provision was thus made to meet the growing necessity.

As it happened that those men of the Brigade belonging to the "Albion" and "Arethusa," ships that had left the shores of the Crimea, after the attacks on the sea forts on the 17th of October, were more sickly than others in November, it may be inferred that they suffered from the want of even this limited advantage.

New Clothing and Slops.—The small quantities of these in charge of the paymaster of the "Diamond" did not go far to supply the Brigade; and it was not until late in November, or early in December, that larger quantities were sent from the ships of the fleet, for issue to those portions of their crews serving ashore. Previously to the arrival of these, it became necessary to procure ankle-boots for the seamen from the stores of the Quartermaster-General, as the shoes they had brought with them from their ships were found useless in wet weather.

After the general issue of clothing and slops that took place early in December, the men were warmly clad; and, indeed, they were so well supplied, that most of them, being possessed of two new pilot-coats, found easily a profitable market for their superfluity among the army officers.

From these circumstances, it would seem, that although the seamen were not generally well clad in the wet period of November, and part of December, yet they were all exceedingly well supplied before Christmas, previous to the setting in of the severely-cold season.

In January, there arrived a most abundant supply of "gratuitous" clothing, consisting of sheep-skin coats, fur-caps, wooden-soled shoes or ankle-boots, and woven or knitted under-clothing, as vests, drawers, stockings, and gloves, in quantities far exceeding the immediate, or even the probable requirements of the Brigade.

It remains now to inquire into *the Duties performed by the Naval Brigade*, so as to arrive at definite conclusions concerning the amount of labour and of exposure undergone by them, especially in the season of cold and wet, when the exciting causes of disease were in most active operation.

The first duty performed was the landing of the ships' guns, at which they were to serve in the batteries, the mounting these guns on their carriages, and dragging them by manual labour, with their shot, shell, and ammunition, to the front, a distance of five miles, over a road unsuited to such weighty loads. The difficulties of this task, and the amount of labour expended in its execution, can only be rightly appreciated in considering the kind of wheels on which the heavy guns were transported—these being simply the trucks intended for use on a ship's decks.

The siege-guns of the Royal Artillery were being conveyed to the

front at this time, mounted on the lofty-wheeled carriages termed devil-carriages, and transported by horse-power.

When this was accomplished, about the 11th of October, the encampment of the brigade was shifted from Balaklava to the plateau above Sebastopol, close to the Woronzoff road; and the seamen were then employed assisting in the construction of the first parallel, digging trenches, raising parapets, constructing platforms and magazines, mounting and fitting siege-guns, and storing ammunition for the bombardment.

Their share of this labour was performed in the daytime, up to the opening of the batteries on the 17th of October; after which date, the amount of labour performed was almost entirely regulated by the fluctuating requirements of the batteries.

Whenever the batteries were open, the whole brigade formed two reliefs, going alternately to the trenches after sunset, to remain there twenty-four hours. Through the night the men were employed repairing the damages of the day, and in replenishing the magazines.

In the daytime, they were divided into two watches, that relieved each other at the guns every two hours. Under ordinary circumstances, the batteries opened their fire at daylight and ceased with a grand round, or salvo, at sunset. During the intervals of the great bombardments, the battery duties were much more easy, as only one-half as many men were required; and these, not through quickly alternating periods of fatiguing labour and of rest, but merely to be in readiness for all emergencies, and to reply to the slackened fire of the besieged.

There being now less danger in going to, and returning from the trenches, as the firing was rare, the reliefs were more frequently sent, being repeated every night and morning; by which the stay of the men in the batteries was reduced from twenty-four to twelve hours.

The brigade was divided into four reliefs through the winter season of wet and cold; each relief taking its turn at the trenches twice in four days, one turn being by day and the other by night, of twelve hours each, with an interval of not less than twenty-four hours intervening.

The night duties of the batteries were light when a bombardment was not in actual progress. Sentries being stationed on the platforms, &c., the remainder of the relief in battery were at liberty to take exercise by walking between the traverses, or to warm themselves or cook at their fires, or to shelter themselves in empty magazines.

These duties in the trenches occupied twenty-four hours out of four days, and on the other three days the seamen were called on to perform the duties of the camp, or to go to Balaklava to fetch supplies, which last, it must be remembered, was done in the worst part of the winter by a party stationed at Balaklava.

There were camp duties on two days, such as constructing cook-houses, latrines, roads, watercourses, and bridges, going sentry, &c.

On the days of journey to Balaklava, in the wet season, the fatigue-party was often absent from the camp from 7 A.M. to 4 or 5 P.M.

The Routine of Duty through the Winter Months, the batteries not being then in active operation, may be briefly defined as follows, for every term of four days:--

1st Day.—To the batteries at daylight, returning to camp in the evening. All night in bed.

2nd Day.—Camp duties through the day. To the batteries after sunset, to pass the night there.

3rd Day.—Returning to camp at daylight to perform light duties through the day, and perhaps to do a two hours' turn as sentry at night.

4th Day.—The journey to Balaklava, when that duty devolved on the brigade in camp, and, at other times, the ordinary camp duties. All night in bed.

5th Day.—Recommences a term as on 1st day.

Thus it appears, that in the most trying season of the winter campaign, the sailor of the Royal Naval Brigade, passed two, and perhaps three, unbroken nights out of four in his tent; and that out of a term of ninety-six hours, he was called on to pass from twenty-four to twenty-eight hours, in two distinct periods, on duty in the trenches.

His post of duty being in the first and deepest parallel, he was enabled to obtain shelter, to construct contrivances for cooking, to take exercise, and was never compelled to remain in constrained positions. By the good regulations in force in his camp, he had warm food prepared for him on leaving it and on returning to it. When in the camp, he could find some leisure, which he might employ in repairing his clothes; and he was not, under any circumstances, called on to make the journey to Balaklava oftener than once in four days, being relieved altogether from this duty in January.

On the point of duty, it must be admitted that these were great advantages in favour of the Brigade.

Having now completed the survey of the *material* and *occupational* circumstances under which the seamen of the Royal Naval Brigade were placed, that, in my opinion, may have influenced its sanitary condition, the evidence adduced may be, I think, condensed into these propositions.

That comparative immunity from the diseases prevalent in the camp in the winter of 1854-55, was enjoyed by the Royal Naval Brigade; and that this favourable condition extended to the mortality from camp diseases, which was small relatively to the number of cases under treatment.

That circumstances conducive to this result are to be found in the predisponents to a healthy condition, in operation among the seamen up to the moment of their landing, which took place sixteen days later than that of the army; and the manner in which the Brigade was enabled to recruit its numbers by fresh bodies of men who had not been debilitated by the influences of a camp-life.

That cholera, dysentery, scurvy, and typhus, which were peculiarly the diseases of the camp, always increasing in frequency in the main body of the army from the middle of November to the end of January, decreased in numbers, collectively, in the Brigade after the end of November.

That this earlier check of disease and amelioration of sanitary condition, were cotemporaneous with, if not dependent on, a fuller supply of fresh meat and vegetables, and a very adequate provision of warm winter clothing early in December.

That the subsequent maintenance of this comparatively good

sanitary condition was attributable to two causes, a large infusion of new men about the middle period of the winter, and the much greater proportion of men, relatively to the amount of trench duty to be performed; that duty being, also, through the winter months, lighter in its nature than that of the Infantry stationed in the trenches; and the relative proportion of men being so great as to relieve those who were on trench duty from the very fatiguing marches to Balaklava during six weeks in the depth of the winter, and to admit, also, of permanent camp regulations as to the victualling and the cooking of food.

These are to my mind, unquestionably the most efficient causes of the great superiority of sanitary condition, in which we have grounds to congratulate ourselves as a service, thankfully, and not boastfully.

But there are *minor circumstances* not deserving, perhaps, of being classed with these, that have exercised no mean influence on the well-being of the seamen in camp,—fortifying them against the advent of disease, and tending to render its hold on the system less intimate. I shall now endeavour to describe the most prominent of these.

The true sailor possesses in his general character, inculcated in the primary education that fits him for his occupation, an adaptability to any new circumstances, and a capability of suiting to his wants and convenience the new objects adventitiously brought within his possession; and he is so frequently thrown on his own resources, that he is compelled to become, in some measure, inventive.

Thus, by education, every man-of-war's man is cook and tailor to the full extent of his class-wants; having food, he knows how render it palatable and digestible; and being supplied with materials, he is sufficiently skilled to adapt them to his comfort and protection; and it may be added with safety, that he is by no means unwilling, or unready to appropriate to the service of his necessities, whatever useful objects good fortune may throw in his way.

The vigilant care exercised by naval officers over the welfare of their men throughout this campaign has been proverbial.

Perhaps beyond the pale of family supervision there is no position of life in which greater regard is devoted by superiors to the well-being of their inferiors than on board a well-disciplined ship-of-war; and it is but fair to conclude, that in changing the scene of duty from the ship to the shore, they carried with them the same relations to each other as had regulated their previous intercourse.

Thus the wants of the seamen, arising from the newness of their position, were often anticipated by those accustomed to foresee and to provide for them; and when, from the force of circumstances, things could not have been anticipated or provided against, every effort feasible through the personal exertions of officers, was made to remedy the unavoidable deficiency.

Lastly, the seamen were in the possession of another advantage over the troops, instrumental of good to them when disabled by sickness. There was close at hand, in the Crimea, an hospital ship for their reception, in which the diseased seamen were afforded such means of cure, as they had a right to expect under the most favourable circumstances of their position in life; and ample proofs were afforded of the importance attached to this by themselves.

On being sent away from the camp, they were at once received into an hospital of their own service, in which they were surrounded by objects familiar to them, and essential to their ideas of comfort. On their arrival at Balaklava, labouring under maladies of the severest nature, it often became the duty of the medical officer to supply the means of reanimating the flagging vital powers, by applying general and local warmth, and by the administration of hot diluents, stimulants, or other means that seemed to be most urgently demanded. It was often most satisfactory to him to observe the gradual restoration of energy, during which cases of most aggravated and complicated aspect, almost hopeless on first inspection, assumed milder symptoms, and, at length, came to present the more simple characteristics of definable diseases.

Although this circumstance could have had no influence on "the causation of disease," yet it served more than any other perhaps, to diminish "the ratio of mortality from it."

How very different was the course of events in the case of the disease-stricken soldier, who, through the winter, could not obtain hospital accommodation before he reached Scutari.

In conclusion, I would state, from all that has ever appeared to me, it would be most unjust, and certainly not a likely means of arriving at truth, to fix the sanitary condition of the Royal Naval Brigade as the standard by which that of the army in general is to be estimated and judged.

The facts which I have endeavoured to arrange and to embody in this paper, are to my idea, conclusive, as to the superiority of position, and circumstances, and of sanitary condition as dependent on these, throughout this winter campaign, of the seamen of the Royal Naval Brigade over the Infantry at the front, who were always undergoing a severer degree of exposure, and performing more harassing duties with disproportionate numbers; being, at the same time, as much dependent, as any part of the army, on their own exertions for their supplies.

On the other hand, the Highland Brigade, and the Royal Marine Battalion, stationed around Balaklava, the Cavalry and the Field Artillery, were, in every respect (regarding duties and supplies), in a still more advantageous position than the Naval Brigade; and thus, for opposite reasons, it cannot be brought into legitimate comparison with any of these portions of the army,

In adducing the Royal Marines as an example on the side of superiority of position, and of comparative exemption from disease, exception must be made of that portion of the corps, detached under Major Hopkins, and stationed with the Light Infantry Division on the heights above Sebastopol, from the 4th of November to the 6th of March. It fought in the battle of Inkermann, and took part in the trench duties of the Division to which it was attached, and suffered equally with it by disease and death.

The only body of troops which has been throughout the siege on anything like equal terms with the Royal Naval Brigade, is the Royal Artillery of the Siege Train, of which the duties have been precisely similar in their nature, and in their alternations of intensity and relaxation, the men composing it being well clothed equally early in the season with the seamen of the Brigade. It had, however, always an advan-

tage in the large amount of horse-power at its disposal for the maintenance of a sufficient supply in the camp; but, on the other hand, the Brigade has had the benefit peculiar to itself, of receiving relays of men from the fleet, this being impossible with any military body deriving its reinforcements from England.

Thus by reason of the various positions and duties of the different corps composing the army, it is manifest that any comparison of the sanitary condition of the Royal Naval Brigade with the combined forces with which it fought, to be correct, or of any utility in the estimation of the causes of disease, should be instituted between its returns and those of the Siege Train of the Royal Artillery alone.

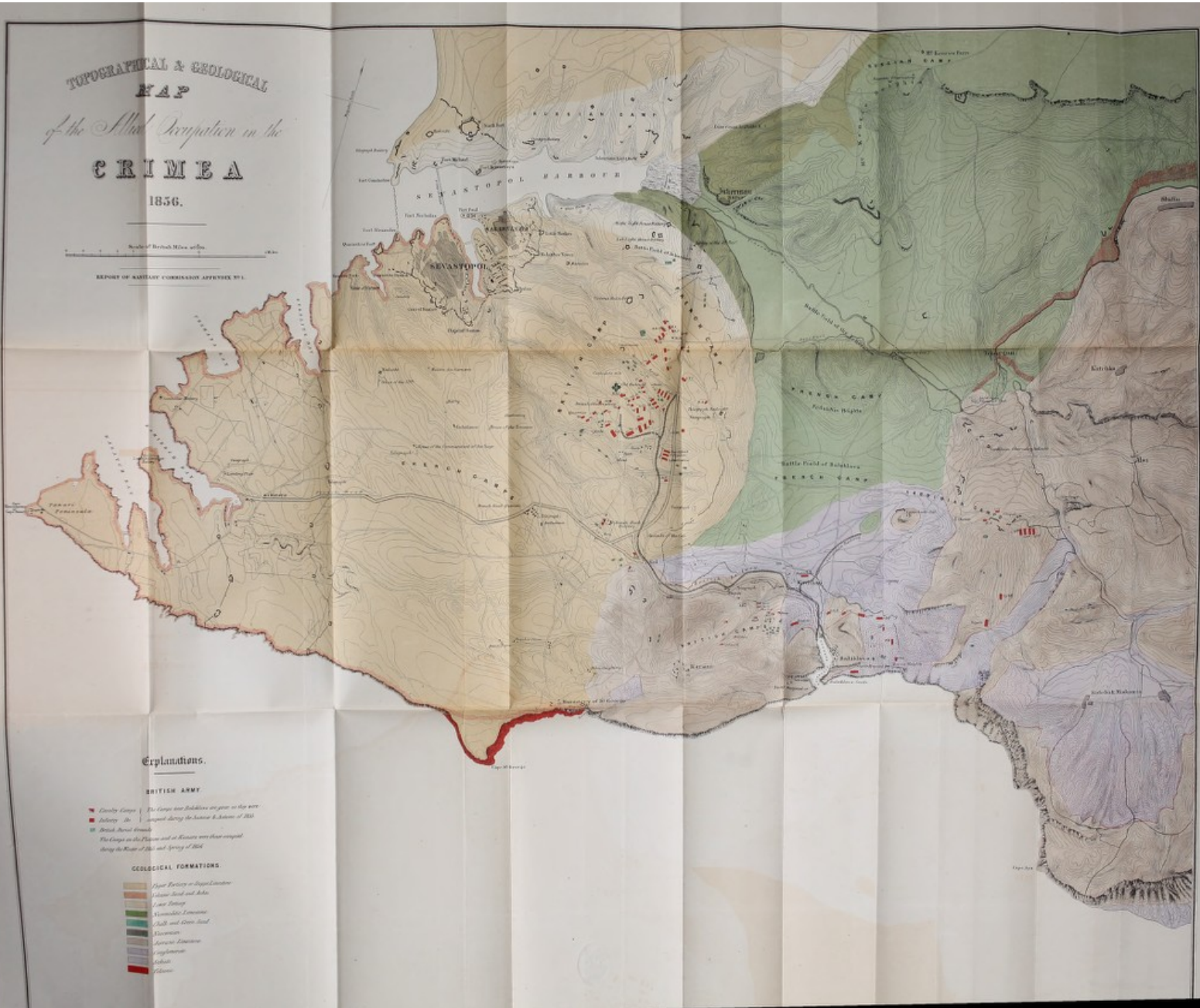
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TOPOGRAPHICAL & GEOLOGICAL
MAP
of the Allied Operations in the
CRIMEA
1856.

Scale of British Miles within

REPORT OF NAUTICAL COMMISSARY ADRIANUS BULL



Explanations.

BRITISH ARMY

- ▣ Cavalry Camps
 - ▣ Infantry Camps
 - ▣ British Army Positions
- The Camps on the Plateau west of Krasno were those occupied during the Month of May and Spring of 1856.

GEOLOGICAL FORMATIONS

- Upper Tertiary or Quaternary
- Lower Tertiary
- Secondary Tertiary
- Triassic and Olden Sand
- Devonian
- Silurian
- Permian
- Carboniferous
- Palaeozoic

