CHAPTER 8

WAU-SALAMAUA

WE have seen how the frontal attack of the Japanese on Moresby over the Owen Stanley Range and the flank attack on Milne Bay were associated with a threat by the enemy on the northern flank, when he made unopposed landings at Lae and Salamaua. These landings not only constituted a potential danger to Moresby and provided valuable sites for enemy bases, but also gave access to the Wau-Bulolo Valley.

This area, famous for its alluvial gold mining, had been developed in previous years by the enterprise of air services, which had established airfields capable of linking strategic points in an otherwise most difficult terrain. The precipitous Kuper Range rose to 10,000 feet in places, and cut off these coastal centres from the interior, where in a deep cleft the Bulolo and Watut Rivers flowed in a basin still several thousand feet above sea level. Progress through this country was slow and laborious; it exemplified a common feature of the uplands of New Guinea, where time of travel was much more significant than distance. Travel by foot often demanded incessant clamberings up and down rough rocky ravines and crossing fast streams, and at the higher mountain elevations over 5,000 feet the moss country began, treacherous and forbidding. The usual variants of tropical growth were seen in different parts of this valley, but of a specially wild ruggedness. The foothills, often very steep, were covered with kunai grass, and the slopes above were clothed with thick forest made almost impenetrable by dense jungle growth. Vines and undergrowth impeded progress and even when the banking clouds above did not blot out the sunlight the traveller still passed through a dense gloom below, where rotting vegetation and pervading moisture soured the air. Clothing was perpetually damp and mud clogged the feet on the narrow trails. In such country it was hard to exceed one mile in each hour, and fitness and endurance were demanded of those who patrolled and fought in it.

A fair motor road had been constructed from Wau to Sunshine, and the engineers improved and extended the lines of communications at a later date. The line of communication with Moresby was long and difficult: from the west side of the Bulolo Valley to Bulldog it ran as an undeveloped jungle track, and connected with the Lakekamu River which entered the ocean some 100 miles from Port Moresby. This was the only route which led overland to the southern coast of New Guinea. The Wau-Salamaua area was intersected by numerous rivers. South of Salamaua Peninsula the Bitoi and Francisco Rivers widened out into important streams, and on the west of the dividing ranges the Snake and Watut Rivers joined with the Bulolo River and entered the Markham River, a broad stream which met the sea south of Lae. Wau was the most important settled area, with considerable technical development from its

gold-mining activities. It had a useful airfield, and its elevation, 3,700 feet, limited the propagation of malaria, though the lower jungle areas were highly malarious.

KANGA FORCE OPERATIONS

When the Japanese landed at Lae and Salamaua in March 1942 two companies of the New Guinea Volunteer Rifles were in the area. They carried out demolitions before the enemy arrived and harassed them from the hilly country behind Salamaua, obtaining useful information from patrols. In the latter part of March "Kanga Force" was formed to carry out certain specific tasks in the Wau-Salamaua area. Major N. L. Fleay was appointed to command this force, which comprised the following: a headquarters to be raised from details in Moresby area; all personnel of the New Guinea Volunteer Rifles under the command of headquarters of N.G.V.R.; a reinforcement platoon of the 2/1st Independent Company, which was *en route* to Bulolo; the 2/5th Independent Company; and a mortar platoon to be raised. This force was to come under command of the officer commanding Kanga Force from 1st May, and its function was to carry out such offensive action as was necessary to protect forward bases and airfields.

The Japanese began to move inland from Salamaua, but the largest component of Kanga Force, the 2/5th Independent Company, was held at Moresby, to protect the Bootless Inlet where there was a risk of a Japanese landing. In the early days of May the battle of the Coral Sea dissipated the enemy convoys meant for Moresby, and the situation eased. The 2/5th Independent Company could then be released for its new assignment with Kanga Force. It is of interest that when the headquarters of Kanga Force, the 2/5th Independent Company and a mortar detachment were flown under escort to Wau, the occasion marked the first substantial air movement of troops in New Guinea. The headquarters of the force was at Wau, from which a wide area was covered by patrols, and the headquarters of the components took up positions at Wau, Bulolo and Bulwa, names familiar on the New Guinea goldfields. At the end of May Kanga Force stated the locations of its units as follows: (a) N.G.V.R. headquarters at Bulolo, "A" Company headquarters at Partep 1 with platoon and patrol bases in the Markham area, and posts overlooking Lae; "B" Company headquarters at Mubo with posts covering tracks to Salamaua, and posts overlooking Salamaua; (b) reinforcement platoon 2/1st Independent Company, headquarters at Bulwa; sections at Mapos, Missim and Kudjeru; (c) 2/5th Independent Company headquarters, "A" and "B" Platoons at Bulolo, "C" Platoon at Bulwa; (d) mortar detachment at Wau; (e) headquarters Kanga Force at Wau.

MacArthur and Blamey agreed that the force would be of modest dimensions, designed for hitting rather than holding. Medical care was complicated by the extensive scattering of the force, and by the wild and mountainous country. Under the original organisation each of the

component units had its own medical officer, and the S.M.O. was Captain McKenna who was already experienced in New Guinea. McKenna later returned to Port Moresby where his experience proved invaluable to Angau.

SUPPLIES AND TRANSPORT

The exacting nature of the work and the rigours of the country imposed a great strain on the officers and men, and might be expected to cause a high rate of sickness. This was evident in the N.G.V.R., whose average age was thirty-five, and who, though most enthusiastic and spirited, could not retain fitness under the arduous conditions. Fleay thought that only 90 men out of 300 all ranks were fit for patrol work. The factor of acclimatisation was thought to be of some significance at times. For example, later on when the 17th Brigade came from Milne Bay to Wau, in the 2/6th Battalion, after a long march to the elevation of the Black Cat mine, a number of men collapsed: possibly height as well as heat may have been a factor.

Feeding the force often caused anxiety, particularly in relation to some of the forward patrols. For instance, N.G.V.R. patrols in the high ground behind Salamaua had dumps of food in reserve, but the landing of the Japanese upset these arrangements, and caused stringency of rations. Even in the less inaccessible places the men were often short of rations, and without the solace of tobacco. Sometimes supplements could be obtained from native gardens, but even men experienced in handling the Papuans often found it hard to maintain good relations with the villages. This could be readily understood when the dominant role of the Japanese in the eyes of many natives was considered. Stores of all kinds were hard to get and, when obtained, hard to distribute, largely owing to the difficult line of communications with Moresby through Bulldog. Air transport was of course the obvious ideal link, but it was not regular or always possible until at a later date improvement in the military position permitted increase in the size of air transport fleets, and so made a higher priority possible for this action front. Defence of airfields was all the more vital as a function of Kanga Force. Ground transport was made more difficult by the reduced number of native carriers available, for here, as on similar jungle fronts, the carriers were invaluable in the distribution of stores and the transport of casualties. Control and recruiting of native labour were handled by Angau officers. The same stringency prevailed for medical stores, and supplies often ran low. The nature of the force's function in itself lessened battle casualties, for serious clashes with the enemy were not common. The usual types of medical disability met with in this tropical country could often be treated in camp, or in the hospital at Wau; for men seriously ill, air transport to Moresby could be arranged, but more regular air evacuation was most desirable. Medical assistants carried out a very useful function in this force, and used their special training to good effect; the medical officers took opportunities as they offered for training the men in first aid work.

HEALTH IN KANGA FORCE

The chief cause of ill health was malaria, which was endemic throughout the area in a varying degree, depending largely on the density of anopheline mosquito population. Organised anti-malarial measures were well-nigh impossible in this force, but suppressive quinine was taken. It was recognised that the less soluble bisulphate was not well absorbed in tablet form. Treatment was not as thorough as could be desired, and the relapse rate was high. This produced a considerable amount of chronic illness with anaemia and splenic enlargement. McKenna pointed out that atebrin should give better results, and that adequate supplies were essential. He also advocated removal of men with chronic malaria to a non-malarial zone for rest and further treatment. Lack of facilities for washing and laundry increased the number of staphylococcal and fungous infections of the skin. Dysentery was fortunately rare.

RAIDS ON SALAMAUA AND HEATH'S

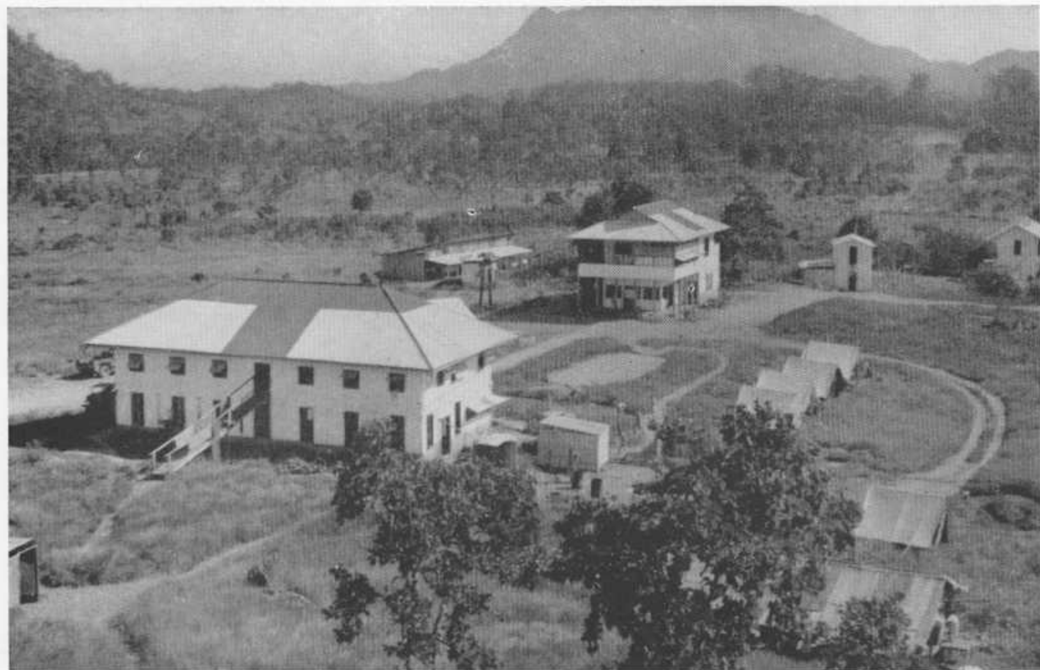
At the end of June aggression was threatening on the other New Guinea fronts, and diversionary action was planned in the Wau-Salamaua area. MacArthur and Blamey had agreed that action should be undertaken on Lae and Salamaua when the time was appropriate, and Fleay now received instructions for attacks on the enemy-held bases. The Bulolo Valley already occupied the attention of a considerable number of troops and large-scale operations were out of the question. Accordingly raids were planned on Salamaua and on Heath's plantation as a preliminary to a move against Lae.

Captain N. I. Winning of the 2/5th Independent Company led the raid on several objectives in Salamaua with great success on 28th-29th June. The strength of the raiding party was about fifty, and the Japanese had a force of about 300 in Salamaua. Thorough preparations were made by N.G.V.R. scouts by reconnaissance and continuous manning of observation posts. While the party was at the Mubo base camp members of the N.G.V.R. were medically examined; 25 per cent were found to be "Class II" and the remainder were selected for training with the 2/5th Independent Company. Supplies were far from satisfactory; they arrived late and the reserves held at Mubo were insufficient to meet the sudden demand of the A.I.F. troops. Simultaneous raids were made on a number of points, including Kela village and the aerodrome. The Japanese replied with shelling, mortar fire and machine-gun fire, and as their losses were estimated at over 120 it was remarkable that the raiders had only three men slightly wounded. Japanese aircraft attacked the jungle tracks, but all the men returned to their base on 30th June. Valuable documents, maps and intelligence material were collected.

The raid on Heath's, planned as a preliminary for a later possible raid on Lae, was successfully carried out on the night of 30th June-1st July, though the force had to withdraw before all objectives were gained. For various accidental reasons complete surprise was not achieved, but the force was able to inflict considerable damage and loss before its early

Brigadier N. H. Fairley
Director of Medicine
A.M.F.

Brigadier W. A. Hailes
Director of Surgery
A.M.F.



(Lieut-Colonel M. S. S. Earlam)

Bomana Mission, Port Moresby.

(Australian War Memorial)

Stretcher cases being transported back to the base by jeep.

(A.A.N.S.)

The 2/9th A.G.H., Port Moresby, 1943.

(Dept. of the Interior)

Heidelberg Military Hospital.

(*Australian War Memorial*)

The A.D.S. at House Banana.

retirement. Major T. P. Kneen, of the 2/5th Independent Company, who was in charge of the raid on Heath's, was killed in this action.

The holding force in the Markham Valley area consisted of about 100 N.G.V.R. men; examination showed that only some sixty were medically fit for patrol work. Arrangements were made to give some respite to the N.G.V.R. and also to a section of the 2/5th Independent Company. The strain on the troops was not merely that imposed by the meticulous preparations for an aggressive raid, or that of the raids themselves, it was cumulative. The defence of the Bulolo Valley occupied a considerable number of the force in supplying the daily patrols, clearly described by the diarist of the 2/5th Independent Company:

> Picture a force dwindled by malaria still gallantly carrying on the tasks assigned it, climbing hand-over-hand up precipitous mountain sides, slithering knee-deep through jungle swamp, wading boulder-strewn streams, wet through continually, and yet with indomitable "guts", never ceasing their probing of Jap lines.

The Japanese reacted sharply to these raids. The enemy air force probed inland from Lae and Salamaua and bombed Mubo and Komiatum, south of Salamaua, shortly after the raids. Attacks were also centred on the Bulolo Valley, and some damage was inflicted on Wau and Bulolo. Enemy reinforcements, about 200 strong, were brought from Lae to Salamaua. Both at Heath's and Salamaua enemy patrols showed great activity: this made it more difficult for Kanga Force to move about, as some of their hitherto hidden tracks were no longer concealed. Another result of hostile action was the effect on the native carrier force. This was particularly felt at Wau on 2nd July where some material damage was done by Japanese planes; here the labour and carrier forces of Papuans fell away alarmingly, and on the 3rd, air attacks caused further thinning of the carrier forces at Bulolo. Supplies became more scarce, and some of the reserve dumps of food were found by the Japanese. Immediately after the Salamaua raid rations were very short: seventy-two men had between them only eleven tins of soup, and seven pounds of rice, with no tea or sugar. The Bulldog line of communications to Moresby was not able to produce a steady flow of stores.

THE JAPANESE EXERT MORE PRESSURE

During July the 2/5th Independent Company found the conditions very trying; they lacked supplies, and had to cope with shell fire and a more active enemy, half their men were sick and many showed signs of exhaustion. Nevertheless the strain on this unit was less severe than on the N.G.V.R., and during July A.I.F. troops replaced others in the areas forward of Bulolo and Wau. On 2nd August a hospital was opened in the Guadagasal Saddle area south of Mubo, with a base at Wau. From Mubo to Wau it took three days to transport casualties: Wau and Bulwa were connected by road, and the distance could be covered by motor transport in an hour and a quarter. In the Lae sector transport times were

greater. From forward patrol areas to a small hospital at Dargan the time taken to carry a stretcher was twenty-four hours and thence to Sunshine four days. At the hospital bases a medical officer and orderlies were stationed. With the devastating journeys to be made through such rough country the problem was not so much that of treatment but that of transport. The medical assistants were able to take considerable responsibility and ran small hospitals with ability. Warrant Officer G. K. Whittaker, who was running a hospital at Bob's, hearing that an Australian was wounded during a Japanese attack in the Markham area, made a six-hour journey on horseback, found him in the bush and succeeded in taking him to Nadzab where a canoe took them back to Bob's camp.

At the end of August a party of Australians was involved in a long and hazardous journey. While Winning was leading a patrol to Busama a depleted band of forty-nine men left in Mubo was threatened by a large band of 130 Japanese, and was forced to attempt a formidable journey over the mountains to the Bulolo Valley. The men suffered great privations in climbing up the range to 10,000 feet, and returned to a post whence, with the help of a friendly native they reached the coast. At one stage they eked out scanty rations by subsisting on a few sac sac trees. They obtained food and canoes and a week later reached the Waria River; barefooted and in rags they arrived at Garaina, after five weeks of struggling through difficult country, and there they met a plane which was establishing a supply dump, and were flown back to Moresby.

The increased activity of the enemy on other fronts was reflected in the Wau-Salamaua sector by the end of August. The landing at Milne Bay and some success on the Owen Stanley Range encouraged the Japanese to press on at Mubo, and the Australian force in this area was unable to retain its forward posts. Despite the infiltration of the Japanese and the capture of Guadagasal the Australians had been able to inflict heavy damage on the enemy in the Mubo gorge without loss to themselves. But, with Mubo lost and the enemy able to maintain a flow of reinforcements into Salamaua, the situation of Kanga Force was changed and the commander realised that it could not then have a high priority in all moves designed to resist the threefold drive of the enemy. Accordingly he decided to burn out and abandon Wau and Bulolo, for it did not seem possible to hold the Bulolo Valley.

The defending force was thus divided; the main force fell back on Kudjeru, and lost contact with the troops in the Markham sector. During the later months of 1942 Kanga Force was chiefly engaged in active patrolling.

During September the Mubo and Markham sectors remained quiet, but the force was able to continue its modified role of harassing the enemy in these areas, and to assure that the Bulldog line of communication with Moresby was kept open, and denied to the Japanese. On 9th October reinforcements from the 2/7th Independent Company arrived at Wau, and began some reconstruction work.

MEDICAL STATE OF THE FORCE

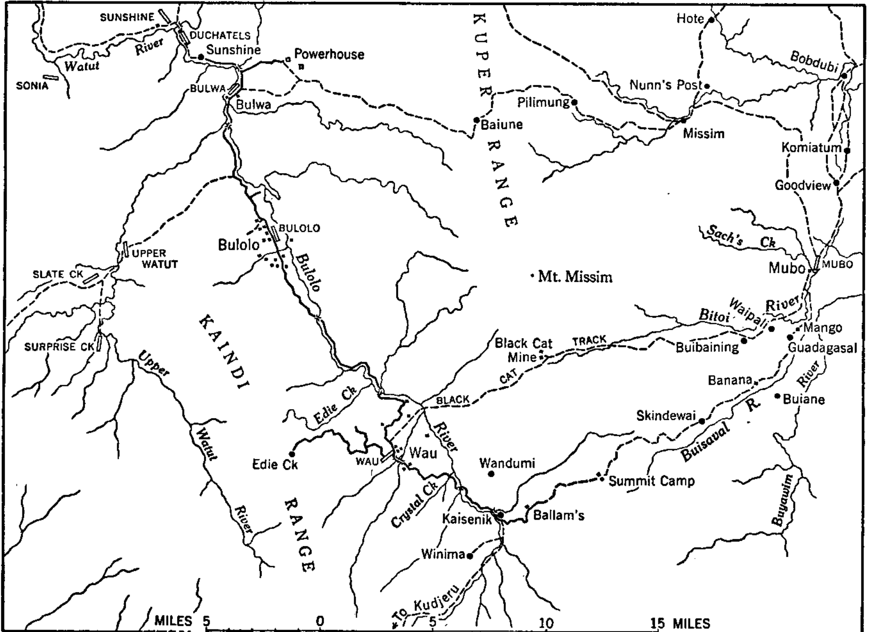
The health of the troops was the subject of several surveys at this time. Captain E. W. Stout, R.M.O. of the 2/5th Independent Company, reported in September that "gastritis" and diarrhoea were prevalent among the men, believed to be due in part to difficulties in digesting a diet consisting largely of bully beef. Few vegetables and little fruit were available. In a later report Stout expressed the opinion that, even judged by the average standard of health among the local troops, 29 men out of 117 examined were not fit for tropical service and should be returned to the mainland for medical reasons. Many of the men had attacks of that vague entity "low fever", no doubt an incompletely controlled malarial infection. Frank malaria was common. Many had septic sores due to infection of scratches, and their ragged dirty clothing made them liable to these and other skin affections. Fresh food was badly wanted, and could be little supplemented from native sources. In some places the natives were living on a diet consisting of little else but bananas. After the arrival of reinforcements, Stout of the 2/5th and Captain J. M. McCracken of the 2/7th Independent Company agreed that the men who had been through this arduous period were not fit for really hard work.

In December the Japanese became more aggressive, especially against the Saddle position, but Kanga Force now had the help of reinforcements, and on 11th January raided Mubo in strength. In spite of the evidence of deterioration of some of the troops, this raid showed that they still had the capacity to carry out a hostile action. Over a period of three days the operation went on. The raiders were successful in taking high ground to the north of Mubo, but the enemy launched heavy counter-attacks on these positions, and the Australians were forced to withdraw to Skindewai. This was the last action undertaken by Kanga Force as originally constituted. There was no doubt about the meaning of the Japanese infiltration inland, which had been going on for some time. A new phase of the long-smouldering activity in the Wau-Salamaua sector was beginning, and to meet the call of a full-scale campaign a larger force was necessary. On 15th January 1943, the first elements of the 17th Infantry Brigade reached Wau and the advanced headquarters arrived on the 17th. Under Brigadier M. J. Moten this brigade assumed command of Kanga Force.

ARRIVAL OF THE 17TH BRIGADE

The movement of the 17th Infantry Brigade to Wau began with the 2/6th Battalion with medical support from a light section of the 2/2nd Field Ambulance, under Captain N. R. Scott-Young. The characteristically unstable flying weather over the mountainous area surrounding Wau was not very favourable, but by 23rd January the reinforcements enabled covering to be provided at the main points of approach to Wau. Major W. D. Refshauge took over a few days later as S.M.O. of Kanga Force, and with reinforcements flown in after the 30th, formed a composite company. The numbers brought in were kept to the minimum because of the great need for combatant troops. Active patrolling towards the Saddle

area and Mubo showed that the Japanese were moving down the Mubo Valley along the Black Cat track. In order to achieve surprise, the enemy had sent only small parties along the usual tracks, and planned to send the main force by an old unused trail originally surveyed by an early German settler. The arrival of this force in Wau was delayed by two causes, the great difficulties of this wild trail, and the gallant delaying action of a company of the 2/6th Battalion which met the Japanese near Wandumi on the 28th.



Wau-Mubo area

Meanwhile, bad weather had delayed over half of the 17th Brigade for several days, and only a thin Australian force could be spared to guard the aerodrome at Wau. The medical personnel were strategically placed. On the 25th, the day after Refshauge's arrival, the Australian troops needing medical cover were placed at Wandumi, the Black Cat area, and the Kaisenik-Summit area; an attack was expected on the 28th. This began early in the morning and the Japanese were able to push past Wandumi in the afternoon and during the night to establish positions on the higher ground ringing the airfield, some as close as 400 yards.

Heavy rain during the night brought dense cloud over the airfield next morning, but just in good time this dispersed, and fifty-seven transport planes arrived from Moresby with the 2/5th and 2/7th Battalions. Troops were actually landed under small arms fire, but the movement was suc-

cessfully completed. The next day sixty-five transports came into Wau with equal success, in spite of a heavy attack on the airstrip by the enemy, who fired on the planes and the troops they brought. More members of the 2/2nd Field Ambulance arrived at Wau during these two days, and helped in the carrying out of the medical organisation planned for the anticipated actions. This was timely assistance, as fighting persisted round Wau against some 2,000 to 2,500 enemy troops.

CARE OF CASUALTIES

The medical arrangements had provided for an A.D.S. about one and a half miles south-east of Wau aerodrome, and south of the Wau-Crystal Creek road. This had thirty-five beds, but the number was increased later to 124. A loading post was set up at the Wau airfield, and with an R.A.P. was later sited in an excavation in the side of a ravine, and could accommodate twelve lying and twenty sitting patients. This was of importance quite apart from the early happenings at the aerodrome, for it was obviously necessary to have a holding post quite close to the airstrip for future air evacuations. The surgical work during the actions at Mubo and Wau was carried out by a surgical team from the 2/9th A.G.H. and the staff of the 2/2nd Field Ambulance. The 2/9th A.G.H. team consisted of Major D. R. Leslie, Captain W. P. Ryan and two orderlies; its equipment was based on that used for a light surgical team in the Middle East. The threat in the Mubo area made it necessary for this team to move to the Black Cat mine three hours after its arrival in Wau. The move was made with difficulty, and the next morning it was apparent that the 2/6th Battalion and the surgical team were in danger of being outflanked. The surgical post was therefore set up half-way back to Wau on the Black Cat track with a guard of four men. The S.M.O. recalled Ryan and an orderly to Wau to work at the surgical post at the airfield, and the rest of Leslie's team remained on the Black Cat track for three days. There were only a few casualties here, and the area was dangerous, hence the team was moved nearer Wau close to the battalion's headquarters, and was then recalled to Wau by the S.M.O. on 1st February. At the busiest time Major Refshauge, and Captains Scott-Young and D. R. Reid, with Captain Ryan as surgeon, and fifty-six O.Rs. were working there.

During this action casualties were collected by stretcher bearer squads attached to each medical officer, but shortage of staff made it necessary for field ambulance bearers to collect wounded forward of R.A.Ps. or to form relay posts. Captain B. H. Peterson, R.M.O. of the 2/7th Battalion, described the conditions:

> I took a squad of stretcher bearers forward and two squads of 2/2nd Field Ambulance bearers formed relay posts along the steep, rough, narrow track at intervals of about 300 yards. (100 yards on this track was like a mile.) Anticipating the steepness and difficulty of the track, we used the boat-shaped wire-netting stretchers used by the miners. We could not have evacuated stretcher cases without them as they had to be half slid, half carried down. They had to be strapped in these stretchers as it was. It was very hard work, but the stretcher bearers did a great job.

Some men were wounded on the airfield; after receiving first aid they were sent straight back to Moresby. One soldier was operated on in Moresby five hours after arriving by plane at Wau. As far as possible only casualties likely to be fit within seven days were held at the Wau A.D.S.: all others were returned to Moresby as soon as desirable. Medical supplies were prompt and satisfactory, but great difficulty was experienced in the replacement of stretchers, splints and blankets. Arrangements were made later for a tally of these stores to be sent after each evacuation so that replacements could be given high priority with the next despatch. An ambulance waggon was fitted up on a salvaged motor van, and with a sedan car was used for evacuations. Trailers were tried without success at that time, although they were successfully used at a later date. Heavy fighting persisted on the outskirts of Wau for twelve days, and as the defenders pressed the enemy back, the action ranged along the Bulolo River at Crystal Creek. On 9th February, twelve days after the attack on Kanga Force began, the enemy withdrew across the Bulolo towards Wandumi, and several days later the Australians had cleared this area. There were 207 battle casualties and 335 sick treated during this period.

Medical officers found, too, that many of the men on patrols needed advice and care. Captain W. M. Quinn, R.M.O. of the 2/6th Battalion, found that after one or more nights in the jungle they were exhausted from exposure and lack of sleep, but a night's rest and attention to minor discomforts soon restored them to full capacity. A convalescent depot was started by Refshauge at Kaindi, Edie Creek: it was functioning before the attack started and when the main threat had passed was taken under command by Captain H. E. Marsden early in February. It proved very valuable to men not yet fit for resumption of duty.

During the hard fighting by the 2/5th Battalion at Crystal Creek, difficulties were encountered in extricating casualties from awkward spots which could often only be reached by hard climbing. Stretchers of the wire cage type were found most useful; carriage was facilitated by lashing handles to each end.

On the 11th the situation was quieter, and a pocket of enemy resistance had been partly dealt with; the 2/5th Independent Company was withdrawn to rest, with the hope of a fortnight's relief for recuperation and dental attention. Lieut-Colonel R. S. Smibert, commander of the 2/2nd Field Ambulance, arrived at Wau on 13th February and assumed the responsibilities of the S.M.O. Kanga Force. In his early reports he emphasised the changes necessary in medical arrangements now that the military situation had altered. The movement of troops to the Bulolo area and towards the Markham area had to be covered; for instance, two medical officers were wanted for a small force going to Bena Bena to establish and cover an airfield, and one for forward work with the 2/6th Battalion. On the other front, the Mubo area, medical posts were set up at Skindewai and at Guadagasal, on the Skindewai-Saddle track: both these posts had facilities for surgery, which was begun in March and April. Ryan and

Leslie acted as surgeons to the teams, and Smibert organised the collection and evacuation of casualties.

In general terms, the preventive aspect was assuming greater importance, with regard to malaria. Though arrangements had been made for a mosquito survey, events had not permitted this; now it was essential, starting with the Bulolo area. Anti-malarial stores had also been indented. Major A. W. M. Hutson arrived on the 15th as a physician to the force and advised on medical conditions in the field. The practical applications of malaria control became an important issue. For example, it was found that during action the 2/6th Battalion had left their nets in unit dumps: arrangements were made to collect them later. The commanding officer was confident that the men would resume the use of nets without trouble when circumstances permitted and made it desirable.

MEDICAL PLANNING

A staff directive from New Guinea Force headquarters at this time indicated the strategy of future operations. The holding of Lae and Salamaua by the Japanese was being made expensive by air operations, and was forcing them to bring troops through the Markham Valley from Madang. This emphasised the vital importance to the Allied forces of the Bulolo area. Wau-Bulolo must be held, and the Wau-Bulldog line of communication down the Lakekamu River was to be developed by construction of traffic facilities. These plans involved the expansion of Kanga Force to divisional strength, with corresponding demands on the medical services.

On the 18th an A.D.S. at Bulolo was ready to receive patients, and arrangements were being made for Captains McCracken and D. W. MacPherson to do necessary surgery at Skindewai, from which area the 2/7th Independent Company and the 2/5th Battalion were making raids on the 21st. Stored blood had been provided from Moresby during the action, and was still available for use: it was found to be usable only for five days after arrival. During quiet periods supplies were reduced. Anti-malarial precautions were enforced in the whole area by an order of Kanga Force. During the Wau action some units had been unable to ensure that all forward troops received suppressive atebrin. As Ford had pointed out, the malarial danger in any particular sector was not so much one of heavy local infection *per se,* but the risk of the satisfactory malarial control at Wau engendering a false security in troops entering the highly endemic Markham Valley without adequate preparation. Another important medical matter emerged at this time, the distribution of scrub typhus. The endemic areas were in some instances known to the Angau representatives, such as Crystal Creek and Edie Creek: personal experience confirmed the notoriously patchy incidence of this disease.

Brigadier Disher, D.D.M.S. New Guinea Force, summarised the position at 23rd February. The M.D.S. at Wau was in buildings and tents, and could hold 130 to 150 patients: the surgical team was stationed here. The aerodrome R.A.P. was being enlarged by digging into a cliff

150 yards from the strip. Five miles from Bulolo, and fifteen miles from Wau, the A.D.S. was able to hold casualties from the 2/6th Battalion. The Bulolo aerodrome was being prepared for use by transport planes. Aid posts of the 2/7th Independent Company and the 2/5th Battalion were at Skindewai; from here native carriers took one and a half to two days to bring patients to a jeephead, whence they were taken to Wau M.D.S. The rest station for convalescents could take fifty men, and hold them for a week or more as required.

Smibert in a report made clear some of the difficulties of transport of sick and wounded. Lying patients were carried by native bearers, but these were few in number. The lines of evacuation likely to be used in future engagements were numerous and long as well as being most difficult. The approximate times for carriage by native bearer teams showed this. For example, Skindewai to Crystal Creek jeep post in three stages occupied twelve hours; Black Cat mine in two stages to Bulolo River took eight hours; Bob's camp to Sunshine by four stages took twenty hours, and then motor ambulances could travel from Sunshine to Wau in two hours. Telephone communication was possible between a number of the staging posts, but as dispersal of the force increased more medical staging posts would be required, covering growing distances, though the help of Angau in looking after camps on the tracks was most useful. Even when casualties reached Wau the uncertainties of air transport to and from Port Moresby introduced further delay.

HEALTH AND NUTRITION

Refshauge reported to the D.D.M.S. that activity was slight at the time, but pointed out that special care was needed to prevent dysentery and similar infections arising from the fouling of the ground in areas previously occupied by the Japanese. Supplies were becoming an acute problem: the field ambulance complained that the food was monotonous, and warned that there were signs of vitamin deficiency among the men. MacPherson found that food was of good quality, but mainly tinned, and that the quantity was inadequate for troops engaged in or resting after hard fighting. An increase in forward rations, especially the provision of hot meals, was found to increase the stability and stamina of the men: on "hard" rations troops lost appetite. In his opinion milk, tea and sugar were required in liberal quantity during action, and further supplies were needed, and an even higher calorie diet was advisable under the arduous conditions of the campaign. McCracken was also dissatisfied with rations received by his unit. After the enemy attack on Wau the unit was cut off from land based supplies, and for ten days was dependent on unsatisfactory air-dropping. A point which may be mentioned in this connection affected numbers of areas. Unless food packages were retrieved they often caused increase in fly breeding: this was particularly evident when meat was included. By the end of the month the area from Waipali to Buibaining was cleared of Japanese and on 1st March the Mubo Valley was also under control.

On the 2nd began the air-sea action since known as the battle of the Bismarck Sea. The Japanese were known to have considerable concentration of ships in Rabaul Harbour, and when a convoy of twenty-two transport and supply ships with naval escort was observed to leave Rabaul and approach the Vitiaz Straits, it was rightly assumed that this carried reinforcements for Lae. General G. C. Kenney sent a powerful Allied striking air force to intercept them and during the 3rd and 4th most of the convoy was destroyed. Without control of Lae the Japanese could not possess the Markham Valley, and their plan of coming down from the Madang area was upset. Blamey's strategy, approved by MacArthur, was now to secure a sea-land base at Nassau Bay, and to divert the enemy's operations from Lae to Salamaua, thus facilitating the capture of Lae.

Early March found Kanga Force sending aggressive patrols into the Markham area, and occupying the heights overlooking Mubo and the Bitoi River winding through the mountains.

Conditions were still unsatisfactory in some camps. At Skindewai, Refshauge found cover for only 200 men, and poor hygiene. These conditions did not necessarily reflect upon the men at this and other forward posts, for there were hardly any men who could be spared for the tasks of hygiene except convalescents, and tools were non-existent. Latrines made from dehydrated potato tins helped to improve sanitation. Some of the shelters erected for patients were at first rough: until sisalkraft could be dropped from the air about June, only the bark of trees was available for roofing. Supplies mostly arrived by free dropping which caused many breakages. Packages were only recovered with difficulty: in moss forests the problems may be imagined. Yet camps such as Skindewai of this period could not be described as other than bad. More discussion went on about rations. Since chocolate was not regarded as an emergency ration, a daily issue of two ounces per man was requested. Unpolished rice was preferred by the independent companies, but polished was supplied. A man with clinical signs of beriberi was admitted to the M.D.S. of the 2/2nd Field Ambulance. Hutson found other men in the field with evidences of early vitamin *B* deficiency, though when some of these men were later returned to Moresby doubt was cast on the validity of analgesia as a sign of thiamin deficiency.

The general health of the 2/5th Independent Company was the subject of investigation at this time, and there was some difference of opinion. Brigadier Moten felt that Stout, the R.M.O., was making too much of the deterioration in stamina and health in this unit, but Smibert, the S.M.O., thought that any regimental medical officer would agree that certain factors were important in addition to endemic disease, such as boredom and the constant threat and tension engendered by the menace of numerically superior enemy forces. The more obviously affected men were examined by Refshauge, particularly with reference to their blood state. He found that twenty-four men averaged 82 per cent haemoglobin. Hutson and Stout examined 114 officers and men of the 2/5th Independent Company, and classified only eight as fully fit, twenty-seven as partially fit, fifty-six

as temporarily unfit, and recommended that twelve others be evacuated or sent for medical board, and the remaining eleven be the subject of later decision. General deterioration was found in these men, who had served for eighteen months in a tropical area; this was considered to be due chiefly to chronic malaria and mild dietary deficiency. It will be conceded that the diagnosis of early vitamin deficiency is not always easy, but there seems little doubt that these men showed decline in general condition, due to multiple causes. On the 23rd, by order of force headquarters intensive treatment of the 2/5th Independent Company began with injections of vitamin *B*. The unit was not moved out, but was given further rest at the rest camp.

MEDICAL ARRANGEMENTS

Further changes were made in the disposition of medical officers in the latter part of March, to provide more help in forward areas, and to allow for wear and tear. A detachment from the 3rd Field Ambulance in Moresby was sent to work at Bulldog-Edie Creek, where the members could gain useful experience. Later a detachment from the 15th Field Ambulance was sent to Wau for attachment to the 2/2nd Field Ambulance. Ryan and Stout were returned to Moresby; the former had a tendon accidentally severed in one finger and was replaced by Major J. M. Yeates. The general medical arrangements were also altered to provide for expected activities, which had begun on 9th March with the forward movements of troops. As might be expected in this type of country, illness was an important cause of wastage: the A.D.S. at Bulolo had an average number of fifty patients, most of whom had malaria. Scrub typhus continued to occur irregularly; in the last three days of March thirteen cases were diagnosed in the 2/7th Battalion area west of Kaisenik. The distribution of typhus round Wau township attracted special notice. Smibert's report stated that the incidence in this area was "rather extraordinary". He pointed out that seventeen cases had occurred within half a mile of the aerodrome.

> If a line is drawn at right angles to the long axis of the drome, all the cases, except one, are to the left or west of this. The other case was contracted at the S.E. corner of the drome. The people in this area have a far higher percentage of cases than any other body of troops, including those who are working in the jungle.

The percentage of troops in this area was only slightly higher, but numbers of troops living in similar conditions round the aerodrome remained well. In the Kaisenik area the men infected represented 8 per cent of the personnel. On 31st March more casualties were occurring west of Mubo, but the staging post at Skindewai was in working order, accommodating twenty medical and twenty surgical patients, and was provided with an adequate operating hut with water laid on through bamboo pipes.

On 10th April medical officers were well spread out, with a surgical team in the Saddle area and at Wau, and posts at Skindewai, Kaindi, Bulolo, Partep 2, Wampit and Missim. Some days later the 2/7th

Independent Company was given a period of rest in the Wau area, so that the opportunity could be taken to deal with the men of this unit should they need intensive vitamin treatment.

EXPANSION OF THE FORCE

Both the 2/7th Independent Company and the 2/5th Battalion were being relieved, and were replaced by the 2/7th Battalion. The time for further expansion of Kanga Force to a division was at hand, and in anticipation of this Colonel N. H. W. Saxby, A.D.M.S. of the 3rd Division, had already arrived, on 2nd April, to investigate the medical conditions and problems of the area. The administrative headquarters of the 3rd Division took steps to have field operation rations dropped to forward areas, and to have deficiencies made up by issues of marmite. It was realised that there was evidence that the dietary of the forward troops was deficient in vitamin *B*, and they were suffering in consequence from poor appetite and lassitude. Malaria was also increasing in incidence; a sudden increase in admissions was observed in the last week of April.

On 19th April Colonel Saxby took up the duties of A.D.M.S., and on the 22nd, 3rd Division headquarters arrived under command of Major-General S. G. Savige. On the same day a light section of the 15th Field Ambulance was ready to leave for Wau, but was delayed by bad flying weather. Kanga Force ceased to exist.

It will be seen that when the early and intermediate stages of Kanga Force had passed, and the force graduated into the responsibility of fitting into the major strategy of the New Guinea war, the medical as well as the military problems assumed greater importance and greater difficulty. The existence of well-known centres of civilisation famous for the lure of gold, had been of some help to those who were asked to fill a strenuous military role with few resources, but perhaps this tended to make less obvious the great dangers and asperities of the undeveloped areas of this country. The mountainous terrain, the long drawn-out tenseness of the force's task, the menace of the same tropical diseases and the inadequacy of transport had imposed a great strain, but there was no doubt that this could be borne all the better by a force competent in size and training to take up the task. Experiences in Milne Bay and in the Kokoda-Buna fronts had prepared the medical services for their part in a fully fledged campaign designed to sweep the Japanese from their holdings on the northern coast and its hinterland.

OPERATIONS OF 3RD DIVISION

The assignment of the command at Wau to the 3rd Division showed clearly how important was this mountainous area stretching between the goldfields and the northern coast of New Guinea with its important sea-land bases. At this time Allied troops were actively engaging Japanese forces on two fronts only; one of these was Wau-Salamaua, the other was northern Burma. The plans of the Allies in New Guinea were being

fitted into a wide strategic pattern. Savige, the divisional commander, at first only had available the 17th Brigade and two independent companies with some artillery. His initial task was that of maintaining a mobile defence which would facilitate the development of an offensive in an active operational zone. This zone, of course, had its focal point at Salamaua, though no direct attack on this base was as yet planned. The 15th Brigade was not yet available, and did not arrive at Wau until the end of May. The enemy had been expelled from Wau, and a line of communication was being maintained through Bulldog to the Lakekamu River to the sea and thence to Moresby. He still held Salamaua, one of the keys to possession of the valuable north coast, and over the rough mountainous jungle fanning out from the civilised goldfields to the seaboard, bitter actions were expected. This country was not merely difficult for all military manoeuvres, it imposed on contending forces a constant struggle for the heights.

It will be seen, therefore, that in spite of holding good bases at Wau and Bulolo, where there were some amenities, the Australian force would require adequate medical attention at numerous staging posts along a most difficult line of communication. Further, medical and surgical work of the "acute" type would have to be undertaken in forward areas, in medical posts pushing on in close contact with the exploring or advancing troops. Here the art of extemporisation would have full play in independent and mainly self-contained surgical centres, budded off from larger medical units. From these posts evacuation of sick and wounded would at this stage be chiefly back to Bulolo and to Wau, and finally to Moresby by air.

When the 3rd Division assumed command, this part of New Guinea could be divided into a number of areas of topographic and strategic importance; these were Wau-Bulolo, containing the goldfields; Mubo and Missim both of immediate significance; Markham leading to the inland valleys between mountains and sea, and Nassau Bay with its potentialities for sea landings. Through these broadly defined areas ran several tracks. The Wau-Mubo track led from the goldfields over high mountains and sharp rocky ridges, reaching 6,400 feet at Summit camp. At Missim a track curved down into the valley of the large winding Francisco River, and on through Bobdubi over more open scrub country to Salamaua. Two other tracks led north to Nadzab and the Markham Valley, one westerly through Wampit, the other towards the east from Sunshine through Wagau along the Snake River Valley.

MEDICAL ORGANISATION

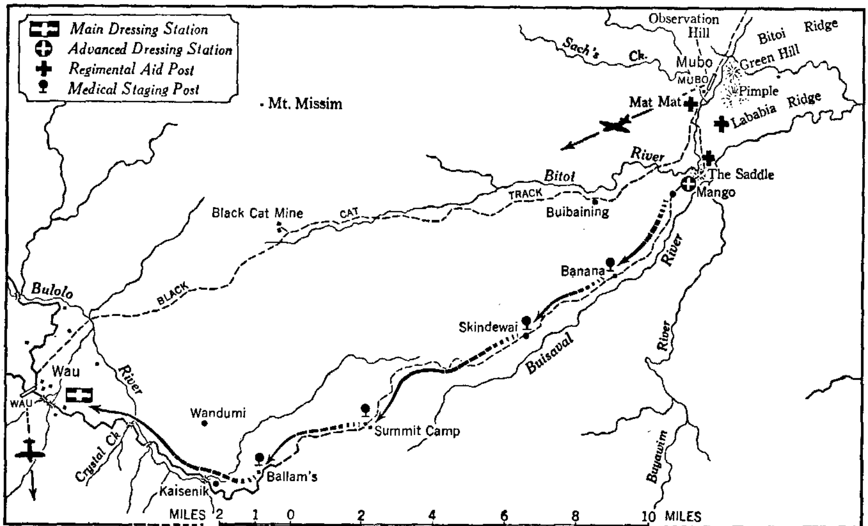
On 22nd April the medical dispositions were as follows. At Wau was a main dressing station of 150 beds; here good surgical facilities were available, and sick and wounded needing treatment at a hospital base could be flown direct to Moresby. An advanced dressing station of fifty beds was at Bulolo, from which patients could be transported by road, either by jeep or by a motor van transformed into an ambulance by local ingenuity. A regimental medical officer was also centred at Bulolo.

The 2/7th Battalion attacked the elevations known as Pimple and Green Hill on the 24th, but failed to break the enemy's hold. An additional medical party arrived at this time, a light section of the 15th Field Ambulance, which was training in Moresby. Until the 3rd Division assumed command, the medical services of Kanga Force consisted of the 2/2nd Field Ambulance, whose strength was brought up to eleven officers and one hundred and eighty other ranks. This unit supplied medical services for all posts in the Bulolo Valley and along the Markham, Missim and Mubo lines of communication. At this time the personnel of the 2/2nd Field Ambulance were in twenty-two separate sites in New Guinea. As the increasing needs of future operations became clear further help was provided. The strength of the 15th Field Ambulance was increased to eight officers and one hundred and sixteen other ranks, and four officers and thirty other ranks on the establishment of the 2/1st Australian Mobile Operating Unit were also brought under the 3rd Divisional command. These additions were made during May and June. Refshauge was promoted lieutenant-colonel, and placed in charge of the 15th Field Ambulance. The A.D.M.S. discussed plans with Smibert and Refshauge in the light of the projected operations, and the organisation was set up accordingly.

The Australians had taken part of Bobdubi Ridge early in May, and shortly afterwards captured high ground at Coconut Ridge. The enemy sustained heavy casualties from these actions, and his lines of communications from Salamaua to Mubo were disrupted. On the 14th the Japanese counter-attacked, and forced the Australians to withdraw from Old Vickers near Bobdubi.

Though these engagements did not inflict substantial loss on the Australians, the wastage from disease was more serious, as men were being sent back every day with malaria and dysentery. Already it could be seen that the losses from disease in recent campaigns had left no deep cautionary impression on the troops carrying the war into new areas. The change from quinine to atebrin as a suppressive of malaria should have brought about a fall in sickness rate, but this hope was not yet being fulfilled. Hygiene too was suffering that neglect which is only too common, especially in small communities. Refshauge, who remained in the Missim area, laboured to improve the general standards in the medical posts, though the greatest difficulties arose not there, but among the combatant troops, especially under operational conditions. New Guinea Force headquarters on 20th May gave Savige his instructions for the prosecution of the campaign: "To threaten Salamaua by aggressive overland operation from Wau-Bulolo Valley, and by thrusts along the coast from the Morobe area." A week later the 15th Brigade arrived, and on 8th June took over all troops in the Missim area, and the headquarters of the 2/6th Battalion assumed command of the Mubo area, which was the responsibility of the 17th Brigade. The 2/3rd Independent Company, patrolling in the Namling area, noted considerable movement and activity among the Japanese troops on the main Salamaua-Komiatum track. Active opera-

tions were proceeding in the Mubo and Missim areas; under these conditions aid posts were necessary at frequent intervals, especially in view of the nature of the country and the limited transport facilities. Extensions of the medical services permitted an A.D.S. of thirty beds to be established at Missim; here and at Pilimung arrangements were made for surgical work to be carried out. In the Markham area a medical post was set up at Sunshine, staffed by the 15th Field Ambulance, and patients were sent on from here to the A.D.S. at Bulolo. The mobile operating unit took over this A.D.S., thus freeing a detachment of the 2/2nd Field Ambulance which was then able to return to Wau.

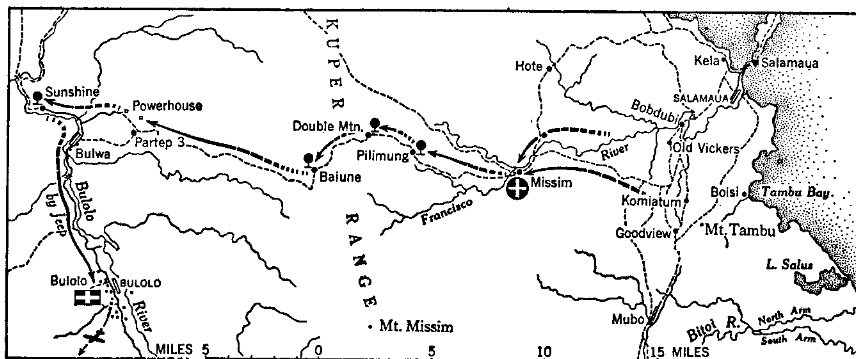


Evacuation 17th Brigade

These moves were in accordance with the conference of the A.D.M.S. with Smibert and Refshauge held several weeks earlier. They had agreed that 10 per cent increase in the battle casualties might be expected in the forthcoming engagements, and made their arrangements so that early surgical treatment and transfusion of blood or serum would be freely available. Recognising, too, that emergencies would throw a strain on staff and supplies, reserves of both were sent as far forward as possible. Additional stocks of surgical instruments were also obtained from Moresby and sent to Missim. The operating unit supplied two surgical teams, and at the end of June such medical officers as could be spared were sent forward in reserve. Smibert and Refshauge were appointed as S.M.O. of the 17th and 15th Brigades respectively, at Skindewai one and a half days' march from Mubo, and at Missim. The general scheme of evacuation provided for a steady emptying of the forward posts, as conditions permitted, while the rest camp was kept full. The M.D.S. at Wau and the A.D.S. at Bulolo maintained a maximum of 100 and 40 patients

respectively, though further expansions of bed states were to be made by July. All sick who were not expected to be well within three weeks were sent back to Moresby. The movement of sick and wounded and carriage of supplies depended chiefly on native bearer squads, but even with expert handling these were hard to get and still harder to keep.

In the Mubo area the R.M.O. of the 2/6th Battalion was at the Saddle, and had forward R.A.Ps. at Mat Mat and Lababia. Here, a sharp enemy attack on 21st June made it necessary to operate on wounded under a tent fly with few facilities. At Mango in the Guadagasal area was an A.D.S. with thirty-five beds, to which a surgeon was attached. A smaller staging post of sixteen beds was sited at House Banana, where patients could stay overnight, as also at Skindewai, Summit and Ballam's, where there was a jeephead. These posts were two to three hours apart, so that walking wounded could take easy stages. Stretcher cases could traverse the line of communication in two to three days without undue fatigue.



Evacuation 15th Brigade

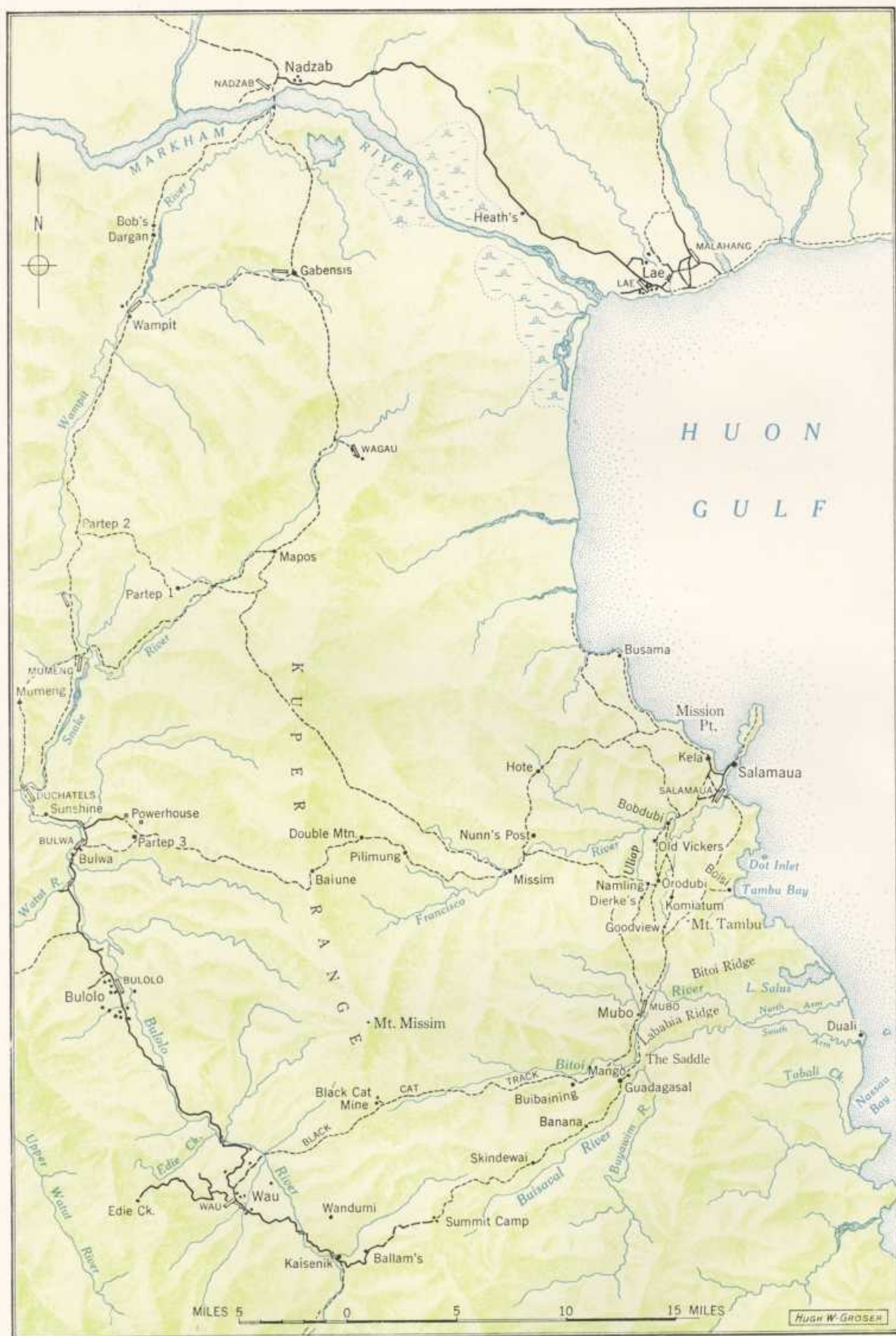
In the Missim area advanced staging posts were set up in three neighbouring places, Pilimung, Double Mountain 8,000 to 9,000 feet high, and Baiune; these posts were four to five hours apart. Another jeephead post was placed at Powerhouse. The more remote areas, such as Markham, were centres for patrolling, and these less concentrated military activities were adequately cared for by a medical officer in the Partep area, and by "roving" orderlies who were available according to needs. Though native porters could not be used at all prodigally on this difficult line of communication, they were invaluable, and great assistance in their management was given by the personnel of Angau. Even a brief perusal of these arrangements shows how the medical needs were assessed by the time-distance factor not only in the evacuation of sick and wounded, but also their prompt treatment; both demanded a liberal hand in the provision of medical officers, supplies and posts. The earlier experiences of Refshauge and Smibert had demonstrated this: Saxby, as A.D.M.S., acted on the same principle, and Disher, D.D.M.S. of New Guinea Force, was

as liberal as possible in supplying medical officers. Allowance was made for adequate attention to be given to the sick and wounded at points not too far apart and without placing undue strain on transport.

The foot tracks varied greatly; carrying over some of them was a very burdensome task, as it was on the Owen Stanley Range. A jeep track was being made from Wau through to the Summit camp, but, to anticipate its history, it was not a success, and broke down in heavy rain. The trail from Powerhouse climbed to 9,000 feet before it fell steeply to Pilimung and Missim through cold wet rain forest. It was barely possible to carry stretchers over this rough muddy track, described by some as the hardest trail in New Guinea. Some of the tracks were passable enough to warrant the carrier teams bringing back supplies on the return journey, but not all were like this. On the Mubo line of communication the two stages from Mango to Skindewai, where the main staging post held fifty beds, were each a hard day's carry requiring twelve boys to a stretcher, too heavy to warrant back-loading of the native teams. From the Guadagasal area to Nassau Bay, on the coast, the trail was mountainous, with some hard climbs. On the track to Mubo, *en route* to Komiatum, the going was reasonable for the type of country. Off these main tracks, however, some of the bases later established were reached only after journeys which were very trying for carrier teams. The Wau-Bulolo section was much easier than these forward areas; the climate was mild and the tracks ran through open timbered country at an elevation seldom greater than 3,500 feet. From Sunshine to the Markham River was a long hard carry, but it was not so exacting as to preclude the use of stretcher teams for patients. For the maintenance of an adequate service in these serial posts several factors were necessary besides a liberal establishment of medical officers and orderlies. These were the regular issues of rations and supplies, usually dropped from the air, allowing adequate provision for expansion or movement of the sites forward or back in accordance with the military position. The establishment of the divisional rest station at Kaindi in the Wau area helped greatly to lessen the strain on other posts; it was now able to care for 100 patients with slight ailments during convalescence.

The nature of the problems in hand showed that the only satisfactory solution would be an elastic organisation capable of following shifting battlefronts, and demanding a high degree of versatility from the medical personnel.

Geneva Emblem. During June a strong protest was made by the medical services against an official direction to remove red crosses from the main dressing station. While the A.D.M.S. and his colleagues recognised that either adequate display of the Geneva emblems or concealment was permissible for a medical unit, they pointed out that the sudden removal of emblems which had been displayed for several months would encourage the enemy to believe that the site was no longer occupied by a medical unit. Further, Refshauge maintained that facilities were better in the M.D.S. as then sited, and that there was good evidence that the Japanese had regard for the Geneva emblem.



Wau-Salamaua

PREPARATIONS FOR RENEWED ACTION

During the latter part of June attacks were expected by the Australians in the Mubo area. Saxby estimated the additional medical support required as surgical teams, remaining rear details of the 2/2nd Field Ambulance, and the 15th Field Ambulance. Transport difficulties delayed their moves, but "A" and "B" Companies of the 15th Ambulance and the balance of the 2/2nd Ambulance arrived, and the 2/1st Mobile Operating Unit replaced a surgical team. A little later, part of the headquarters of the 15th Field Ambulance also arrived. The appointment of S.M.Os. to the two brigades simplified administration and control. The medical arrangements were by now well forward, though there was still some shortage of reserve supplies. It was recognised that air-dropping could not always be entirely regular, for calls on transport planes were great, and other missions had important claims, but on the 30th, the day when enemy activity flared up again in the Mubo area, the M.D.S. at Wau was almost destitute of medical stores and liquid fuel, and had very little food. To keep the forward posts supplied was no light task, for these really constituted a chain of small hospitals, with an ability to expand quickly when need arose.

ACTION ON THE RIDGES

At the end of June the 15th Brigade, under Brigadier H. H. Hammer, moved eastward from the Missim area, and with the 58th/59th Battalion launched an attack on the high ground posts at Old Vickers, Coconuts and Bobdubi. This movement was designed to synchronise with a landing on the coast to the south by a United States force.

Landing at Nassau Bay. To this end preparations were being made; at Nassau Bay "D" Company of the 2/6th Australian Infantry Battalion was to give support. On 30th June the first wave of a United States force landed at Nassau Bay. In this early landing operation difficulties were met which caused trouble in timing the movements as planned. The weather was bad and the sea rough; the barges were insufficient in number, the troops were inexperienced and were unable at first to achieve cohesion, while the land party had trouble in crossing the Tabali River and the adjoining swamp. The 2/6th Battalion contrived to consolidate as a supporting force on 1st July, near the mouth of the Bitoi River. Under more favourable conditions further landings of American barges were made on the 3rd, which was reasonably close to the original date for landings on Woodlark and Kiriwina Islands.

The Japanese in the coastal areas were far from inert, and had shown increased hostility during the past two weeks, both by attacks on the 2/6th Battalion, and by heavy bombing of the area. Some heavy assaults were beaten off before the landing took place, and little damage was suffered by the supporting troops, though the attached native carrier force was scattered for several days. By the sixth day after the landing three American companies were ashore with some guns and supplies. Australian troops had provided some cover for the American landing, and the

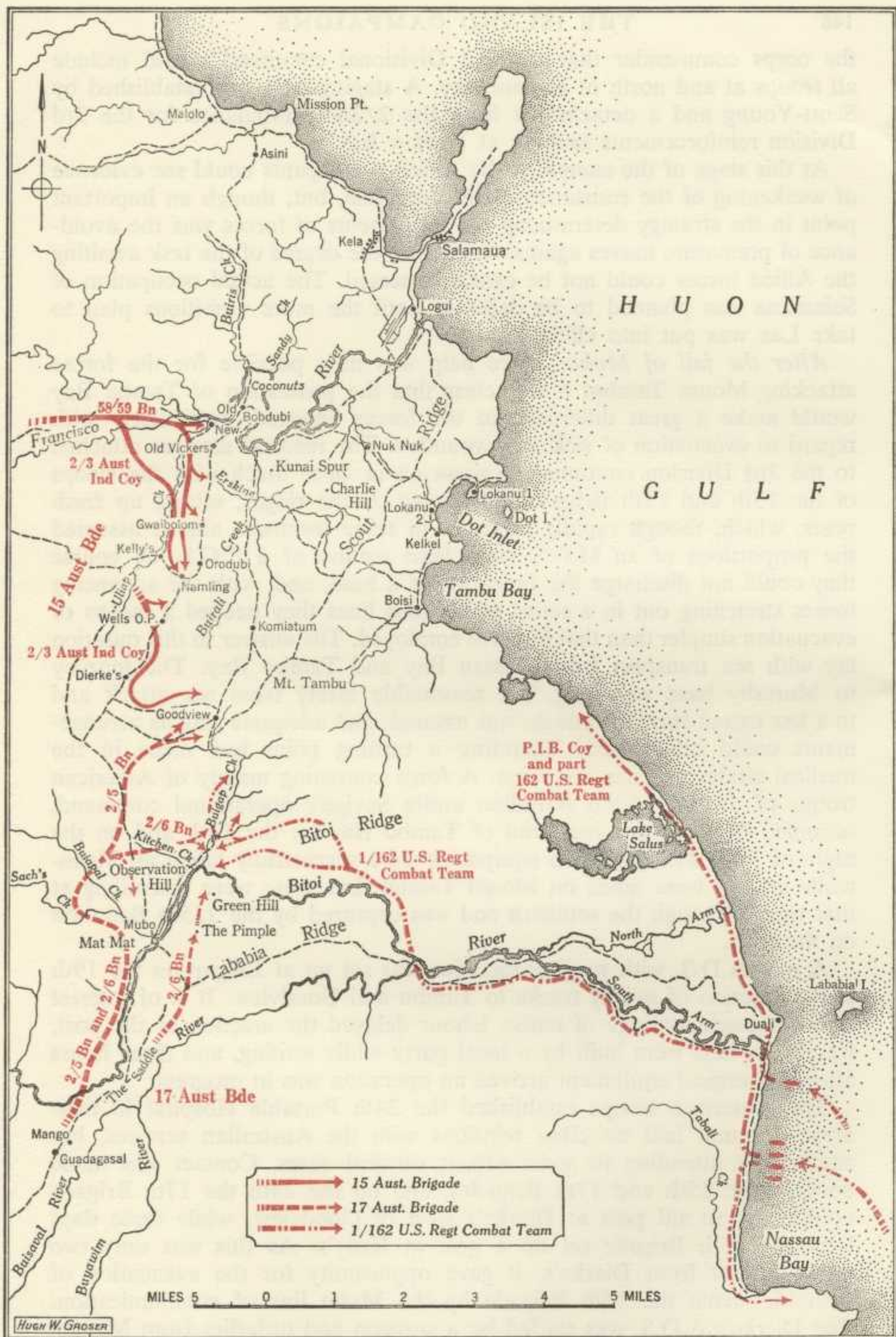
Australian medical services were prepared to give attention to sick and wounded until the landing force was established.

While consolidation of the United States I/162nd Battalion (known as MacKechnie Force) was taking place at Nassau Bay, successful diversions of the Japanese by the Australians were taking place on the high ground inland. The 58th/59th Battalion made a wide attack on Bobdubi Ridge, and carried out an ambush on 3rd July. Growing air strength was used to supplement attacks on objectives in the Mubo Valley, and the organised American force had reached Bitoi Ridge on 8th July. The Australian 2/6th Battalion attacked Observation Hill, and was approaching the American force. The Australians were using their familiar method of aggressive patrols which had proved so effective in this country, and were supported by the American field artillery.

The 17th Brigade at Mubo. While sea-land bases were being set up on the coast south of Salamaua, the Australian position on the heights above Mubo was being greatly strengthened. The number of Japanese in the forward area was being reduced and their retreat was blocked. New posts were set up to deal with the forward problems in the 17th Brigade area. Quinn set up his R.A.P. for the 2/6th Battalion at Sach's Creek; at Mat Mat staging post patients could be given necessary care, which included not merely ordinary comfort and hot drinks, but even resuscitation by intravenous infusion. Complete control of Observation Hill was not gained by the 17th Brigade troops for some days after the southern slopes were taken, and during this period sick and wounded had to be carried to a staging post at Reeves' post. Here they rested for the night, looked after by a medical officer and a medical orderly until they could go on to the well-equipped Mango A.D.S. This organisation was transferred to Goodview Junction as soon as a direct route was open.

On the 12th the Australians took the Pimple and moved on to take Green Hill and the Mubo aerodrome, which promised to be extremely useful when made practicable for use by light aircraft. During these attacks special medical arrangements were made at Lababia, but these were not needed, for after initial resistance at these points the enemy withdrew. The following day troops of the 17th Brigade moved past Observation Hill to the north, where they came into contact with elements of the 15th Brigade at Goodview Junction. Old Vickers on the heights was still strongly defended, and resisted the 58th/59th Battalion, though farther south the 2/3rd Independent Company had some success. Farther north in the Markham area the 24th Battalion patrolled actively against the Japanese troops deployed towards Salamaua.

Medical arrangements at this period followed the requirements of the actions. After the initial periods of the landing at Nassau Bay medical attention to the American force was supplied by the American medical corps, and thus, although members of the Australian medical services gave needed treatment to American troops, they had no general responsibility to the main forces. Difficulties arose between the United States and Australian force command, but these were overcome by a direction of



The 3rd Division attack, 13th July

the corps commander that the 3rd Divisional command would include all troops at and north of Nassau Bay. A staging post was established by Scott-Young and a detachment from the 2/2nd Ambulance for the 3rd Division reinforcements landing at Nassau Bay.

At this stage of the campaign the Allied participants could see evidence of weakening of the resistance of the Japanese, but, though an important point in the strategy determining the movements of forces was the avoidance of premature moves against Salamaua, the degree of the task awaiting the Allied forces could not be exactly assessed. The actual occupation of Salamaua was planned to be deferred until the more ambitious plan to take Lae was put into effect.

After the fall of Mubo. More help was now possible for the forces attacking Mount Tambu; it was clear that the possession of Tambu Bay would make a great difference to the forces engaged, particularly with regard to evacuation of sick and wounded. The medical services attached to the 3rd Division continued to press on in close touch with the troops of the 15th and 17th Brigades advancing on the ridges, setting up fresh posts, which, though rapidly built-up, in some instances almost assumed the proportions of an M.D.S. or a light section of a C.C.S. Of course they could not discharge the functions of a base, and, with the advancing forces stretching out in a series of tenuous lines they needed a means of evacuation simpler than that hitherto employed. The answer to this question lay with sea transport from Nassau Bay and Tambu Bay. The journey to Moresby base was long, but reasonable safety from sea attack and to a less extent from air attack, was assured, and adequate staging arrangements could be devised. Therefore a turning point had come in the medical strategy of the campaign. A force consisting mainly of American troops of the III/162nd Battalion under Savige's operational command, occupied the southern headland of Tambu Bay on the 17th and on the night of 20th/21st guns and equipment were successfully taken in. Meanwhile attacks were made on Mount Tambu, but these were unavailing at that time, although the southern end was captured by the 2/5th Battalion on the 16th.

A new A.D.S. with surgical facilities was set up at Buigap on the 19th at the junction of supply tracks to Tambu and Goodview. It is of interest that, although shortage of native labour delayed the erection of the post, frames for huts were built by a local party while waiting, and three hours after the surgical equipment arrived an operation was in progress.

The American troops established the 24th Portable Hospital in their area; this unit had no close relations with the Australian services, but assisted by attending to some urgent surgical cases. Contact was made between the 15th and 17th Brigades, and on the 24th the 17th Brigade established an aid post at Dierke's west of Goodview, while three days later the 15th Brigade set up a post at Kelly's. As this was only two hours distant from Dierke's, it gave opportunity for the evacuation of casualties from the 15th Brigade by the Mubo line of communication. The Dierke's A.D.S. was staffed by a surgeon and orderlies from Mango,

and after delays in the receipt of cover and bedding, which were brought up by carrier train, work began. By keeping a squad of fourteen natives at Dierke's and two squads at Buigap one stretcher could be taken daily to Mango from each A.D.S.

The I/162nd United States Battalion took over the Tambu area from the 2/5th Australian Battalion, and the 24th United States Portable Hospital moved up near the Buigap A.D.S. with two more native bearer squads. As many as fifteen stretchers were in use in these two posts in dealing with the casualties. The carrying time from Buigap to House Mango was three and a half hours. Stretcher carriage from Mango to Summit was satisfactory, and an improved track allowed back-loading to be used. If a patient needed urgent treatment overnight he could be taken on direct to Skindewai. Meanwhile, work was proceeding on the Mubo aerodrome and the use of an ambulance plane from this airfield was in sight by early in August.

Meanwhile the 15th Australian Brigade, answering a Japanese assault on Orodubi, attacked Bobdubi Ridge. On the 28th the 58th/59th Battalion took Old Vickers in the same mountain area, and covered the Bobdubi-Komiatum track.

Air transport from Mubo. The Mubo aerodrome was ready for traffic on 10th August and a plane landed and took off successfully. It could carry one lying and one sitting patient, and by making an early start in the morning before the weather thickened and reduced visibility, could make five daily trips to Wau. On Mubo Ridge there was a small post of twelve beds; from here patients were sent to Mubo aerodrome by stretcher teams if these were available, or by walking if they were able. Some medical personnel also came in to Mubo by air, and medical and Red Cross supplies were brought in 20-pound loads from Wau. These were of convenient size for sending by carriers who took patients from Goodview to Mubo. This evacuation route could only deal with small numbers, but was most valuable for men whose condition demanded early treatment at a base area. At this stage an increasing flow of traffic began by barge.

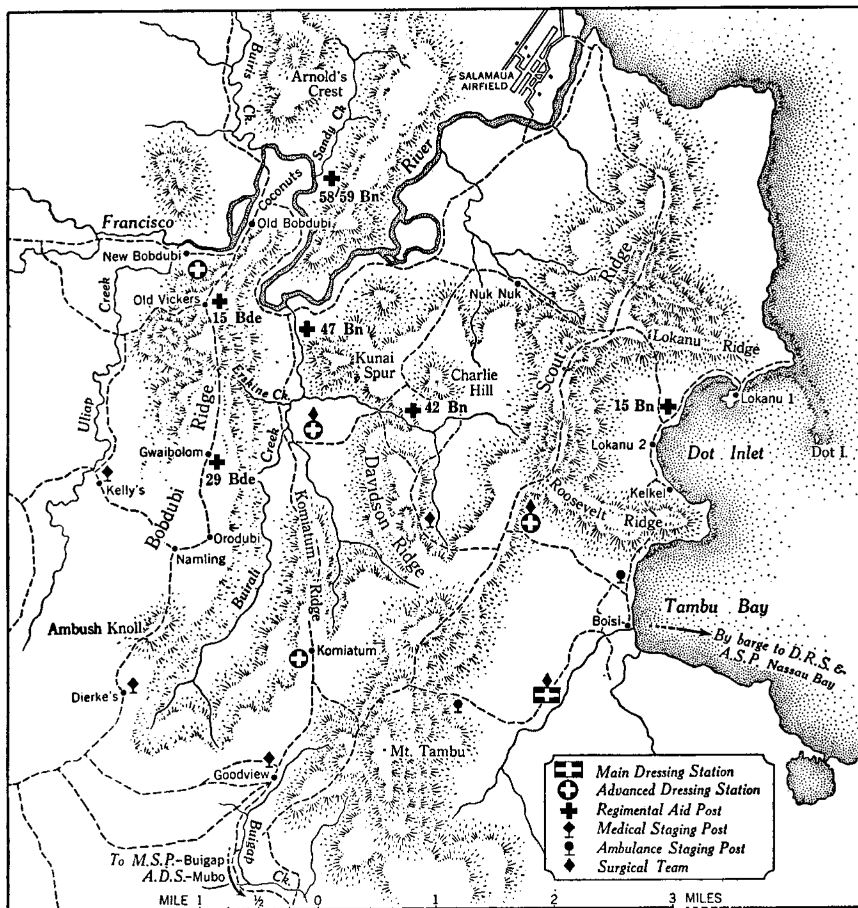
Early in August there was considerable fighting around Komiatum, and the enemy line of communication was cut and held. Troops of the 17th Brigade attacked Komiatum on the 16th, and the 29th Brigade, added to the 3rd Divisional force, had its 42nd Battalion also in action.

After overcoming enemy resistance at Goodview Junction the 2/5th Battalion proceeded northwards on the 19th and met the 2/6th Battalion at Komiatum. They continued along the Komiatum track and exerted pressure on the withdrawing enemy. Two days later Australian forces drove the Japanese from the Komiatum-Bobdubi-Salamaua track; this followed the plan by which the enemy would be driven north from his vantage points without a definite attack on Salamaua itself.

The American force had occupied Mount Tambu on the 19th. Here, their objectives were limited by the terrain, in which "the precipitous razor-backed ridges and high isolated features of Mount Tambu made frontal attacks against a strong enemy impracticable".

MEDICAL AND SURGICAL FACILITIES

During August, action continued in the Missim area, and an increasing number of casualties called for prompt transport arrangements and greater facilities for forward surgery. The increase in surgical work was illustrated by the progress of the mobile operating unit, which, without being invested with all the equipment designed to make such a unit independent, was



Wau-Salamaua dispositions

moved to areas where it was most needed. During July it had worked at the A.D.S. at Missim, which had been taken over by the 15th Field Ambulance, and after moving to Meares' Creek three hours away, left a detachment behind to deal with other casualties. The team then moved to A.D.S. Kelly's just in time to start work as casualties arrived. By 24th August they had treated 123 surgical cases, chiefly men wounded in the assaults on Vickers Ridge, Bobdubi and the Namling and Orodubi

areas. The numbers treated were a reflex of the bitter fighting in these areas. Captain R. K. Constable, who had remained at Missim, now took over at Kelly's and the "light team" of the operating unit moved to the post at Bobdubi. This brought the surgeons closer to their work, and obviated a carry up the Uliap Creek by night. This work concluded, Constable took his team with the advancing force down the Francisco River, and up Sandy Creek towards Salamaua.

The A.D.S. at Kelly's rose rapidly in importance, and for most of the time had 120 beds. Until 23rd August the staff included two surgeons, two medical officers, one dental officer and thirty-five O.Rs. Later one surgeon and several O.Rs. were sent to establish a medical staging post at Bobdubi, which, like Nunn's post, had over twenty beds. At Missim the A.D.S. had fifty beds, with one medical officer, and another staging post was opened at Hote with fourteen beds. The 15th Field Ambulance found it convenient to use the R.A.P. of the 58th/59th Battalion as a staging post, to which an additional medical officer was attached.

Unit natives collected wounded in front of the aid post, and native bearers allotted to the battalion carried stretchers; twelve bearers were needed in hilly country and eight in flat. The average time elapsing from wounding to operation was eight hours, and the minimum five hours. Occasionally men were missing for much longer periods, from thirty-six to ninety-six hours: these figures are excluded from the above averages. When the Bobdubi post was established these figures were greatly improved, the average falling to five hours. Admittedly in certain areas where natives were not being used for supplies the carrier system was wasteful, but later one stretcher per day, the initial rate, was increased to four per day. At the end of August a still shorter line of evacuation was possible, through A.D.S. Erskine, though only four stretcher cases a day could be handled by the post. Sometimes during this phase of the campaign stretchers would accumulate, especially at Kelly's, where at one time thirty-six were waiting forward movement. This forced the evacuation of convalescing patients who would have been able to return direct to their units had a further period of rest been possible. During the period 4th to 31st August the medical establishments varied in number and strength according to need. Medical evacuation was carried out over a line of communication not much otherwise used; this rather enhanced the difficulty of handling casualties. Refshauge reported that he considered that the increasing fatigue of the troops caused lack of vigilance, and suggested that this might have been responsible for a greater proportion of severe injuries necessitating movement by stretcher.

Medical supplies for Bobdubi were usually dropped by air at Nunn's post; but later arrangements were made to drop at Bobdubi. At times there was an embarrassing shortage of some essential medical stores; this was due to an increase in the general sick rate, as well as in battle casualties, to occasional delay in dropping of supplies, and also to some extent to the lack of a dispenser in the area who could have been usefully engaged in checking and forecasting the local needs. Rations were fairly

satisfactory, but it was hard to provide comfort or variety for sick men.

The medical services took the opportunity to estimate the physical condition of the troops to find out how they had stood up to the trials of two months' campaigning. The general health of the men could be fairly assessed from studying them over a period as they passed through the posts: medical officers described it as "only fair". There were signs of fatigue to be seen, to which Savige had also drawn attention in his reports. More important than these factors were the sick rates due to infective conditions and the growing incidence of disorders of the skin. These latter were not altogether preventible, but malaria and typhus could be controlled in part, yet they were rising in frequency.

ADDITIONAL TROOPS ARRIVE

The headquarters of the 3rd Division was now due for relief; a wider strategy was centring on Nadzab and Lae, and the men were tired by their successful efforts of past months. The 29th Brigade, comprising the 15th, 42nd and 47th Battalions, began to land at Nassau Bay, and on the 24th August relieved the 17th Brigade. On the 26th the 5th Australian Division headquarters took over from the headquarters of the 3rd Division. After some weeks of attack the American force took Roosevelt Ridge overlooking the northern end of Tambu Bay and Dot Inlet on the 29th. Two days later the 47th Australian Battalion took Kunai Spur, an inland ridge rising from the long Scout Ridge in a bend of the Francisco River.

MEDICAL ORGANISATION AT NASSAU AND TAMBU

In addition to these highlights in a series of actions which were steadily pushing the Japanese back, and lessening the value to them of Salamaua as an active base, work was done in consolidating the coastal areas now held by the Allied forces. These bases were of great value not only as future stepping stones, but also as inward channels of supply and outward channels for sick and wounded. Once the Tambu Bay line of communication was safe it could be used to send patients from the Mount Tambu area by barge down the coast to Morobe, though greater facilities for medical care were wanted at the loading points. After Goodview Junction and Mount Tambu had been captured the way was clear to Tambu Bay, and evacuation of sick and wounded through Wau ceased altogether.

When the 42nd Battalion came under command in this area a light section of the 7th Field Ambulance was attached, and formed a medical post at Boisi on Tambu Bay. From this beachhead barges took patients to Nassau Bay, where there was a jeephead with a surgical post, but this could not go farther forward owing to problems of water supply. No surgeon was sent with the 42nd Battalion, and as the chief surgeon of the American force in Tambu seemed doubtful about supplying an emergency service to this battalion, an Australian surgeon was sent from Goodview with equipment and staff from the 7th Field Ambulance at Nassau.

The main body of the 7th Ambulance had arrived at Nassau Bay on 10th August, when a section began to set up on the foreshores of

Tambu Bay under Major J. A. Hill. This beach was exposed to shell and mortar fire, as it was only one-third of a mile from a ridge still held by the Japanese. The post was consequently well dug in. Lieut-Colonel S. D. Meares, the ambulance commander, brought up a surgical team to Tambu Bay, and finally selected sites for both an A.D.S. and the operating team. A week later the A.D.S. was opened at Tambu, and entered on a period of service lasting some two months under Major W. V. Connor. On the 14th Meares and a surgical team with Major Hill, Captains W. S. L. Stening and G. H. Solomon left Nassau Bay and selected sites at Tambu Bay for an A.D.S. and a surgical team. It was also found necessary to keep staging posts on the beach at Tambu Bay and to the north at Dot Inlet so as to ensure care of the sick in transit. By the 17th these arrangements were complete. The 7th Ambulance established an A.D.S. at Erskine on the 26th, about two miles inland from Tambu; here again the position was exposed to enemy attack, though the site was an excellent one, on a high flat mound, with covering bamboo alongside a stream. It was on the line of communication from the 47th Battalion near the winding Francisco River: seaward from the 42nd Battalion was another post, A.D.S. Green. Here a post was opened later on 7th September to treat and stage casualties. This was one of the few sites where water was not readily accessible: here it could only be reached down a steep declivity. An M.D.S. was established at North Tambu, also with a surgical team.

The 9th Field Ambulance also supplied medical cover for Nassau Bay. Major P. G. Heffernan took a light section of this unit to set up an aid post for use during the American landings, and here this detachment worked with help from the 2/2nd Field Ambulance until after the 17th Brigade had left the area.

A still wider-flung distribution of medical work was that farther north in the Markham area where the establishment of covering airfields at Bena Bena and elsewhere were foreshadowed, as part of the coming battle for Lae. A medical staging post was also maintained at Sunshine, and at other advanced posts such as Mumeng and Partep 2. These moves extended the zone of active preventive medicine, for the increasing importance of endemic diseases and the problems of their control were evident in viewing their expansions, particularly in anti-malarial work.

WORK OF MEDICAL POSTS IN JULY AND AUGUST

The medical and surgical posts were planned to conform to the particular type of warfare in which only frequent staging posts could make reasonable handling of sick and wounded possible. Indeed some of the patients, such as those suffering from severe typhus, might be better kept in a stationary post for brief rest and care than to be exposed to another trying journey. The A.D.S. and the operating centre were placed at the most secure forward area where casualties could usually be seen by the surgeon within twenty-four hours. Other posts not equipped for surgical work could hold minor sick from the more forward units, or keep men long enough to make it possible for them to walk back. Orderlies were

able to maintain staging camps holding six to twelve beds. In areas possessing such stability as could be given by the presence of a battalion even if only in part strength, a light section of a field ambulance could carry out these tasks admirably, and could also support a medical officer able to do surgery. The expansions of some of these posts were remarkable. In anticipation of the needs of the operations in July, the Wau M.D.S. had increased its beds to 200, and the Bulolo A.D.S. to 80 beds, but even these tasks were not so exacting as the work involved in expanding some of the more remote and extemporised aid posts often sited in virgin jungle. Transport was always a vital factor. For instance, when the jeephead of the Mubo track was moved to Summit camp, Ballam's post could be closed, and Skindewai then expanded to 80 beds. Mango post, twice bombed, was re-sited in a safer place, where its capacity was increased to 50 and later to 120 beds. Here two surgical teams were employed, with facilities for simultaneous operating. The small posts in which minor and major measures of resuscitation were carried out have been mentioned: from these patients were sent on to larger centres as soon as wisdom and security dictated.

In general the facilities were greater than on the Owen Stanleys, as, despite the very rough nature of the Wau-Salamaua country, medical officers and orderlies could be brought up nearer the actual front line with the same or less expenditure of time and energy. Logistic problems had been brought nearer solution by improvement in supplies, by greater experience of packaging and by practical experience in air-dropping, both with and without parachutes. Some of the trails were less formidable than those traversed in the earlier campaign, but others were exceedingly rough and primitive. Distances were still measured by time, and wounded men's chances were often favoured by the brief period elapsing before they arrived at a surgical post. The establishment and maintenance of a series of fresh posts in response to tactical demands could not have been accomplished without a liberal hand in providing men and supplies. Among the necessary supplies tools deserve a special mention: without these, even the materials at hand in the jungle were of little use.

Many of the aid posts were reached by narrow jungle trails often passing through streams for considerable distances. The staging post was a combatant responsibility, but the medical services were concerned with its site and convenience, its water supply, its hygiene, and its facilities for supply by aircraft, remembering that most of this was done by free dropping. Near the staging post was a medical post usually run by members of a field ambulance. Orderlies stationed in intermediate posts were competent to look after patients, adjust dressings and give morphine. They could be trained to give intravenous injections and anaesthetics under supervision, and to acquire knowledge of operating room technique, including application of plaster and splints. All this required considerable versatility, but well-chosen men again proved that it was within their capacity. Naturally supervision by a medical officer was desirable, but this was not always possible. Some of the smaller posts with a peripatetic

Evacuation 15 Aust Bde } Native Carriers
Evacuation 17 Aust Bde
Evac. from Markham Valley
Evacuation by Jeep
Evacuation by Aircraft
Evacuation by Barge
Main Dressing Station
Advanced Dressing Station
Medical Staging Post (Med. Off.)
Ambulance Staging Post (Med. Ord.)

Wau-Salamaua general line of evacuation

medical officer supplied a great variety of services. Fluid replacement was an important requirement of wounded men. Citrated blood was given on many occasions, taken from volunteers, including suitable patients and healthy soldiers in neighbouring units. Pooled serum was used extensively. Delays in transfusions were rare, in fact the need for blood was usually anticipated, thanks to the help of a vigorous and effective signal corps. On occasion blood was actually waiting, cooled and ready when the patient arrived.

The actual experiences of a sick or wounded man from a forward surgical post to a hospital base are best appreciated by a brief description of the movement from an A.D.S. such as Kelly's to Moresby, via sea transport from Nassau Bay. Usually a wounded man was fit for onward movement one or two days after operation, and left the A.D.S. at Kelly's after breakfast. A team of twelve native bearers carried him on a stretcher to the A.D.S. Dierke's in three or four hours. During the first hour the bearers waded one to two feet deep along the Uliap Creek, and then climbed a fairly steep track to Dierke's where the 2/2nd Field Ambulance fed and rested the patient and gave him any necessary medical care till next morning. The trail then led past the A.D.S. Goodview, where a very ill patient could be left if unable to continue the journey at once, and Buigap was reached in three or four hours over a track at first steep and slippery and then leading over a part much improved by the engineers, past the 17th Brigade headquarters. Again, at Buigap the patient and his fellows fed and were rested overnight, and on the third day were carried to the 7th Field Ambulance's M.D.S. at Tambu Bay over a steep but well made track. The United States Army headquarters and their portable hospital were passed on the last easy stage. A good road now led to the coast, where the patients were taken after nightfall and were kept in a safe dug-out until barges arrived. After these had been loaded in the dark they sailed late at night for Nassau Bay. Here the men were moved to the beach, where a medical officer was available if needed, and orderlies provided hot drinks. Early next morning large barges went on to Morobe, and here the sick were disembarked and taken by ambulance a short distance to the A.D.S. The 2/2nd C.C.S. ran a light section here, a mile from the beach. Patients who needed prompt surgical treatment could be taken to the C.C.S., and any who required further rest or care were left at the A.D.S. Most of the men were taken on the same evening after dusk by sea transport, usually a barge, and arrived during the next morning at Oro Bay. On the fifth day they were taken by road to the M.D.S. of the pleasantly situated 10th Field Ambulance, where they were fed and given any necessary attention.

Medical orderlies were in attendance throughout the trip, and most of the patients were able to move on the same afternoon by road to Dobodura, where at the A.D.S. they had a meal and slept the night. Early on the sixth day the patients were driven to the airstrip; usually the hour of start was unnecessarily early, as the times of the arrival of planes were often uncertain. As a rule the men were returned for break-

fast, and did not leave the ground till the morning was well advanced. There now remained only a brief air trip over the range in transport aircraft, and early afternoon saw them in Moresby. Ambulances took them to hospital and the long journey was over, unless their condition warranted return to the mainland by hospital ship, sea ambulance transport or aeroplane.

During the last phases of the Salamaua campaign the only essential differences in the work of forward posts were those of administration, owing chiefly, as we have seen, to the changes in the military position which permitted the use of sea transport. The Tambu A.D.S. thus became the clearing house for the 15th and 29th Brigade areas. The 47th Battalion troops were sent there through the Komiatum staging post, and those from the 42nd Battalion were passed through a single stage from the Davidson A.D.S. This post differed from most of those on higher ground: its water supply was drawn from a deep gully, which influenced the siting of the post. The theatre was floored by timber fashioned like railway sleepers.

CAPTURE OF SALAMAUA

Early in September the work eased, as the phase of attack on the Japanese gave way to a brief period of exploitation and then to one of pursuit. These changes accompanied and followed the events associated with the operations against Lae. It has been pointed out earlier that the capture of Salamaua was evolved as part of the major strategy which comprised the establishment of airfields, and the possession of bases on the north coast, beginning with Lae. The operation for the capture of Lae was begun on 4th September,[1] and after this move was made there was no longer any reason for delaying an advance on Salamaua. The alteration in medical tactics followed the military movements, and as the phase of pursuit of the Japanese south of the Francisco River began, so the need for a number of the advanced medical posts disappeared. The capture of Charlie Hill enabled Allied troops to clear the enemy from Scout Ridge and to sweep across from the already captured Kunai Spur to the river. The 15th Battalion overcame Japanese resistance on the coast, and by threatening their rear line drove them from the area south of the river.

The succeeding Allied advance permitted the 29th Brigade to push forward to the Salamaua airstrip just across the flooded Francisco. The 42nd and 47th Battalions successfully crossed the river, the isthmus, which is a topographical feature of Salamaua, was occupied by a platoon of the 42nd Battalion on 11th September, and also Kela along the coast to the north. The previous day the S.M.O. of the area accompanied the second forward company when they crossed the Francisco, to look for a building suitable for a surgical team. On the 11th Captain R. W. Klein and a surgical team moved forward to Chinatown, Salamaua, so as to be in readiness, but the pursuit was too rapid for the selected site to

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[1] These operations are described in Chapter 9.

be used. Other points to the north had fallen on the 13th, and on the 18th the 15th Brigade met part of the 24th Battalion which had been engaged in the Markham Valley. Salamaua was no longer a significant position to the Japanese: even before Lae fell the Wau-Salamaua campaign had ended, and preparations were under way for fresh operations in the Huon Peninsula and the Ramu Valley.[2]

MEDICAL REVIEW OF THE CAMPAIGN

NUTRITION

During the first period of the Wau-Salamaua campaign attention was given to evidences of impaired nutrition in the troops engaged in the Wau-Bulolo Valley and along the lines of communication. A group of twenty cases of beriberi was reported; these were not severe, but attracted notice because it was thought that a certain degree of debility seen in many other men might perhaps be partly due to a deficiency of the *B* complex. Routine survey showed that malarial anaemia was not the cause; malaria was not an important hazard on the goldfields. At first it was thought that the proportion of men with some degree of vitamin deficiency might reach as high as 50 per cent, but this figure was probably an exaggerated estimate based on vague clinical evidence. Rest and appropriate diet soon restored these men to health.

In the ensuing campaigns the position with regard to nutrition improved owing to two factors: a better operational dietary of more adequate nature and content, and extended facilities for aerial dropping of supplies. In some places the diet could be supplemented by fresh fruit. From Bulolo to Sunshine pawpaw trees grew along the road, and other gardens furnished citrus fruits and sweet potatoes. The great increase in facilities for air-dropping of supplies is well illustrated by the fact that at one time in February 1943 the R.A.A.F. unit at Wau had only three parachutes, whereas six months later there were huge dumps of parachutes round the Mubo area which could not be economically collected.

Since the question of dietetic malnutrition had been pointedly raised, greater emphasis was laid on the question of supplies and rations. Reliance could not be placed on carrier trains to maintain supplies: the numbers were insufficient, and illness among the natives was not infrequent, especially as the lines of communications stretched out more and more. On occasion loss of equipment occurred, as for instance in one action of the 2/3rd Independent Company with the Japanese, when practically the whole of the unit's medical equipment and stores was lost. Air-dropping provided the answer: when its use was extended from ammunition and general supplies to medical stores the position was greatly improved. Certain material was nearly always scarce, for example, hygiene stores, but others, such as medical comforts, were obtainable in useful quantities. The Army Service Corps helped greatly in providing these dietary sup-

[2] Australian casualties Wau-Salamaua 22nd April-11th Sept 43: killed in action 33 officers, 316 other ranks; wounded in action 54 officers, 700 other ranks.

plements, especially extra sugar, tea, milk, coffee and tomato juice. Custard powder, wheatmeal and dehydrated fruit were valuable additions to the diets of medical posts.

Early in 1943 when the rehabilitation and training ground of the Atherton Tableland was in full swing, a general appraisal of the health and nutrition of the hard worked troops was more easily made. Practical trial showed that the physical state of these young veterans was unimpaired, and once the lingering traces of malarial infection were removed, good feeding and disciplined exercise restored the men to health, ready to meet whatever tasks awaited them in the future.

ENDEMIC DISEASES

Endemic infections other than malaria did not prove serious wasters of men, as many such conditions did not cause sustained illness. There were of course other significant avenues of loss in addition to malaria. Scrub typhus was not statistically serious, but it was always potentially dangerous in the individual. Prompt evacuation of patients in the early stages of typhus posed a problem both of diagnosis and of transport. Local and personal preventive measures, stimulated in the later phases of the campaign by the work of McCulloch and his colleagues, were effective and had a valuable educational influence.

The introduction of an efficient "miticide" was an important step. Dibutyl phthalate ("Betty") was chosen by the Australian Army on account of its persistence in fabric, even after washing. It was also felt that it was wiser not to use dimethyl phthalate ("Mary") for typhus prevention in spite of its known potency, as there was a possibility that it might be used by the troops more for typhus prevention than the really more important prevention of malaria for which it was intended. Clearing the kunai grass from the perimeter of camps and avoiding camp areas infested by rats, possible animal vectors, were measures which appeared to lower the incidence of infection.

Diarrhoeal diseases were as usual a constant though not serious cause of disability, particularly in the more distant and isolated posts. The bacterial type of disease was not definitely demonstrated in most instances, but its clinical manifestations were those of a mild bacillary dysentery. Hygiene has been mentioned from time to time. The breakdowns which had early produced epidemics of diarrhoea and dysentery had been remedied by stricter supervision of units. Better facilities were possible in the later phases of the campaign, and fouling of the tracks was less in evidence.

Better provision was made for washing of clothes, but this did not help much in the control of the growing tide of skin affections which were appearing in the force in the form of tinea and impetigo, and other forms of infective lesions. The climate was in part responsible, and shortage of appropriate medical supplies made treatment difficult. In addition the ancient injunction of *primum non nocere* was not observed as closely as would have been wise. It must be admitted, however, that

the medical officer was hardly able to give that degree of rest, or ensure the frequent application of wet dressings which would have been desirable. Further the practice of dermatology in the jungle was not so favoured as in general hospitals, and even there the problems of the skin were still only partly solved at a much later date. However, a good deal was done by the introduction of a non-irritant treatment by Captain P. F. R. Brown, R.M.O. of the A.A.S.C. 3rd Division, who had special dermatological training, and who was sent by Refshauge from Missim to Kelly's at a later stage of the campaign, and demonstrated the value of simple saline dressings.

In the 15th Brigade, during the final operations in the Bobdubi region, Refshauge noted the increase in fevers in general, due in part to relapsing malaria, and infections, often of the skin. He thought that the increase in skin diseases was of multiple origin, and related to the continual wetness of clothing, with a lowering of personal hygiene, fatigue, and possibly some lack of vitamins.

One important problem was that of the diagnosis of febrile disease. As on all tropical fronts, there was need for pathological facilities, particularly to establish the diagnosis of malaria, the commonest cause of pyrexia. In operational areas the prevalence of illness temporarily designated as P.U.O. exceeded the occurrence of battle casualties. For example, Meares reported that the 7th Field Ambulance had treated 146 battle casualties during the last phase of the battle for Salamaua, while 443 sick were treated during the same period: of the battle casualties sixty-five were stretcher cases. Of ninety-two P.U.Os. fifty-seven were due to malaria and thirty-five of these were primary infections.

The advice and help of a physician were appreciated in the outposts as well as in the large dressing stations of the field ambulances. In May, Hutson relinquished the duties of a regional consultant through illness, and was replaced by Lieut-Colonel S. W. Williams. The presence of a temporary consultant in an area was found to be of definite value, quite apart from the work of the permanent medical and surgical consultants attached to the Land Headquarters.

Water supplies seldom raised difficulties in this country, though the usual abundance in the valleys was not always found at higher levels. Chlorination was only carried out when large streams were used as sources of supply: small rivulets were usually safe in mountain country, and it was sometimes possible to reticulate the water through bamboo pipes.

MALARIA CONTROL

As the thin lines of fighting men pushed along the ridges and followed the mountain trails from height to valley, malaria became the troops' chief disability. As they pressed on along the tortuous river beds towards the goal of the coast the danger increased. A particular hazard was associated with this constant change of elevation: the high wet ridges, colder and less agreeable to the anopheline vectors, presented less danger of infection by malaria than the valleys below. Further, relative immunity

(Australian War Memorial)

Evacuation down the steep Boisi Ridge

(Australian War Memorial)

Native bearers carry a wounded soldier over a rough bridge across the Francisco River.

(Australian War Memorial)

Walking back from front line at Mount Tambu to the A.D.S. after being wounded. The bridge crosses a small gully which after heavy rain becomes a raging torrent.

(Australian War Memorial)

Typical country in the Wau-Mubo area.

The A.D.S. at Mount Tambu. *(Australian War Memorial)*

On the way to Lae.

(Australian War Memorial)

on the high ground tended to make the men careless in the hot steamy valleys. Most of the troops engaged had been previously in malarious areas, many of them at Milne Bay, and it was estimated that 70 per cent of the force had been infected. Therefore many of the attacks were relapses of benign tertian fever, and it was noted that men fatigued and weakened by a period of strenuous service in forward areas had a higher incidence of such attacks than those recuperating in the rest camp.

During the latter part of the Salamaua campaign, some figures, such as those quoted by the 7th Field Ambulance, suggested that malaria was more common than was always apparent. Relapses of infections contracted in other areas were responsible for numbers of individual attacks, but these were decreasing, owing in part to the superior suppressive action of atebrin. As previously pointed out, the lessened transmission rate associated with the high wet ridges would tend to lessen the overall rate, though transmission increased in the valleys.

As the centre of operations moved north it opened out other areas which called for consideration. Major T. M. Clouston, D.A.D.H. of the 3rd Division, after a visit to Tsili Tsili and the Watut district in July reported on the malarial position there. The area lay in a valley, and was low-lying and swampy. There were many mosquitoes, particularly of the culex variety, which bit during the day-time in shady areas; malarial vectors were also present, they were breeding locally and were active at night. This area was classed as hyperendemic and the chances of effecting physical control were somewhat remote, but personal protection was essential, and required augmented anti-malarial stores. Saxby agreed as to the risks, and estimated that a weekly rate of 3 per cent might be expected.

In a district of very different topographical type Major Fenner, malariologist to I Australian Corps, late in August made an appreciation of the coastal zone south of Salamaua, including Morobe, Nassau Bay and Tambu Bay. In the Tambu Bay area in particular anophelines were breeding extensively in creeks and jeep tracks, and there were many malaria-infected natives in the area. The presence of an Angau native camp in the middle of the military area enhanced the risk from this source. Personal protection was good here on the whole, though carelessness in clothing was noticed among troops in transit. The efforts of an efficient malaria control unit had helped to reduce the incidence rate.

In Morobe anti-malarial discipline was poor to the point of disregard of established rules: Brigadier H. G. Furnell drew up a strong directive to commanders as to their responsibilities. The frequency of dengue in Morobe was an indication of the failure of units to deal with breeding places. Eighty cases had occurred in a month, causing a loss of 450 man-days among a population of 1,000. In Nassau Bay discipline was fairly good, though many bad breaches were seen.

A little earlier than this, the measures taken by the 3rd Division had already reduced the weekly rate in the divisional areas from 24 per 1,000 per week to 10 per 1,000, with a later rise to 14 attributed to

heightened military activity. Furnell recommended further instruction of medical officers in the entomological and epidemiological aspects of malaria, and its accurate laboratory diagnosis. Burston had already drawn attention to the rising malarial rates in the Wau area, and the anxiety that this must cause. He had previously advised the D.D.M.S. to bring clearly before all commanders in the force their responsibility for seeing that appropriate discipline was maintained, if risks of a repetition of malarial losses in the Buna campaigns were to be avoided. The examples quoted illustrated the persistence and care in malaria control which would be needed in campaigns extending up the north coast, especially with the added risks of movement by land and air.

In the field more vigorous preventive measures were taken: these could be more thoroughly applied in the goldfield districts than in the wilder jungle areas. Stress was laid on methods of personal protection, and of these the most important was the taking of a suppressive. The general change from quinine to atebrin which had been made early in the year was without doubt an important advance, though at this time no really accurate mass studies had been made.

Six months earlier steps had been taken to ensure adequate supplies of drugs and other medical material urgently needed for the prevention of tropical diseases, in particular malaria. In September 1942 Blamey had sent an able and forceful technical commission consisting of Brigadier Fairley and Dr Adrien Albert to the United States of America and the United Kingdom, and in March 1943 this was followed by Mr B. Egan and Lieut-Colonel C. W. Ross, who had special knowledge and experience in problems of medical supplies. These delegations did much to ensure a constant flow of anti-malarial drugs and supplies from America to the Pacific island front.

In June a great idea was put into effect, the establishment of the Land Headquarters Malaria Research Unit. This unit carried out research in the laboratory and the field, set out to discover what therapeutic weapons were to hand, how effective these were and what was their mechanism of action, and also threw clear light on the vital processes of the causative parasites and their characteristics of transmission. It was not to be expected that the first fruits of this ambitious research would be gathered at once, nor was it suggested that practical enforcement of the established preventive measures would wait while their true scientific basis was established. Already experience at Milne Bay had shown how effective control of malaria could be if it was wholeheartedly enforced as a disciplinary measure by combatant units.

Other important steps had been taken to implement all useful methods of malarial control. Entomological units were set up to investigate in the field the scientific side of insect vectors of disease, and to enable their habits to be related to the technique of prevention.[3] To the personal methods of prevention was now added the use of dimethyl phthalate, a

The establishment of entomological units is described in this Volume, Chapter 12, In Australia 1943-45.

really effective mosquito repellent lotion, much superior to the greasy and unpleasant substitute for Dover's cream hitherto in use. By June repellent lotion and atebrin were in fairly constant supply even under the most difficult conditions imposed by the terrain of eastern New Guinea. One form of propaganda which was found useful was the publishing of the weekly incidence figures of malaria in all units of the division. This helped to show what reduction could be made by the faithful application of preventive measures within each unit, and how problems of manpower were thereby affected.

A question which arose here was that of the use of nets in the forward areas. It was thought that nets were risky during patrol work and therefore they were not used regularly. Deterioration from the constant moisture was rapid, and replacements were not easily obtained. One of the questions raised in the United States by Fairley was that of mildew-proofing of nets, and a satisfactory standard was agreed upon for nets to be used in the South-West Pacific area. During June up to 180 cases of malaria per week occurred, but intensive efforts reduced this figure, and by the end of the quarter the number had been reduced to 80 per week.

Peterson summarised his experiences with malaria precautions in forward areas with the 2/7th Battalion:

> Owing to difficulties of distribution due to frequent moves, two or three platoons were without suppressive atebrin for several days (about three to five). Otherwise the atebrin discipline was good. From the start, although the men had orders to carry a net, there was a shortage of nets. I cannot say how much, but probably about 25 per cent of the men had no nets on arrival in the Mubo area. I complained about this, and over 500 nets were sent up and the deficiencies made good about the end of April. It still took a couple of weeks to get the men accustomed to malaria discipline again, however. There were many occasions, of course, when nets could not, in my opinion, be used—on fighting patrols, and when in action in trenches. But a more conscientious use of mosquito lotion and clothing discipline would probably have cut down the rate of infection appreciably. It must be remembered that on the coast near Duali is a hyperendemic area.
>
> Mosquito veils and gloves could not be obtained. In any case, whether picquets (in action) could see clearly enough with veils on is open to question. I should think gloves would interfere with the rapid and effective use of fire-arms.
>
> It may be worth mentioning that the men who must keep a close watch on malaria precautions in action in this type of country are platoon and section commanders, particularly the latter. The company commander cannot keep a watch on all his men—the section commander can. This, I think, is the main weak link as far as battalions are concerned.

It will be seen that all known weapons were produced in this conflict; their effectiveness depended on the completeness with which they could be used. There still seemed to be a feeling that malaria was a medical matter, even officers sometimes failed to realise that the simplest and most vital precautions were a responsibility of the troops and their leaders. Malaria control was already established in detail in every formation and unit of the army, but the means of its day-by-day implementation did not rest on a sufficiently firm disciplinary basis. Well organised units had their routines, but something more systematised was required. The senior medical officers of the 3rd Division, engaged in the difficult country north

and east of the goldfields, Saxby, A.D.M.S., Smibert, S.M.O. of 17th Brigade and Refshauge, S.M.O. of 15th Brigade, evolved the type of organisation needed to produce results.

During the period 1st May to 1st October units of the 15th Brigade were disposed in highly malarious country and carrying out patrol and sentry duties. Some of the posts occupied were in country which was malarious but not dangerously so, and certain elements were for variable periods in contact with the enemy. Owing to prevailing operational conditions native compounds were at times sited unduly close to bivouac areas. The degree of dispersal was characteristic of many operational areas in this country and it was obvious that only a unified method of malarial discipline could satisfy the requirements already clearly laid down, or be translated into successful prevention of malaria. It was of course understood that all anti-malarial routines should be followed in order to achieve results, but those depending on the personal performance of each individual soldier were most important. If adult vectors were numerous the faithful wearing of anti-malarial clothing, and use of an efficient repellent would minimise infection, and if covert infection occurred, as it almost certainly would, M.T. malaria could be cured and B.T. could be prevented from becoming manifest if an adequate suppressive such as atebrin was regularly taken in correct dosage.

As time went on units and formations whose members were kept on an insistent discipline were able to meet both the Japanese and the anopheline enemy without dangerous thinning of their ranks. An excellent example was set by the 15th Brigade whose commander, Brigadier Hammer, stood behind his unit commanders in enforcing their obligations to their men in malarious country. He proved that strict preventive measures could be put into effect while troops were in contact with the enemy. The 24th Battalion laid down an ordered routine which its commander, Lieut-Colonel G. F. Smith, promulgated as an Administrative Instruction on 8th November.

The rules laid down included the distribution of atebrin tablets to troops on parade (the men were actually seen to take the drug); inspection of their clothing, particularly that of guards and sentries was carried out, not by an N.C.O. but a platoon commander, who reported to his company commander. All company commanders and an officer from brigade headquarters were present at the parade. Nets were also inspected by platoon commanders, huts were sprayed and nets properly disposed. Difficulties of dispersal were met by the use of signals: early in December 128 miles of cable were required to complete the linkage of the battalion and ensured that all orders were obeyed. It was clearly stated that this daily routine was an officer's responsibility.

As will be seen, even these simple but stringent rules were not sufficient to prevent entirely the incidence of malaria, but the results obtained proved that the proper carrying out of the prescribed methods of malaria control depended on the unit officers and on the integrity of every man in the unit.

WORK OF SURGICAL TEAMS IN LATER PERIOD

The experiences of the surgical teams for the period of three months from 14th June to 13th September were much the same as those recorded earlier. Teams detached from the 2/1st Mobile Operating Unit were sent forward mostly on foot and worked at Missim, Meares' Creek, Kelly's, Uliap Creek, Bobdubi and Erskine. Major Row in a report on this work recorded that at Meares' Creek twenty-six operations were performed up to 22nd July, and during the next month, up to 24th August, 123 at Kelly's. Surgical work then declined in amount till the fall of Salamaua on 11th September.

At first, work was only slight at Missim, but a rush occurred later in July when sixteen casualties arrived almost simultaneously: two theatres were opened to deal with them. Operations performed here over the whole period numbered 245. Practically all urgent cases had received attention within twelve hours after wounding. Wounds of the extremities and long bones were relatively common: there were seventy-five of the upper extremity, including fifteen compound fractures of the humerus and six of the forearm, and twenty-four of the hands. Compound fractures of the femur occurred in eleven cases, and of the lower leg in fourteen out of seventy-five injuries of the lower extremity. Nine abdominal wounds were seen; of seven involving the peritoneal cavity only one was followed by recovery. Very few head wounds were seen: most were fatal. Steel helmets were not usually worn. Three cases of gas gangrene occurred, but the amount and degree of wound infection seen was much less than at Soputa. Fourteen chest wounds were treated; in eleven of these haemothorax developed; this was treated by intermittent aspiration: two became infected. "Sucking" wounds, five in number, had been closed successfully by the medical officer or his orderly. During the 2/7th Battalion attack on the Pimple, Sergeant W. Russell successfully stitched a sucking chest wound by the light of a cigarette within twenty yards of an enemy post.

Blowflies were most troublesome and persistent. Maggots did no apparent harm except to the patient's morale. Chemical means of control such as 1 per cent chloroform solution or boric acid were not tried at the time. Other teams which worked at Mango, Buigap, Tambu Bay, and North Tambu, operated on a total of 181 patients, mostly at Tambu Bay A.D.S.; of these eighteen were American troops. Stening reported that eleven compound fractures of the femur were treated, ten of the lower leg, fourteen of the hand, fourteen of the feet, six of the humerus and ten of the forearm. Local gas gangrene occurred in one thigh wound, and one wound of the buttock, but wide excision gave good results. Three out of four men with compound fractures of the skull recovered. Thomas splints were found most satisfactory by the teams for fractures of the femur.

A special report on resuscitation was compiled by Captain H. R. Macourt from the 15th Field Ambulance. In this he emphasised the importance of beginning the treatment of primary shock well forward, by relieving pain by posture, splinting and drugs. Most casualties needed

some measures of resuscitation, even if only of a minor kind such as hot sweet drinks. Greater degrees of shock were treated in the R.A.P. with blood serum usually one litre, sometimes given as rapidly as 500 c.cms. in half an hour. Men with injuries known to produce severe shock such as compound fractures of the femur, were treated early and thoroughly. A few rigors were observed early in the campaign, but greater care with sterilisation of the apparatus practically abolished these. When they did occur during a transfusion the procedure was not stopped, but reduced to the lowest practicable rate. The training of orderlies in resuscitation work was found to be essential.

Other reports gave similar accounts of the work done. In evaluating this it should be remembered that even reaching these posts was physically difficult, and work was often done there under conditions of great discomfort, depending to some extent on the weather.

ORGANISATION OF A "JUNGLE" FIELD AMBULANCE

The concept of "jungle warfare" really depends on considerations of transport. Refshauge outlined the principles established by the experiences of the field ambulances and their sub-divisions during the Wau-Mubo-Salamaua campaign, for the period January-September 1943. He pointed out that in jungle warfare the whole or part of the line of communication involved was impassable to wheeled transport; supplies and ammunition could come forward only by carriage e.g. by native porters, or by being dropped from the air either directly (free dropping), or by parachute; casualties could be transported back only by carrier teams. The field ambulance still retained its usual functions of remaining mobile, collecting and transmitting casualties. But in a country such as that which lay between the goldfields, with a few organised roads, and the coast, the time of transport of a wounded man might be long enough to be prejudicial to his recovery. Hence, in certain circumstances, there must be multiple posts, and it was then essential to bring a surgical team as far forward as possible, and therefore to train staff who could cope with technical responsibilities. Thus to the customary functions of a field ambulance was added surgical treatment carried out not only in the M.D.S. formed by the headquarters and the A.D.Ss. formed by the two companies, but if necessary, in each of three sections formed by sub-dividing each bearer company. Two of these sections would then have a medical officer in charge and the third a bearer officer. A unit of twenty-five beds was found to be the most practical. Further sub-division was sometimes necessary to provide staging posts. Extra nursing orderlies were drawn from the orderlies of the headquarters establishment to assist in working the 150 to 250 beds often required in an M.D.S.

In order to maintain efficiency it was found desirable to have equipment of sections interchangeable. Certain additional equipment was also needed, for example, it was necessary to produce palatable food for patients in an A.D.S., and this could not be properly done without extra cooking equipment. "Improvisation" as Refshauge remarked "is a good word and

is useful if used properly." The equipment, like the unit, had to be mobile, and this was best ensured by packing it in boxes containing not over 35 to 40 pounds. Each section needed about fourteen days' supply of medical stores and comforts; any emergency requirement could be obtained by carrier. Light tabletops of the venetian blind pattern were found useful; these could be carried by native boys.

Light water-proof tarpaulins when available provided good cover for wards, a theatre and accommodation for staff. Sisalkraft could also be used, but the time needed for erection was greater. The siting of these A.D.Ss. was important, chiefly in relation to the R.A.P., so that no time would be lost in giving surgical service. It was desirable for an A.D.S. to be on a line of communication, to avoid being off the main track for supplies or evacuation of troops.

Beds of some kind were necessary in all forward posts in which patients were kept overnight; the problem of weight was met by making and carrying bed-sails of canvas which was found much better than the conventional blanket. The following constructional points are worth noting as the product of experience in these jungle areas. It was important to give unobstructed passage to stretchers through the surgical wards; the uprights therefore should be placed off-centre. Operating theatres needed two tables, round which there should be ample room for movement. The resuscitation ward was, as on other fronts, next to the theatre: it could with advantage be part of the operating theatre.

Collection of casualties. Certain requirements were essential in this campaign. It was found convenient to have native bearers allotted to unit aid posts so that casualties could be carried back promptly to the A.D.S. The cooperation of the brigade staff captain was invaluable in these arrangements, which usually allowed the bearers to make several trips a day, provided that the A.D.S. was close enough to the R.A.P.

Treatment of casualties. The ambulance could of course not control the time-lag between wounding and surgical treatment, but time could be saved by having a surgical A.D.S. as near the R.A.P. as was safely possible. Prompt resuscitation was also essential, for the treatment of shock and haemorrhage was a prime function of the ambulance staff. Each section was capable of running a resuscitation centre on accepted lines.

Forward Surgical Posts. As in the Alamein campaign the blood pressure was found to be the most reliable guide to the degree of shock present. At these posts the medical officers and nursing orderlies were required to be competent to take and give blood or other infusion fluids, to perform gross typing of blood and to sterilise the apparatus. Record was kept of blood types of patients and also of personnel in neighbouring areas. Communication between unit and ambulance posts was highly desirable so that the surgical staff could be warned in advance of requirements, such as blood.

Nursing orderlies were trained in the after-care of patients and post-operative nursing was well supervised. This training extended also to orderlies attending patients suffering from endemic disease.

Evacuation of Casualties. Two different policies determined the transport of sick and wounded. Under certain conditions the ideal was to send all casualties out of the brigade area; on the other hand conditions might dictate the holding of as many sick as possible in this area. As a rough guide those likely to be fit for active work in fourteen days were held. Of course the first condition often could not be fulfilled, and these apparently conflicting policies were reconciled as far as possible by the judgment of the A.D.M.S. and S.M.O.

Where rapid onward movement was desirable walking patients were sent on with all possible speed to the next post; these often could safely include men operated on the previous day. Stretcher cases were selected on a priority basis which was made out each evening to suit the changing conditions of transport.

Where patients were temporarily held, more beds were needed, and provision was necessary for unexpected admissions. It was found that holding patients expected to recover within two weeks enabled some 70 per cent sick to be returned to the lines. Brigade rest areas were most helpful. Slightly wounded could be held in the forward areas; these usually approximated to 5 per cent of all wounded.

Supplies. The maintenance indent system was not a success, owing to the continual increase caused by the ever-lengthening string of staging posts. Another problem was the provision of containers: boxes and cases could not be sent back, and there was a continual demand for them. Bondwood boxes were regarded as "invaluable" by the A.D.M.S. They were light, water-proof, marked with the Red Cross emblems, and back-loading was possible without much loss. Specially designed boxes were used for dropping from Wirraway adapted trainers. Later, when forward supplies were maintained by air-dropping, indents were divided into a surgical indent for fifty patients and a medical indent enough for two weeks' supplies; they could be sent forward as required.

Much experience had been gained, and lessons learnt from these skilfully fought actions, and the individual and collective work of the medical services had been invaluable to the medical corps and the forces involved. Now we must turn our attention to the actions on Lae and Nadzab which overlapped the conclusion of the Salamaua operations, and formed an important prelude to bold actions on the Huon Peninsula.