VOL. LXIV. No. 3 SEPTEMBER, 1950

THE ROYAL ENGINEERS JOURNAL

CONTENTS

THE ROYAL ENGINEERS JOURNAL—SEPTEMBER, 1950 VOL. LXIV. No. 3

THE ROYAL ENGINEERS JOURNAL

Authors alone are responsible for the statements made and the opinions expressed in their papers.

VOL. LXIV

CONTENTS

SEPTEMBER, 1950

THE COUNCIL OF THE INSTITUTION OF ROYAL ENGINEERS

(Incorporated by Royal Charter, 27th February, 1923)

Patron—HIS MAJESTY THE KING

President

Major-General Sir Eustace F. Tickell, K.B.E., C.B., M.C. 1948

Vice-Presidents

Major-General H. B. W. Hughes, C.B., D.S.O., O.B.E. 1948
Major-General A. D. Campbell, C.B., C.B.E., D.S.O., M.C. 1948

Elected

Brigadier A. G. Bonn, C.B.E., M.C. 1948
Lieut.-Colonel W. B. Sykes 1948
Major-General C. A. West, C.B., D.S.O., M.C. 1948
Colonel F. C. W. Fosbery 1948
Colonel R. P. G. Anderson 1949
Colonel R. K. Millar, D.S.O. 1949
Brigadier J. S. W. Stone, C.B.E., M.C. 1949
Brigadier C. D. Steel, O.B.E. 1949
Major W. M. Inglis 1949
Brigadier I. L. H. Mackillop, C.B.E. 1949
Brigadier C. G. Martin, V.C., C.B.E., D.S.O. 1950
Lieut.-Colonel F. A. Rayfield 1950
Colonel R. M. A. Welchman 1950
Major G. Widdowson 1950

Ex-Officio

Brigadier C. E. A. Browning, C.B.E., M.C. ... ... D/E.-in-C., W.O.
Colonel L. O. Clark, O.B.E. ... ... A.A.G., R.E.
Brigadier B. C. Davey, C.B.E. ... ... Comd., S.M.E.
Brigadier R. Gardiner, C.B.E. ... ... D.Tn.
Major-General L. D. Grand, C.B., C.I.E., C.B.E. ... ... D.F.W.
Brigadier J. C. T. Willis, O.B.E. ... ... Dir. of Mil. Survey
Colonel C. M. Maclachlan, O.B.E. ... ... D/Comd., S.M.E.
Brigadier L. F. Heard, C.B.E. ... ... Comd., Trg. Bde., R.E.

Corresponding Members

Major-General K. Ray, C.B., C.B.E., D.S.O., *Union Defence Force, South Africa* ... ... 1st January, 1949
Lieut.-Colonel A. R. Currie, D.S.O., *D.F.W., New Zealand Military Forces* ... ... 1st January, 1949
Colonel H.W. Love, O.B.E., *Chief Engineer, Canadian Army* ... ... 1st February, 1949
Brigadier J. Mann, D.S.O., *E.-in-C., Australian Military Forces* ... 1st March, 1949

Secretary and Editor R.E. Journal

Brigadier C. C. Phipps, C.B.E., M.C. ... ... 13th January, 1945

Bankers

Lloyds Bank, Ltd., Cox's and King's Branch, 6 Pall Mall, S.W.1.

3,600. 1.9.50.

Imperial Government of Persia into the feasibility of using the discharge of the River Lar. In its lower reaches the Lar, which below Pulur is renamed the Heras, flows on its way to the Caspian Sea through the province of Mazanderan where the rainfall (about 40 in. per annum) is adequate for general agricultural needs. Compensation water is required, however, for irrigating rice crops on the coastal belt.

These preliminary investigations confirmed that a tunnel driven through the Lavasan Mountains which form the watershed between the Lar and Jaji Rud Valleys, would permit of water being diverted from the former into the latter river ; in addition, there existed a possibility of hydro-electric development from this proposal for the supply of extra electrical energy to the Tehran area. The provision of a power supply from this source served to enhance the potential value of the project, for the development industry in the Tehran area would thereby be encouraged and increased employment would naturally follow.

Coupled with irrigation water and hydro-electric power, there existed the further possibility of augmenting the existing water supply of Tehran in the event of present resources proving inadequate to meet further demands.

2. Scope of the Engineering Project

The general scope of the engineering project is shown in a panoramic drawing (Plate 2). Plate 3 shows a longitudinal section which illustrates most clearly the magnitude of the scheme. The Kalan-Amam Mahnak Tunnel is over twelve miles long and passes under the Fil-i-Zamin Mountains which are about 11,000 ft. high.

A summary of the main headings into which the engineering scheme has been divided, is as follows :—

(*a*) A dam in the Lar Valley with provision for passing compensation water to Mazanderan.
(*b*) A tunnel between the Lar and Jaji Rud catchment areas.
(*c*) Hydro-electric development in the Jaji Rud basin.
(*d*) A dam at Latiyan on the Jaji Rud.
(*e*) Hydro-electric development in the Jaji Rud basin.
(*f*) A tunnel between the Jaji Rud Valley and the area to be irrigated north-east of Tehran.
(*g*) Canalization of the Jaji Rud below Latiyan.
(*h*) Irrigation development north-east of Tehran and at Varamin.
(*i*) Power transmission.
(*j*) Access roads and miscellaneous works.

SURVEY WORK FOR THE RIVER LAR PROJECT FOR THE IMPERIAL GOVERNMENT OF PERSIA

By BRIGADIER R. E. FRYER, O.B.E. (RETD.)
(Late Director of Survey, Middle East)

With grateful thanks to Sir Alexander Gibb and Partners, Consulting Engineers, for permission to quote from their Engineering Report (dated December, 1945) on this project and to publish certain sketch maps and diagrams from that Report, and also for most helpful criticisms of my text.

Photographs 2 and 3 were taken by Sapper H. S. Tucker, R.E., on the job in 1945, and my thanks are due to him for them.

1. INTRODUCTION

THE River Lar project was first heard of by the Survey Directorate of G.H.Q. Middle East, Cairo, in November, 1944, in the form of a personal letter from the Director of Survey at the War Office. As this project, both from an engineering and a survey point of view is very interesting, a description of it may prove of value to readers of this Journal. (See Plate 1 for general location map.)

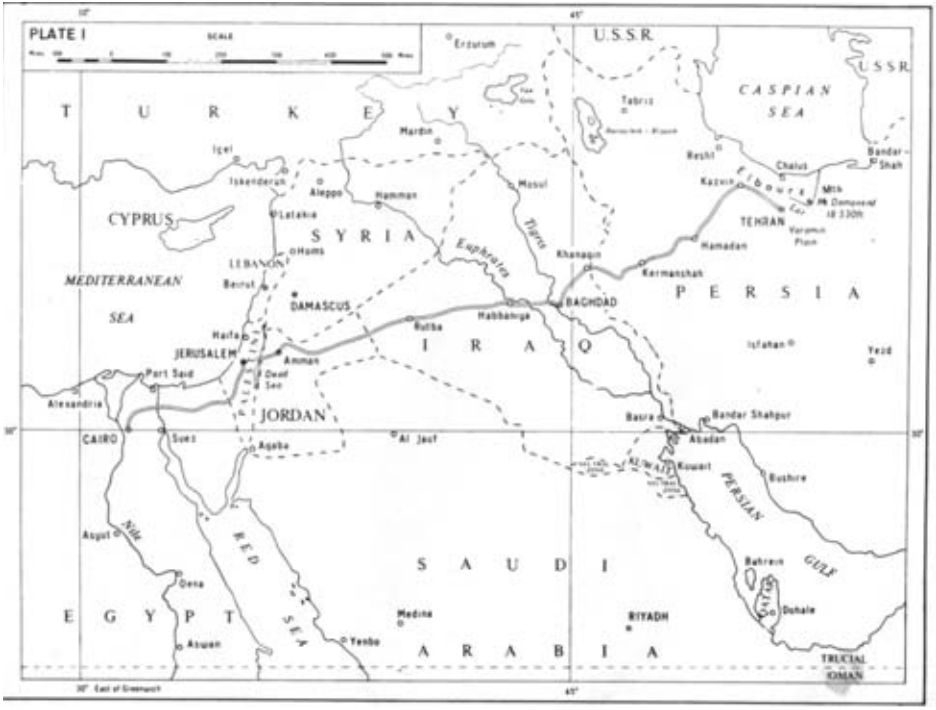
During recent years, the rapid growth of the city of Tehran, the capital of Persia, has introduced a number of problems calling urgently for solution. Among these problems are :—

(*a*) The need to produce adequate supplies of foodstuffs in the neighbourhood of the city to meet the increased demands of the population.

(*b*) The need to provide additional employment and a general raising of the standard of living of the people.

Within a short distance of Tehran occur fertile tracts of land which, through lack of water for irrigation purposes, are relatively uncultivated. Of these areas, in which the average annual rainfall is only about 10 in., the Varamin Plain and the area lying to the north-east of Tehran between the foothills of the Elbourz Mountains and the main road from Tehran to Pul-i-Jajirud, come within the scope of the Lar Valley Project. The Varamin Plain has made, and continues to make, a considerable contribution, in the form of cereals and vegetable crops, to the needs of the Tehran area, but this contribution is largely dependent on the Jaji Rud, the discharge of which is at present uncontrolled and unpredictable. The area to the north-east of Tehran is devoid of any reliable source of water and therefore remains comparatively uncultivated.

The urgent need for additional supplies of water led to preliminary investigations being made by the Ministry of Agriculture of the



Survey Work For the River Lar Project

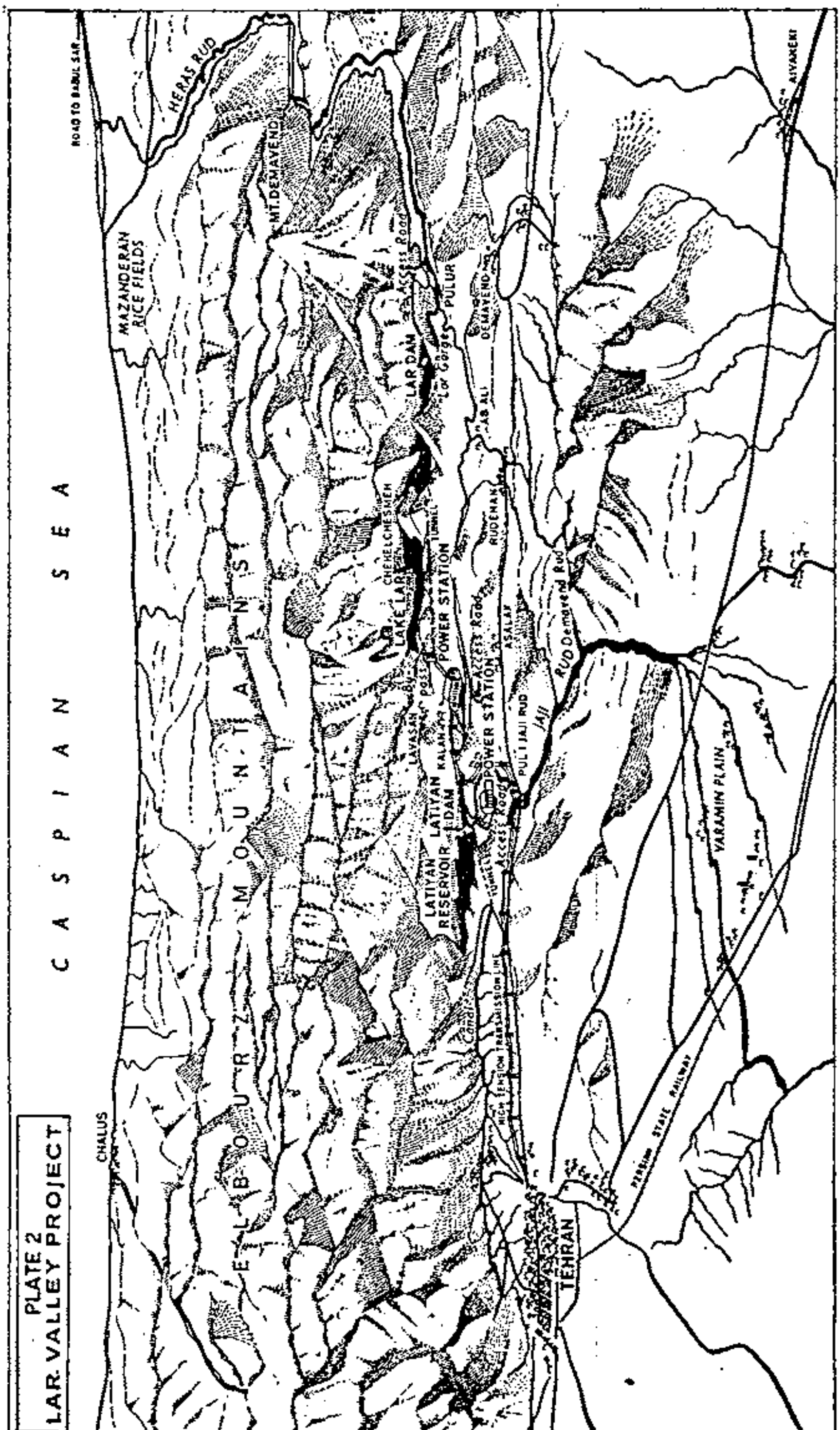
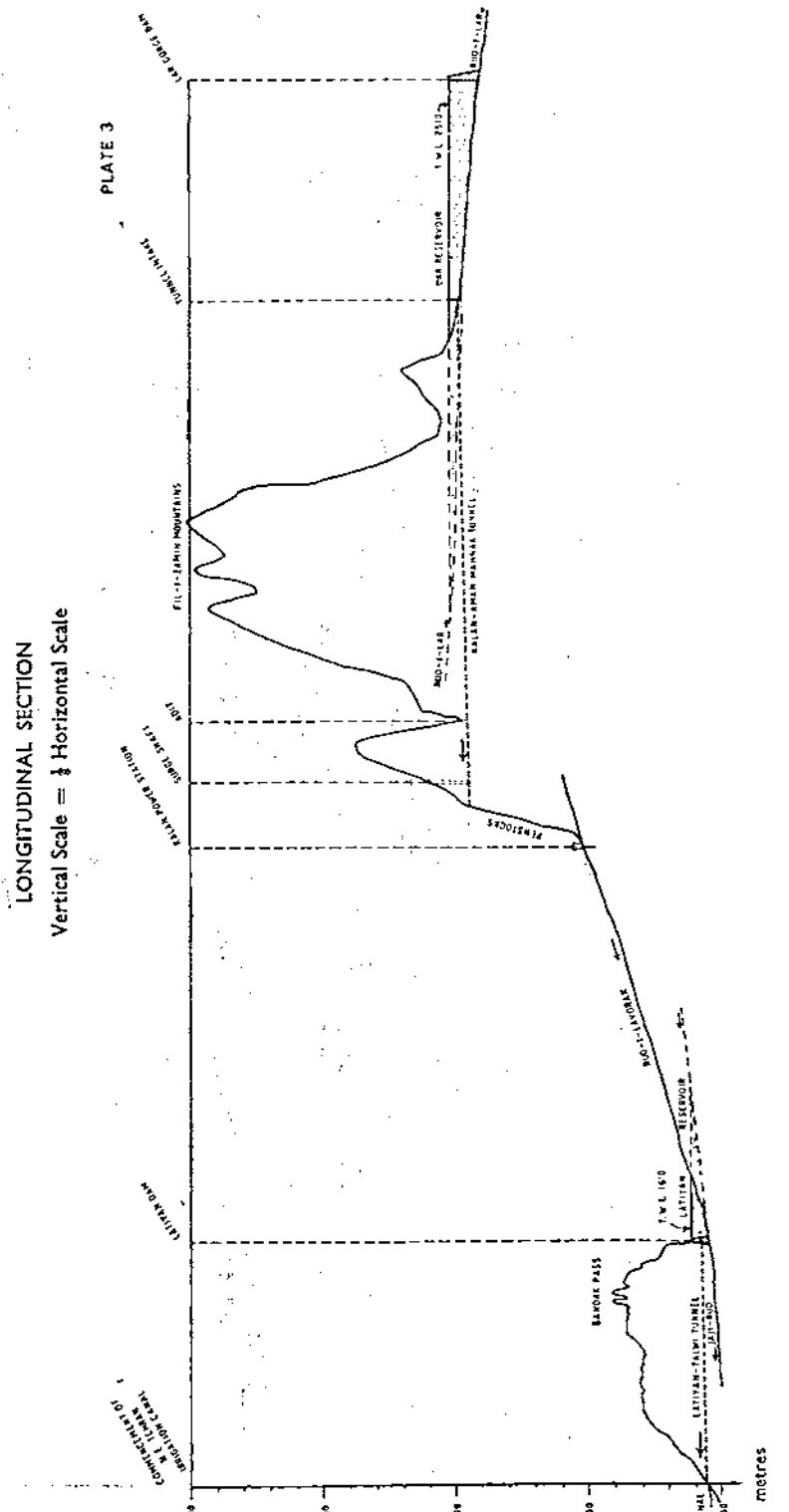


PLATE 2
LAR. VALLEY PROJECT
CASPIAN SEA
ELBOURZ MOUNTAINS
CHALUS
HERAS RUD
MAZANDERAN RICE FIELDS
MT. DEMAVEND
Access Road
PULUR
LAR DAM
Lar Gorge
DEMAVEND
AB ALI
CHEHELCHESMEH
LAKE LAR
TUNNEL
POWER STATION
RUDENAN
LAVASAN
By-pass
Access Road
POWER STATION
ASALAK
PUL I JAJI RUD
JAJI RUD
Demavend Rud
LATIYAN DAM
LATIYAN RESERVOIR
TUNNEL
Access Road
HIGH TENSION TRANSMISSION LINE
Canal
TEHRAN
PERSIAN STATE RAILWAY
VARAMIN PLAIN

PLATE 3

LONGITUDINAL SECTION

Vertical Scale = ½ Horizontal Scale



From the above brief introductory remarks, it can at once be seen that the engineering project is immense in its conception and if a British firm is eventually entrusted with carrying out the work, it will mean many millions of pounds being spent in England by the hard currency country of Persia.

3. Scope of the Survey Project

(a) General

A reliable investigation of the engineering side of the Lar project had made it abundantly clear that it would be necessary to supplement the existing maps of the area. These maps, revised by Indian Field Survey Companies of the 10th Army about 1942, were on the scale of ¼-in. and 1:100,000. The ¼-in. was based on an old Survey of India sheet, but the 1:100,000 was a new map made during the war when the threat of the Germans in the Caucasus was very strong. These maps were most useful for a preliminary study of the engineering project, but it was realized by the Persian Ministry of Agriculture that, particularly in the Lar Valley itself, they were neither sufficiently accurate nor to a large enough scale to enable reliable data to be obtained.

The extremely mountainous nature of the country—Mount Demavend is over 18,000 ft.—makes ground survey difficult and slow (see Photo 1). Nevertheless, at the time dam sites were being reconnoitred the Persian Ministry was in process of plotting a 1:10,000 map of that section of the Lar Valley likely to be inundated by the proposed reservoir.

Although these maps were very valuable in studying the project, they did not constitute an up-to-date and accurate map of the complete area.

In order, therefore, to obtain such information, it was decided to proceed with an air survey covering not only the Lar and Jaji Rud Valleys, but also the areas likely to be brought under cultivation as a result of the scheme. Owing to war conditions existing at this time (end of 1944) it was not possible to obtain the services of civilian aircraft and ground survey personnel for the work, but in view of the important nature of this project, Sir Alexander Gibb and Partners, who were the consulting engineers, decided to approach the British War Office and Air Ministry to see if they could undertake the work.

It was at this stage that we in Middle East Survey first heard of the Lar Valley, and for several years to come we were destined to hear a very great deal more.

(b) Financial Conditions

As the flying, the survey on the ground, the plotting and subsequent printing of the maps were all to be done on a repayment basis as between the Air Ministry and the War Office, and the Consulting

Engineers, we in Middle East were immediately confronted with the most horrible question, " How much will the job cost ? " followed as always by, " How long will it take ? "

To answer either of these questions in Cairo at that time was very difficult indeed and was made even more difficult by the fact that for a long time it was seemingly impossible to get reliable information as to the precise area of the required survey or the specification of the final maps.

The cost of the work fell under two heads :—

(*a*) Cost per sq. mile by the R.A.F. for the flying and production of the air photos.

(*b*) Cost by Military Survey for the ground work, plotting, fair drawing and printing of the maps.

In the early days of 1945, letters and signals on a high priority went between Cairo and London and the estimates for the flying varied enormously, being as high as £12 per sq. mile and as low as £4. It was, however, not clear to Survey on what area and on what specifications the Air Ministry were basing their figures and we spent much time trying to get both these matters cleared up without any real success.

On 14th February, 1945, the official War Office wire to the Commander-in-Chief, Middle East, arrived and asked if Survey could do the work by August and if so to give estimates of the cost. The scale of the required map was then given as 1:10,000 with contours at 10 ft. V.I. and the area as 500 sq. miles, but this " may be extended to 1,800 sq. miles."

In order to answer this signal, the Director of Survey prepared a long technical note for the B.G.S. (Ops.) at G.H.Q. which was dated 19th February, 1945.

The main points made in this letter were :—

(*a*) Impossible to make any hard and fast estimate of time and cost until more precise details of extent and nature of survey are known. (Approximate estimates were then given of about £14 per sq. mile for the 500 sq. miles with printed copies available not before 1st January, 1946.)

(*b*) Specification seemed unnecessarily severe and a less severe one was suggested.

(*c*) Even if the entire resources of Middle East Survey were used on the job, it could not be done by August. Moreover, the other operational commitments in Palestine and for Allied Force H.Q. (A.F.H.Q., Italy), must be considered.

(*d*) It was essential to get something settled quickly as field surveyors must start to move to Persia from Egypt in April, if possible, because of the weather.

Photo 1.—Mount Demavend, 18,530 ft., from the air. Caspian Sea in the distance.

Survey Work For The River Lar Project For The Imperial Goverment Of Perisa

Based on the Director of Survey's note, the C.-in-C., Middle East, sent a wire to the War Office on 22nd February, followed up by another on 9th March, giving a revised higher estimate of cost. This was found necessary after consultations with the Military authorities in Baghdad who told us of the very high cost of hiring mules in Persia.

Wires and letters continued to fly both ways until well into May—in fact, until the Conference in Cairo on the 23rd May—when something definite was at last decided.

Before, however, we see what was finally decided at this Conference, it would be as well to mention that in March (exact date not known), an Army Council letter had gone out from the War Office to the Consulting Engineers, Sir Alexander Gibb and Partners, giving the " apparent " actual costs of the work, but saying that they must accept liability for full actual cost which it was thought would work out at approximately the figure given in the first part of the letter.

4. Cairo Conference of 23rd May, 1945

This Conference was attended by Mr. Olivier, who was Sir Alexander Gibb and Partners' representative in Tehran and who had flown down to Cairo from that city, the Director of Survey, Middle East, and his representative from Baghdad, two senior R.A.F. officers from the Operations Branch of G.H.Q., R.A.F., Middle East, the Command Photographic Officer, R.A.F., M.E., and an R.A.F. financial adviser.

Mr. Olivier produced two plans, one showing the area for which photography and mapping were required, and the other the division by scales and priorities.

These requirements were the photography of some 1,800 to 2,000 sq. miles covering Mount Demavend in the north-east and Tehran in the west. The northern portion of about 900 sq. miles was to be mapped at 1:50,000 scale and the remainder at 1:10,000 scale. The contour interval for both scales was to be 10 metres up to 3,000 metres above M.S.L. and then 50 metres.

The maps of an area of about 500 sq. miles were required by 1st November, 1945, the rest as soon after as possible.

The Director of Survey pointed out that as regards the Field Survey, the main difficulty was the acute shortage of personnel and the time limit for completion of the first priority area. It was, therefore, essential that the areas to be surveyed should be cut down to the bare minimum and the rather rigorous specification reduced as far as possible.

It was then finally decided that :—

(*a*) The contour interval for the 1:50,000 survey should be 50 metres throughout.

(*b*) The contour interval for the 1:10,000 survey should be 10 metres up to 2,000 metres and thereafter 50 metres.

Later it was agreed it should be 10 metres up to 1,500 metres, 20 metres from 1,500–2,000 metres and thereafter 50 metres.

It was later (November, 1945) decided by the Director of Survey that the scale of the survey under (*a*) should be 1:25,000. The contour interval remained the same.

5. R.A.F. Photography

Having fixed the scale and the area of the required maps, it was possible at once to say that photographs were required at an average scale of 1:48,000 for the 1:50,000 area and 1:24,000 for the 1:10,000 area. Aircraft would thus have to fly at about 35,000 ft. over " A " area and about 17,000 ft. over " B " area, using a K.17 camera with a 6-in. lens and allowing for the large ground height variation in the mountains. The original idea of using Baltimore aircraft was ruled out as they had not sufficient ceiling and it was decided by the R.A.F. to employ Mosquitoes.

At the end of this Conference, everyone felt much happier except, perhaps, Mr. Olivier of Sir Alexander Gibb and Partners as he had no option but to accept the fact that the cost of the survey to his firm might very much exceed the price already quoted to the Persian Government for both the flying and the mapping.

6. Causes of Delay in Starting

It can be said that the basic cause of most of the trouble in the delay in starting this job—some five months—was finance. A consulting firm of engineers like Sir Alexander Gibb and Partners naturally require a firm estimate to work to, even if they had not been pressed by the Persian Government to provide one. In all their normal contract dealings, they would get such a firm figure. Government departments (War Office and Air Ministry) involved naturally wish to avoid being committed to any firm figure in case that should turn out to be wrong in the event.

Of course, Sir Alexander Gibb and Partners were themselves having troubles as they had to contend with inadequate means of communications as between Tehran and London. Neither their London Office nor Tehran had an opportunity of studying this vast scheme in detail and they had perforce to change their ideas of what was really wanted as a result of their actual studies which they were making in the field. Thus we in Cairo were getting information

as to revised plans in advance of this information reaching London. These conditions were largely cleared up after the Conference of 23rd May, 1945.

7. Events After the Cairo Conference

The sequence of events after the decisions taken at the Conference on 23rd May, 1945, was as follows :—

(*a*) On 2nd June, 1945, the R.A.F. issued their operational Instruction No. 88 for one Mosquito aircraft of No. 680 Squadron to carry out the air survey. This aircraft arrived in Tehran on 6th June. It crashed on take-off on 11th June and became a complete write-off. It was replaced at once and successfully completed the flying by 2nd September, 1945. The time taken was thus just 3 months and the total flying hours were 38 hrs. 10 min.

(*b*) Survey instructions were issued to the R.E. personnel undertaking the ground survey on 2nd June. An advanced party (one officer, twenty O.Rs.) reached Tehran on 18th June and the main party (two officers, thirty O.Rs.) a little later. Survey on the ground began on 20th June and finished on 1st December, 1945, a total time of just over 5 months.

(*c*) Actual plotting of the air photographs on the Multiplex machine began in the office of 512 Survey Company, R.E., at Tura Caves, Cairo, on 1st October, 1945, and sufficient bromide copies of the urgent plots required were received by Messrs. Alexander Gibb and Partners in London in time for their detailed report to the Persian Government in December, 1945. The final printing of the twenty-two sheets of the 1:25,000 maps was completed early in 1947. Of the 106 sheets of the 1:10,000, the northernmost sixty-two were plotted and proved by survey in Middle East by the end of 1947. Of the forty-four southernmost sheets which were plotted and proved under the War Office in England, there was considerable delay. All 106 sheets were finally printed by the middle of 1948. Thus, it took about 3½ years to complete this task.

8. Flying for the Survey

(*a*) *Personnel, Equipment and Aircraft*

Mosquito aircraft (XVI) were used to fly the Survey. Adequate stores and supplies were flown up from Egypt in two Dakota aircraft to Mehrabad Aerodrome, which was four miles west of Tehran.

(*b*) *Camera Installation*

Type K.17 6-in. cameras were used. Two cameras were originally fitted :—

(1) One to the starboard position in the bomb-carrying compartment.

(2) One to the rear position in the rear camera compartment.

To fit the latter, the complete camera window and frame had to be removed to eliminate " cut-off." This fitting was later discontinued due to a camera " freeze-up " at 35,000 ft., and also due to the fact that the aperture caused a forced upward draught which carried a considerable amount of dust to the interior of the tail unit.

The majority of the Survey was, therefore, carried out using the front camera enclosed in the bomb-carrying compartment. A type 38 mounting was modified to lower the camera to within ¼in. of the sealing window and very little "cut-off" was experienced from the 10-in. window fitted in this position.

(*c*) *Survey Requirements*

Survey requirements were as follows :—

(1) Control strips as a preliminary to the Survey.
(2) Accurate scaling, entailing not more than 100 ft. height error in flying.
(3) Minimum aircraft and camera tilt.
(4) A 55 per cent fore and aft overlap.
(5) A 25 per cent lateral overlap.
(6) Minimum cloud shadow not to exceed 2 per cent on any run.
(7) Minimum shadows in the deep valleys.
(8) One machine-dried check print required from each negative followed by a further four prints from each accepted strip flown.

It was appreciated that the foregoing specification demanded a high standard of flying in view of the nature of the terrain and the inadequate maps. It also required a good photographic quality of all the negatives for their eventual production in the form of positive images on glass for use in the Multiplex plotting machine. All this imposed certain limitations under which photography was not possible and these were mainly weather.

(*d*) *Survey Preliminaries*

As a preliminary to commencing the survey, control strips were required to be flown as follows :—

(1) Large scale flown at a height of 17,000 ft. giving an average scale of 1:24,000 and covering terrain ranging from 3,000–6,500 ft.
(2) Small scale flown at a height of 35,000 ft. giving an average scale of 1:48,000 and covering the higher terrain ranging from 6,500–10,000 ft. and more.

Three strips at each scale were flown which provided an eastern, central, and a western control strip, all of which ran in a northerly direction. These strips, except the central one, deviated outwards from the southern base line which measured 20 miles in length, towards the northern base line which measured 56 miles in length, the length of the central strip being 58 miles.

From these control strips, ¼-in. and 1:100,000 map sheets were marked up with the appropriate strips to be flown.

Control strips mounted on linen, marked with the appropriate start points, intermediate check points and the end of runs, were prepared in convenient size for the use of air-crews in the air and R.E. Survey on the ground.

To complete the flying, nineteen runs were required at the 1:24,000 scale at flying heights varying from 15,000–18,500 ft. For the 1:48,000 scale, seven runs were necessary at flying heights varying between 31,000 and 35,000 ft.

(*e*) *Weather*

The prevailing wind at both heights was favourable and drift never exceeded 4 deg. maximum.

Cloud was inclined to form at 5,000–7,000 ft. over the Caspian Sea during the whole four months and gravitated towards the mountain ranges to the south, often rising and obscuring the high ground to be photographed, or ruining prospects of photography by the large amount of cloud shadow cast over the area.

Another local disability experienced was the thick dust and smoke haze which persisted as a cloud mainly confined to the Tehran area, but often spreading over a large area and rendering visibility very poor.

On occasions, the air-crews had to abandon sorties as the ground, in particular areas, was not even visible from a height of 15,000 ft. although ground conditions might have seemed ideal. As a result of these weather disabilities, the number of really good photographic survey days was very limited. Over a period of eighty-six days covering the months of June, July and August, 1945, the weather can be summarized as follows :—

	Over Plains	*Over Mountains*
Number of good days ..	21	15
Number of fair days ..	16	3
Number of cloudy days ..	32	68
Number of thick haze days ..	17	Nil

Early September brought more settled conditions and really good survey weather, but these conditions did not remain favourable for long, as the approach of the colder weather brings snow to the mountains.

(f) Flying Operations

Originally, two air-crews were detailed to carry out this very exacting type of flying, but the work was mostly carried out by one crew under Flight Lieutenant Elliott, R.A.F. This officer is very much to be congratulated on the high standard of his work throughout the operations.

The maximum variation in flying height permitted did not have to exceed 100 ft. from the mean height. The fore and aft overlap was standardized at 55 per cent and entailed either an increase or decrease in time interval setting, due to the constant rise or fall of the ground whilst flying east or west. All runs were made in an east–west direction on reciprocal courses.

The shortest run photographed was 20 miles in length and runs progressively increased in length up to run No. 26, 58 miles in length which completed the area.

The average duration of each flight was about 2½ hours and entailed the exposing of one film magazine of 190 exposures.

Flying was between 1000 hrs. and 1400 hrs. daily in order to carry out photography when shadows were of the minimum length.

Very little aircraft tilt was found to exist on checking the runs flown, but a constant error of 1 deg. existed with the camera installation. This was tolerated by us.

The maps used were fairly reliable as regards large details, but in certain areas were found to be topographically incorrect. For example, a mountain in the north-east corner of the area, of some 14,000 ft. on the map, was found photographically and visually to be non-existent.

Under these conditions, the control strips were found to be essential and were used by the navigator throughout to supplement his map information, providing as they did accurate start and check points which could not have been identified from the existing maps.

(g) Concluding Remarks

The main handicap was the limited number of good photographic days. A number of these days, as always, coincided with aircraft unserviceability. Although the R.E. Survey Party were working on the ground at the same time as the flying was in progress, they were not able to provide any kind of ground control to aid the air-crews. A Survey officer worked with the R.A.F. detachment for about two months and was then withdrawn and his duties of checking of runs, etc., devolved on the R.A.F. Photographic Officer.

9. Ground Survey Side of the Project

Most detailed instructions to the R.E. Topo Sections, who were to carry out the ground survey, were prepared at Survey H.Q. by

Captain Alexander of the South African Surveys and were issued in Cairo on 2nd June, 1945.

These orders gave all necessary details concerning the scale of the final maps required, the contour interval and the priority within the area. Details as to how the planimetric and height control points were to be spaced, identified, and marked on the air photographs were minutely explained.

As the ultimate plotting was to be done on a Multiplex plotting machine in Cairo, it was most important to get the positioning of spot heights correct on the photographs and very detailed instructions were issued as to how to achieve this.

Notes about interpretation of detail, especially man-made features which would be of use to the compilers at the base, were called for and these were to be given on the backs of the photographs.

These orders which covered several pages of foolscap were, of course, prepared in an office at the base and we shall see later how difficult they were to carry out physically on the ground.

10. Next Phase

The Survey preliminaries were thus completed and it now remained to get the aircraft and Survey troops on to the ground in Persia and start work. From the R.A.F. angle this was fairly easy as all they had to do was provide enough transport aircraft to lift all their stores and equipment required for the Mosquito aircraft to do the flying. Actual flying began on 10th June, 1945, i.e., just eight days after the operational instruction was issued in Cairo. This was followed by the bad news, already mentioned, that the first Mosquito had crashed on 11th June. It was replaced by another but was flown by the original crew.

The distance from Cairo to Tehran by road is about 1,500 miles and the administration for the move of the ground survey troops, provision of tents, adequate transport, warm clothing, etc., took some time, but the advance party of one officer and twenty men arrived in Tehran on the 18th June and was shortly followed by the main party of two officers and thirty men. Not bad going. Administration problems quickly arose and the question of sending up eighteen men to replace eighteen due to go to the U.K. on release and leave schemes arose as early as 6th July. Flying was held up at the start by bad weather and the question of using the existing rather unsatisfactory American tri-metrogon air photos for trig recce was suggested pending the receipt of the first survey photos from the R.A.F. Captain Alexander of South African Surveys from Survey Directorate, who had gone up to Tehran to help, got bronchitis on 9th July and did not get out of hospital till 15th July and he returned to Cairo on 26th July.

However, on 19th July, the R.A.F. reported the flying 45 per cent completed and by 13th August the job was 90 per cent done and it was fully completed on 4th September.

The job was thus launched from the H.Q. end and before going on to see what were the fortunes of the R.E. Survey Party in the wilds of Persia it will be interesting to recapitulate a few dates.

Job first mentioned in Cairo	November, 1944
Flying started	10th June, 1945, finished 4th September, 1945, i.e., about 3 months
Survey (on ground)	Started 20th June, 1945, finished 1st December, 1945, i.e., about 5 months.

11. R.E. Survey Party

As previously mentioned the R.E. Survey Party which moved from Sarafand in Palestine to Tehran in Persia consisted of three officers and fifty O.Rs. They left in two parties and both arrived in Tehran on schedule, taking ten days over the 1,500 miles journey.

The vehicles with the party consisted of :—

1 Staff car (four-seater utility)
1 15-cwt. water truck (200 gal.)
7 15-cwt. load carrying vehicles
2 8-cwt. Chevrolet personnel carriers
4 3-ton load carrying vehicles.

The journey was done in the middle of the hot weather and was most uncomfortable, as many personnel were obliged to travel on loaded stores trucks in positions permitting little or no shade from the sun, or any comfort. The temperature reached 135° F. in the cabs of the vehicles and was often between 110–120° F. in the shade outside.

After arrival in Tehran, seventeen of the party went sick with varying complaints but health otherwise was consistently good throughout the Survey. A medical orderly was attached to the party but he had little to do. The open air conditions under which the men lived undoubtedly did much to keep up health and the interesting and arresting nature of the country had a challenging effect to which they reacted by conquering most of the physical difficulties.

(*a*) *Trig Scheme* (Plate 5)

It was decided to carry out a recce of the whole area to make a trig scheme and this task was begun in the northern area on 3rd July and finished in the middle of August, 1945. The southern area was done later (October onwards).

The country was difficult in the extreme and called for tremendous physical efforts by everyone. It says much for the O.C. of this party, Captain Dicks, R.E., and the officers and N.C.Os. directly concerned with the trig recce that they ever climbed the peaks, often rising 11,000–12,000 ft., and overcame the troubles of sickness, nose bleeding and other such things associated with mountain climbing.

There were existing trig points in the area, fixed years before by the Survey of India. Some points were found and some were not and time was too short for extensive searching.

Actual observing was begun on 11th July and an early snag was met in that the observers failed to climb the peak Kamar Dasht (12,470 ft.) as reached by the trig recce party. This of course meant a change in the original scheme. Control was most difficult in the north-east of the northern area, in the neighbourhood of Mount Demavend (18,350 ft.), as the great bulk of the mountain itself and its attendant ridges precluded observations to the south.

The whole major trig scheme is rigid within itself, but in the extreme north-east is not tied in to the available Survey of India points, though it is tied in to certain of these points further south. Plate 5 shows how this was done.

(*b*) *Fixation of Planimetric and Height Control Points*

There were in all some 600 points to be fixed in the two areas and the instructions on the fixing and choosing of these ground control points given by Survey Directorate were such that a planimetric control point occurred on every other air photograph overlap in a strip and a height control point on every overlap. In order to reduce work and indecision on the part of the field parties to the minimum, the general principles governing choice of points were given in advance, and the overlap areas (taking into account both lateral and fore and aft overlap) were marked in pencil on the backs of the air photographs, before the field parties took them in the field. A surveyor thus knew the area on each photo in which he was required to choose and fix a point.

Each party consisted of two surveyors and an interpreter. Only four days a week were really available for actual technical work owing to the slow mode of travel and the necessity for carrying out all necessary cooking, feeding and camping arrangements, plus the arduous and broken nature of the country. This meant that in a whole day probably only one hour was spent on actual observing and booking, and normally a surveyor fixed one or two points by resection each day. Ten such parties were employed.

All resections were machine computed and only occasionally were points fixed by intersection due to the impossibility of resection.

Data regarding the control points, where position on the photographs had been pricked by field parties, was written on the back of the photos, against red or blue circled pin pricks, once the computations were completed. Height and co-ordinate lists were then compiled and sent to Survey G.H.Q. in Cairo and the first batch was dispatched by air on 19th September, 1945.

(c) Lessons

No such project should be attempted without a trained reconnaissance party, sent well in advance and not rushed for time.

There is no doubt that on this project, but for the tremendous efforts of the sappers concerned, the job would not have been done in time.

The great difficulty experienced by surveyors in the very barren and broken country in pin pointing their position after trying to read their route from an air photograph as they proceed on the back of a mule, inevitably led to misidentifications of positions on the photographs. Such misidentifications meant that all the effort, time and technical work spent on such points was wasted. Seven or more banked Multiplex projectors would cut out the need for so much ground control and permit more care over the choice of fewer more easily identifiable points. Such Multiplex instruments were not, however, available in Cairo at this time. All we had was one bar of three projectors which the Americans so kindly loaned to us.

All field work with the exception of a small portion in the Rudehan area was finished by 30th November, 1945, as planned, and this small area was completed shortly afterwards. The main party on the return journey reached Baghdad by train on 9th December, 1945, having completed a most difficult job very well.

(d) Administration

In every one of the reports of the O.C. in the field to G.H.Q. in Cairo it was clear how important and how difficult were the administrative arrangements for this project. These arrangements were even more difficult at the end than at the beginning of the job because of the order to evacuate Persia by 1st December, 1945. This meant that the R.A.S.C. and N.A.A.F.I. dumped large quantities of stores on the unfortunate O.C. who had most inadequate guards to look after them. On 26th September an item of 4,000 bottles of beer is mentioned and also fourteen motor tyres worth fabulous sums at this time. On the 25th October there was a grouse against the R.A.S.C. that they had issued nothing but Woodbines for weeks. In every report the question of the constant changing of surveyors due to the rapid demobilization of the Army at this time was mentioned.

12. Plotting at G.H.Q., Cairo

As previously mentioned, the first twelve photographs were sent off from Tehran by air on 19th September and they safely reached Cairo on 22nd September. They were sent to O.C. 512 Field Survey Company., R.E., for Multiplex plotting on 24th September, 1945, with full technical instructions.

The Multiplex available, as previously mentioned, was of one bar with three projectors and none of the operators available could be called experts. An area of priority was laid down and later a further priority within these initial priority areas was found to be necessary.

It was only too evident that time was far too short to have any chance of producing the finished coloured maps of the northern area, as required by Sir Alexander Gibb and Partners, by the end of the year, 1945. It was, however, essential that Sir Alexander Gibb and Partners should send in their detailed report to the Minister of Agriculture of the Persian Government by 1st January, 1946. The only hope then was for Sir Alexander Gibb and Partners to lay down exactly what areas were urgently required for this report and we would supply bromides of each Multiplex plot as they came off the machine. This was agreed to and done and the report was submitted to the Government of Persia on 1st January, 1946. It was a most excellently printed document of about fifty pages and included a reproduction of our plots on the scale of 1:25,000 covering the important area of the Lar Gorge and tunnels to the Latiyan Dam.

The whole of the work for the 1:25,000 map was done by Middle East, but the task for the 1:10,000 was very large and Survey at the War Office agreed on 14th August, 1946, to assist by taking a block of forty-four sheets which they hoped to complete by the middle of 1947. Owing to many troubles which occurred it was much later before the task was done.

13. Final Maps

Colours and Layout

There were in all twenty-two sheets of the 1:25,000 map and they were printed in six colours and a specimen is shown on Plate 6. The sheets were on geographical sheet lines measuring 7 min. 30 sec. in both latitude and longitude and were gridded with the appropriate grid.

In the 1:10,000 series there were 106 sheets printed in four colours and these were 3 min. in latitude and longitude and were gridded. A specimen is shown on Plate 7. This series covers Tehran and is an excellent up-to-date map of the Capital.

14. Conclusion

It only remains for me to mention one other matter and that is the cost of the work. It will be remembered that this job was being done on a repayment basis by the Army and the R.A.F. for Sir Alexander Gibb and Partners who were responsible for supplying the maps to the Persian Government.

This type of financial estimate is always difficult in the Army but this one was more so than most and I had considerable trouble in providing the War Office with any reliable figure. The figure had to allow for such things as :—

Pay of troops
Cost of rations
Pay of interpreters
Hire of mules
Vehicles (mileage)
Hire of Ordnance Stores
Local purchase
Air and rail passages
Accommodation

and a few other things I cannot now remember.

The finally agreed price was fixed by me while on a visit to London at an interview with the Finance Branch of the War Office early in February, 1946, and the most I can say is that the cost was not much more per square mile than that agreed after fierce argument at or before the commencement of the job. Our actual obligation to Sir Alexander Gibb and Partners was to supply

(1) 2 complete sets of air photos.
(2) 22 copies of each printed map
(3) 2 sets of kodaline film of each colour of each of the printed maps.

The Royal Air Force and the R.E. Survey Service have, I think, reason to be proud of their achievements on this job, even allowing for the delays in producing the final printed maps. I think I am right in saying that the Army has never attempted a similar type of job before and quite likely never will again. All those who took part in the work, whether in the field in Persia or in Tura Caves and elsewhere in Cairo, will not easily forget the name "Lar Valley." All the long hours put in will, however, not have been wasted if British firms do eventually get the contract for carrying out this tremendous engineering project.

LEGEND

All NEW Points fixed are prefaced by letter P and followed by the letters M for occupied main stations, I for intersected points and R for resected points and followed by a serial number i.e., P3/M, P16/I P11/R, etc.

Previously existing major trig. stations shown △ i.e., KIYASAR.

Established major stations shown △ i.e., P3/M

" intersected " " ○ i.e., P16/I

" resected " " △ i.e., P11/R

All intersected and resected points are not shown on this diagram to avoid congestion.

Rays shown ——·—— or ————— — — — indicate that the observations were made to points which had previously been fixed i.e. △KIYASAR or to newly fixed major points △ P3/M.

Rays shown ————— — — — — show observations to intersected points ○ P11/I , or from resected points △ No.1.

Roads or tracks shown ═══════ RIVERS ——

Heights where given are in feet.

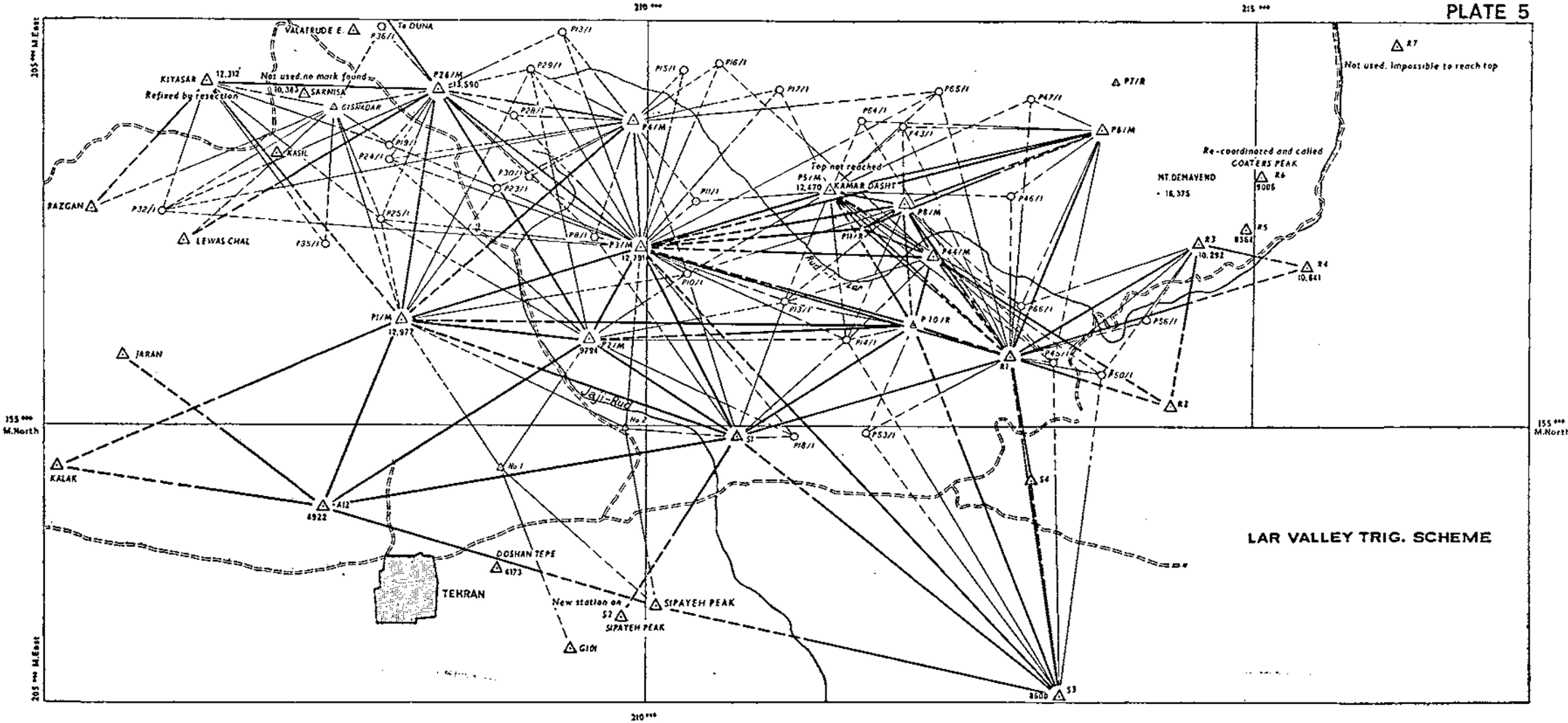


PLATE 5
LAR VALLEY TRIG. SCHEME
210 000
215 000
205 000 M.East
155 000 M.North
VALATRUDE E.
To DUNA
P36/1
P13/1
KIYASAR 12,312'
Not used, no mark found
10,383 SARNISA
Refixed by resection
P26/M 13,590
P29/1
P15/1
P16/1
P17/1
P65/1
P47/1
P64/1
P43/1
P4/M
P7/R
P6/M
GISHADAR
P28/1
P19/1
KASIL
P24/1
P30/1
P23/1
RAZGAN
P32/1
P25/1
LEWAS CHAL
P35/1
P8/1
P31/M 12,791
P11/1
P5/M 12,470
KAMAR DASHT
Top not reached
P46/1
P8/M
P11/R
P44/M
Re-coordinated and called COATERS PEAK
MT. DEMAVEND + 18,375
R6 9006
R5 8561
R3 10,292
R4 10,641
Not used, impossible to reach top
R7
P10/1
P37/1
P1/M 12,977
P21/M 9798
P10/R
P66/1
P56/1
P14/1
P45/1
R1
P50/1
R2
JARAN
Jajt-Rud
No 2
S1
P18/1
P53/1
No 1
KALAK
A12 4922
S4
DOSHAN TEPE 6173
TEHRAN
New station on S2 SIPAYEH PEAK
SIPAYEH PEAK
G101
8600
S3

PLATE 6

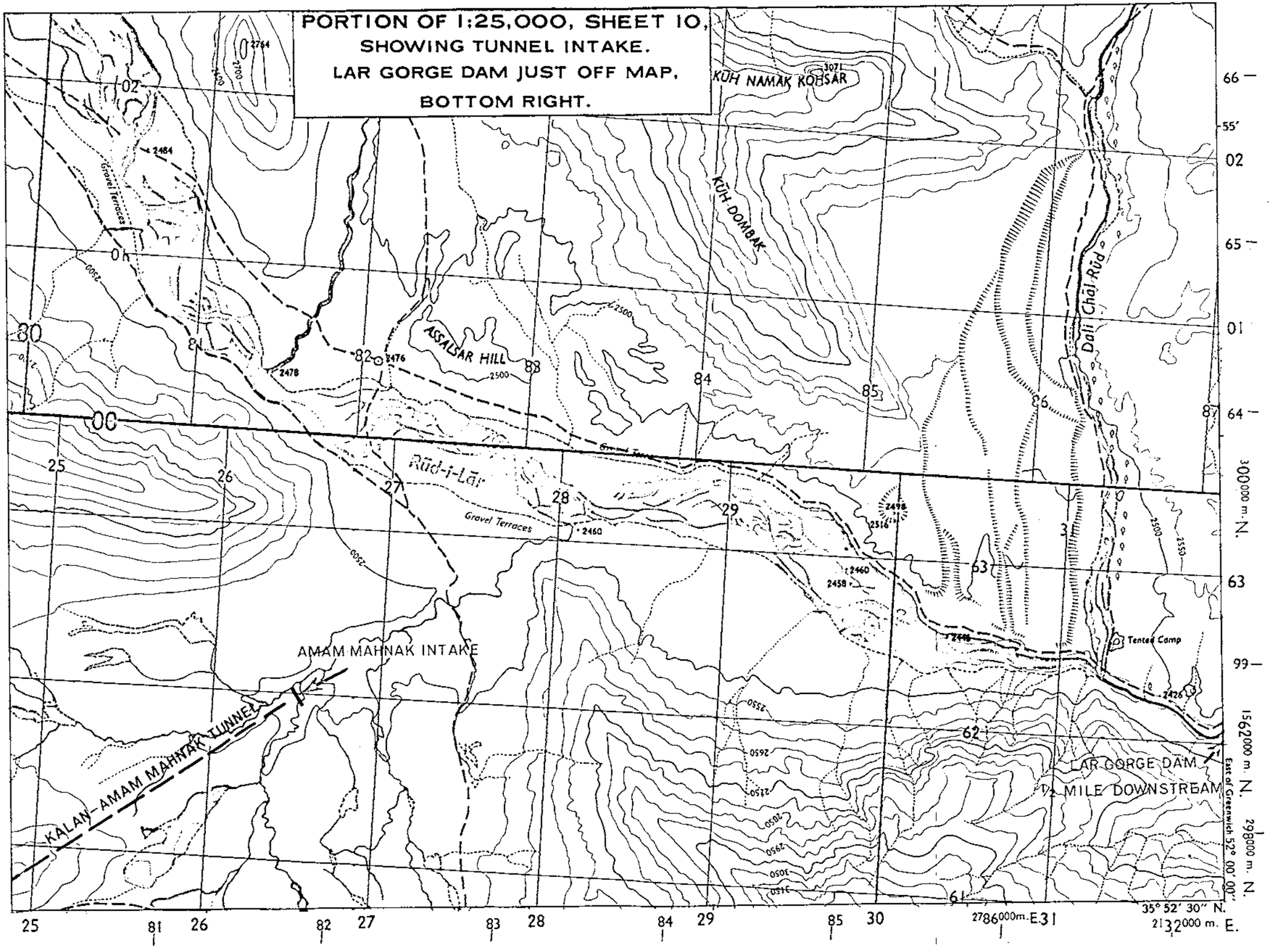
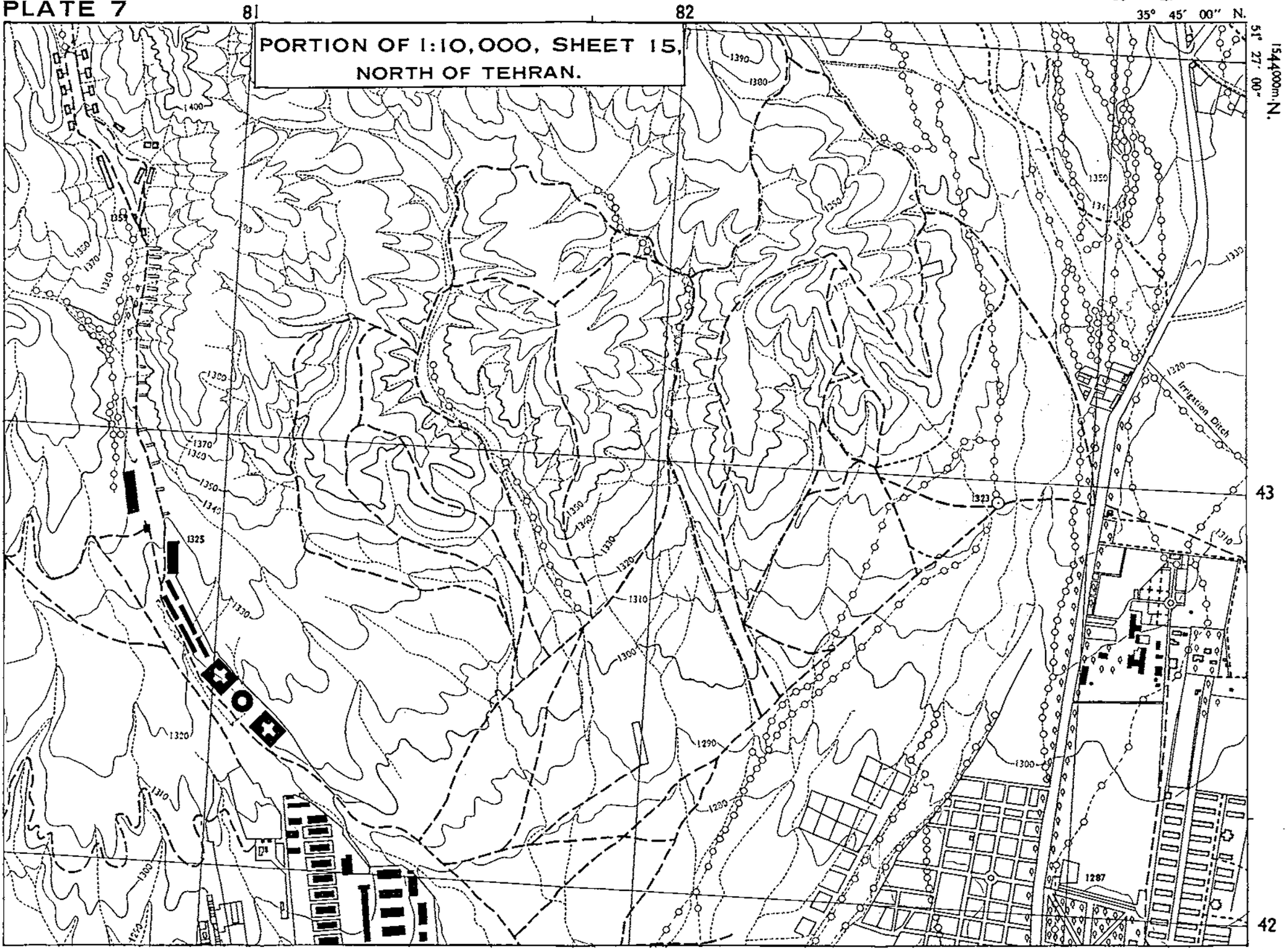

PORTION OF 1:25,000, SHEET 10,
SHOWING TUNNEL INTAKE.
LAR GORGE DAM JUST OFF MAP,
BOTTOM RIGHT.
KŪH NAMAK KOHSAR
KŪH DOMBAK
ASSALAR HILL
Dali Chāl Rūd
Rūd-i-Lār
Gravel Terraces
AMAM MAHNAK INTAKE
KALAN-AMAM MAHNAK TUNNEL
Tented Camp
LAR GORGE DAM
½ MILE DOWNSTREAM
300000 m. N.
1562000 m. N.
298000 m. N.
East of Greenwich 52° 00' 00"
35° 52' 30" N.
2786000m. E.
2132000 m. E.

PLATE 7


PORTION OF 1:10,000, SHEET 15,
NORTH OF TEHRAN.
81
82
2083000m.E.
35° 45' 00" N.
51° 27' 00"
1544000m.N.
43
42
Irrigation Ditch
1323
1325
1287

C.R.E., NOBODY'S SAPPERS

(Concluded)

By COLONEL A. CRICHTON MITCHELL, O.B.E.

WESTERN DESERT, 1941

FIRED by the promise of a move we were not long in getting the remaining vehicles we needed; and, in default of instructions from H.Q., B.T.E., we made our own plan for that move. This was accepted but I could not get executive orders to go. I pestered daily and by 6th January was told laconically by "Q," B.T.E., that in Middle East few orders appeared before moves took place: one just moved. In this case, however, I was told I was lucky: the orders were being typed and I would get them that evening. Nothing had appeared by next morning so I "blistered" a staff officer; he had forgotten. We got the orders by midday and found they included last minute instructions to take tents. Even a modified scale of tents weighed 42 tons and the R.A.S.C. just had no lorries. We loaded what we could and said the rest could follow by rail: if they did they failed to reach us by the time I was captured three months later. That same evening brought a second afterthought: our advance party could move, but our main body would await further instructions. By then we had acquired a slight distrust of Cairo staffs and we were not going to be split up. I went to see "Q" of Cairo Sub-Area: not his business but B.T.E's., he said, but he played and we soon ironed things out.

On 8th January, Constant and the advance party left Almaza and ran through to Daba in two days. On the 9th the rest of us pulled out and were escorted through Cairo by motor cycle police. A check at Mena Corner to send on the harbour party and then we followed, reaching Wadi Natrun by 1430 hrs. Arrangements worked well and we harboured without difficulty—widely dispersed vehicles, piquets posted, shelters dug beside each vehicle, vehicles checked over, refuelled and camouflaged, a hot meal, no lights after dark and most of us were asleep in our bivvy shelters by 2000 hrs. But Bray, my most excellent batman from Barnsley, striking rock whilst digging my bivvy shelter, was heard to remark tiredly to my driver: "Lumme Albert, I think some . . . must have started foundation for 'ouse 'ere and forgot to build 'ouse." Next day a similar drill and we harboured at Bahig: on the 11th we reached Daba without incident. As our first major move it had been planned as a drill in easy stages but it had gone well: we had moved 119 vehicles and motor cycles 222 miles and our only casualty was a motor cycle with a broken fork.

My first sight of Daba on my earlier desert trip had been in a sandstorm with visibility 15 yds., and it had the reputation of being the dustiest place in North Africa. Now it showed itself properly,

but as a depressingly primitive place of a few huts and clusters of tents. Not for long, however, as I woke in the early hours of next morning choking and covered with sand. A foul sandstorm was blowing : most of our tents were either down or in tatters : visibility was 10 yds. and it was quite easy to get lost within one's own camp area. It took us two days to get vehicles, equipment and clothing clean and the camp in order : then we had another sandstorm. That one caught Radcliffe, Constant and myself on reconnaissance near the beach. Radcliffe's scout car got stuck in a salt marsh and we could not move him. Leaving him water and rations, Constant and I started back to camp for the winch lorry, but the sandstorm was then at its worst. I was also driving a scout car, straight into the wind : the ground was hummocky but one could not see the bumps : one just bumped them. From the driving seat it was difficult to see the ground beside one's car ; or rather, one saw what appeared to be a fast-flowing river of sand running under the car at about thirty miles an hour. That and the bumps were an altogether weird experience, as if one were at sea, and I became almost " sandstorm sick." Although we were merely crawling along—it took an hour to do three miles—the sand rushing beneath us gave the impression of speed. In fact, I thought I was speeding and jammed on the brake : we still seemed to be going along out of control, but in reality were standing still with the sand going past us in a sort of brown twilight. We had five of these " something " sandstorms in our first week : Daba was maintaining its reputation.

We were not long, however, in getting into the full swing of training, as Daba allowed more extensive exercises, with units and sub-units out for greater distances and longer periods. We concentrated on desert driving and navigation ; track reconnaissance and approach marking by night ; laying, locating and lifting minefields ; water supply ; and road work over a rocky spur at Abu Tina. And in as many exercises as possible we automatically included harbouring drill and administration, employing an extemporized " B " Echelon to maintain units harbouring out for the night. I went out to see these exercises as much as possible and often came back with mixed feelings. Officers and men were keen enough but too impetuous : they took time to realize that impetuosity and dash in final tactical execution only succeeded where preliminary planning had been cool and thorough. And they had to learn to work silently.

We had a great deal of trouble with vehicle failures, generally the front axles of our Fordson trucks and nearly always at a " life " of about 2,500 miles. They were not robust enough for desert work ; nor were they new ; but there was also the human factor of bad driving. For a nation of motorists the British Army of those days produced outstandingly bad drivers. Their training had been too

short and they took less care of a government vehicle than if it had been their own : they had yet to learn that on their care of a vehicle might depend their own lives in the desert. But most of all they completely lacked " hands " for a vehicle in the way the old-time horse driver had hands for his animal—and intense pride, too, in the fitness of his animal. But an epidemic of pay stoppages for negligent breakdown put an almost immediate end to the trouble. On genuine failures, however, we had quite enough bother : we were allowed no spares in the unit as Ordnance would only supply on production of the broken part and that meant at least a six-weeks wait. Luckily, in Basil Terrell we had an excellent M.T. specialist and he quickly took on the job of building up these stub axles. Another difficulty arose from the excessive overloading of many vehicles. It was not that we carried much private junk : we had ruthlessly left most of that in Messrs. Cooks' store in Cairo. But the official loads were grossly overweight. In a 15-cwt. truck, for example, desert equipment (sand channels, reserve water, petrol, rations, cookers, blankets) took 4½ cwt. : personnel took another 11 cwt. so there was officially nothing for engineer equipment. The Field Park Troop had a full 3-ton load of anti-gas stores, but no vehicle allotted in the establishment : its Field Stores Section had one 30-cwt. lorry for 4½ tons of stores. We had no " B " Echelon vehicles at all and did not look forward to taking over Farewell's after these had been knocked about in the desert operations. We reported all this, but nothing happened. Expecting this, however, we had started to reorganize equipment, pulling back from troops a good deal of their ample demolition and water supply gear which was concentrated in Squadron Headquarters. This made troops much lighter for normal working, yet they had essentials : it also allowed any one troop on a special task to have adequate supplies of appropriate equipment, self-contained in its own vehicle temporarily attached. To rub home all these matters and to consolidate our training thus far we held a special Officers' Week at the beginning of February, paying special attention to engineer reconnaissance, the organization of engineer tasks and general administration. Troops were run temporarily by their N.C.Os.—a form of practising " officer battle casualties " and seeing what these N.C.Os. could do on their own. I also had a word with all of them, telling them just how far I thought they had got both as leaders and as engineers and how much farther they had to go. But we were fortunate to have S.S.M. Simon and T.S.M. Cumper as the seniors in the two units : their experience and example were invaluable.

In the nine months since we had been formed I had tried to follow a definite policy. My job was something far bigger and harder than merely giving orders. Most of the unit were quite inexperienced whilst this was the fifth war, big or small, at which I had assisted ;

and it was for me to pass on experience, to explain, teach and guide, to influence without interfering, correct mistakes without cramping initiative ; above all, to avoid running a one-man band. "The colonel's uplift," my young had called it. Primarily I wanted them to be leaders and in this I was fortunate : officers and men were fundamentally a good lot and the stuff was there if I could shape it. But they would only learn by doing things themselves and I did not mind if they floundered in their first attempts. At times I would keep them on a tight rein ; at others, relax and watch ; then perhaps take the strain again. I had also another rôle : I was both "big gun" and "umbrella" to my officers in their dealings with other authorities : but only if necessary and they must fight their own battles as far as possible. So far as higher authority was concerned I alone was responsible for everything, good and bad, in the unit : I took the bouquets and the bricks, and if I passed them on that was a family affair. I would, of course, occasionally get depressed at how slowly we seemed to progress : at these times I would go and take a peek at some other unit and perhaps come away heartened. I remember seeing a unit harbour alongside us one night, their vehicles like an Ascot car park, their whole *bandobast* so like a travelling circus that I almost expected to see a tame lion stroll past. We were not as bad as that. It was all intensely interesting, this creating of a human machine and gradually making it work, and for me it was a constant urge to give of my best. Our unofficial motto was : "We'll get there yet," and before I parted from these men they were to show in great fashion that they had got there. I think the real spirit and foundation of all this was laid in Sheppey, as there we had a worth-while job and our efforts were appreciated. Middle East had only maddened us with irritating trifles—fortunately not for long enough to kill the fine flower of these youngsters' enthusiasm.

Daba was a most uncomfortable place and we were glad to move another fifty miles west to Bagush on 10th February. There we went into the old force headquarters camp and used one of their messes dug into a sand dune. Bagush was delightful by comparison : we had excellent weather and no sand storms : we were by ourselves, sheltered amongst white sandhills and with one of the Mediterranean's loveliest little landlocked bays invitingly at our doorstep. The men's spirits soared and when I gave them a day's holiday, their first day off since New Year, they bathed and played games on the sands like a bunch of kids. Our training followed former lines but we added two new jobs : one, a hill-road up the steep scarp at Sidi Haneish ; two, the lifting of live and often over-sensitive mines from the Mersa Matruh defences. This proved a foul job as we were given no mine charts and had little idea of the extent of any minefield or the number of mines laid : drifting sand might expose some or bury others

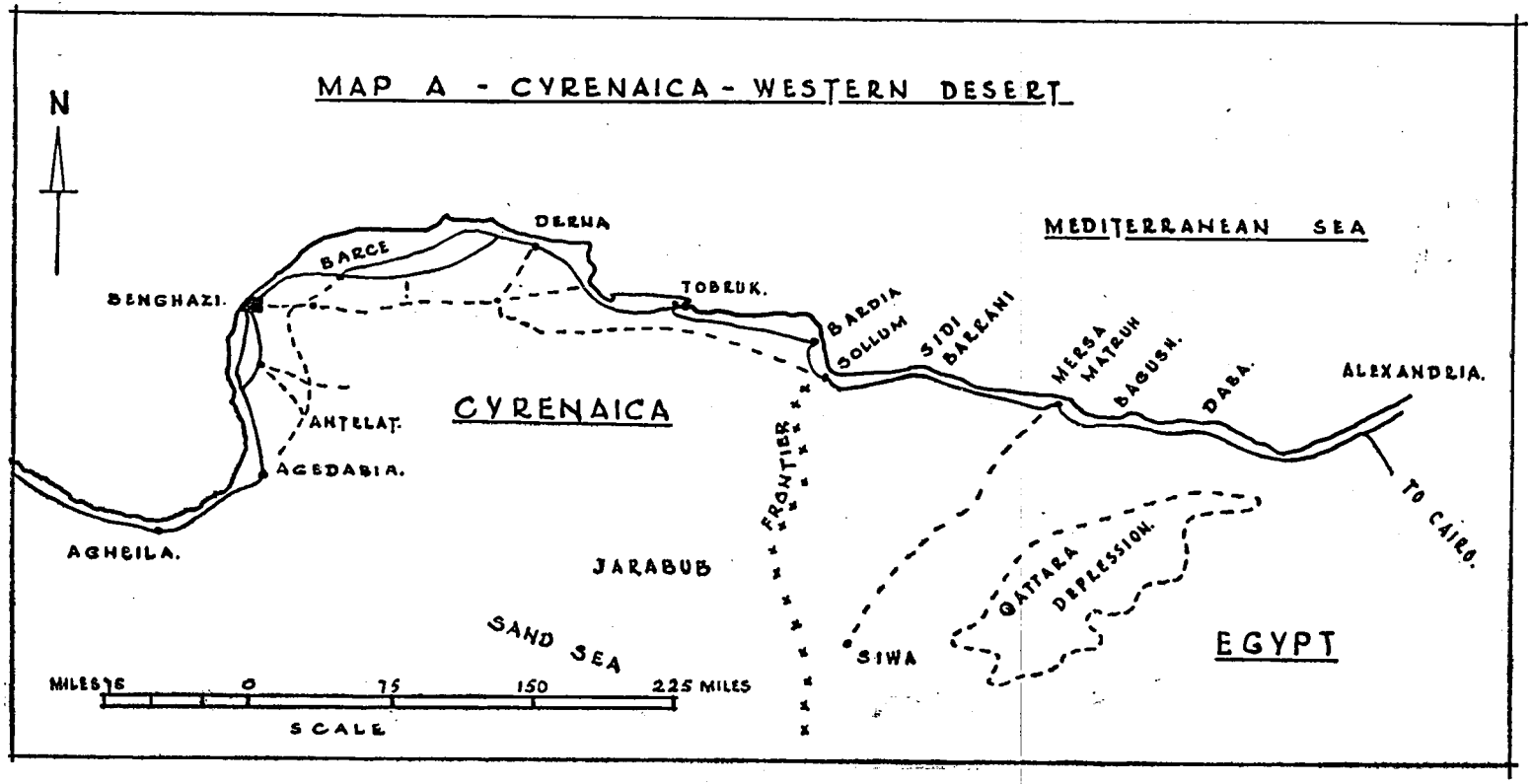
deeply. Many local pattern mines were far too sensitive to be lifted. Sub-units took on this work in rotation as useful training and altogether we cleared 23,000 mines in twenty-three days. Only one accident, when a truck carrying " neutralized " mines exploded : the two men in it were blown to bits and the twisted chassis half buried in the sand.

Sheppey and Almaza had taught us the elements of scrounging but now we were getting almost too proficient. At Daba we had " made " four Italian 5-ton lorries which proved most useful. An officer found a road roller unattended near Matruh and got it almost to Bagush before he was overtaken by an irate sapper sergeant and told to lay it down. It was much the same with a 15-cwt. truck which another Matruh sapper left about. A portable lighting set, the odd compressor and concrete mixer, explosives, cement and water supply gear had also come our way, but I felt I had eventually to say " Stop " or we would get a bad name.

British troops had occupied Benghazi on 7th February. It was the end of a phase, or at least a breathing space in which to take stock. As part of our " uplift " we had had periodical discussions on the war situation amongst officers and N.C.Os., and the moment seemed right for another. Italy had signally failed on her Greek and North African fronts, and Germany would have to help considerably if her Axis partner was to remain effective. Hitler generally thought in terms of the offensive and of surprise : he aimed at quick results and preferred the most direct route. His ultimate goal was England : would he again consider invasion in the spring to counter our successes in North Africa ? It meant all or nothing, however, and his Luftwaffe had failed. Alternatively, he might swallow Spain, sealing the Mediterranean and allowing his U-boats and Air Force to strike farther into the Atlantic against our vital shipping : this might be almost as quickly effective as invasion, more economical and less risky : would it lead us into another " Peninsular War "—if we could get to Portugal in time ? But little of this was of direct assistance to Italy, and Germany might be compelled to act in the Mediterranean. There were rumours of a German Desert Korps landing in Tripoli, of increased Nazi pressure in the Balkans : together, they might be an effective pincer threat to the Suez Canal. So long as Russia remained a friendly neutral and there was no risk of a British landing in North-West Europe a limited Mediterranean adventure might be reasonably safe. Control of the Greek coast allowed air action against Middle East and might threaten our position in Libya. But it deprived Hitler of some of his advantage of concentration and interior lines and it was a long way round to his real objective, England. Napoleon, however, had had a similar idea.

On our side we had cleared Cyrenaica with about two men and a boy and a lot of bluff, but we could hardly hope to repeat the process. Administrative factors seemed to say "No" to going on to Tripoli at once: we had Greece and Abyssinia on our hands and there might be new commitments if the German threat developed. Mr. Eden and General Dill visited Cairo and went on to Ankara and Athens. Mr. Roosevelt said he would not allow Germany to win. Mr. Churchill, broadcasting to the U.S.A., said: "Give us the tools and we'll finish the job." It was a courageous gesture, for we stood almost alone and were critically short of everything. In the Middle East, at the end of long communications, we were desperately thin on the ground over an enormous area, with several major tasks and perhaps others to come. We simply had not the resources for everything and it was a case of first things first. Abyssinia, for example, might take low priority for the moment. Benghazi gave us a strong forward left shoulder to Malta, besides great depth in front of the Delta and Canal; but might not Tobruk be almost as good? We could then better help Greece and bolster Balkan resistance. Our foothold in Greece seemed more important than possession of Benghazi. To "finish the job," of course, we had to get back into the heart of Europe in sufficient numbers to thrash the still powerful German Army on its home ground: the Middle East seemed a long way round to the German Army in 1941, and for the time being we could not act offensively on this scale. The Axis sprawled across Europe like a large black spider and we must first prevent it from extending its hold, then try to cut off its legs one by one before striking at its body. Our historical flair was for widely dispersed footholds on the enemy's coast and we should not abandon the one we had in Greece: offensively or defensively it might prove of enormous importance. Such were some of the ideas that ran through our minds during that time. Mostly question marks, it might be said, but the time was one of doubt and scarcity: Alamein was still eighteen months away. For that reason it is perhaps well to recall these days.

The Seventh Armoured Division was coming out to rest and its temporary sappers were returning to Palestine: we might join the division somewhere in the back area. It was disappointing to have missed the battle, but there would be others. Meanwhile, we had done almost all the training we could usefully do by ourselves: the next stage must be in co-operation with other arms and would be better under non-operational conditions. But we were still really nobody's children—or almost everybody's. We were officially under H.Q., B.T.E., but had seen little of them since leaving Cairo: now both G.H.Q. and Seventh Armoured Division were to claim us. On G.H.Q. orders Colin Edwards moved off to Libya on 22nd February with his Troop of the Squadron, but to make him up to


MAP A - CYRENAICA - WESTERN DESERT
N
DERNA
BARCE
BENGHAZI.
TOBRUK.
MEDITERRANEAN SEA
BARDIA
SOLLUM
SIDI BARRANI
MERSA MATRUH
BAGUSH.
DABA.
ALEXANDRIA.
ANTELAT.
CYRENAICA
AGEDABIA.
FRONTIER
TO CAIRO.
AGHEILA.
JARABUB
QATTARA DEPLESSION.
SAND SEA
SIWA
EGYPT
MILES 75 0 75 150 225 MILES
SCALE

establishment we had to immobilize part of each other troop. On 2nd March, Bill Loring took 143 Field Park troop off in pursuit of Edwards. Hardly had he gone when I got orders to move the whole outfit back to Cairo, presumably to join Seventh Armoured Division. But an hour later came another signal ordering us all to Libya. This was fantastic and in any case we were no longer mobile : I felt the only course was to invite myself to Cairo to clear up the mess. I drove back on 5th March but at first met with little success at either G.H.Q. or B.T.E., except to be immediately invited to a large cocktail party. Next day, however, I had a long talk with General Creagh of Seventh Armoured Division and he was charming. Definitely, he said, we were to join the division as soon as possible, train with it and train it in assault crossing work and other engineer operations. Did this last mean Syria or the Balkans, I wondered ; but my main thought was that here was a very different outlook on sappers to what I had previously seen. Hopes soared, only to be dashed again when I went back to G.H.Q. for confirmation and orders to collect my flock in Cairo. Brigadier Gaussen (D/E.-in.C.) said there might be other things brewing for us : he appreciated our impossible position, but at the moment could not be more definite. I had gained little from the trip except perhaps to get ourselves back into people's minds.

Although British forces had advanced deeply into Libya, they had kept largely to the coast and had not attacked or been attacked by the Italian frontier garrison at Jarabub, 140 miles south of Sollum. It was now decided to clear this up and 18 Australian Infantry Brigade was detailed for the task, whilst I was ordered to find one troop to co-operate. I wanted to go myself as the force commander's engineer adviser but this was not allowed, so I selected Weston's No. 3 Troop of the Squadron. Little was known of the Italian garrison or defences, but I coached Weston in the possible tasks and hoped for the best. The force moved south from Matruh on 15th March and Jarabub fell on 21st. I heard little detail except that our sappers had done their job well, but had had six casualties.

With Weston's departure and Edwards and Loring already in Libya, I was left nothing to command except my Adjutant and Radcliffe, with only one Troop of his Squadron : things were again becoming fantastic. On 18th March, however, Brigadier Gaussen visited Bagush and said we could go forward to Libya. The 2nd Armoured Division had recently arrived from England, but half of it, including all its sappers, had gone to Greece : the other half had relieved Seventh Armoured Division south of Benghazi. We were to join the division there on short loan : at least we would again be concentrated and with a formation where we might function properly. I left Bagush on 21st March and moved to Bardia that day.

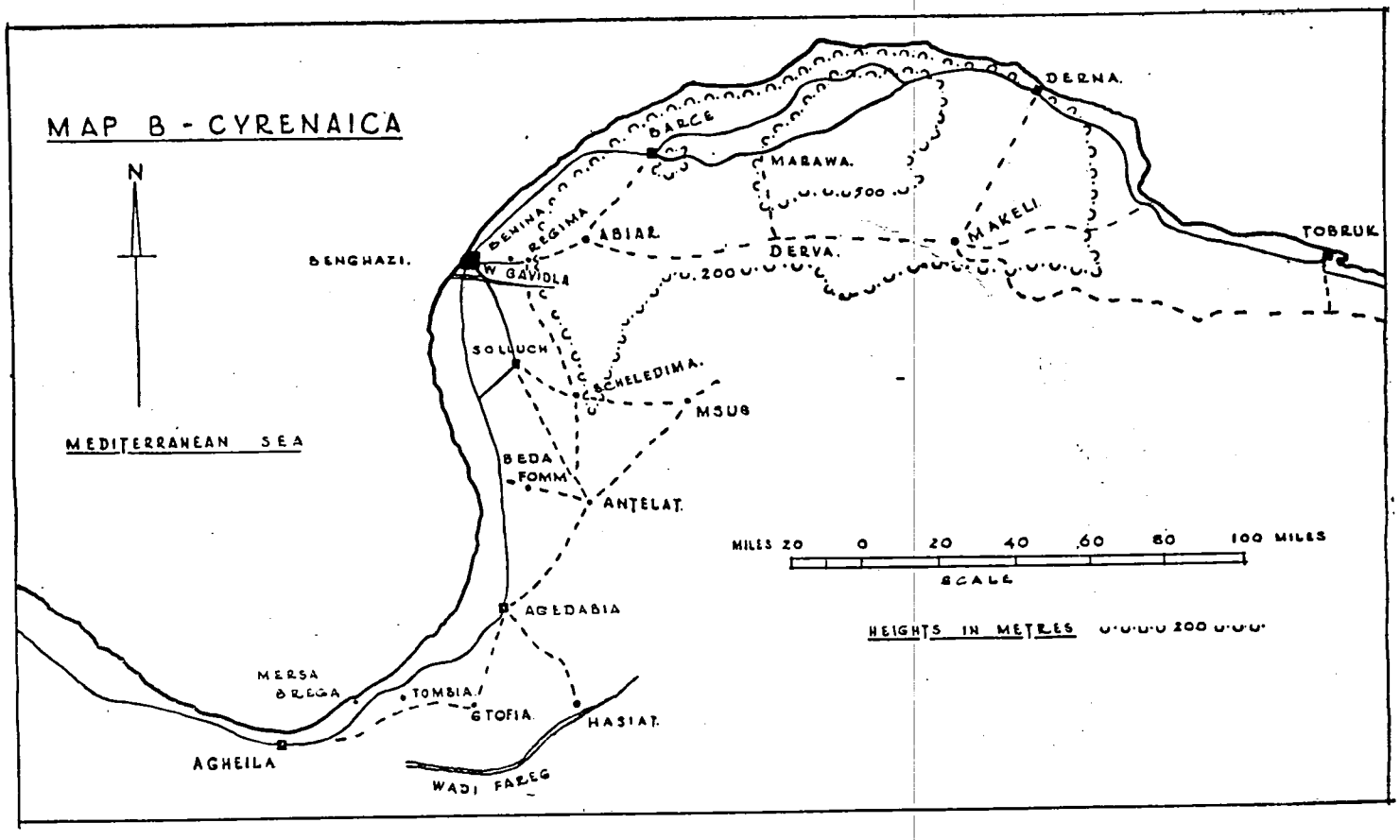
Fort Capuzzo, near Sollum, looked somewhat dishevelled after the Navy had treated it to heavy shell : Lower Bardia, where I spent the night with 552 Field Company, was full of fleas and Italian aniseed gin. Next day through Tobruk to Derna ; and on 23rd to Barce, where I had lunch with Brigadier Kisch, the Chief Engineer, and General Neame. Cyrenaica Command's policy was offensive, I was told, and my main work with 2nd Armoured Division would be " forward roads and water." I continued south on the 24th and by late afternoon reached 2nd Armoured Division Advanced Headquarters at Tombia. But on the way I had been four times strafed from the air. The enemy seemed to have complete command of the air here, and on that long straight road our convoys and even single vehicles were generally hunted by daylight. I was driving and kept lookout ahead and to the right. Adams, my driver beside me, kept watch to the left ; whilst Bray kept watch in rear in case any of these aircraft sneaked up behind our tail. The moment we saw a Boche aircraft coming up or down that road we pulled into the side, jumped out and lay doggo in the sand : nothing hit us but it was an irritating waste of time. Radcliffe, following a few days later, was equally strafed and had some vehicles knocked out. Loring and Edwards, I found, had already lost fourteen men and twenty vehicles in such attacks.

" The White Knight Motor Company "—March 1941

Forty miles south of Agedabia I had found the 2nd Armoured Division's sign—a white plumed helmet—and was soon at its Advanced Headquarters harboured amongst sandhills about a mile off the road. I met General Gambier-Parry, the Divisional Commander, and Colonel Younghusband, his G.S.O. I ; and the first thing I learnt was that the division had been put at thirty minutes' notice to pull back, as German troops had that morning pushed our patrols out of Agheila and occupied the place. Divisional Headquarters was very dispersed. My own pitch was about half a mile from the General's office and almost as far from the mess, so I carried a compass after dark. The division was also very dispersed, with only one weak armoured brigade and half the Support Group covering a front of about fifty miles from Mersa Brega south-east along the Wadi Fareg, and with rear elements stretching back to near Antelat. My " parish " thus covered about 4,000 square miles of almost featureless, billiard-table country ; and the nearest support was the Australian Division around Benghazi, 150 miles from our forward positions. In order to maintain contact with the weak Italian remnants it was perhaps right in the first instance to go forward, but with Germans now in North Africa the answer might be different.

The division had borrowed an Australian field company and on the morning after my arrival Major Risson, its O.C., took me round part of the forward area and to where Loring's unit was working with 3rd Armoured Brigade on the left. On the 26th I went to see the rear area, with Edwards' troop working round Agedabia and Rear Divisional Headquarters north of that. The division had had no C.R.E. since reaching Libya and there was no divisional engineer plan: my units worked directly under lower formations. In the way of engineer policy I could learn nothing very explicit except that the C.R.E., Australian Division had earlier drawn up a comprehensive plan of possible work in the area. But we had not the resources to carry it out and, since withdrawal seemed likely, it no longer applied: a fresh appreciation was necessary. The "G" plan was vague, since how far or fast or often we would withdraw depended so largely on the enemy; but I assumed we would go right back to the rolling gebel country south-east of Benghazi to watch the Australian open left flank. The points I had to consider included the featureless terrain with no natural obstacles; my labour limited to about a hundred working numbers, as Risson's company had to rejoin its division on 30th March and Weston's troop had not yet arrived; the scarcity of engineer stores; above all, the time factor, before and during withdrawal. Lastly, we were strangers to the area and the division, and time and reconnaissance were essential to learn the possibilities and limitations. It was clear that all I could do would be to destroy all water and resources over as deep a belt as possible, so as to delay the enemy or limit him to light forces in the forward area. I could crater landing grounds at Hasiat and Agedabia, also the main road at a few points; could booby-trap buildings in Agedabia and lay mines on tracks behind rear parties. We needed a week for all this: in the event the enemy gave us six days, but we did our job. I also decided to bring my units under divisional control: I would want them in depth for leap-frogging when we began to go back. I reduced my own headquarters by sending back the heavy office lorry, so we were left with only three light vehicles, each self-contained: my Ford saloon was henceforth "home" and "office" for myself, my batman and my driver, with reserves of food, water, petrol, besides ourselves and our kits.

Engineer work on this plan started in earnest on 26th March. Every known well in the area, except about three for final supplies, was destroyed by pouring a drum of diesel oil into it and then blowing in the wellhead. All spare stores which R.A.S.C. and R.A.O.C. could not backload were destroyed. Tony Weir played havoc with Hasiat landing ground and was later to lay mines on tracks behind 3rd Armoured Brigade rear parties. Edwards destroyed the Agedabia landing ground, prepared four pairs of road craters and was invent-


MAP B - CYRENAICA
N
MEDITERRANEAN SEA
BENGHAZI.
BARCE
DERNA.
MARAWA.
DEMINA.
REGIMA
ABIAR.
W. GAVIDLA
DERVA.
MAKELI
TOBRUK
SOLLUCH
SCHELEDIMA.
MSUS
BEDA FOMM
ANTELAT.
AGEDABIA
MERSA BREGA
TOMBIA
GTOFIA.
HASIAT.
AGHEILA
WADI FAREG
MILES 20 0 20 40 60 80 100 MILES
SCALE
HEIGHTS IN METRES 200

ing fiendish tricks amongst the ruins of Agedabia. Reed somehow kept us up in essential stores. Everyone was working like a beaver despite scarcities, distances, the appalling dust on these tracks and periodical air strafes. I sent in daily reports to the Chief Engineer at Barce, but only much later heard he had never received one of them. Radcliffe's Squadron Headquarters with Grant's troop reached Antelat on 28th March and I told him to get to know everything about the area—a beginning of our disposition in depth. Risson's company returned to Benghazi on the 30th and I suggested to his C.R.E. that we have an east-west line through Scheledima, exclusive to me, as the boundary between our parishes : I wanted to avoid gaps and this gave him the gebel and us the open desert for the time being.

On the 30th, Advanced Divisional Headquarters moved forward about fifteen miles towards Mersa Brega. The Boche seemed to have found our Tombia harbour as bombing had increased : in the new site, too, we would be in closer touch with units should excitements develop. We were not to know at the time that we would have only twenty-four hours there before having to pull back in a hurry. On the 30th March, I accompanied the General on a hundred miles reconnaissance of his forward area. We first visited 3rd Armoured Brigade on the left, then went south and west across the Wadi Fareg—little more than a geographical expression—where we contacted some of the K.D.G. armoured car patrols holding a forward observation line. How desperately thin we were everywhere on the ground, I remarked to the General. In front of us, he said, were probably one German Panzer division and one Italian division—perhaps 300 tanks and 8,000 infantry. On our side " The White Knight Motor Company," as he called his division, had that day twenty-three—repeat twenty-three—working cruiser tanks, a squadron in captured Italian tanks and an armoured car regiment : for infantry we had one Territorial battalion and a company of Free French. We had neither defences nor obstacles to help us, and the whole open flank of the desert was the enemy's to roam at his will. One may say that in tanks and infantry he had roughly an eight to one superiority, and behind us we had no support within 150 miles. It had all the makings of an unnecessary tragedy.

Tip and Run and Capture—April, 1941

A morning air report on 31st March indicated a long column of enemy vehicles moving east towards the Wadi Fareg : dust made it impossible to see if they were tanks or lorries but they did not press their threat. In the late afternoon, however, enemy tanks attacked the Tower Hamlet's position at Mersa Brega and captured a forward feature. A party of Edwards' troop, preparing craters on

the main road west of Brega, was caught by enemy artillery fire but finished its job : it then became mixed up in the tank attack but Corporal Noyes managed to withdraw his men. Another detachment of the same troop was on water duties at Brega wells when the tanks came in : only five minutes warning of the infantry withdrawal was given and the sappers were left unprotected, but Lance Corporal Morrell managed to load up his precious pumping gear, destroy the wells and get his men clear. Good work by two young sapper N.C.Os.

Withdrawal was ordered that night to prevent the weak division being isolated or overrun, and Advanced Headquarters moved back sixty miles to north of Agedabia, a seven-hour crawl in pitch darkness and choking dust along the Gtafia track. Right at the start we had to abandon a mess lorry with much of our precious drink and the General's private thunder box. From Agedabia, on the morning of 1st April, I started out to find my units. The Field Park Troop had pulled back to near Antelat, leaving Weir to lay mines behind 3rd Brigade. Edwards' troop was mostly in Agedabia on water supply and booby traps, but had crater parties on the main road to the south. Squadron Headquarters and Grant's troop were south-west of Antelat. All known wells and stores south of Agedabia had been destroyed. The General's plan was for the Support Group to pull back by Agedabia, Antelat and Scheledima, whilst 3rd Armoured Brigade moved by Antelat and Msus on the open left flank. There was also the main road Agedabia–Benghazi to watch. We might therefore have to operate three arteries for water and demolitions, so could get little depth or leapfrogging at first. I warned the Field Park Troop for the central Scheledima route ; Grant for the Msus route ; Edwards to come back from Agedabia by the main road and then swing east to rejoin Squadron Headquarters on the Scheledima track. I hoped we would contact Australian sappers about Scheledima in accordance with my earlier proposal to their C.R.E. I was again in Agedabia that afternoon and found Edwards' sappers destroying R.A.F. stocks of bombs, ammunition and petrol. There was some firing to the south of the town but the enemy seemed to be following very cautiously and no aircraft worried us. General Neame, the Corps Commander, had a conference at Divisional Headquarters during the day and it was decided to make no further withdrawal that night.

On the 2nd April we got word that Weston's troop was on its way forward from Jarabub but, as I did not want to bring it into a moving battle, I asked the Chief Engineer at Barce, to move it to Abiar, where it would be a fresh reserve for us to fall back on. On that day, too, the Field Park Troop moved to Scheledima for water supply ; whilst Advanced Headquarters made a short bound back

to Antelat in the morning and then moved again in the late afternoon. Our screen south of Agedabia was being slowly pushed back and a small battle developed south-east of the town. That evening the Msus route was cancelled and 3rd Brigade ordered to move by Scheledima. This simplified the engineer problem and we could again get some depth in our dispositions : Squadron Headquarters and Grant's troop could move through Scheledima on track and water reconnaissance towards Regima and Abiar and also contact the Australians.

Squadron Headquarters moved just before dark on the 2nd, but Moore, Grant and Edwards were all out on jobs and had not heard the new orders. I had also lost trace of Advanced Headquarters since its second move that day. I decided to wait around Antelat in the hope of picking up my strays and finding where Headquarters were. Quite a lot of traffic was concentrating on Antelat and as I stood at a main track junction I was asked by many drivers if I had seen their units. It was the fog of war and I did my best as a traffic cop. Peter Moore and Brian Grant came through : they had just done a good job near Beda Fomm where, with only their two drivers to help them, they had tipped 3 tons of ammunition down a well, then blown the watertower and well. Edwards came by later : he had been about the last man in Agedabia, he thought, as the Tower Hamlets had withdrawn straight through the town whilst he was still destroying last wells and fixing booby traps, and he had finally raced away under close range fire. There was now only Tony Weir with 3rd Brigade to account for, but I did not see him. Some Free French came through, their trucks piled high with chicken coops : they had neither orders nor a map but were in good heart, and I pushed them northwards on their way. Next came a truck with an excited corporal shouting " Mass retreat. The Jerries are coming." I stopped him and said I'd shoot him if he did not keep quiet : his truck engine was the only sound I could hear in that still night, so the arrival of Rommel's Panzers did not seem very imminent. After that, nothing ; and I wondered if these really were the rear parties : they had certainly seemed in a hurry. But where were 3rd Brigade and had the Tower Hamlets kept to the main road ? Had the Boche also held to the main road or gone to bed in Agedabia ? There was something uncanny in this feeling of being alone in the desert, and I wondered if I really were the last man of the British Army. As there was nothing to be gained by further waiting I drove north. At a track junction, where the signpost had been smashed, I felt that Scheledima should be to the right, but nearly all wheel marks went to the left, and these I followed. In another mile I came on a lorry convoy facing north—the petrol convoy for 3rd Brigade, I learnt, so why the devil were they still full and facing north ? The convoy officer said he had been told to

go to Antelat, but had heard everyone was retreating : had this been the panicky corporal again ? I had seen nothing of the brigade, but felt it was still to the south and might need its petrol, so I ordered the convoy to turn about and damned well find the brigade. I then continued along the track, but became worried at the amount I was veering west : I swung half right across country, but soon found the going too rough for my Ford saloon in the dark. It was madness to go on, for if I broke something I would be completely stranded. So we halted and took turns to sleep and keep watch. We heard nothing but the drone of Boche bombers overhead : the Panzers had evidently gone to bed. But I was feeling far from fit as something like dysentery had got hold of me, probably due to the dust, the salty water and my general exhaustion.

Soon after first light on the 3rd April we could see a town to the north-west, probably Solluch. We swung right and soon found headquarters near Scheledima, also the Field Park Troop busy on water supply. No sign of the Australians, but there was ample water and Loring said he could carry on. He had seen nothing of the Squadron go through, so I got him to send Reed northwards on track reconnaissance towards Regima : we were on new ground now and I wanted to get some idea of the going. I drove south again and soon found the Squadron : it had harboured for the night because of rough going and in the morning had delayed to destroy some birs (underground water cisterns) it had found. This had made it late, so I told Radcliffe to push on hard to the north. The 3rd Brigade also came along and there was no sign of the enemy. We were now less dispersed as a division, nearer support and the friendly hills, and for the moment at least we seemed to have shaken off pursuit. In the afternoon I moved north with Advanced Headquarters and as I had had no reports from Radcliffe or Reed I hoped all ahead was well. About dusk Constant told me that John Bond had just come into the Field Park Troop with a handful of No. 3 Troop. This surprised me after my message to Barce, so I went over to see Bond. He looked a bit shaken and had a sad story to tell. From Jarabub the troop had come forward as fast as possible and at Barce the previous day had been told to find us at Antelat. It had pushed on during the night and in Benghazi had again been told to make for Antelat, but at first light that morning, evidently near Solluch, it had suddenly been heavily attacked by Stukas. Weston had been badly wounded in the leg, but he and other wounded had been got to a field ambulance : a few dead had been buried at the site of the attack. Bond was not clear as to exact casualties, but he had brought in eighteen men, all he could collect. This was our worst blow yet and the heavier because I felt it had been unnecessary.

About the same time, too, Advanced Headquarters reached the Wadi Garidla and found it a deep rocky gorge, quite impassable for wheels. What had the Australian sappers been doing? Where were Radcliffe and Reed and why had I had no reports? There was nothing for it but to call up the weary Field Park Troop with its compressors to make that narrow camel track across the gorge fit for our heavy vehicles. Headquarters would have to halt, probably for most of the night. Constant went off in search of the Squadron while I scouted west along the wadi bank for a better crossing: neither of us was lucky. The sappers worked magnificently, while the rest of us sat around, had a meal and waited. But there was at least one light in our darkness: we watched Benghazi and Benina go up in flames and smoke as their garrisons prepared to withdraw. Utterly wasteful destruction, but war is like that. The General got his big A.C.V. and a few priority vehicles over the wadi during the night, but the remainder waited till daylight when they could see better. I think we all prayed hard that no Boche morning reconnaissance would find us. Constant and I crossed about 0800 hrs. on the 4th April, Constant unfortunately holing his rear petrol tank on a rock: but he plugged it with soap and carried on. In the end, however, a good many vehicles had to be abandoned in that wadi.

At Regima we found the Australian infantry left flank, facing *west*, and they were actually mining the one track by which all our vehicles could get up the scarp. On the top I found the Squadron: it had considered the Garidla crossing quite impossible to improve in the time so had swung west and crossed nearer Benghazi. Reed had sent a message which I had never received. It was unfortunate, but I had already seen enough of the confusion and uncertainty of withdrawal: I blamed nobody and hoped we would have better luck in future. I told the Squadron to remain where it was, contacting the Australians and making quite sure that the one scarp track was properly blown before any Boche armour could get up it. I went into Abiar, found Loring, who had also just arrived, and together we went to look at a water tower we saw. We were about 40 yds. from the tower when there was a loud explosion and the tower dissolved in dust and stones and bits of flying steel. We ducked and were untouched but then we heard laughter from a crowd of Australians about 150 yds. off. When we looked elsewhere for water we realized they had fouled every well they could find by throwing dead dogs and goats into them. We finally found water that afternoon about five miles away.

About 1600 hrs. I was told that Divisional Headquarters and some units would move to Marawa that night and that 3rd Armoured Brigade, still behind us, would move on the southern flank by Got

Derva. I got Loring's unit off to Marawa ahead of the division and then I started back for the Regima scarp to order the Squadron to Got Derva during the night. Half-way there I met Peter Moore tearing along in a scout car. Tanks, he said, were approaching the scarp from the west and the Australians had packed up : what was the Squadron to do ? Together we went to see Radcliffe. Were they really German tanks, I asked, or a K.D.G. patrol coming in from the main road ? In the dust and setting sun it was impossible to tell, but there was no doubt about the Australians going. The mines on the scarp had also been blown and the track was impassable. What to do ? Abiar was a dense huddle of headquarters and soft vehicles which would not be cleared till dark : its rear towards Regima was covered only by the Squadron, which was now certainly isolated but in no evident danger of immediate attack. It must cover Abiar till dark, then go on to Got Derva and water 3rd Brigade ; but as a temporary move it could pull back half-way to Abiar as a rearguard, in closer touch with the situation there.

Back through Abiar and I soon overtook the tail of the division moving slowly through the choking dust. Barce seemed to be mostly in flames and smoke as the Australians burnt their stores. On to the main road and up the steep Barce scarp we were a long snake of closely packed, crawling vehicles. The night seemed endless : my eyes were inflamed with the Barce smoke, my nose and throat almost choked with sand. I found myself falling asleep at the wheel, so handed over to Adams. I was still asleep when we harboured at Marawa about 0500 hrs. on the 5th, but an hour later went over to the mess truck for breakfast and Marjorie Anderson's lovely " Good morning " on the radio. Were we really in the same world as that voice, with all that it implied of order and cleanliness ? It seemed impossible as one looked at these officers grouped round the truck with mugs of steaming tea : they were hollow-eyed and dead tired ; unshaven and grimed with dirt : but for a moment that lovely voice could brighten their morning in this godforsaken patch of Libya. Back at my car, I had started to shave when Brigadier Kisch, the Chief Engineer, arrived. He had had no reports or messages from me—and I none from him : he knew nothing of what we had done or how we stood. It was difficult to tell him quickly everything, to make him realize the efforts we had made unceasingly for what seemed an eternity, to get an idea of what the future might hold for us. Later, I learnt that the Australians were to go back along the only main road : " first stop Tobruk " it seemed, " and the road to themselves." We would turn south again to Got Derva and watch the open flank. But in coming to Marawa we had wasted twelve precious hours in throwing off pursuit. I heard later from a British officer prisoner who had talked with some of Rommel's staff, that when the German air first reported our

move south from Marawa, Rommel would not believe it and sent out another reconnaissance. When this confirmed it he is reported to have said : " They're mad and now I've got them."

The Squadron was already on the Derva route so the Field Park Troop could comb the area north of this for wells to destroy : our policy of the waterless belt still held good. I went off ahead of Divisional Headquarters to see some wells, but the map was bad and the track ran into difficult broken country : after some exhaustive mountaineering by motor it took me four hours to reach Got Derva. En route I saw figures on a knoll : British or German ? Approaching cautiously, however, I recognized British khaki and found a Rifle Brigade subaltern and his platoon. His regiment had been rushed up from Egypt to help cover us back and was holding a thin screen of posts north of the Derva valley. But I was the first person he had seen since he had got there. Not a soul in Got Derva and the wells were almost dry despite a recent report saying they were full. I turned west in the hope of finding either more wells, Divisional Headquarters or the Squadron ; and had just met Headquarters when Boche bombers caught the column in difficult ground where it could not easily disperse off the track. It had two Bofors guns, but one was quickly knocked out, and these bombers continued to swoop down on us almost unmolested like great black bats. I was thankful I was not at the centre of the target, but the attack did surprisingly little damage and Headquarters later moved on to Got Derva. There Loring appeared : all his officers were out on jobs but he had found some wells. I had seen nothing of the Squadron or 3rd Brigade, however, so sent Constant off west again to explore. Information arrived that an Indian Motor Brigade and a Field Troop of Sappers and Miners had been sent up to hold Makeli and would come under our command. As the division would move to Makeli next morning I sent Loring there that evening to find out all about the water and to contact the Field Troop. About midnight Constant and Radcliffe arrived at Derva : the Squadron had also suffered from the bad map and had been caught by the Boche bombers, but was now harboured a little to the west. I gave Radcliffe a drink and we bedded down for three' hours sleep—the second time since 30th March that I had unrolled my valise and actually lain down to sleep.

I was away early and alone on the morning of the 6th April, but before long was overtaken by the C.R.A. (Colonel Todhunter). Had I heard the news of a light German column reaching Makeli and demanding the surrender of the Motor Brigade ? Todhunter had been sent ahead to organize a fireplan for the place. But with what ? The Motor Brigade had no artillery and Divisional Headquarters had just three anti-tank guns and three medium tanks.

Reaching Makeli, we could see the Germans all right to the south and south-east of the Fort, but they were not yet in strength. If only 3rd Brigade could get here with a few tanks it could clear up that lot pretty quickly, but where was it? The Indian Motor Brigade had occupied a half circle round the Fort and water, but could not also hold the high ground to the north. Loring was gradually collecting his unit on the high ground, but later had to move as the Germans had got round to the north-east and his harbour came under fire. There was ample water in the Fort. The Squadron, after improving a wadi crossing west of Makeli, moved near the Fort inside the Indian perimeter. No sign yet of Divisional Headquarters so I went back west, but, not finding them by dusk, I again turned towards Makeli. Approaching the western perimeter, I turned on my car lights to show I was friendly but was at once met by several bursts of machine-gun fire. I halted and doused my lights but the bursts continued, fortunately all high so I took no harm. This was evidently no place for a young lad in a Ford saloon, but I managed to find Rear Headquarters in some broken ground to the north-west. It had little information on the general situation and only spasmodic wireless touch with Advanced Headquarters somewhere to the west: neither group was sure of the other's location. It was eventually decided to move west and find Advanced Headquarters, and about 2300 hrs. we crawled out rather noisily from the shelter of the hills. Soft sand in a wadi bottom gave us trouble in the dark, and Captain Flower and I were there till 0100 hrs. before we got the last of the vehicles through. The noise we made must have reached high heaven, but the Germans had shown a surprising dislike for night movements and we were left undisturbed. When we caught up with the rest of the party it had found no trace of Advanced Headquarters. It was sheer madness for so many soft vehicles to roam aimlessly and noisily about the desert within a mile or so of enemy armour, so at first light on the 7th, we all scuttled into the shelter of some hills. When we again got touch with Advanced Headquarters we found to our surprise that it was in Makeli: the two groups had passed each other in the night. We were told to come home, but in doing so got involved in some private battle: at least, we found ourselves being shot up from two sides at once. Then a Gunner officer appeared and said he could lead us in by a covered track. In Makeli a second demand for surrender had been refused, but German strength had increased and they were now on the high ground to the north of us as well as to the east and south. About 1800 hrs. they shelled our southern perimeter but did not put in any attack. We had to get something on that high ground, however, if we were to avoid being too closely pinned; and some units were detailed for this, including the Squadron which

occupied an inner keep on Sangar Hill. Machine-gun bullets zipped angrily across that hillside till dark.

The General had to decide what he would do. Corps could send nothing to help us : our 3rd Brigade and the Support Group were not at hand, and the Australians were presumably in Tobruk. In Makeli we had the Indian Motor Brigade of three newly mechanized Indian cavalry regiments, in soft vehicles and without artillery : our own Divisional Headquarters had its three tanks and three anti-tank guns, but we were otherwise a mass of administrative and other units and in no sense a fighting force. Yet we had to do something if we were not to be quickly ringed in and hammered to bits. We had to break out east and go hard for some place like Tobruk, a hundred miles away, and the real core of our problem was whether we tried it that night or next day. By night there was, of course, the difficulty of maintaining touch and cohesion, of preventing too many vehicles from crashing in wadis or rough going. But there was the possibility of surprise ; whilst we would not be under aimed fire from ground or air and were unlikely to be closely followed in the dark. The decision, however, was for a breakout at first light. Our three tanks would punch a hole in the enemy ring : the Motor Brigade would widen this and hold two " touchlines " on its flanks : the main mass of soft vehicles would pour through the gap and, using dust for concealment, make for Tobruk as hard as they could go. Several of my officers and N.C.Os. had small parties out on independent jobs, mostly to the north where we hoped they would get clear. There was, however, Mike Parker of the Squadron, about thirty miles west of Makeli waiting to mine a defile after 3rd Brigade had passed. I had no news of him or the brigade, but I had to get in touch if I could. I called on the Squadron for a volunteer officer and party and got Colin Edwards away just before dusk. He never found Parker, who had got clear, but Germans were in occupation of the defile and as Edwards was trying to get back to Makeli he himself was captured. It was a brave action on his part.

On the morning of 8th April we were all in our allotted places long before first light. But our three tanks of yesterday had dwindled to one and that was late. Not till well after first light did it move forward and, with the Motor Brigade, try to punch a hole to the south. The enemy opened everything they had on this weak spear-head and quickly halted it, and before long a message came from Brigadier Vaughan of the Motor Brigade that he could make no progress. General Gambier-Parry at once swung away right-handed, followed by his Headquarters and a mass of units including the Squadron and Field Park Troop : it might be easier westwards where there had been fewer Germans the night before. We soon came under fire from north and south, however, and seemed to be

running into a V-shaped pen with the fire at increasingly close range. After perhaps a couple of miles the General's A.C.V. stopped and I ran across from my car to see if there were fresh orders. "No good here. We'll turn east again and see if we can just charge through." So round and off, hell for leather: one kept station as best one could and followed the dust-cloud in front. But in that mad rodeo the big A.C.V. had better cross-country performance than my car and I found it difficult on the rough going. After about a mile my car was hit three times in quick succession. A bullet hit the bonnet without doing any apparent harm. Another came through the open window at my side as I was driving, hit something inside and bits buzzed about like angry wasps: one fragment tore my batman's trouser and another stung me in the right leg. Finally, a fair-sized shell splinter ripped our petrol tank and as I watched the indicator fall I wondered how much farther we would get. But just then the General's A.C.V. stopped and a German tank appeared out of the dust from the east with an officer standing in the open turret. I had only a fleeting glance of him but was told it was General Rommel. General Gambier-Parry and others got out of the A.C.V. and went up to him. Every British vehicle in sight had halted and we had surrendered.

Germans appeared from everywhere and our men were told to dismount. For a time nobody paid any attention to me and I was able to burn papers and collect some clothes and food. Then a German soldier came up and shouted something incomprehensible: I looked at him hard and said: "Ich bin Oberst-Leutnant." A young German officer appeared and, in French, asked me for my revolver: he then saluted magnificently, turned and ticked off the soldier and the two went off together. All rather strange, I thought, but it had been a strange morning in some ways. I went on burning papers and collecting essentials but most of the men were being marched off and we three round my car began to look a bit conspicuous. The car was "dead" but there were plenty of serviceable vehicles around and I considered the possibility of grabbing one of these. But there were also plenty of serviceable Germans around: they had not again interfered but they were watching and they were all armed. Twenty or thirty rifles and tommy guns within 50 yds. made a poor start for a break in daylight and might lead to general shooting. So we humped our kit and followed the crowd. Meanwhile, as we heard later, part of the Indian Motor Brigade had found a hole and got away.

For the next thirty hours we sat huddled in the sand near Makeli Fort, ringed in by guards and getting only a cup of salty water from our captors but no food. A sand storm did not improve matters. A British aircraft came over: uncertain whether the mass on the

ground was British or German but coming under German flak, it dropped two small bombs—aiming badly, thank God—and flew away. I got my men together and had a quiet talk with the N.C.Os. They had nothing to be ashamed of, I told them, and had not let the side down : some of them had done magnificently. But from then on things would be more difficult and I looked to them to help the men keep their chins up. We were not a big " bag " but of my own unit eleven officers out of fourteen and about 120 men out of over 400 were prisoners. I thought of the year since we had been formed and of our five months in Middle East, and I wondered what some of these youngsters thought of war. They had certainly not expected it to be so unwarlike, with so much plain human inefficiency, irritation and discomfort, so little thrill and fighting. Here they were prisoners and there had been practically no storybook battle at all. I thought, too, of these last nine days and nights of withdrawal. We had made a tremendous effort but it had failed. From Mersa Brega to Makeli, by the route we had taken, was 300 miles, but my speedometer registered 1,100 miles for the period. We had hardly rested and it was only now that we could relax that we realized the utter weariness and even sickness that had gripped our bodies for days. Yet in that huddled crowd I did not see a man whose tail was down.

It was a sad ending, however, to our first high hopes. One could not just blame 2nd Armoured Division : it was admittedly weak and new to the desert, but it was facing a considerably superior enemy on ground which gave that enemy every advantage : it had done all that such a force could have done. The fault lay elsewhere and fundamentally in having practically no Army to meet the finest fighting machine in the world. We had not the tools or the men but that was historically the British way of war. Despite all the difficulties, however, despite the long heavy strain of withdrawal, not one of the officers and men whom I was privileged to command let me down. To most of them war was a new game but they had played it splendidly. Months later, as prisoners in Italy, General-Gambier-Parry and I managed to exchange letters and in his he wrote :—

> " I never really had the opportunity of thanking you for all you did during that difficult time that ended so dismally for us all. You and your chaps were splendid and if I seemed to fail to appreciate it, I can assure you that it was only due to the anxieties and preoccupations of the times we lived in during these last few days. I am deeply grateful and shall never forget it."

I feel it is due to the officers and men who died or were wounded or went to long captivity that I should record these words here.

SAPPERS AND MINERS IN SAIGON

By MAJOR J. H. CLARK, M.C., R.E.

SOON after the Japanese surrender in 1945, 20 Indian Division heard that it was destined for French Indo-China. We started practising our French at once, but as we were speaking and thinking in Urdu every day of our lives, it was very difficult to make headway with a third language, in spite of School Certificate Credits. The C.R.E. spoke French fluently, and this proved to be a tremendous asset in dealing with civilian engineers; though eventually he found it quite an effort to speak Urdu to the troops, because his thoughts were all in French. Later on, to the French, the troops were all *les Gurkhas* quite impartially, due to the fact that there was a heavy preponderance of Gurkha battalions in the division. Our Sikhs, particularly, were not amused.

The plan was for the division to concentrate in Saigon by air and by sea; then, using Saigon as a base, to send out parties to round up the scattered Jap surrendered forces and take over their duties from them—mainly guarding bases, depots, dumps, airfields, ports, etc. The Japs were then to be interned before being dispatched to Japan. As soon as a French division arrived from Europe we were to hand over to them and go. It will be seen that this plan was much delayed by the Annamites, when they realized that the French would be returning, and that the semi-independence given them by the Japs was unlikely to be continued by the French.

Saigon, with its huge Chinese-Annamite quarter of Cholon, is the largest city in French Indo-China. Its wide boulevards, cathedral, parks, estaminets, modern office buildings, gardens, clubs, theatre and cinemas must have made it a very pleasant place before the war. The Saigon River is navigable to ocean liners right up to the city, which has extensive port facilities, warehouses, rail services, etc. The quays were little damaged, but the cranes and other plant were out of action. There were berths for about half a dozen liners and cargo-vessels at once, and about as many more for cruisers and destroyers. There were many more berths for light naval craft and port vessels. The whole area was intersected by waterways and canals, which were crowded with barges and sampans. The airfield was two miles out of Saigon to the North at Tanh-Song-Nhut. It

had been fairly heavily bombed by American carrier-borne aircraft earlier in the year, but had been largely repaired. Cholon was a vast dirty bazaar area, inhabited by Chinese and Annamites, and notorious for its night-clubs and high incidence of unpleasant diseases.

The first arrivals in Saigon by air were members of R.A.P.W.I.—Repatriation of Allied Prisoners of War and Internees. The General followed with some of his staff (including the C.R.E.), members of the Control Commission, and a battalion of Gurkhas. They got a tremendous welcome from the French and were royally entertained on French foods and wines in restaurants and night clubs. The Japs observed the terms of surrender. They had no alternative, because the Supreme Commander of all Jap forces in S.E. Asia, Field-Marshal Count Terauchi, had his H.Q. in Saigon. He was getting a steady stream of orders from Lord Louis Mountbatten concerning his troops all over S.E. Asia, and he was in no position to disobey them. However, this did not prevent individual Japanese from deserting and joining the Annamite guerillas.

The C.R.E. had taken with him an E. & M. officer, Bill L——, an Australian who had done technical work as a civilian for the Australian Government and also for the Americans in New Guinea. He had held the rank of Hon. Major in the U.S. Army. On applying for a commission in the British Army he was immediately made a 2nd Lieutenant, and came to us a few months later as a Captain (S.O.R.E. III). The E.-in-C., S.E.A.C., met him in Saigon, and after doing a tour of all E. & M. work with him, said he was to join his staff in Kandy as a S.O.R.E. I, which he did three months later. He was a brilliant E. & M. officer and the C.R.E.'s right-hand man. He was also quite fearless. The first day the trouble started, he was driving with the Gurkha Battalion Commander just outside Saigon, not knowing that anything was in the wind, when suddenly a burst of L.M.G. fire riddled the back of his car. His companion was about to return the fire with his Tommy-gun, when Bill told him not to move on any account. He got out of the car unarmed, started back up the road to the man with the L.M.G., and told him in the broadest and most lucid Australian some home truths about the nature of his birth, and of his chances of reincarnation in a future life. He then strolled back to the car, turned it round, and drove back the way he had come, leaving the Annamite still puzzling over what had happened. The Battalion Commander later removed two bullets from the seat he was sitting in.

From then on, life in Saigon became more lively, but less pleasant. The Annamites had at last realized that we had come, not only to remove the Japs, but also to reinstate the French. The Viet-Nam had been given a large amount of independence by the Japs at the

expense of the French, and they were not going to have the tables turned on them, nor allow themselves to be ruled by the French again. They had been well armed and well trained by the Japs on Jap lines. They had learnt all the dirty Jap tricks, and were no mean fighters. Moreover, they were well led by Jap deserters, for the most fanatical Japs had refused to surrender and had deserted the Jap army to lead the Annamites. Naturally these Japs were the toughest and had the most initiative.

Before the trouble started, everything was running more or less smoothly in Saigon. Although they had surrendered, the Japs controlled everything, acting under British orders. They gave orders to the French civilian engineers who were responsible for the power station and other smaller generating stations, and for the water supply. These French engineers merely controlled the plant through skilled Annamite foremen and mechanics, and were not themselves capable of doing any repairs, nor did they know the more intricate details of the machinery, nor the layout of the electrical and water supply systems correctly, for which up-to-date plans were not available.

When the trouble started, the whole Annamite labour force, skilled and unskilled, ran away, and it was found that the French engineers could not cope on their own. Everything ran down and stopped. There was no electricity and no water beyond what was in the storage reservoirs. The Annamites attacked the French in Saigon and in Cholon. Atrocities were committed, barricades erected in all the streets and boulevards, and sniping was always breaking out unexpectedly. Another trouble was the lack of transport. One or two jeeps only had come by air. Jap lorries and cars, originally taken from the French, were requisitioned by us, but they were in a hopeless state of repair. The best the writer could do for himself was a Citroen, which went quite well, but had no brake fluid or hand-brake. One soon thought nothing of changing straight down into bottom gear after violent engine revs, switching off the engine, and steering for dear life with one's thumb on the horn. Fortunately it didn't matter much what one hit, as long as one didn't hit it too hard.

By this time, only two battalions of Gurkhas and a large number of commanders and staff had been flown in. Due to very bad weather and diversion of planes, this source of supply was drying up, and the first troops to come by sea were not yet due for a fortnight. They were already embarking in Rangoon. Besides our own troops, there were some French colonial troops who had been in French Indo-China before the Japs arrived and who had been interned by the Japs. They were of doubtful value after their long internment, but were used for policing the streets of Saigon. The only other

troops available were the Japs, and they were very good when used properly. It was an unusual situation, because the Japs were fully armed and friendly with the Annamites. At first orders were issued to the Japs as to the dispositions and tasks of their troops, but this was found to be unsatisfactory, because naturally the Japs did the absolute minimum that was required of them, and could not be trusted to report back fully or truthfully. Then British officers were allotted to the Jap forces, their orders being not to command, but merely to issue instructions to the Jap commanders on the spot, and make sure they were carried out. This system worked well, because the Japs excelled themselves so as not to lose face in the eyes of the British officers. In fact it was rather embarrassing when a Jap soldier leapt to his feet and presented arms in the middle of a shooting-match, and the British officer had to return the salute lying on his stomach in the bottom of a ditch.

The E. & M. officer meanwhile was having a ceaseless struggle with the power station and the water supply. He got the power station started up again with the help of the French engineers, but almost immediately everything went wrong. The generators were driven by steam turbines and luckily these had not been tampered with. But the Annamites had very cunningly sabotaged the fuel elevator to the furnaces, and also the electric motors that drove the water injectors for the boilers, and many other things. A labour force of 200 Jap soldiery working in shifts was used to carry the fuel in sacks from the barges in the canals to the furnaces. The fuel was a mixture of coal and maize. Bill started to re-wind several of the injector motors himself in a workshop he found in the Annamite quarter, but was lucky to find some Jap marine engineers who were able to complete the task for him.

There were six boilers in the power station. Bill considered himself lucky if he could get three working at once. Sometimes he could only keep half a boiler going, as the boilers were fired in two separate halves. The firebricks were in an advanced state of deterioration, and had to be renewed by a Madras S. & M. Field Company, whose advanced party had been flown in. Sometimes the power station had to close down completely for short periods, but Bill's main responsibility was to generate sufficient power continuously to keep the electric pumps in the Artesian wells operating, and pumping water into the Saigon storage reservoirs. If ever the water supply had failed, the consequences would have been disastrous. Apart from the French and Jap population in Saigon who had their water piped into their houses, all the Chinese and Annamites in Cholon drew their water from fountains and press-taps in the streets and market places. There were no shallow wells used in the area because the water obtained from them was very foul, and all canals

and waterways were tidal and brackish. The water that was pumped into the reservoirs came from ten artesian wells, about 200 ft. deep, scattered throughout Saigon and Cholon. Electric motors drove rotary pumps through vertical shafting in every case.

These wells and the power station were the key to the whole situation. They were all closely guarded, originally by Japs, but when our troops arrived by sea, the wells were guarded and operated by Indian sappers, and the power station was guarded by infantry and operated by Bill and the French engineers. All these places were often attacked by night, but though we suffered casualties, serious damage was never done to any of the plant, though the main instrument panel and switchboard at the power station once suffered from mortar splinters.

Having control of the switchboard in the power station often proved very useful. There was always a curfew at night, and no street lights. If a unit got attacked at night, it could ask for the street lights in its area to be put on, which was a nasty surprise for the attackers who were caught in the open.

When the rest of the division eventually arrived by sea, Saigon and Cholon were quickly cleared up and occupied by our troops, and became comparatively safe places again, though there were often sporadic outbreaks of fighting and grenade-throwing, particularly at night. One brigade occupied the south and west, and another the north and east. Both started working outwards and trying to clear the Annamites away in front of them. This was never very successful, because they couldn't cover all the ground and the network of waterways at night, so that, after dark, armed Annamites used to slip back into the city. They would fire from a window, or lob a grenade, then disappear from sight, hide their guns in the ground and start doing some innocent job of work. When our troops searched the buildings, if they could find no arms, there was nothing they could do. The Annamites would always say very helpfully which way they saw the man running after he had fired. They were all dressed the same in loin-cloths, or ragged shirts and shorts.

The third brigade went out twenty or thirty miles to the north of Saigon to two places called Bien Hoa and Thu Dau Mot. At first the intention was to concentrate, disarm, and intern all the Japs in that area, but it was soon realized that this was clearly not feasible, because there were 70,000 Japs in French Indo-China, and we just hadn't sufficient strength to intern them as well as deal with the Annamite menace.

All this time, a small mission had been kept at Pnompenh, the capital of Cambodia. Owing to the hostility of the Annamites and local shortages in Saigon, we were buying food, fresh vegetables, etc., from the King of Cambodia. The Navy towed barges down the

Mekong River with landing craft, often against active Annamite opposition, the distance from Pnompenh to Saigon being some 250 miles by river and canals. The King of Cambodia liked plenty of pomp and ceremony, and had a golden throne in a hall paved with silver, fifty wives and a Royal Ballet. He surrounded himself by all sorts of taboos, and by astrologers and Brahmin priests. The leader of the mission to the King of Cambodia was a Lieut.-Colonel, one of the battalion commanders, and after he had been there a short time he realized that he wasn't being treated with quite the respect that he deserved. He quite rightly put it down to the fact that he always wore a sombre green jungle battle dress, which didn't attract much attention. So he asked the General if he might be given a slightly higher local rank, so that he would have a bit more colour to display. The General replied that he might assume any local acting unpaid rank he desired, not exceeding his own, and that a much-decorated brigade commander had been instructed to supply him with red tabs and hat band and sufficient different coloured medal ribbon to make up four rows.

The sapper tasks, apart from guarding and operating the wells, were mainly repairs to roads, airfields, billets, water supply and the electrical transmission system. The sappers also had to provide parties to go out with the infantry to do bridging, watermanship or demolition work. As usual, they were never idle.

The job of making billets habitable, especially after they had been wrecked by the Annamites, became so great that the Divisional Engineers could not cope with it themselves, in addition to their other tasks. A Jap Engineer Regiment was formed under a Colonel Matsuzaki and Major Tanaka. Incidentally the latter, being the writer's opposite number, eventually surrendered his sword to him, and was quite pleased that it should go to someone he knew, rather than be put into the common pool. (It is a fine sword, reputed to be 200 years old.) A Jap D.C.R.E. was appointed and four Jap G.Es. with their A.G.Es. They were called J.G.Es. and J.A.G.Es. Their D.C.R.E. worked under ours, one of the Field Company Commanders, and their J.G.Es. under our four G.E.s, who were four subalterns from two of the companies, two for Saigon and two for Cholon. They had several hundred Jap sappers working, and they worked very well too.

The Field Park Company had the job of taking over all Jap engineer stores, and checking and issuing them. This was greatly muddled by the fact that the Japs had different ideas from ours about what were Engineer and what were Ordnance stores. Also their English translation of the name of a particular store was often different from its English name. Their equipment on the whole was good.

A French division started arriving in November. It was a division with a big reputation from Europe and it was used to fighting in armoured cars. Jap tactics, as practised by Annamites and guerilla warfare under tropical conditions were a new experience for them, and they ran into a lot of trouble in the shape of ambushes. They were given a separate area to work in, and must have been a far more satisfying prey for the Annamites than the tough and experienced Gurkhas. Their ideas on driving, moreover, did not always agree with ours. Our Indian drivers had just got used to driving on the right of the road, and to observing the French rule that at a cross-roads any vehicle coming in on your right takes precedence, and any vehicle coming in on your left gives way to you, except in the case of national highways, which have priority. They were driving very carefully on the whole, and were rather upset when Saigon took on the appearance of La Place de la Concorde in Paris during the rush hour.

It had become a matter of custom when fired on or ambushed to take the only retaliatory measure that was found to have any effect. This was to burn to the ground the hut or house from which the shots came, and any others round about. It seems harsh on the innocents among the guilty, but in actual fact there were very few innocents. They all supported the terrorists, and were never anything but hostile to us. Thereby hangs a tale.

The wells, which a Bombay S. & M. Field Company were operating and guarding, were continually being sniped at at night. It was irritating for the sappers, because they had strict orders never to fire unless they had a target, and of course they never had. Eventually at one well the Sikh Naik in charge was killed by a burst of sten gun fire from a near-by house. The O.C. of the company got angry, and obtained permission from Brigade to destroy all the houses near the wells. The same morning the Sikh platoon burnt down eight houses at that well. They had considerable difficulty in doing so, because they were made of very tough teak and there was absolutely no wind to fan the flames. Even when saturated in petrol, they did not burn very effectively. The O.C. then indicated to the Subahdar where he could start on another lot in the afternoon near another well, at the corner of a huge Chinese-Annamite slum, but separated from it by roads on all sides which would act as fire-breaks. At 1500 hrs. that afternoon an urgent telephone call brought the O.C. to the scene. It was obvious what had happened two miles away. A black pall of smoke hung over the rooftops. The difference between the morning's and the afternoon's burning was that these huts were made of dry thatch and that a strong wind had sprung up. The Subahdar had only fired one hut, and now the whole hutted slum was an inferno half a mile long by a quarter of a mile wide. The

inhabitants were panic stricken, and crowded the roads and blocked them with their goods and chattels pulled out of their houses. The first hut had burnt out in a matter of seconds, but the wind had blown the flaming thatch on to near-by hut, which had gone up in flames also, and distributed burning thatch as much as a hunded yards further away on to other houses. And so it grew and spread literally like wild-fire. It was an appalling situation ; with the high wind spreading the fire further afield every moment, the whole of Cholon was threatened, because there was no firebreak wide enough to stop the fire, and no time in which to make one. The only bright spot was that the mobs of shrieking humanity were too panic-stricken to start any shooting. The feelings of the O.C. may well be imagined. It was certain that the whole of Cholon was going to burn down, that tens of thousands of people would be homeless, if not killed or injured, and he was responsible. Futile attempts were made to stop the fire with all the water-tank trucks, pumping sets, men and buckets that could be obtained, whilst the unhappy O.C. turned over in his mind what he was going to say at his court martial.

However, quite suddenly the wind dropped and actually blew gently from the opposite direction, and some light rain fell. The fire went no further. The houses burnt themselves slowly down to the ground, and as the smoke cleared the full extent of the devastation could be seen. Several thousand homeless Annamites and Chinese drifted out to clear ground outside Cholon, and started to encamp there in the open. The Sikh Naik had certainly been given a worthy funeral pyre. An anxious O.C. sat down and wrote his report, and had a worrying time waiting to hear the outcome of it all. But his luck was in ; for the Chinese had been making trouble for some time, and when their complaint about the fire went to the authorities, accusing the allied forces of committing all sorts of other offences against them, they received a reply to the effect that they were doing nothing but obstructing the allies from carrying out their tasks. They cheated the troops, ran evil places of entertainment, spread disease, sheltered terrorists, and profited from both sides whatever happened. If they didn't co-operate in future, there would be another Fire of Cholon. The incident was closed, and there was practically no more trouble from sniping in that area for some time, although it all started again later on when the French were taking over.

In November, it was decided that the Japs should be interned at Cap St. Jacques, a town and fortified headland at the mouth of the Saigon River. It is a long peninsula, and would be easy to intern them there by having troops at the neck of the peninsula. A sapper officer and the D.A.Q.M.G. went down there in a Jap gunboat on a water supply and accommodation reconnaissance.

They were the first of the Land Forces to go there, and were met on the jetty by a deputation from the Jap Naval Station there. They were bowed ashore by some sort of Admiral whose sword trailed along the ground, and after much heel-clicking and the inevitable polite hissing intakes of breath which accompany these proceedings, they drove along to the Grand Hotel in the only three serviceable cars. Quantities of chicken, lobster, eggs, fresh vegetables and rice were produced. They had brought their own drink. No business was done that day.

All the vital parts of the pumping machinery for the Cap St. Jacques water supply system had been removed by the Annamites, but there was plenty of good water in shallow wells, because the ground was clean, and not so low lying as in Saigon. The Annamites, however, had blown two reinforced concrete bridges on the road, which the Japs would have to use to get to Cap St. Jacques, and the Bombay S. & M. Field Company had a lot of fun the following week repairing them. In one case, they used Jap railway bridging equipment, heavy box-girder sections which pinned together, and which required a special steel derrick to launch each girder. In the other case two reinforced Fleming lifeboats were sunk on a falling tide, and embedded themselves on the bottom of the river to make mud-sills for two single bent trestles, which carried an improvised timber bridge. Nameboards provided the clue as to the nature of the men who built the bridges. The first was Khalsa Pul, and the second was Mahratta Pul.

The sappers and equipment had all gone down to Cap St. Jacques in barges towed by a Jap tug, and the equipment had been taken on to the sites by water also. The Sikhs lived on their site, and the Mahrattas lived in the Grand Hotel. The Japs made up the beds with the original hotel linen and beautiful coverlets. Curtains were hung and embroidered towels put out. Each room had its own wash basin and bidet, the latter being used mainly for washing feet. The sappers behaved very well in the place, kept it clean and tidy, and only one man tried to get away with a carpet.

Soon after this, the writer left the division and French Indo-China to return home, so he did not see the final disarming and internment of the Japs, nor the hand over to the French. The division was split up between Borneo, Celebes, Java and Malaya, before it was finally disbanded and dispersed to India.

Looking back on those few months in Saigon, the fact that stands out most clearly is that the greatest credit goes to one man, the brilliant Australian E. & M. officer. It was by his knowledge and untiring efforts that water was supplied continuously to hundreds of thousands of people in Saigon and Cholon in the face of great difficulties, thereby staving off an appalling disaster.

"RHINE MAIDENS"

By LIEUT.-COLONEL R. E. BLACK, D.S.O., R.E.

RECENTLY, when browsing through some snapshots of varied vintage I came across some which stirred up memories of certain boating adventures on the Maas and Rhine. Two reproduced here each show a landing craft sitting on a transporter. I can remember it looked a little uncomfortable, like a duck making a change of ponds on the carrier of a bicycle. It is over five years since those snapshots were taken, giving a perspective in which many details are forgotten but main issues remain clearly in the mind. So I am writing down the story as it paraded itself in my memory.

The first scene is at Borgsharen on the Maas, in November, 1944, when 30 Corps Troops, R.E., were building a Class 40 floating bridge. A subaltern was in charge of a raft being towed by a G.S. ("Grays") motor boat, or rather the motor boat was being towed by the raft. For an explanation of this turn to page 64 of *Bridging, Normandy to Berlin,* though of course if you yourself were one of those who wrestled with the Maas in flood you will understand at once. I have forgotten the outcome of that particular struggle, but I do remember the subaltern coming ashore afterwards and muttering "... ruddy disgrace to a maritime nation." He was not referring to any errors of seamanship: his feelings were entirely directed at the motor boat. His comment was very understandable but perhaps hardly fair; the motor boat was a worthy little craft, though *not* for the purposes for which we then wanted it. It made a handy run-about for ferrying a few men or small stores across the river, but on the Maas in flood that represented about the limit of its capacity.

The next scene is in March, 1945, on the River Waal, near Nijmegen, where we were having an all too brief rehearsal for bridging the Rhine. Our previous experiences had led to heart-felt pleas for more powerful craft, and we were delighted to hear that two or more specimens of something called a "Mule" would be available. They were to join us for training, manned by the crew of Transportation Sappers who would handle them in the operation. Furthermore, two did in fact appear, but this auspicious start received rather a jolt when we saw them. Powerful they certainly were, but hardly as handy as we had hoped. They were of a square and

solid appearance, and I was told they weighed 35 tons. At the bows they were fitted with two vertical pushing bars, and they seemed to us to have been designed to push the *Queen Mary* around. Nevertheless, the crew succeeded in working out with us some sort of a technique for using them, but mules were not the right animals, though no doubt splendid for their normal tasks. I never discovered how it was proposed to get them to the Rhine and there to launch them, but it didn't matter because their use for the operation was abandoned. Meanwhile the vital time drew ever nearer.

Our next companions were two landing craft, personnel, manned by naval crews. These weighed only 10 tons or so, and were lowered into the water over a vertical quayside in Nijmegen, by a super-size road-mobile crane, also naval. Alas, they only had one brief day's training with us, and the bridge-building processes must have seemed all very strange to them. However, adaptability being as much second nature to the Royal Navy, as it is to the Corps, we quickly began to learn each other's patter. Of course, if we could have had another day . . . but there wasn't another day.

Meanwhile, I was inquiring how the L.C.Ps. were to become water-borne in the Rhine at the appropriate time and place. I learnt that it was intended to launch them a mile or so upstream of Rees, at a miniature harbour where there was a vertical quayside. Four, I think, were to be launched by a unit of G.H.Q. Troops, R.E., who would retain two for their own watery tasks and send the other two downstream to us. Now we were to build the first Bailey Bridge on 30 Corps front at a point some 600 yds. *downstream* of Rees, the focal point of the assault. The plan was to establish a bridgehead on either side of the town and then strike inwards to encompass its fall, but I cannot say I felt optimistic about the timing forecast for that happy event. I would have made no claim to have been entitled to an opinion, but if anyone had asked me I would, as it happened, have been right. Anyway, I was certainly unhappy about the L.C.Ps. reaching us at the early hour at which we were intended to require them, if indeed they arrived at all. Anyone can guess the result of my saying so—two of the craft became ours to transport and launch, and the launch, naturally, was to be at our own site. We had but little over forty-eight hours in which to prepare.

We were soon not worried about the actual journey ; a temporary cradle on a transporter would answer that problem. Launching was the difficulty. The road-mobile crane at Nijmegen was not exactly river-bank-mobile, and further it had little reach and there was no vertical face on our stretch of the river.

The scene is again the river-side at Nijmegen. A "Le Tourneau," crane rigged to a tractor, stands in several feet of water, and the

tractor itself is paddling. By an all night effort, this combination, the only one of its kind within hundreds of miles, has been brought from Bourg Leopold. It is unique and imposing. An L.C.P., to which slings are being attached, rides at anchor beneath the crane, and in the background lurks a transporter. The L.C.P. is about to be lifted. The tractor and crane will then waddle from the water and deposit their burden on the transporter. It will thereby be proved that the reverse process is feasible . . . but the L.C.P. never left the water. Something broke. I can't remember what, but mercifully the craft was not yet in mid-air. I think it was the tractor which expired irrevocably, giving us a rather hollow feeling in the stomach as we counted the hours to the " off."

As a matter of fact, I think some start had already been made with an alternative plan. If so, it was just as well because it was a desperate scramble. The idea was simple. A cradle for the craft was built on runners so that it could be pushed along the ground, and of such a size that it could sit, complete with craft, on a transporter. The first item to arrive at the launching site was a dozer which dug an elongated hole in the ground, about 3 ft. deep, ramped at one end and with a vertical face at the other. The transporter then backed down into the hole via the ramp, until its tail end reached the vertical face, and this brought the bottom of the runners to ground level. The dozer then pulled the cradle, with craft, along the ground, and off the transporter. When clear of the hole the dozer reversed and pushed the cradle down into the river ; it did not merely push it back into the hole because a certain amount of slewing was possible. To overcome the fact that the craft projected beyond the end of the cradle, and consequently was in danger of taking the push, the cradle was provided with a sort of pram-handle with which the dozer made contact. The cradle was pushed into the water until the craft became water-borne.

Before I recount whether this scheme rose in practice to the excellence of its theory, my mind insists on recalling a certain other scene. In the small hours of the morning, somewhere south of the Reichswald, I visited 211 Corps Field Park Company in a shed which they had appropriated. They had hurriedly installed their own lighting and a small party were sweating away on a half constructed raft. They looked rather tired but seemed to be enjoying themselves. I asked a sapper about some detail of the job, but he was incapable of finding words and had to answer by pointing. He was one of those who can only express themselves through their hands, but his hands were eloquent. I recall this scene because it illustrates the value of first class tradesmen. It is not always a question of the high quality finish of their work but of the greater speed with which they do a job normally requiring a lesser degree of skill. In addition,

given ruling dimensions, they can be left to figure out details for themselves, which is of such tremendous value when those above them are "flat out" on other things.

The cradle, though simple, required some care in design. The brackets on which the craft rested had to be shaped accurately to the curves of the hull, which varied appreciably between the two boats although they were twin sisters. The placing of the brackets, too, required some thought, in order that they might bear against the hull where it was strongest, and it did not seem very strong anywhere. The Navy, I may say, viewed these goings-on somewhat anxiously, but I think they were reassured to find that some of us were quite familiar with boats.

We had time for just one launching rehearsal. It went as planned but with one snag—when the craft became water-borne so did the cradle, and glued itself to the bottom of the craft! The runners were of iron and somehow the cradle *looked* heavy, and I don't think anybody had thought of it clinging like that. Elementary of course, my dear Watson . . . but the obvious is not always apparent to tired minds working against time. Anyway, the complaint was easily cured by a further dose of iron, added in appropriate places to the cradle.

And so the twins became "Rhine maidens."

In view of the gallant and successful work which they did for us, it may seem ungracious to recount a near tragedy in which one of them was concerned, but the scene haunts my dreams to this day. Only two bays remained to be brought into bridge and the gap to be filled was well over towards the far bank of the river, from which extended a long landing-bay and two floating-bays. I arrived at the head of bridge on the near side of the gap and noticed that several upstream anchors thereabouts had been cast much too close to the bridge. It was almost dark and as I peered at the cables rising from the anchors at an unpleasantly steep angle, I decided that two of the anchors would have to be re-cast further away. I instructed the anchor party in a G.S. motor boat accordingly, but the weight of an anchor and the drag of the strong current on the cable were too much for their boat. They partly raised one anchor but nearly capsized themselves in the process, so I told them to desist and ordered up an L.C.P. which was then at hand. Up to this point things had been arranged so that the L.C.Ps. did all their work below bridge, and I shall kick myself eternally for not leaving them there. The one in question steamed up through the gap and the sappers on board soon had the anchors re-cast. It only remained for the L.C.P. to return through the gap. What exactly it did I don't know as my attention was diverted elsewhere, but I suddenly saw it sweeping downstream broadside on, overlapping by half its length the far portion of the

bridge, and with only a dozen yards between them. The stern was towards the far bank and the coxswain therefore had his back to it, and seemed at that moment oblivious to the overlap. I gave such a shout that I had no voice for days—I expended a week's supply in half a second. No doubt others shouted but I didn't hear them above my own scream. The coxswain reacted with commendable quickness, putting the craft full ahead—but too late. The overlap was not eliminated and the stern hit the bridge with an ugly thud.

All considered, remarkably little damage was done. The end of the bridge extending from the far bank was shifted 20 ft. downstream but the landing-bay and floating-bays remained more or less in line, pivoting on the rollers at the shore end of the landing-bay. By sheer luck, it did not come off the rollers, and after renewing various snapped cables we were able to bring the whole lot back to the correct alignment. I think that only the pontoon actually struck had to be replaced. In fact, we got away with it comparatively lightly—but if I am sometimes heard to scream in the night it is only a return to voice-production on the Rhine.

Before leaving this scene, let me point out that the L.C.P. was operating in fast narrow waters, obstructed by sundry cables, that the crew had been at it for many hours, sometimes under fire, and that it was dark. Further, they were engaged on tasks for which they had had only a few hours' training. It is myself that I am still kicking, not the coxswain.

What emerges from these browsings among memories? For me, many things, but let me pull out a few plums, familiar fruit but worth re-tasting.

It is easy for a user to complain of the tools placed in his hands. It is as well to remember that he will be lucky indeed if the " best available " always coincides with " the best."

We must have high class tradesmen for reasons of speed, if for no other.

For us, any form of boating experience is worth the proverbial guinea-a-minute.

If a buxom River Goddess puts forth her strength, to obtain the mastery so must we, in 100 h.p. units I reckon, and manned by ourselves of course.

Photo 1.

Photo 2.

Rhine Maidens

550-ft. piled bridge over the Bilin river built by Japanese, under supervision of 60th Indian Field Company, between Bilin and Papun. This bridge carried Class 12 traffic. All timber was extracted locally. The wide span under constuction was for the passage of logs.

A Close Up Of The Japanese Soldier

A "CLOSE-UP" OF THE JAPANESE SOLDIER*

By LIEUT.-COLONEL T. H. F. FOULKES, O.B.E., R.E.

WHEN the first two atom bombs put an end to the war in the East one was tempted to forget everything that had happened there before. But in the long run the vital energy of the Japanese, the geographical situation of their islands and the immensity of their population, taken together, must ensure them a significant part in world affairs, a part, too, which the British Commonwealth can ill afford to ignore. Exactly how it will be played must still remain a guess, but in so far as the past can be a guide to the future the behaviour of the Japanese Army at the time of its eviction from Burma may well be worth recording.

The Fourteenth Army's 500-mile advance, which ended in May, 1945, with the occupation of Rangoon by other Allied troops, penned the remnants of a Japanese "Army," still some 20,000 strong, into the jungle-covered hills which run north from the capital and are known as the Pegu Yomas. 4 Corps had passed down the Sittang Valley to the east and 33 Corps down the Irrawaddy to the west of these hills, and so surrounded them.

In July, after quite absurdly contemplating the recapture of Rangoon, this conglomeration of broken enemy units made a concerted dash eastward for the River Sittang in the hope of bursting out of the bag and joining up with their friends on the farther, eastern bank.

But along the Mandalay road they found their way blocked by the 17th Indian Division, their oldest enemies in Burma, who were none the worse prepared to receive them for having captured their operation order on the body of a dead Jap officer a few days before they moved. Reinforcements from the divisions north and south of us had already moved to the threatened areas. And so, starved, sodden, and exhausted by many reverses, rank with tropical disease, and lacking equipment and supplies, the great majority of these former conquerors perished in the swamps. The destitute Burmese villager, with a long bamboo, arrested the processions of dead in the streams which lead into the Sittang, took their rags to supply his own desperate needs, and pushed them off again on their hideous way to the sea.

Defeat was absolute. But such was the enemy's discipline that, true to form even in such extremes, the prisoners now totalled only 1,000, nearly all picked up half-dead. Indeed, the number who

* This article was written in 1947.

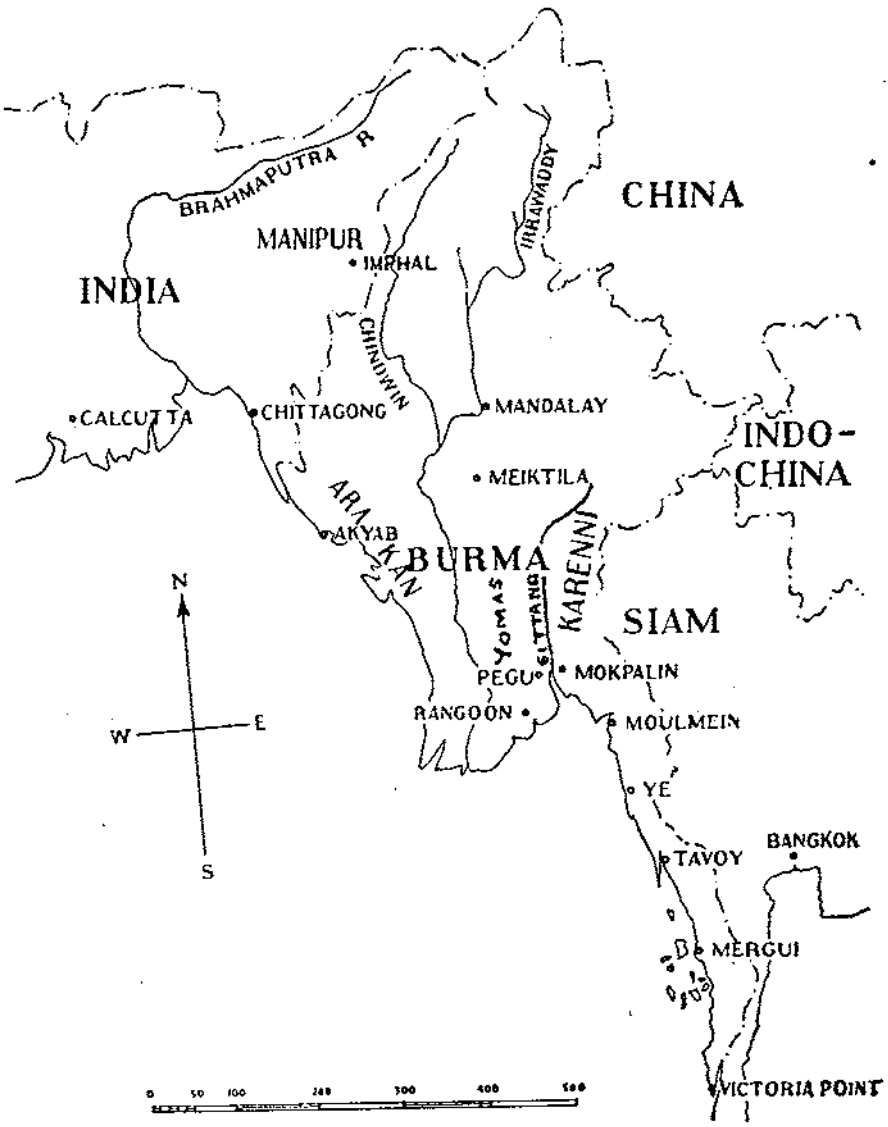
gave themselves up was no more than twenty men out of the total 20,000. On one occasion, at least, an entire infantry section, when cornered, formed a huddle and blew themselves up all together with their last grenade, obediently avoiding surrender ; and isolated soldiers summoned the strength to fight like tigers before being pulled down by packs of Burmans. No doubt they were savages, but they did not lack courage.

While this account was being settled, troops of the Japanese 18th Division from the other side of the Sittang tried to stage a diversion and succeeded in recrossing the river at Mok-pa-lin. This was a most arrogant division, with a fighting reputation from China, Singapore and Upper Burma, and after the killing astride the Mandalay road was over, the 17th Indian Division, of which the present writer was C.R.E., took over the Mok-pa-lin sector and were preparing to eject these warriors of Kyushu, when the " whistle blew for time " and the war was over.

At that period I was familiar with the look of the ground from the air through frequent flying to inspect engineer work on the Sittang Railway and the Pegu Canal, and to watch the floods which were banking up and threatening the town of Pegu. I had sometimes flown over the Japanese positions on the railway and in the wooded hills beyond the river, and had never been able to detect a vestige of enemy life ; but now that the war was over there was a sudden change. The Japs emerged from the earth and vegetation like insects, by their hundreds ; stumpy little officers strutting about with big boots and dangling swords, mounted men slouching on shaggy ponies, and marching troops bent double by mountains of awkward kit, all looking from the air more like a Christmas present for a small boy than a redoubtable enemy. Rigid orderlies saluted mounted officers, and cumbrous lorries staggered through the mud, or stuck. Diminutive boats displaying Red Cross flags showed very distinctly on the river, and toy sappers struggled with a little timber bridge. It was hard to believe that so much strength could have remained hidden till now, but such was the standard of the enemy's concealment everywhere.

For the first few days they were inclined from force of habit, or else distrust, to crouch or run for cover when my giddy pilot zoomed down at them, but some, from the very first, rather surprised me by being human or impudent enough to laugh and wave at our little Auster.

The Army's first peace-time tasks were to round up the remaining troops and help to restore the life and economy of this very battered country, bombed by both sides and twice fought over. Some of us were disappointed at the enemy's rather " narrow-minded " surrender just when our time seemed to have come at last, but we now turned our surplus energies to these new labours.


BRAHMAPUTRA R
CHINA
IRRAWADDY
MANIPUR
IMPHAL
INDIA
CHINDWIN
CALCUTTA
CHITTAGONG
MANDALAY
INDO-
CHINA
MEIKTILA
ARAKAN
AKYAB
BURMA
KARENNI
SIAM
YOMAS
SITTANG
PEGU
MOKPALIN
RANGOON
MOULMEIN
YE
TAVOY
BANGKOK
MERGUI
VICTORIA POINT
N
W
E
S

MAP 1.

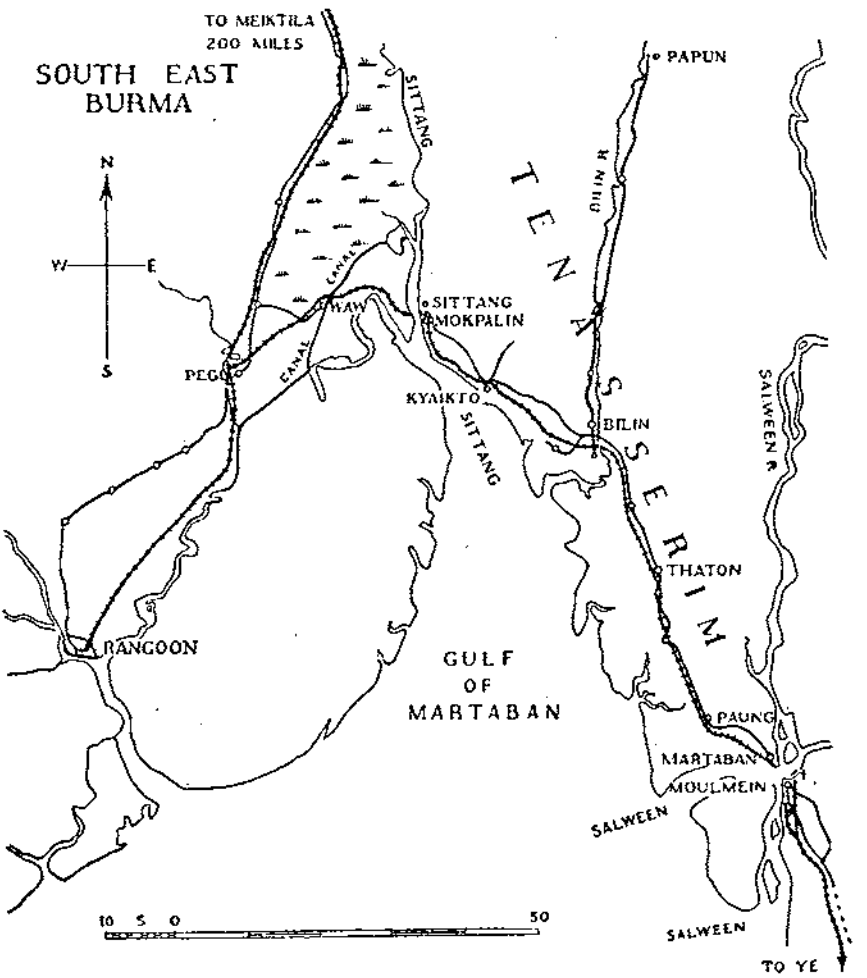
From now on the Japanese were at our disposal for work, and whatever their hidden motives may have been, the following account will show how they behaved during the early months of peace.

Divisional Headquarters and a large part of the division was now to move south-east, on a rather optimistic time-table, from Pegu to Moulmein on the other side of the Gulf of Martaban ; and as the seaward approaches to the port were still blocked by our own mines, we were forced to follow the blasted and saturated route by road, rail, canal, and ferry through Waw, Kyaik-to, and Martaban. We were to take the surrender of some 70,000 troops of the Japanese Twenty-eighth, Thirty-third, and "Burma Area" Armies, who were extended from Mok-pa-lin in the north to Victoria Point, 500 miles further to the south.

As most of the country was still under water, we could not move at all till communications had been patched up, and the Divisional Commander decided that I should at once cross the Sittang with an armed Japanese escort to explore the ground ; the Brigade Major of the leading brigade was to come too. At this time we had no knowledge of Japanese post-war behaviour, but we knew quite enough of their excitability and dirty tricks to feel distinctly interested in their reactions to our visit.

John K. and I approached the river bank "by train," that is, in a crazy old jeep on rail-wheels, taking along Robin G., the subaltern of 60th Field Company, R.I.E. (Madras Sappers and Miners) who was to start the work on the far bank. We also took a Royal Signals officer, searching in vain for copper line, and my personal retainer, "Boji." This old Jemadar of the former Burma Sappers and Miners, who had run out from his village to meet us near Pegu, knew every inch of the ground we were to visit, having been fourteen years a warder in charge of convicts in the Mok-pa-lin stone quarries. As a local Burman and a sapper, he was always a most valuable man on reconnaissance.

Standing on the high river bank, upstream of the ruined bridge, we watched our Japanese guide push off from derelict jetties on the other side and cross 600 yds. of brown and swirling water. His craft was a dug-out canoe paddled by two soldiers, good watermen, and displaying a rather incongruous Red Cross flag for protection. On stepping ashore he introduced himself as Captain Aoki, politely and confidently in good English, obviously without fear of the rudeness or violence we could have expected had the situation been reversed. He was about half the size of my husky companions and looked like a child dressed up. All being ready, we now prepared to cross over. By significant contrast our own craft was a high-powered launch, which had come many miles round by devious water-ways to meet us, but our dignity had a temporary setback when a boat, on which Robin put one foot to step aboard, swung out and made him


TO MEIKTILA
200 MILES
SOUTH EAST
BURMA
N
W
E
S
SITTANG
CANAL
CANAL
PEGU
HAW
SITTANG
MOKPALIN
KYAIKTO
SITTANG
PAPUN
BILIN R.
TENASSERIM
BILIN
SALWEEN R.
THATON
RANGOON
GULF
OF
MARTABAN
PAUNG
MARTABAN
MOULMEIN
SALWEEN
SALWEEN
TO YE
10 5 0 50

MAP 2.

do a very slow "splits" before he finally fell into the river on his back. I noticed that our guide had to turn away to hide a smile and conceal such deplorable lack of self-control.

But what was a mere wetting after such a moist war? We quickly hooked Robin out and were soon tearing across the coffee-coloured water towards a very peculiar reception committee waiting on the other bank. The swarthy little adjutant of the local regiment looked ill-disposed, the engineer captain seemed to be up in the clouds, the infantry subaltern with round, ruddy cheeks was just enjoying the fun, but it was the elderly gentleman in the garb of a second lieutenant who attracted my attention. He seemed well educated and spoke quite good American, and the other officers appeared to treat him with some deference, perhaps from the usual respect on the part of the barbarian for education, or "culture." They were all reasonably well dressed in khaki tunics and breeches, mackintoshes, boots and leather gaiters. Their soft, peaked, khaki caps had the usual yellow cloth star sewn on in front. For badges of rank they wore the little red and gold tabs sewn to chest or collar, with stars according to their seniority. They had not yet been relieved of their swords. For hot weather we much preferred our own loose olive-green bush shirts and trousers.

An armed escort of a dozen men was drawn up in two ranks on the jetty. These were dressed much the same as the officers, but wore khaki shirts instead of tunics, puttees instead of gaiters, and inferior canvas shoes—no doubt for lack of boots. They were armed with the very long Japanese bayonet and the long and clumsy rifle, with which they presented arms, British fashion. Of all shapes and sizes, they looked a villainous crew, ranging from the short, sturdy type, with sperical head and ruddy cheeks, to the lanky, yellow and cadaverous. One had a piratical scar right across his face. They were badly shaven and dirtier than they need have been, and were the last sort of people by whom one would wish to be captured. As we moved off they formed two parties, in front and behind, and slouched along sulkily with rifles drooping over their backs.

In the course of a long walk in heavy rain we examined the bomb-churned water-front and the possible exits for our motor transport, the sad remains of the railway station, the little timber bridge I had already seen building from the air, the ruins of Sittang village without a roof remaining, and the small Pagoda Hill which commands the great railway bridge. It was from this same hill that the Japanese four years before, after working round the flank of the 17th Division, had opened small arms fire on the bridge; and it was this bridge which had been blown up before a large part of the division had got across. Since those fatal days the division had seldom been out of contact with the enemy, and it was good to feel that the wheel had now come round full-circle.

As we climbed the hill surly mutterings came from the escort, and one of the officers presently asked us to walk less quickly, a request which we were pleased to ignore, having the longer legs. There were small parties of Japs everywhere quartered in shelters and ruined huts, each with a sentry on guard, and most of these saluted smartly as we passed, but we took no notice of those who only came to attention to avoid any suggestion of " saluting the sentry." In strict accordance with Allied orders the " Rising Sun," normally ubiquitous, was nowhere to be seen.

There is reason to believe that the Japanese in Burma had some respect for the British officer and were puzzled by his influence over Asiatic troops. In any case, the attitude of these officers was—outwardly at least—respectful, and while making full allowance for the fact that the Jap loves to be esteemed by his betters and held in awe by others, I felt that these officers expected nothing from us but fair treatment and courtesy, their manner showing all the assurance of a decent and civilized enemy.

Without permitting any sort of familiarity, such as exchange of views on the end of the war, we encouraged our guides to talk, as we had much to find out. The dreamy engineer, who was obviously not over-burdened with brain, returned very careful and deliberate replies to simple questions about the depth of the river, the tidal bore, the state of roads and tracks, and damage to the railway. But they all gave the impression of being practical men.

When a Liberator flew high over us on its way to Siam they looked up and murmured, rather surprisingly, " Consolidated," from the full title, " Consolidated Liberator," and obviously had to resist an inclination to take cover.

No security orders could prevent us any more from wearing our divisional sign, the Black Cat with tail erect, and curiosity prompted me to ask them what they thought this meant. One feebly volunteered : " An insignia ? " ; another declared, no doubt from schoolroom memories as well as bitter experience : " The black cat brings good luck." But none of them showed much interest or seemed to realize that it might till recently have served to identify our division which they had long been mistaking for the 7th ; and we learnt later that this stupid though distinguished formation, bearers themselves of the Imperial Chrysanthemum, thought so much less of Military Intelligence than feats of arms as to dismiss the whole subject as " a pain in the neck."

Before we recrossed the river a table was set up at which we sat and made notes while the Japs stood by. The unexpected offer while we were doing this of a plate of sweet cakes was rather too fraternal for my liking, but while I hesitated, the elderly second lieutenant exclaimed with a laugh : " It's all right. They're not

poisoned ! "—a nasty enough remark because of the idea it disclosed. In the end we did eat some and felt none the worse for it later ; and whatever they may have been thinking about golden opportunities they saluted very keenly with many a courteous bow and smile as we boarded our launch—this time without mishap.

A few days later, accompanied by Jimmy J., who was temporarily commanding 60th Field Company, I continued my exploration southward by road for about eighty miles, through little bamboo towns and villages, as far as Martaban on the right bank of the huge Salween, and so passed all through the area still occupied by the Japanese Twenty-eighth and Thirty-third Armies. On this occasion we were provided with a young Japanese interpreter who talked perfect American, as well he might, having been a dry cleaner with his father in San Francisco from childhood. He wore the blue zigzag badges of the civilian in military employ, and as such, can have cut very little military ice ; but if he had been required to die for the Emperor, no doubt he would have done so as readily as did the many Japanese civilians who were hastily enrolled in Rangoon to delay our advance, after the capture of Meiktila in March had shattered the enemy's defence of Burma.

On this occasion I got my first impression, from those I saw on the way, of senior Japanese staff officers. With their well-made uniforms and gold aiguillettes, their keen and determined expressions, their good bearing, and sometimes even good looks of a sort, the best of them seemed a race apart from the ordinary, scruffy, little regimental officer. Outwardly, at least, these men still showed no signs of defeat. Though Western progress had been so rapid in Japan during the last two generations, in Tojo's war, commanders of good social standing could still reach high rank by simple fighting qualities, regardless of any great mental attainments, and so it is hardly surprising that the Japanese Army should long ago have copied the Germans and adopted the "Chief-of-Staff system" of command, down as far as the regiment, backing up their commanders with a select corps of staff officers who underwent very long and rigorous training before they could even qualify for the staff. This may perhaps account for a tendency among Japanese commanders after the war, when asked awkward questions about their past miscalculations, to say : "My Staff appreciated . . ." instead of saying : "My appreciation was . . ." The number of trained intellects, in fact, was not yet enough to go round. Nevertheless, it would be a great mistake to under-estimate the achievements of their experts—for instance, the design of their fighter aircraft, the accuracy of their naval bombing and the very skilful conduct of their Burma campaign of 1942. Japanese staff officers in the rôle of political gangsters with their marked ability did much to shape their

country's pre-war policy, and unless the class from which they came has undergone a wonderful change of heart, they must be looking forward to renewing their old activities as soon as they may.

Burmese villages can be pleasant places of sunlight and cool shadow, palm trees and pagodas, bright clothes and sunshades, and plump and merry folk, and the sun was shining when we drove through the little town of Kyaik-to. Here I was surprised to see Japanese troops, off duty, on very easy terms with the people, sitting inside the vendors' bamboo stalls and talking and joking fluently with Burmese men and women—a thing I have never seen done, either before or since, by British or Indian soldiers. Tommy Atkins is justly famous as an ambassador, but his is a different way. "Now, now! Don't you run away from me. I'm just a barkin' dog!" I once heard a repentant soldier say to two frightened Burmese children. The Japanese, at the time of *their* retreat, envied us our comparative success with the Burmese, but one glance at this scene in Kyaik-to was enough to show the real advantage they held with their fellow Mongolians and Buddhists over the Indians and ourselves. I knew a good example of this sort of liaison later on, when the enemies of a rich old Burman in Moulmein were pleased to recall that the detested Kempi Tai (Japanese Gestapo), while billeted in his house, had been in the habit of addressing his wife as "Mother." Many Japanese soldiers married Burmese women; and there must be some Japanese deserters living with their wives in Burmese villages to this day.

Japanese brutality to the Burmese caused much less resentment than one might have expected, for in the East, cruelty is commonplace. What Eastern race, after all, is noted for its kindness? I remember, for instance, a taxi-driver in Akyab who laughed with glee when he swerved to run over a tiny puppy waddling across the road. Torture can be delightfully amusing (especially when inflicted in public on one's friends), and is so quickly condoned that one of the great difficulties of investigating war crimes in Burma was to persuade the friends and relations of the victims to take the trouble to come and give evidence on what they regarded in a few months as old history, best forgotten.

On the other hand, British injury to national pride, however unconscious, was an altogether harder thing to forgive. The British-led Indian Army, so powerful and so foreign, was scarcely a thing to be loved by the Burmese and only the oppressed minorities, such as Indians and Karens, were really very pleased to see us back. A Jap in Burma to-day would not necessarily be unpopular.

This is not to deny that, once the issue of the war was certain, the Burmese were glad to be rid of the defeated army, and at one place where we stopped the car that day a young Burmese woman,

on seeing our British uniform, came across the road and spoke earnestly to the Japanese interpreter, who explained, when asked (in the best tradition of his calling) that she was giving him the Burmese equivalent of " Good riddance ! "

As we went further south we overtook columns of tattered, weary, sweating troops, the Yellow Peril on the ebb, receding towards their appointed concentration areas, every man patiently stumping along with body leaning forward to balance the mountain of baggage and equipment on his back. When abruptly asked why the Japanese Army had so many stragglers, the interpreter solemnly explained that *those* were the malaria cases ; and when I inquired if the troops were glad the war was over, he replied with some feeling : " Of that there can be no doubt." Reflection on what the Japanese soldier was prepared to endure recalls an incident during the battle for Imphal when a Japanese general is supposed to have retorted to the lamentations of his ally, the commander of the " Indian National Army," bewailing the miserable plight of his troops : " Well then, why don't they commit suicide as our men do ? "

Martaban, like Prome and many other Burmese towns, was so devastated by bombing that it was impossible to tell, when we reached it, what the place had looked like before the war. Railway sidings and steel jetties had been twisted into wild contortions, all dwellings had vanished, and only the solid brick pagodas remained erect. Far across the Salween we could see Moulmein, and further still, the solitary limestone crags which spring abruptly from the plain and are such a curious feature of that far-off landscape.

We were relieved to find that there was a timber jetty in use by the Japanese at Martaban, which was almost good enough for our purposes, so that it was only necessary to give orders to the local engineer regiment to strengthen it before we returned to Mok-pa-lin. The weather had now completely changed and we tore along northward through torrential rain, till halted by breaches in the road where we had to change vehicles and at muddy diversions where the car was almost carried by clusters of grunting and heaving Japanese.

As soon as we had patched up the Sittang Railway and the Pegu Canal, the division trickled forward, as planned, and started crossing the Sittang in landing-craft. But before the divisional transport could reach Kyaik-to we had to reinforce a two mile stretch of sodden causeway over paddy swamps with hard stone ; and here the Japanese engineers for the first time co-operated in a big way by starting from the southern end and meeting us in the middle. Simple as the project was they had obviously worked out their part in great detail. Coloured charts made by the " company drawing officer " (presumably the only one who had the skill) were eagerly produced to show the state of the work and the stock of materials in hand, not to mention their own zeal.

Excluding the Thebu Chaung, 200 ft. wide and then in spate, and a number of smaller streams, there was no major obstacle between that causeway and the Bilin River. The road and railway bridges over this formidable gap had been thoroughly blown by our own division during the retreat in early 1942 and now, in late September, 1945, the river was nearly 700 ft. wide and so swollen with rain that water was flowing across the main road, and the whole valley bottom was flooded. It was not easy to establish a ferry for the divisional transport in such conditions, and our quick success was very largely due to the work of the Japanese at improvised pile-driving, for long piers on each side were essential. Operating without much heavy transport in a country rich in timber, and lacking prefabricated bridging equipment, such as our Bailey bridge, they had had at least four years' continuous experience of pile-driving as the normal method of making a bridge. In fact, one might suggest that Japanese military operations owed much of their success to the luxuriant supplies of timber on the spot, just as their feeding problems were eased by the fact that they were rice-eaters in a land of rice. However that may be, the efficiency of a Japanese engineer unit was, so we learnt, judged to a very great extent by the number of timber piles it could drive in a day. Not that there was anything of British solidity about their work—except when we insisted—for their designers did not hold with factors of safety. But they had a well-founded trust in their timber and used it with an instinctive sense of structure (which, incidentally, goes far to explain the remarkable resistance to shell-fire of their earth-and-timber "bunkers"). Improvisation they carried to extremes; any object of suitable size and weight made a good pile-driving monkey. Cordage and manpower was the order of the day, and though one might smile at their methods, the results were never to be despised (see photo). With active Japanese assistance, then, long piers were very quickly built; the 70-ft. Bailey raft began to move, and the troops surged on to Thaton and Martaban, still just up to time.

Most of the Japanese worked naked, except for a loose-fitting loin-cloth like a little apron fore and aft, and perhaps a topee, or a peaked cap with a "Beau Geste" sun-flap at the neck; and it was a comic sight to see a dozen, toothy, expressionless faces all in a row, some be-spectacled and some with old-world tropical head-gear, peering over a heavy timber baulk as they prepared to lift. Though there was nothing remarkable about their strength they had short legs and big barrels (as good sappers should) and they hauled and lifted very well together, singing and chanting to keep in perfect time. They worked tirelessly and with great enthusiasm, apparently for the sheer love of toil, although it rained most of the time and was very hot between showers. The elderly C.O. of this

regiment was obviously much more a soldier than an engineer. His officers showed amused interest when he took out his engineer pocket book to make a calculation, and open rejoicing followed when he dropped a nought.

Months later when we received some good equipment we built a 660-ft. high-level Bailey at this site on piled timber piers and no one could have been keener on the success of the project than the Japanese we then employed. They quickly taught themselves the simple uses of Bailey and were always on the job at daybreak. When the permanent approach roads of this new bridge were nearing completion, a shaven-headed interpreter, along with a Japanese captain, having duly bowed and sucked his teeth respectfully, delivered himself as follows :—" This Japanese officer has been in charge of many of the main roads in Japan. Of course, he has no great experience in tropical conditions, but please excuse him if he suggests that you should use a little more bitumen."

The round trip across the Salween from Martaban to Moulmein and back took three hours, and the division made the passage on an extraordinary assortment of archaic motor craft, still manned by Japanese and flying little Union Jacks produced from heaven knows where. Inside Moulmein we met with the same co-operation. Arms were ready stacked and listed for surrender, including several thousand treasured swords, some of which had been handed down for many generations. Roads were specially signposted for our benefit and buildings were labelled : " Quarters for the British Troops." We found many good tradesmen to reinforce the workshops of 414 Field Park Company (Bengal Sappers and Miners), and the Indian I.W.T., but the best effort of the Japanese carpenters and shipwrights was the building of twelve teak-wood sailing dinghies from a blueprint of the General's—beautiful little craft which gave us endless amusement.

The Japanese had the status of " surrendered personnel," not prisoners of war, which meant that they kept their military organization and remained under the command of their own officers, an arrangement which had every advantage from our own point of view and taught us a lot about their ways. Discipline and saluting were exemplary ; we demanded nothing less. A visit of apology by a senior officer followed the smallest lapse on the part of a private soldier, and the reporting of offences was simplified by sewing a detachable name-tab to every soldier's shirt, to be torn off if required. They bowed or saluted whenever it was physically possible to do so, and even when carrying heavy loads. Punishment of their own people was prompt and savage, though I never knew the details, and Japanese officers would angrily slap and kick their own men in public. But perhaps the most impressive proof of Japanese discipline

was their elimination of venereal disease. It was rumoured that the penalty for infection was death or permanent exile from Japan, but however that might be, our doctors said there was virtually none of it among the 70,000 troops we rounded up.

This high standard of discipline after hostilities seems to have been general among the troops who surrendered to the Indian Army in Burma, Indo-China and Siam. There were indeed some isolated cases of truculence on the part of Japanese officers, particularly among those who came from remote garrisons and had not enjoyed the healthy experiences of defeat, but such misguided persons were promptly reduced from "surrendered personnel" to prisoners of war and soon ceased to give offence.

One of my first actions on reaching Moulmein was to call for a detailed engineer report in English from the notorious 9th Railway Regiment, who had inflicted so much misery on Allied prisoners of war and Asiatic forced labour in building the railway between Moulmein and Siam, which they were still operating under the direction of some of their late prisoners. A painstaking and voluminous reply, in triplicate, penned out on fine rice paper, with diagrams, tables, and charts quickly gave us the information we required. Whatever their crimes may have been, these were very capable railwaymen, and our Transportation Service was glad to make use of them before they were brought to trial. In the meantime, one or two of their officers anticipated the sentences of the Tribunal by suicide. In spite of all their cruelties, I do not think that a written report by a Japanese general in Moulmein was entirely insincere when he said: "The remains of the dead (from the railway) are being handled with reverence, so that the souls of the departed may rest in peace." They had, in fact, less regard for the living than the dead, whether Japanese or not.

It was very far from our intention to allow them to enjoy a rest-cure while they waited for repatriation to Japan. There was plenty of hard labour in store for them, and the threat of employment on "the C.R.E's. roads" was sometimes used as encouragement.

The largest single work we undertook with Japanese labour was the Ye Road, on which the Tehri Garhwal Field Company employed 5,000 troops of all arms under a Major-General. Ye had been the southern terminus of the pre-war railway from Moulmein and from Ye there is a road to Tavoy. But the bridges had been so severely damaged in the war that it was necessary to forget the railway for a time and to fill the sixty-mile gap north of Ye with a road for light traffic, especially as coastal shipping was stopped by unswept mines. Gravel surface and timber bridges, in the main, were all that our resources could provide, but once they are "seasoned" these roads do well.

Before these Japanese troops left their concentration area they were enjoined by their senior general to " display the national skill," and this they did to such good effect that we completed in four months what in peace would normally have taken years. The Army Commander, when he flew over the alignment and saw the great gash running through hill and forest and over the distant horizon, exclaimed : " By gad ! you must have a lot of bull-dozers ! " though, in fact, by that time we had none. As a token of keenness, commendable slogans, such as " Quickness and certainty," were written up outside their labour camps, and though their daily tasks were severe and entailed long, hot marches to and from their camps, and in spite of small rations, they often worked on rest-days entirely of their own accord and without even mentioning the fact.

As impressive as their capacity for earth-shifting was the neat finish of their digging. New cuttings and embankments looked like sliced cheese, till the first monsoon got at them. One ceased to wonder that the Japanese Army could go to ground so quickly—guns and all.

This road-making presented an animated scene. Trees were toppling over all day long, and the view opened up as our 100-ft. belt of clearing moved forward through the jungle. The diggers of side-drains and cuttings were hidden by the showers of dust and earth they threw up. Hundreds of rammer-men chanted and thumped together, while strings of carriers with baskets of earth and cans of water built up the embankments in thin layers from the bottom. Dozens of wells were sunk to get this water. Many thousand cubic yards of yellow laterite and gravel were dug up from numerous pits, spread out, and rammed. Elephants softly delivered heavy timbers to the bridge-builders. Pile-drivers banged them in.

The Company Commander in charge, a Hindu, issued his daily orders in English through a Japanese interpreter, and these were passed back to him in writing the same evening with explanatory sketches to remove any doubt. Man-management was easy. One merry little Sapper and Miner from the hills of Garhwal in charge of forty Japs, when asked by an inspecting general what he would do if his party slacked, replied with a grin that he would speak severely to the Japanese officer ! In fact, the lash could not have proved more effective than a little adverse criticism applied in the right way.

As in the case of the Japanese when building their Burma–Siam Railway, not so many miles away, we were determined to extract the last ounce of work from our labour, but in contrast to them, we well knew that this demanded sound administration and fair, even if severe, treatment. Our doctors quickly stamped out malaria and beriberi, and the men looked clean and fit for work, for which they seemed surprised and grateful, and I am certain that none of this

did anything to lessen our prestige. Our dealings with the Major-General, a trim little man in a white cotton shirt, were very formal and his behaviour always punctilious. He never failed to bow solemnly on arrival and departure, and he stood to attention till permitted to sit upon a stool. His answers were clear-headed and precise. Among the troops, I remember two grinning, shaven-headed goblins, barring the way and bowing low to my jeep, the one saying: "Cannot going," and the other: "No go," because the usual track was blocked by fallen trees.

We employed thousands of Japanese on many other works, including roads and camps, and though one cannot deny that there was a little shirking and evasion where supervision was insufficient, they proved, on the whole, to be remarkable labour. Sceptics will say that this was all part of a plot to curry favour and escape their just deserts, and, no doubt, their wily leaders had some such idea in mind. But the most impressive feature of the Japanese Army was its discipline, reinforced as it was with religious and political tyranny. "Death is lighter than a feather, but Duty is heavier than a mountain." If the Emperor wished them to co-operate sincerely with the Allies, that was quite enough; the troops were bound, not only to co-operate, but to do so sincerely and without asking why. Moreover, we who saw their expressions all the time knew that most of them enjoyed co-operating with us and relished any opportunity of displaying success.

As for their odious and almost universal cruelties, the veneer of civilization is very new and thin and often fails to hide the savage beneath. But it would be a mistake to suppose that throughout the war they were invariably fiendish. There seems to be some kindness as well as much cruelty in their individual make-up, and had their leaders not believed in, and ordered, "frightfulness" as a matter of policy, their individual conduct might perhaps have been different.

Maung Gyi was an astute and courteous Burmese engineer who had been employed by the Japanese during their occupation of Moulmein before we took him on; and when I asked him what he thought of his late masters and how he accounted for their triumphs early in the war, he thoughtfully replied: "They are the most *energètic* people of Asia."

Every great state has its traditional foreign policies based to a large extent on unchanging geographical factors, and successive generations of statesmen patiently pursue these objects by dint of whatever bargaining power they can summon, and undeterred by such temporary setbacks as unsuccessful wars. There are said to be some hundred million Japanese. We know more or less what they want, and it only remains to be seen how they will go about it.

THE GUNDULPH POOL

By " EXCAVATOR "

" *For we're working very hard*
Down at Upnor Hard "

(From *Hurrah for the C.R.E.*)

THE CONCEPTION

THE decision that the S.M.E. was to return to its old home at Chatham brought with it a number of problems, one of the thornier being the question of a suitable site for wet bridging and watermanship.

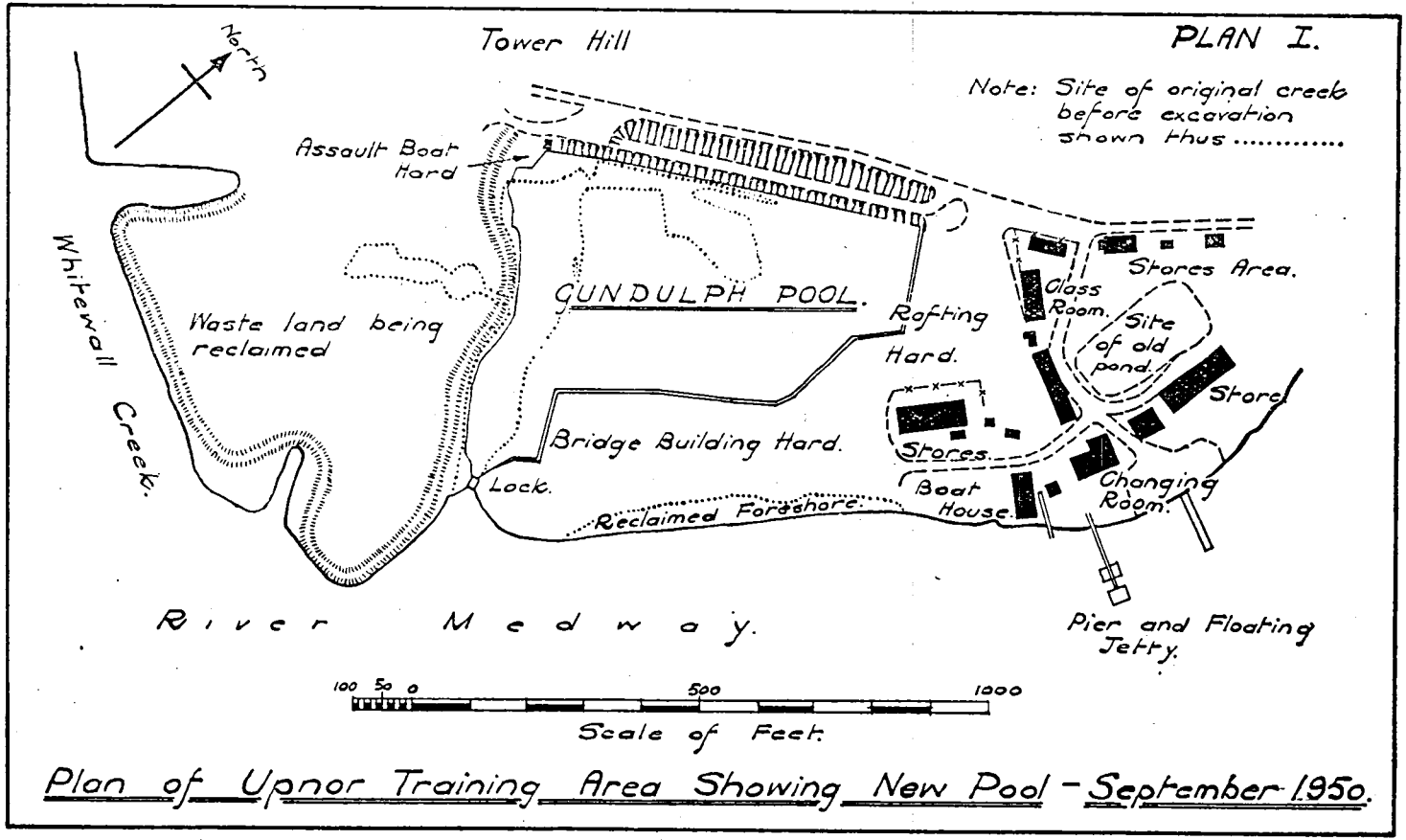
The old pond at Upnor was obviously inadequate for the many large types of modern bridging equipment ; and the Medway, tidal and swift flowing, was too tricky for elementary instruction ; no other river or inland water exists within reasonable distance of the S.M.E. So the only answer was to make a new and better pond, and this is the story of the " Hole at Upnor," now more respectfully christened " The Gundulph Pool " after a former Bishop of Rochester and the King's Chief Engineer in 1078.

THE SITE AND DESIGN

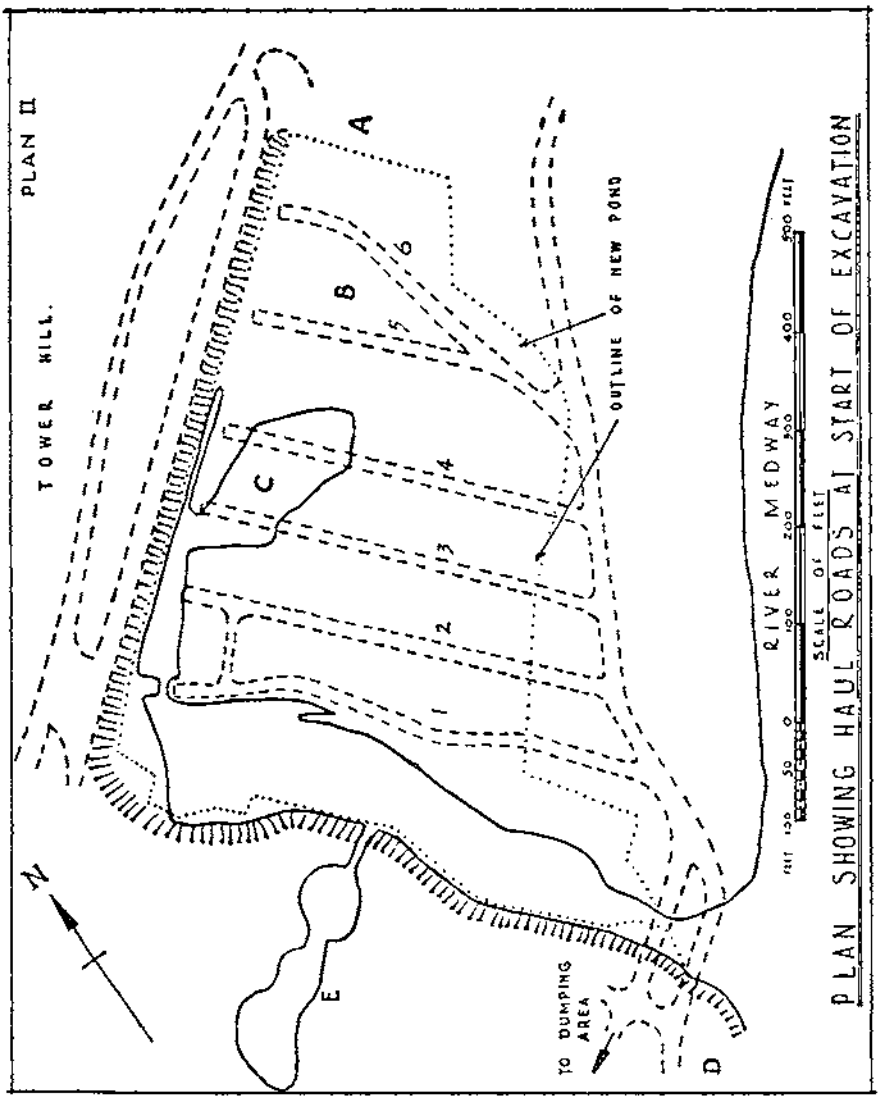
At first it was thought that the quickest method of obtaining a large pond was to dam the entrance of Whitewall Creek, a large inlet about half a mile upstream of Upnor (see Site Plan I). But on further consideration, this scheme was turned down due to the low marsh land, completely covered by some tides, that formed one bank of the creek.

The site finally chosen was immediately upstream of the existing pontoon sheds, where existed a small unnamed creek flooded at high water.

A survey of the area was carried out by the Survey School and the dimensions of the pool were agreed to (and surprisingly never altered) by the Fieldworks and Bridging School. The pool was to be 700 ft. long with a width varying between 550 ft. and 200 ft. It was to have a minimum depth of 4 ft. 6 in., with top water level coinciding with the average high water level of the river. This plan involved the excavation of about 60,000 cu. yds. of a very sticky blue clay, the low spots of which were flooded at high tide (see Plan II).



Plan of Upnor Training Area Showing New Pool - September 1950.


PLAN II
TOWER HILL.
A
B
C
D
E
1
2
3
4
5
6
OUTLINE OF NEW POND
RIVER MEDWAY
SCALE OF FEET
TO DUMPING AREA
N
PLAN SHOWING HAUL ROADS AT START OF EXCAVATION

The problem of connecting the pool to the Medway was also considered at this time, and the first of a long series of schemes and designs proposed. These ranged from massive lock gates, large enough to float in the R.E.Y.C. yachts, to a weir in the surrounding bank fitted with removable timbers to keep out the higher tides. Most of these schemes were shot down on the question of expense, as the whole project had to be carried out on a " no visible cost " basis, and it was not until months later that some money and stores were found, a final design approved, and the lock constructed.

Preliminary Work

At the beginning of 1949, the approved design was sent to H.Q. Ripon Wing S.M.E. and passed to the Plant, Roads and Airfields School who were to undertake the job. The school was, however, still at Ripon and the first thing to be done was to send down a 19 R.B. Dragline and a D.6. Angledozer with a 6 cu. yd. scraper to carry out trial diggings. They arrived at Upnor at the beginning of March and found that most of the area, soaked twice a day by the tides, was unworkable in its existing state. Nothing was achieved until a dam was pushed across the mouth of the creek, to the horror of the Command Land Agent who by then had not completed purchase.

The move of the Plant Wing of the P.R.A. School then started in mid-April, and while the Plant Training Squadron, as it was soon to be called, established its living quarters at Kingshill Camp, near Hoo, the plant and stores started to arrive by road and rail. For the next month all the men, including forty on various courses, were fully employed unloading equipment and stores, setting up the Workshops and maintaining the plant. However, a start was made on the site by setting the dragline to dig a drainage ditch to allow the area to dry out.

Plant Resources

The preliminary trials showed that, except in the area " B " (see Plan II), the ground was unsuitable for scrapers. All the earth would have to be dug by excavators and carried away by some means. Here the trouble started. The Plant Squadron possessed about forty tractors of various makes and sizes and twenty excavators, all with full range of equipments; but the sole resources for earth carrying were an Athey Wagon and four 3 cu. yd. dumpers, all waiting to be pensioned off after long service under the hands of countless ham-fisted students. The hunt was on ; at first, it was said that tippers could easily be hired and everyone sat back and relaxed until these hopes were dashed by lack of money to pay for them. Next, Decauville Track with tipping skips was tried ; but

the excavated material was so glutinous that it was extremely difficult to load the skips with a dragline and quite impossible to tip it out of them when loaded. Dumpers then appeared to be the answer, and twelve 3 cu. yarders were acquired from various sources, but these gave a good deal of trouble. It was easy to overload them with the heavy clay, and if the load was not placed centrally, they were liable to throw their drivers when they hit a bump. Suddenly, like a gift from the gods, an offer was received from War Office of eleven Muirhill (20 B) 6 cu. yd. Diesel Dumpers for Troop Trials. Seven of these arrived at the beginning of June.

When the decision was made to use dumpers, it was planned to build temporary " haul-roads " out over the marshy ground from the firm ground near the river bank. On each of these embanked haul-roads a dragline was to be positioned, to work back along the road loading into dumpers at the rear. These haul-roads connected with a service road along the river bank, over the temporary dam, to the dumping area on the Whitewall Creek end of the site (see Plan II).

The resources for plant repair consisted of a team of sapper plant fitters responsible for field repairs. Behind them, at the Plant Workshops, were some thirty R.E.M.E. personnel. These form part of the Plant Training Squadron and are responsible for the heavier repairs.

The Excavation

Plant and operators and a few Field Engineers became available from other work towards the end of May, but little excavation could be done as the area upstream of the creek had not yet been purchased, and there was nowhere to dump the spoil. However, the time was not wasted as an intensive drive was made to train additional plant operators, especially for the new dumpers. Dumper drivers were not at first trained to maintain their machines, as it was intended that this should be done on a " pit " system, with one or two fitters and some maintenance men going over each machine in rotation. This scheme, however, fell through due to the shortage of fitters who all became involved in heavier repair work.

At the beginning of June, 1949, the 19 R.B. Dragline finished the drainage ditch and was set to dig out the inland edge of the pool dumping the spoil on the bank behind itself. Three tractors and scrapers were now used to bring in hard clay from area " B " for the base of the haul-roads. These machines frequently bogged down in the sticky clay but, with the assistance of dozers filling in the softest spots, the 18 in. of base were quickly placed and consolidated with a sheepsfoot roller.

The surfacing of the construction and haul-roads remained a

Photo 1.—Four draglines at work. Beyond creek can be seen grab in dump area. (June, 1949.)

Photo 2.—Excavation from hard roads. Loading 6 cu. yd. dumpers.

The Gundulph Pool 1,2

Photo 3.—Panorama from Tower Hill. (June, 1949.)

The Gundulph Pool 3

Photo 4.—Panorama from Tower Hill. (June, 1950.

The Gundulph Pool 4

problem for some time. It had been planned to obtain gravel from the top of Tower Hill, but closer investigation showed that there was only a small quantity there. Unsuccessful attempts were then made to obtain gravel on a " no cost " basis from the local quarry owners, and a start was made to bring in ash from local electricity and gas works with the two tippers belonging to the Plant Squadron. This supply was completely inadequate, and not till after the land on the far side of the creek was purchased was it realized that a large area of gravel from 3 to 6 ft. deep existed at " D." This fortunate discovery solved the problem and the scrapers soon surfaced the first two roads to a depth of about 6 in. This gravel was used in the construction of all the haul-roads, and later on as a base upon which to construct the lock.

At the beginning of June, the land required for the dumping area was acquired and a circular haul-road was soon pushed through, though a D.8 Dozer sank almost to the top of the engine and was nearly lost in the process. Two $\frac{3}{8}$ cu. yd. draglines were then started at the end of the 1st and 2nd road and the spoil was dumped as near to the small pond (" E ") as possible. In an attempt to fill this pond, a $\frac{3}{4}$ cu. yd. grab was brought in, but the excavated material was coming in too quickly and the ground on which the excavator was working was so boggy that dozens of sleepers were lost moving it a few yards. Dozers were also tried in spreading this material, but they either bogged down completely or got so much of the blue clay packed in their tracks and rollers that they could barely move themselves along. After this no attempt was made to spread the material ; it was just packed up as tight as possible by the dumpers assisted by small dozers.

The scrapers continued to build haul-roads and also widened roads Nos. 1 and 2, as it was found that the original width of 24 ft. was not sufficient to work two large dumpers side by side. Another job for the scrapers was to bring material to build a second dam, inshore of the original one, to provide a better traffic circuit. Due to the exceptionally dry summer much more of the material at " B " was removed by scraper than was first anticipated and enough good material was eventually obtained to build a fifth haul-road and raise area " A " about 3 ft.

As roads Nos. 3 and 4 were completed, two further draglines were stationed there, and with more 6 cu. yd. dumpers coming into service, as the best of the drivers were trained to operate them, it was just possible to keep four excavators fully employed. The original plan had been to complete the excavation by 1st April, 1950, and favoured by continual fine weather, progress was well up to the target at this stage, despite trainee operators and the usual crop of breakdowns.

As soon as the full eighteen dumpers were available, the control of dumper, scraper and grader work became difficult, particularly as there were also two face-shovels working in the area, mainly on training, but doing some useful work. A tubular steel scaffolding tower, however, built near the start of roads Nos. 2 and 3, solved the problem, as from it an N.C.O. was able to control the flow of all plant and record the daily output.

From June to the end of July the output increased steadily as the trainees and dumper drivers became more skilful, and as the ground dried out more and more. At this stage, however, it was decided that the excavation of the pool must be completed before the winter, and an intensive production drive was started. Output competitions, where the dumper drivers and dragline operators received an extra day off for the best weekly performance, were started and work was more closely supervised. Still this was not enough, and the production rate had to be raised still higher. The bottleneck was dumpers. Already a number of the small dumpers, far from new when received, had become casualties, and one of the new 6 cu. yd. dumpers never ran again as, after a break in the transmission, for which spares could not be obtained, it was cannibalized to keep the others on the road. The repair of the dumpers was given the highest priority, and those which did not require spares were quickly back at work. Six more 3 cu. yd. dumpers were received ; and by using spare scrapers also to carry spoil, it was possible to work five roads at once.

Throughout August and up to the middle of September, output from the five $\frac{3}{8}$ cu. yd. draglines averaged about 800 cu. yds. per day, while the 19 R.B. working on the north and east bank, piled about 200 cu. yds. behind itself. By mid-September the area up to road No. 4 had been completed, and two 19 R.B. Draglines were set to work from the remaining haul-roads.

Output was maintained to the middle of October, when heavy rain caused delay. The mud became almost unmanageable, dragline work was awkward and slow, and dumpers had increasing difficulty in reaching the dumping sites. However, on 23rd November, after a desperate struggle, the last bucketful of mud was lifted from the excavation, to the relief of all concerned.

The Lock

Work on the project was still far from ended ; the " hards " were in some places 2 ft. deep in mud, and in others covered by high dumps of spoil ; but nothing could be done until drier weather arrived. The lock, however, still remained to be built and about the middle of November, the Civil Engineer School produced a plan which met with general approval. Sheet steel piles were obtained

from Longmoor and some money found for other stores, so orders were given to go ahead.

The first task was to clear out the soft silt and mud from the area between the two dams, and backfill with gravel and rubble. A 19 R.B. Piling rig was able to work on this and, by the middle of January, a sheet steel piled sealing wall was driven across the entrance to the pond. Eight 30 ft. and twelve 25 ft. 12 × 12 in. concrete piles were then driven to support and key the 24 ft. square base of the lock. This base, of 2 ft. thick reinforced concrete, was completed in appalling weather at the end of February.

This work had all been undertaken by the Plant Training Squadron, with the help of various experts on piling and concreting. Now it was the turn of the Workshops, who completed the large mass concrete walls behind brick shuttering, and started to make the lock gates.

These were each constructed of two Bailey Panels, welded side by side and covered with steel plates. They were hinged at the bottom and were to be opened by lowering them with a small winch to a horizontal position on the concrete aprons of the lock. While these were being made, the Plant Squadron backfilled behind the walls with earth from Tower Hill, drove sheet steel pile wing walls and concreted between these to make sloping aprons. The inner dam was removed and at the beginning of May, with the gates in position, a dragline and dozer soon removed the outer dam. Soon water flowed into the pool and the Bridging School were able to get their equipment afloat.

Preparing the Hards

By the end of March, 1950, the area had become dry enough for plant work, dozers were soon engaged in forming the hards, and dumpers, loaded by face-shovels, were set to work on other heaps of spoil. By the last week of May the area between the pond and the river had been levelled, graded and partially covered with a 3 in. layer of ashes. Other dozers were brought in to start spreading the muck in the dumping ground. This, although it had been drained considerably, was still very glutinous. Dozers frequently stuck ; but gradually made more and more progress.

By the end of May, the pool was ready for opening, and in July fully in use. The Bridge Building hard had been surfaced with 6 in. of gravel and sand, and the spoil removed from all surrounds. A high platform for long landing bays had been built on the north bank and the old bridging pond was being filled in. The work of improving the site will, however, go on for several years. There is still much to be done in surfacing the access roads, improving the

hards, and developing the area between the new pool and Whitewall Creek. The work is all first-class training for the Plant Squadron, the men of which have worked with real enthusiasm.

Conclusion

The opening ceremony of the pool took place on the 1st June, 1950, in the presence of those who had contributed to the work. The lock gates were released by Mrs. Davey, who named the pool "Gundulph." As water entered, the Dean of Rochester offered up the following prayer :—

> "Oh Lord Jesus Christ who blessed and taught men by the lake of Galilee and whose mercy is over all Thy works, bless we beseech Thee this work of the Royal Engineers of to-day for the better instruction of Royal Engineers of the future. Prosper the Corps in all its works and ways, and ever keep them under Thy protection. And this we ask in the name of the Father and the Son and the Holy Ghost. Amen."

During the ceremony a plaque, set in a small monument by the lock, was unveiled by Brigadier B. C. Davey, Commandant, S.M.E. It bears the words :—

THE GUNDULPH POOL

THIS STONE COMMEMORATES THE OPENING OF THE LOCK IN JUNE, 1950. OFFICERS AND OTHER RANKS UNDER INSTRUCTION, EXCAVATED SIXTY THOUSAND CUBIC YARDS OF EARTH, BUILT THE LOCK AND MADE THE SURROUNDING HARD. THUS GOD'S MIRACLE OF THE TIDES BRINGS WATER TO THE POOL WHEREON GENERATIONS OF ROYAL ENGINEERS MAY LEARN THE ART OF BRIDGING.

THE FIRST SETTLEMENT OF EGYPT AND THE SUDAN

By Lieut.-Colonel C. E. Pierson, D.S.O.

POLITICAL and military events from the Egyptian rebellion of 1882 to the conclusive battle of Omdurman on 2nd September, 1898, have been covered in detail by many authorities. This most worthy period of our history affords so many examples of perseverance, loyalty, co-operation, resource and courage in battle and elsewhere that only good can result from making a summary of developments, followed by a selection from accounts which, in our opinion, will appeal to those whose wish for more enlightenment may have been stimulated.

Britain Accepts the Task

By 1875, when Great Britain bought Suez Canal shares, all European powers were concerned in saving the Ismail Government from bankruptcy, but as only Great Britain was prepared to take active steps in quelling the resulting military rebellion it was willingly left to her by all concerned.

Events Leading to Campaign of 1896–8

The naval bombardment of Alexandria and landing was in July, 1882, while the skilfully conducted flank movement of the British Army under Lord Wolseley completed the pacification of Egypt after the successful Battle of Tel el Kebir on the 13th September.

But many years were to intervene till the full effect of British guidance could be used, especially as the co-lateral rebellion in the Sudan, under the fanatical leadership of the Mahdi, had resulted in many serious reverses to the British-led Egyptian forces, culminating in the murder of General Gordon (26th January, 1885) who had been sent out on a mission against the slave trading and to hand over government to the more worthy chiefs ; and the final decision, after ineffective efforts at his relief, to retreat to the original border, leaving detachments of the newly formed Anglo-Egyptian army at its frontier posts. Thus the policy under the Liberal Government, which was replaced by a Conservative one in 1885, had been disastrous, having entirely failed to appreciate the situation and the urgency of an orderly Sudan to ensure Egypt's growing prosperity.

Economics

Prosperity of the world depends on easy communications. The Suez Canal route to Bombay is almost half that round the Cape and passes through countries of ancient civilization.

In Egypt itself the Nile irrigation scheme would increase the income by £500,000, the proportion of water wasted in the Nile above and below Khartoum through evaporation being immense.

It was obvious that a British naval and military expedition to the Sudan could be regarded as a mission of deliverance from barbarism rather than one of vengeance or selfish exploitation of a weaker power.

Geographical

The Nile, whose chief tributary rises in the Victoria Nyanza, excepting two bends round the Dongola and Berbera provinces, flows roughly due north into the Mediterranean and covers 3,400 miles. The part which was used in the operations from 1895–8 covers over 1,300 miles, made up as follows :—

Cairo to Hamadeh	340 miles (rail)
Hamadeh to Assuan	205 miles (boat)
Assuan to Shellal	5 miles (road : first cataract)
Shellal to Halfa	216 miles (boat)
Halfa to Dagash	247 miles (rail) (by Dec. 1897).
Dagash to Berber	115 miles (road) (railway after July 1898.
Berber to Atbara	23 miles (road) (do.)
Atbara to Wad Habeshi ..	110 miles (road and boat)
Wad Habeshi to Omdurman	66 miles (road)
	1,327

For cataracts see maps A and B.

Points to note are :—

The Dongola and Berber loops (see map B).

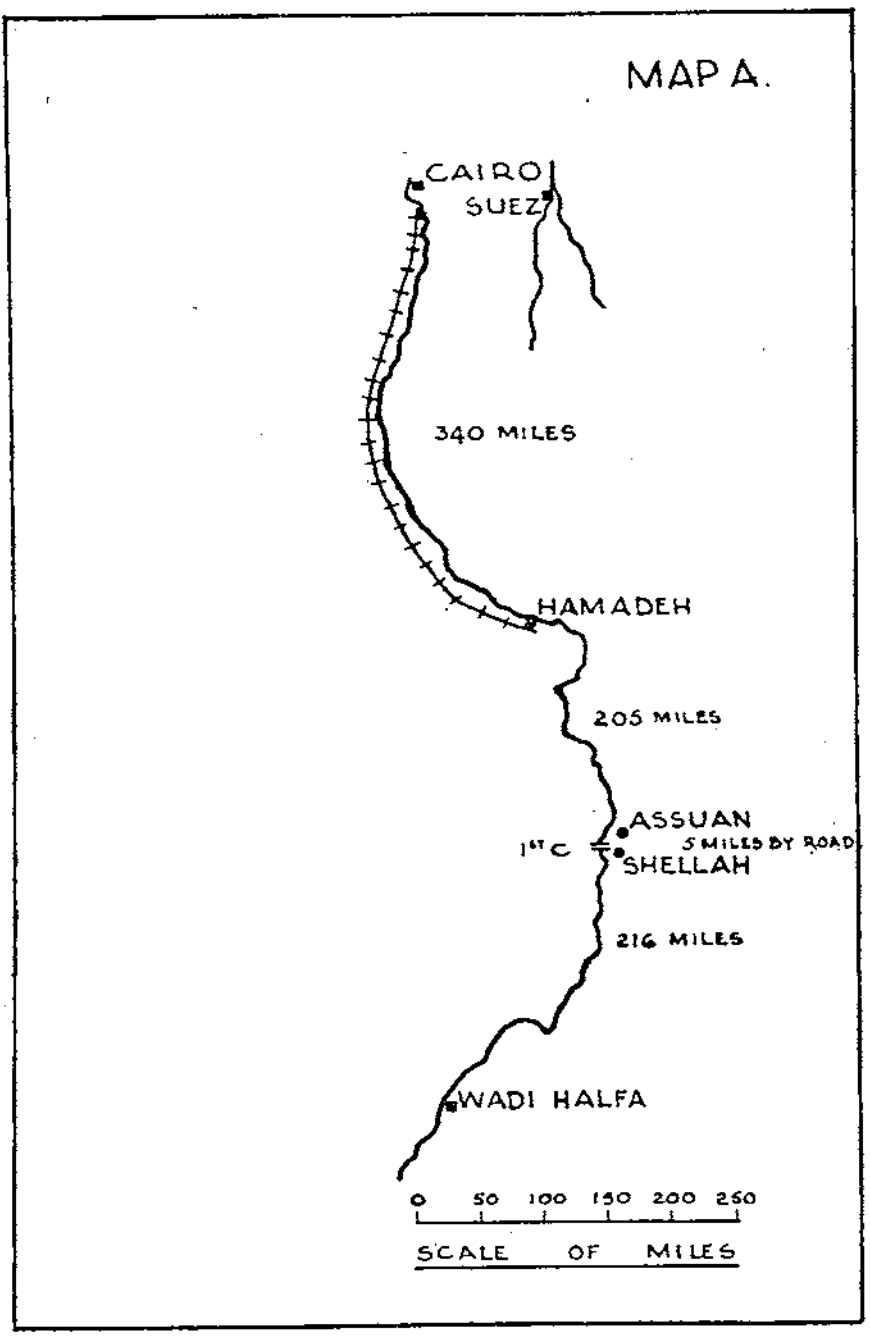
The need for changes of forms of transport due to cataracts, prevailing winds, water courses and short cuts.

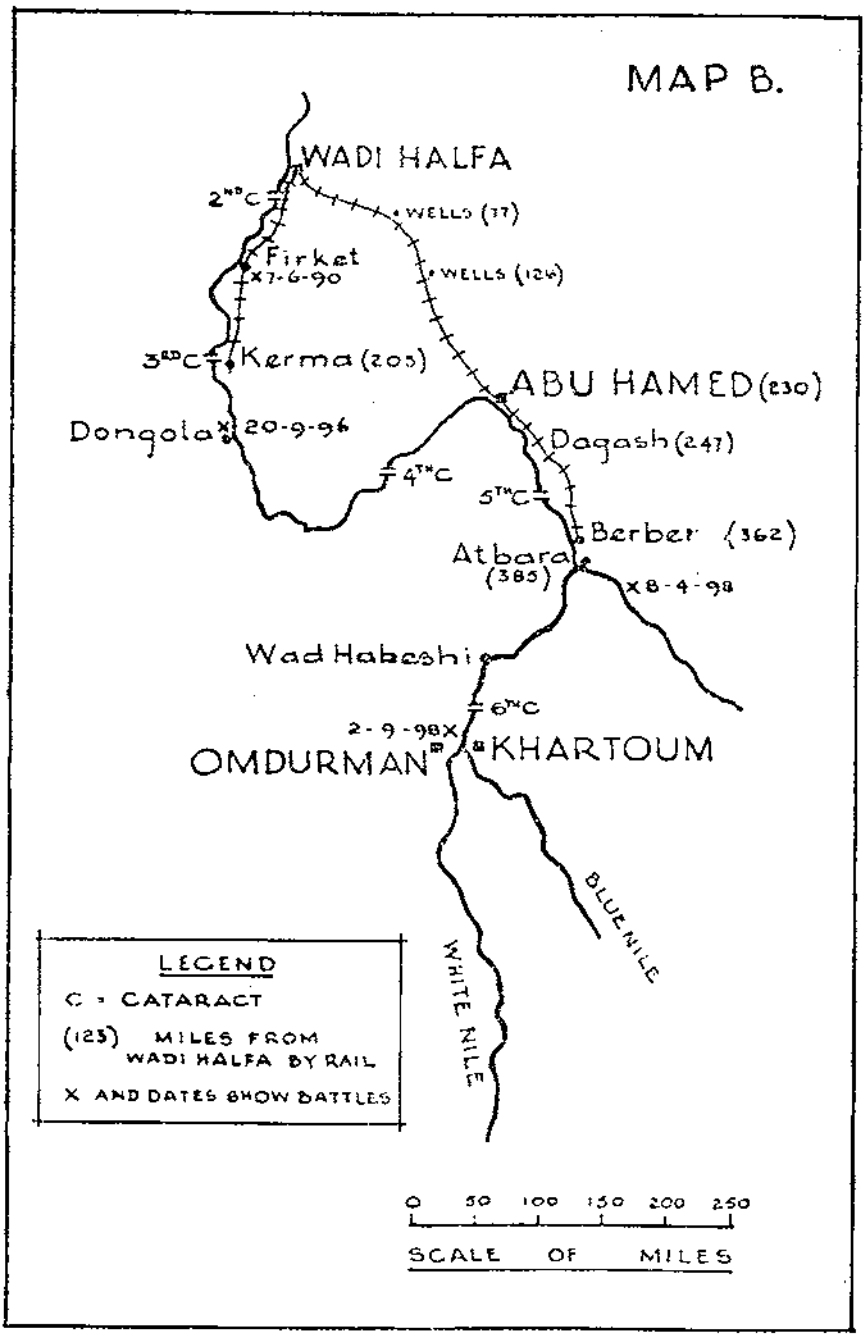
The Plan

From 1885 until the advance ordered by Lord Cromer to the Sirdar on 12th March, 1896, the British Government had determined to do all in its power, as means allowed, to restore prestige.

The responsibility for the final naval and military plan fell on Lord Cromer, the Consul General, and Lord Kitchener, then Sir H. Kitchener, who had been chosen out of several as Sirdar or C.-in-C. Egyptian Army, which had been developing steadily under British leadership in these intervening ten years.

The size of the force depended on the development of the river and rail transport, and their respective ability to overcome cataracts and water supply.


MAP A.
CAIRO
SUEZ
340 MILES
HAMADEH
205 MILES
ASSUAN
5 MILES BY ROAD
1ST C
SHELLAH
216 MILES
WADI HALFA
0 50 100 150 200 250
SCALE OF MILES


MAP B.
WADI HALFA
2ND C
WELLS (77)
Firket
7-6-90
WELLS (124)
3RD C
Kerma (205)
ABU HAMED (230)
Dongola
20-9-96
Dagash (247)
4TH C
5TH C
Berber (362)
Atbara
(385)
8-4-98
Wad Habeshi
6TH C
2-9-98
OMDURMAN
KHARTOUM
BLUE NILE
WHITE NILE
LEGEND
C = CATARACT
(123) MILES FROM WADI HALFA BY RAIL
X AND DATES SHOW BATTLES
0 50 100 150 200 250
SCALE OF MILES

If the Dervish Armies attacked, so much the better, in any case a superiority in efficiency and weapons would ensure a steady advance, which was eventually to be completed in two years three months.

First actions took place at Firket, 7th June, 1896, and Dongola, 20th September, 1896, both with little loss to the Egyptian Cavalry and Infantry Division, but great hardships and loss of life by fever were experienced at the depots and in railway construction along the Dongola bend.

Three more cataracts and the rugged condition of the river banks delayed progress and were the chief factors in the Sirdar's bold decision to construct the Desert Railway. Although General Hunter moved with a flying column by the river line to the capture of Abu Hamed in August, 1897, the main advance for troops and stores was by the desert railway, which was the chief factor in the success of the campaign. The 230 miles from Wadi Halfa to Abu Hamed was laid by August, 1897, and an extension to Atbara via Berber, of a further 155 miles, by July, 1898. Wadi Halfa had become a Crewe —Abu Hamed an Aldershot. The gunboats by August, 1897, had passed the cataract at Berber and obtained valuable information. The Mahdi had died in 1885, and was succeeded by the Khalifa at Omdurman. Mahmoud, in command of the advanced Dervishes, was making a stand on the Atbara. The railway had enabled a British brigade to assist in the attack on the Zareba, 40 miles up the dry river bed. After a Cavalry reconnaissance in force, a night advance was made on 8th April, 1898. By dawn a semi-circle of carefully disposed brigades, after an artillery bombardment, advanced from the north of the Zareba and with severe hand-to-hand fighting, went through it and put the remnants to flight.

Losses were 80 killed, of which 25 were British, and 500 wounded, out of 13,600. The Dervishes lost 3,000 killed, including 40 Emirs, many thousands being wounded, out of 20,000.

By midsummer the railhead was approaching Berber, which had been evacuated by flotilla action. The Sirdar now built up the force to 26,000 :—

One British Division of 2 Brigades, under General Gatacre ; 4 Egyptian and Sudanese mixed Brigades ; 21st Lancers ; Camel Corps—8 Companies ; Egyptian Cavalry—9 Squadrons ; 2 British Batteries and 5 Egyptian Batteries ; R.E. of 2nd Fortress Company ; 20 M.Gs. ; and flotilla of 10 Gunboats and 5 Steamers.

Concentration was made at Wad Habeshi, 66 miles from Omdurman between 23rd and 26th August, below the sixth cataract.

The 2nd British Brigade, under General Lyttleton, joined in August, consisting of 1st Northumberland Fusiliers, 1st Grenadier Guards, 2nd Rifle Brigade, 2nd Lancashire Fusiliers.

The 1st Brigade, as at Atbara consisting of 1st Warwicks, 1st Lincolns, 1st Camerons, 1st Seaforths, was now under General Wauchope. The last four marches from Royan Island were made in battle formation into Zareba camps : 21 days' rations were distributed ; 14 in the steamers, 5 in regimental barges, 2 with the troops. The final Cavalry and Camel recce. on 1st September found over 40,000 Dervishes massed near the city facing the advance; the Khalifa scheming to destroy his enemy by direct assault and encirclement, which his great numerical superiority appeared to justify. The night of 1st–2nd September was spent in great anxiety, in the semi-circular zareba with the Nile behind, for fear of night attack on the army in battle array on the river bank. Fortunately the Khalifa, dividing his 53,000 Dervishes into some half-dozen masses under Emirs, had decided on a dawn advance to overwhelm his enemy and drive the remnants into the river. The battle was in two stages, first, the attacks which were held, being almost destroyed by the disciplined fire of the gunboats, artillery and extended lines of our well-directed infantry, after which the Sirdar ordered Brigades to advance and wheel left in echelon so as to give no time for the Dervish remnants to reform in Omdurman and there fight a defensive battle. During this movement, there were two unco-ordinated attacks by concealed reserves of some 20,000 Dervishes, concentrated chiefly on Macdonald's rear Brigade from west and north respectively. The Lincolns sent from the 1st Brigade (brought back to his support) arrived just in time to restore the situation, with fire and movement on the critical northern flank, after which the advance to Omdurman was resumed, the remnants being driven away south and west by cavalry and long-range infantry fire.

A night of utmost discomfort followed in and around the town : the Union Jack and Egyptian flag were hoisted on the next day in Khartoum with honours.

British losses :—

3 British Officers killed	17 wounded
30 British O.Rs. killed	136 wounded
30 Natives killed	300 wounded

Some 550 total out of 26,000.

The 21st Lancers (killed 24 ; wounded 70) sustained by far the greatest percentages of casualties, through their being surprised by 3,000 Dervishes hidden in a nullah, when charging another body estimated at 300.

Enemy losses :—

9,700 killed 5,000 prisoners 15,000 wounded

"Thus ended the battle of Omdurman, the most signal triumph ever gained by the arms of science over barbarians.

Within the space of five hours the strongest and best-armed savage army yet arrayed had been destroyed and dispersed with hardly any difficulty, comparatively small risk and insignificant (i.e., 2 per cent) loss to the Victors." "*River War*" *by Winston S. Churchill, published in 1900. He took part in the battle as a Troop Leader of the 21st Lancers.*

The cost had been a mere £2½ million, of which the troops cost £1 million, the rest was materially productive on railways, river and telegraphs as they contributed to the pacification and prosperity of the Sudan, and incidentally to the honour of the British Empire.

The vital part played by the Desert Railway and Telegraph from Wadi Halfa to Abu Hamed, 230 miles, and its extension by another 155 miles to Atbara calls for reference to *The R.E. in Egypt and the Sudan* by Lieut.-Colonel E. W. C. Sandes, D.S.O., M.C., R.E. (retd.), published in 1937 by the R.E. Institution: Chapter IX. Here it is seen that its success was primarily due to the Sirdar who organized it, chose the staff with Lieutenant E. P. C. Girouard, R.E., as director and his adviser, and took on himself the great responsibility of selecting the best gauge, finding water and overcoming adverse opinion of eminent railway engineers as to its possible completion. The same strength of character was equally valuable to his country eighteen years later, by inspiring many thousands to enlist in divisions bearing his own name and acquiring their own special *esprit* which has seldom if ever been surpassed. Colonel Sandes's history has excellent pictures and maps, and shows in Chapter X, page 252, how the Sirdar's achievements were in no small degree due to his selection of as many as seventeen officers of the Corps to be actively engaged in the final battle.

For official eye-witness account see *With Kitchener to Khartoum*, Blackwood 1899, by G. W. Steevens. This concise and scholarly survey of the campaign and its causes is becoming almost extinct.

Another Eye-Witness

There are not many survivors who were in the final battle, so it will be interesting to add a note by Mr. S. W. Harries who, as a Grenadier, served with the 1st Battalion in the reinforcing 2nd Infantry Brigade. He enlisted in 1897 for five years' colour service and then joined the police. Though this birthplace is at Kidwelly in Camarthen, he has for many years been a much-respected inhabitant of Woking.

Through natural modesty he has made no mention of the fact that only supreme fortitude and self-control enabled anyone to pass through such experiences without going sick, as did so many in the 2nd Brigade, due to their having no time to get acclimatized to the severe tests to health from weather and sanitary conditions in this campaign.

"We, The First Battalion, Grenadier Guards, were stationed at Gibraltar in 1898. In July of that year we were ordered to join Kitchener's Army in the Sudan Expedition. As part of the 2nd Infantry Brigade we left Gibraltar on the Troopship *Julunga* on July 19th. After a tedious journey by boat, train and foot we arrived at Wad Habeshi about the middle of August. There the rest of the Army were assembled before making a general advance. On 26th August the real business began. We were all served out with 100 rounds of ammunition. We marched for several days through loose sand and rough bushes, under very hot sun with very little water. Several men needed medical aid. On September 1st reveille was at 4.30 a.m. We had breakfast and were on the move by 5 a.m. There had been a storm during the night and we were wet through when we started but soon got dry with the hot sun, and had benefited. This last march to the river position was very trying too, being so rough under foot. About 11.30 a.m. we were struggling along, very weary with it all, when we heard gun-fire ahead which put new life into us. The Kerreri ridge of hills prevented us seeing far but later we discovered that the gun-boat had opened fire.

"At 12.30 there was a lull so we stopped to partake of some bully beef, biscuits and hot tea, when a sudden alarm was given that the enemy was advancing in great force: so we had to get into battle formation and eat at the same time, and we waited some time at the ready. Then our scouts informed us that the enemy had made a halt so we were to rest. We were not very perturbed. We had great faith in our Leader and Commander-in-Chief, Lord Kitchener, and our officers, and felt that they would get us through, whatever our position. We expected the enemy to make the attack under cover of darkness but, to our relief, it was not till the next morning that he made the attack on our position. Our scouts were out: they sent word that an immense body of Dervishers had formed into three groups and were making straight for us. We could hear their hideous war cry—once heard never forgotten. Then we saw them advancing, thousands of them, their white banners flying. There was perfect silence on our side, we were waiting for the order to commence. Suddenly the silence was broken by the Artillery on our left and the battle opened up. Our fire was playing havoc on their massed advance: we felt what brave and fearless leaders they had for they came galloping up through tremendous fire, urging their followers on. One could see horses and riders brought down and others spring into their places. At that phase of the battle a body of horsemen appeared, apparently about to charge, when it seemed as though all our fire was directed on them. We experienced no further trouble from that quarter. Soon, the enemy's main body seemed to be breaking up.

"At about 10 a.m. our Brigade, which was on the extreme left, received orders to move forward in line, wheeling to our right. Here we came into action for the second phase of the battle. By pressing on we caught up with the left of the Su anese Brigade, when two large forces of the enemy were seen in the scrub. Their presence threatened the British left: it was at once detected and smashed up, chiefly by artillery fire. The whole Army continued to advance while firing. This did not cease until noon, when the enemy appeared to have had enough and took to the hills, the Egyptians pursuing with the Cavalry and Camel Corps.

"Omdurman was still a few miles away. Kitchener's intention was to advance and take possession but so many men were exhausted that he decided to halt and rest. A few men were sent down to the river to get water for the troops, which was a mixture of mud and sand, and brown in colour but very precious. It was no wonder there was so much fever and dysentery. We then had our usual meal, viz., bully beef, biscuits and tea. About 4 p.m. we were ordered to get ready to advance, feeling much better for the rest. When reaching the outskirts of Omdurman the different regiments were ordered to take different routes through the city. We anticipated some fighting but were greeted by screaming women. One attacked a man who was carrying a captured banner: she fought hard for it but in vain. We reached the other side without serious trouble and soon got into the open, where we were commanded to halt and form the usual square. I was told off that night for outpost duty and felt quite safe on patrol, for we had one of our finest officers in the Guards in command, Lieutenant Harvey Bathurst. We felt we could follow him anywhere. That was the last of our operations and thankful we were.

"At the end of the Campaign we might ask ourselves, was it worth it? I say a hundred times, yes. It meant the liberation of the Sudan from a great and cruel tyrant and his evil forces. We also felt that the success of the Campaign was of vital importance to the prosperity and well-being of the country. One also felt it was a very just cause we were fighting for. The enemy had been guilty of murder and pillaging for years. A few months previous to our arrival the brutes had slain over a thousand Jaalins, a peace-loving tribe. Our scouts discovered near Metemmah the last Jaalin camp, where more than a thousand poor bodies lay about in the sand, dried into mummies by the heat. These poor souls had been slain by the brute, Mahmoud, while on his way down country to Atbara. Fortunately, the 1st Brigade captured him at that battle, for his followers had also been the murderers of the beloved General Gordon. No doubt our success gave a great blow to the hideous slave traffic. Among our prisoners we found a poor German schoolmaster who had been their slave for years, in chains. His name was

Neufelt. He became the guest of our officers. No doubt, these horrors and worse, could be multiplied by the score. I had a feeling that the Providence of God was over us, else why did our enemy refrain from attacking under cover of darkness for it would have been greatly to his advantage and much more serious for us. He was in the position to attack the previous afternoon. So let us thank God for so great a victory at so small a cost.

" Mr. Steevens, in his account, criticizes the zareba defence as being more costly in casualties than a trench ; we knew this but had no time to make one. Also he blames the cavalry for making their very costly charge ; on the other hand, as we ourselves found, it was very easy to fall into an ambush in the undulating waterworn ground which all had to traverse.

" My battalion remained at Omdurman for some days on various duties until urgent orders came for it to deal with trouble in Crete. We set off in gyasses and on the first night a heavy storm overtook us, sinking many and causing widespread confusion and loss of property. The Northumberland Fusiliers overtook us and themselves embarked on our Crete transport, leaving us to return home to London, where we were received by the Duke of Cambridge amidst general enthusiasm from the British public. We took station there, with all normal duties of the Household Brigade, until the opening of the South African war."

AN APPROACH TO THE CIVIL ENGINEER

By MAJOR J. S. W. BENNETT, T.D., R.E.

AS future war increases the volume of big work to be done it may demand the virtual integration of the Royal Engineers and the civil engineering industry. Such an integration will only be successful if it disturbs the existing civilian organization as little as possible and if the military engineer and his civilian opposite number are speaking the same language.

To this end the Royal Engineer may with advantage cultivate a wide acquaintance not only with the work of consultants, contractors and departmental engineers, but also with that of their associates in such diverse fields as, for example, geology and conveyancing. He should seek to comprehend the civil engineering industry in all its aspects, from provisioning to professional etiquette, so that he may the better use it as a weapon should it ever be put into his hand as such.

Since to understand the man is to be far towards understanding the nature of the industry itself, it is of value to appreciate the special problems that confront the civil engineer and the characteristics and habits of thought which they engender in him.

The industry, in partnership with its sister Architecture, is an old one which during the last five hundred years has been concerned with the improvement of techniques relating to existing structural forms. For since the problem of superimposing a circular dome upon a square base by means of a vaulted construction, without recourse to beams, was finally solved in Hagia Sophia in the middle of the fifteenth century, no new structural form was developed until the recent advent of the reinforced concrete membrane. It is therefore one of the diminishing number of the fields of man's activity in which man and his techniques have kept pace with one another. Its principles are understood and applied by large numbers of competent men engaged in its practice and through them it emerges as a broad and stable humanism.

It requires of those who embrace it three principal attributes.

Elsewhere the possession of a "feeling for engineering" has been assessed as an invaluable asset to the engineer. It has been described as an instinct, not owing itself wholly to any combination of practice and precept but springing from an almost subconscious appreciation of the needs of the task. That this is true there can be no question. In what follows, this attribute will be referred to as "technical ability," a term intended to convey something more than the formal application of technical learning to the solution of a particular problem.

Yet a man possessing this ability only will certainly be relegated to a minor rôle in the civil engineering hierarchy, for there are two other important attributes necessary to him. The first of these can best be illustrated by an anecdote.

A famous civil engineering contractor was asked to give final approval to the draft of a tender which his firm was about to submit for a contract. The draft was a document of forty or fifty foolscap pages expertly prepared by an experienced staff. He glanced through it for only a few moments, during which his feeling for engineering was satisfied. The other attribute, one that put him in the chair he occupies, then came into play. Turning back towards the beginning of the draft he encircled with pencil a single figure. "Add," he said, "another three shillings a yard to the cost of excavation and I will approve it." That addition proved later to represent the final profit on a successful contract.

The civil engineer, in whatever capacity he serves the industry, consultant or contractor, is always faced with the question of cost in terms of profit and loss to himself and to his client. It colours his

approach to every problem and is the final arbiter in most of his decisions.

To do well for two shillings and fivepence what anyone can do for half-a-crown is his passport, not merely to professional advancement but even to continued employment.

It will be recalled from the story of *Collette* that the Commandant of St. Cyr said of the cadet who eventually met her that he would be the envy of his confreres for a generation. But he added that the cadet who thought up the scheme that furnished the money would one day be a Marshal of France.

For every hour spent by the civil engineer in the purely technical solution of engineering problems many more hours are spent in assembling as economically as possible money, men, material, transport, plant and fuel, in arranging accommodation, supervising staff, watching welfare and ensuring that he is not overwhelmed by his own overheads.

The second attribute required of the civil engineer is, then, a power, preferably inborn, dextrously to handle the economy of the industry. This is the middle third of his professional competence, buttressed on the one side by technical ability and on the other by developed powers of man management.

The methods and practices of civil engineering are based upon financial considerations that are paramount. In civil engineering they hold the place which logistics occupy in the business of soldiering. Yet these methods and practices have been evolved, over long periods, to save both time and material and the military engineer should be slow to assume that he is in a position to instruct the civil engineer in these matters when they become colleagues. Further, the experiences of the last decade have given the civil engineer so much practice in the solution of problems arising from shortages of labour and material that both he and the military engineer meet here on common ground.

There are, nevertheless, occasions when the soldier's acceptance of the pressure of necessity must warrant a modification in the civilian's attitude. The prodigal use of labour, uneconomical use of material and qualification of specifications for a limited " life " are expedients to which resort is made more often in engineering in the field than in the heavier work that this article envisages. But in war, since the military problem so often revolves round the availability of time to the exclusion of other considerations, the military engineer engaged in heavy work may consider himself compelled to adopt methods which are at times frankly uneconomical, and to the acceptance of which his civilian colleague may need to be persuaded.

In parenthesis, it is worth while to reflect that whereas circumstances may cause a soldier to spend many years without opportunity

to test his training in the fire, yet from the moment of leaving his school or university the civil engineer is in the field and stays there throughout his career, a hardening process inducing a vigorous self-reliance among the survivors. Yet the material rewards he receives in his competitive calling are rarely commensurate with either his ability or his achievement. Part at least of his reward springs from a requited creative impulse and a strong sense of vocation.

In the third attribute, an ability to manage men, we have a field in which the Royal Engineer may expect to meet his civilian brother on equal terms from the outset.

It is well to consider that in this field the civilian achieves results solely by the exercise of a robust personality and a keen eye to the minor humanities. He has no status save that of his own creation. Where he cannot lead he will not be able to drive. His standards of discipline are not less important to him simply because he must apply them in a manner more subtle than that which, in the last resort, is required of a soldier. And the raw material with which he works, miner, steel erector, plant operator and the rest are hard, not docile men, swift to resent any supposed trespass, with an ear half cocked to political agitation, but with a keen sense of the ridiculous and a fierce self-pride.

I have spoken of economic facility as the middle third of the pillar of successful engineering practice. This does not imply that it is the most important part, though without it nothing else can stand. Each of the three parts is essential to the others and each of equal importance, though, of the three, technical competence can be bought the most cheaply.

The civilian engineer of stature then, the man with whom the military engineer must deal if the civil engineering industry is to be an effective weapon, is of a robust attitude of mind. He combines technical ability with the power to handle men, peers as well as subordinates, according to his will and in a field where compulsion by disciplinary power is virtually unknown. Upon this firm foundation he bases a clear-sighted appreciation of time and cost in all their manifold interrelations and he will regard as dilettante whomsoever may not comprehend their significance.

These three attributes will not always be found combined in one man and only at the highest levels are they sure to be. Elsewhere they may be embodied in a triumvirate, but to recognize them in their correct relation to one another is necessary for our right estimate of this industry and our acceptance into partnership with it.

THE LEVANT ENGINEER BATTALION

C.R.E's. Headquarters ; 1216 (Levant) Road Construction Coy. R.E. ; 1226 (Levant) Artisan Works Coy. R.E. ; 1227 (Levant) Artisan Works Coy R.E.

By His Honour Brett Cloutman, V.C., M.C., K.C.,
Official Referee of the Supreme Court,
(late Lieut.-Colonel R.E.)

From the wilderness and this Lebanon even unto the great river, the River Euphrates, and unto the Great Sea, toward the going down of the Sun.

Book of Joshua,
Ch. 1, v.4.

The Levant

THE Levant from the Island of Cyprus across the Gulf of Alexandretta to the Turkish border ; east to Aleppo and the Orontes, across the Syrian Desert to Palmyra and the Euphrates ; south to Damascus and Mount Hermon and west to the Bekar Valley with the great Temples of Baalbek ; through the Cedars of Lebanon and back to Beyrout and the Mediterranean coast ; this is an area full of historical interest and natural beauty, but a strange recruiting ground for a battalion of the Corps of Royal Engineers.

It began like this. In June, 1943, the R.E. Training Depot at Moascar on the Suez Canal was called upon at short notice to house and hold for an indefinite period some 1,000 Syrian and Lebanese recruits intended for work as labourers in the docks of the Middle East. These unexpected visitors seriously disturbed the programme of the depot which, after six months, was getting into its stride on conversion from a base camp to a training depot.

Two decisions were taken. First that the depot would not be used as a transit camp for stevedores ; but that having been sent there, every effort would be made to hold them and train them as recruits for the Corps. Secondly that in view of the continued warnings of shortage of manpower in the Army and of the need to utilize skilled workers at their trades, the fresh material would be carefully combed with a view to retaining the more promising men for R.E. works units.

Recruit Training at the R.E.T.D.

Accordingly the training commenced on fairly standard lines, except perhaps that the newcomers had to be taught the very elements of European hygiene ; to sit at table instead of squatting ;

that if they liked to eat bacon it would not poison them, even if they were Moslems ; that table knives were not issued for the purpose of being ground into daggers by some native craftsman in the adjoining town of Ismailia ; and that we rather discourage the observance of Ramadan, when for a whole month good Mohammedans fast all day and get sleepy, and feast all night and make a noise.

Also they had to learn enough English to understand the names of their tools and of Engineer equipment. These endeavours seemed odd two years later, when the *lingua franca* of the battalion was quite undoubtedly Italian.

On the whole training went well through the summer of 1943 ; and, as opportunity offered, those who were unlikely to make sappers were drafted away to docks operating companies for work as stevedores.

Regrettable lapses of discipline there were, including a distressing tendency to run hashish from Syria into Egypt where it could be sold for large sums ; and also to " flog " Army kit and blankets, and to reappear in Arab-town dressed in the native gallabeya.

The Cypriots

In November there was another surprise in the form of some 200 Cypriots sent over to be trained into an Artisan Works Company. Whilst it is true that this draft contained a certain proportion of reasonably useful tradesmen, the task of training them into soldiers did not sound any easier when it was learned that these " volunteers " were, in the main, the contribution of the Cyprus Communist Party to the war effort. Indeed when it was discovered that they comprised some of the most " difficult " elements in Cyprus, it sounded quite awkward ; but it must be added that for the first three months at least they were an exceedingly well-behaved body of men.

In any case the training system of the R.E.T.D.—the " Sausage Machine "—stood up to the strain, and in due course Syrian-Lebanese and Cypriot training parties " passed off " on the square and were a real credit to their instructors. It was almost touching on one of these inspections to notice a newly tattooed Union Jack on a brown Syrian arm, quite covered with flies !

The Companies

The next problem was to organize this material for war, and, applying the maxim *Divide et Impera*, it seemed wisest to form companies half of Syrian-Lebanese Arabic-speaking, and half of Cypriot Greek-speaking personnel, with British Officers, senior N.C.Os. and a proportion of sappers and drivers.

On this basis it was possible for the R.E.T.D. to offer to G.H.Q., M.E.F., one Road Construction Company and two Artisan Works Companies. These were in time offered to C.M.F. and accepted. They became 1216 (Levant) Road Construction Company; 1226 (Levant) Artisan Works Company; 1227 (Levant) Artisan Works Company.

They were ultimately fused in the Levant Engineer Battalion, whose device shows the Lion of Cyprus beneath the Cedar of Lebanon.

The somewhat optimistic memorandum proposing this formation is dated December, 1943 (Document A).

The units being now officially authorized, there was more than a little competition, both among officers and senior N.C.Os. at R.E.T.D. for posting to the new formation. The highest standard that the depot could produce was called upon for this British cadre, every Officer and N.C.O. being personally interviewed, and it is certain that nothing less would have made a success of this experiment.

Company Training

So the training continued for yet another three months on a company basis. Platoons were sent to the School of Military Engineering at Gebel Maryam for bridging camps, and the special training that was asked for and given in "delaunching" and removing Bailey bridges erected by parties of British students was of real value later in the Italian theatre..

Platoons were also sent out on building projects under the Works C.R.E. and on welfare schemes at Geneifa, Tahag, and Tel-el-Kebir: and this training also was of direct importance in teaching platoon officers to make the most of their very limited resources of competent tradesmen.

The most exacting task was no doubt the training of Arab drivers and a small proportion of operators excavator for the Road Construction Company. Ultimately British drivers had to be found for the heavy duty vehicles and for most of the engineer plant; but in general and after much weeding out and more than a few accidents, the necessary grade was reached for 3-ton lorry and tipper drivers.

The disheartening aspect of this training work is well recorded in the *cri-de-cœur* of a subaltern in February, 1944, (Document B).

Overseas and Route 16

On the 7th April the companies were inspected by the Deputy Engineer-in-Chief, M.E.F., prior to their embarkation, and a personal note which he sent to C.M.F. after his visit is given in Document C.

Soon after, the companies left Egypt and reached Taranto in May, being eventually deployed along the great Adriatic highway to Eighth Army, known as Route 16. There in Termoli, Vasto, S. Vito, and Pescara they remained until November.

In June an officer in regimental command of the units formed an unduly depressing view (see Document D) ; but in spite of all this a great deal of work was done and well done.

There were amusing incidents also. Who but a " Leb " could contrive to lose his A.B. 64 (pay book), and get punished for his carelessness ; and then within a week bring it back triumphantly on the shoulders of his colleagues ! It had been found in the corner of a field securely guarded by a 4-ft. snake coiled on top of it !

Then there was the Sunday afternoon football match between British and Italians watched by some hundreds of enthusiastic Italian villagers. As usual the game ended in a fight and the British team were being beaten up. The Arabs soon took a hand and their guard turned out with rifles. Firing wildly into the air as in a desert " fantasia " they terrified the locals who scrambled for safety and the ground was cleared in less time than the story takes to write !

The principal achievement on works was certainly the delaunching and removal for use in battle of over 2,000 tons of Bailey Bridging by one A. W. Company alone, including some of the most difficult mountain sites in Italy. The last job was the clearance of the Sangro Bridge, a quarter of a mile long and the longest Bailey in the world, and the substitution of a " Flambo " bridge on the same site.

Meanwhile the Road Construction Company had mastered the technique of manufacturing and spreading " premix " bitumen carpet for the section of Route 16 from Vasto to Casalbordino Junction. The American bitumen used was difficult to handle and the task as left by the company was a credit to it.

The letters in Document E show that their work generally was not allowed to pass without recognition and appreciation and that the formation had proved its worth.

During this period the companies had been officially formed into the Levant Engineer Battalion under their own H.Q., and as a battalion they now moved to Naples.

Lammie Camp

The battalion's new task was not an easy one. It was the construction of a great luxury camp including wine bar, a cinema, a theatre, post office, and welfare centre—a most remarkable range of amenities for the British soldier.

The task took four months and at the end of it Lammie Camp on the Autostrada, was one of the best overseas camps in the British Army. A letter from the Chief Engineer is Document F.

But again there were many difficulties. The battalion was quartered in the most appalling slums of one of the worst slum cities in Europe. Losses by theft were incredible. Eight thousand sheets of corrugated iron were stolen from the camp while in charge of Italian armed guard ; one company suffered a loss of £1,500 worth of tentage ; and worst of all, on Christmas Day a riot broke out in which the Italians attacked a party of Levant troops, who retaliated with considerable violence. A Cypriot soldier was murdered and an Italian woman killed during the firing which followed.

Route 67 and the Forli Pass

Perhaps this was one reason why, on completion of the camp, the battalion was moved close up to Eighth Army on the eve of the attack of the 9th April. From Dicomano, near Florence, and over the Forli Pass to Forli itself and adjacent routes, they were required to maintain 100 kilometres of mountain road comprising an extensive programme of bridge reconstruction and Bailey removal ; opening up and working a number of quarries and laying a stretch of premix bitumen carpet over the mountain pass and round the hairpin bends for several kilometres on either side.

There on their mountain task, Peace Day overtook them in May, 1945.

Finis

That in substance is the story of this war-time expedient. This at least is certain ; that for a full year the Levant Engineer Battalion replaced a similar number of British troops, and this replacement was a contribution planned in the Middle East to help out the manpower shortage of the R.E. in Italy.

When the battalion dispersed, in part to the British Isles, in part to Cyprus, and in part to the new Republics of Syria and Lebanon, it left behind it a series of tasks, which, if not spectacular, were none the less creditable.

That the training and handling of these troops was a trying and thankless task, no one knows better than the writer of this note. But those who saw the job through will take away with them memories of men of the Levant—men of little education and less manners—and yet men who on the whole loyally stuck to their work and to their Officers and N.C.Os.—men who went back to their villages with different ideas of life because they served in the British Army.

DOCUMENT "A"

December, 1943.

A MEMORANDUM RELATING TO THE PROPOSED FORMATION OF CERTAIN UNITS OF COMPOSITE NATIONALITIES FROM PERSONNEL NOW AT R.E. TRAINING DEPOT, M.E.F.

1. *Generally*

As appears from the modified W.Es. sent herewith, the proposal is to form :—

1 Road Construction Coy.
2 Special Artisan Works Coys.

being companies each with two standard sections with their normal establishment of tradesmen and two sections of pioneers working under R.E. Officers and N.C.Os.

The proposal is based on the trades and training capacity of some 700 non-British personnel, divided into 250 Cypriots and 450 Syrian-Lebanese and is subject to the ruling that no unit is to include more than 50 per cent of the latter.

2. *Trades*

The Cypriots comprise the necessary number of tradesmen of a fair standard ; also some twenty-five Drivers I.C. The Syrian-Lebanese on the other hand include very few competent tradesmen; they produce very useful working parties and have been so employed on works in the Canal area for some months ; a considerable number have been trained successfully as Drivers I.C. and the necessary number have been trained as Operators Excavator.

In both cases careful and continuous supervision is required on maintenance and this will be necessary for some time ahead. As Operators Excavator they have proved satisfactory on straightforward work under supervision. Considerable practice is needed before they will be competent to undertake the more difficult work, and for this reason a large proportion of B.O.Rs. is included in this trade.

There are also a number of the more technical trades in which (as appears from the proposed W.E.) it is deemed advisable to allow for B.O.Rs.

3. *British Personnel and Interpreters*

Officers to be British in all three companies with the exception of four Cypriot officers who appear, after a month's work, to be both reliable and competent.

N.C.Os. to be British down to and including the rank of full Corporal, but a number of Cypriots bid fair to make good N.C.Os.

In all companies the Lance Corporals will be non-British.

As to the Cypriots there are ample interpreters from the officers downwards. As to Syrian-Lebanese the interpreters will be in the main Lance Corporals.

Reinforcements for the Cypriots will be available to a limited extent from the Cyprus Regt. Base Depot, in common with other Cyprus units, and for the Syrian-Lebanese from R.E.T.D., in each case after passing through R.E. Training Depot.

4. *Control*

The units proposed to be formed will in substance be the equivalent of one Road Construction Coy., one Standard Artisan Works Coy. and one Pioneer Coy. of eight sections including its own R.E. supervisory personnel.

Handled as a group this should form a flexible and useful organization. This is advisable for three reasons :—

(*a*) For the normal purpose of suiting the personnel to the work.

(*b*) For the particular purpose of adjustment of trades and Cypriot and Syrian-Lebanese N.C.Os. within the sub-units. Since the scope of movement in a composite unit is so much less than in a homogeneous company, cross postings within the group must become necessary more often than in British Units.

(*c*) For reasons of administration and discipline that will be separately discussed.

5. *Discipline*

A question has been raised as to the effect of discipline of composite formations as now proposed.

The answer is that with firm handling, very high regimental standards, and the best available quality of British personnel, there is no reason for apprehension.

Curious as it may seem, crime has been practically unknown among the 250 Cypriots during the month that they have been at R.E. Training Depot. They mix readily and well with British troops. Their education is (on Middle East standards) exceedingly good and their keenness on training is remarkable.

The Syrian-Lebanese have been most carefully selected from over 1,000 that have passed through R.E. Training Depot. They are amenable to discipline and when at work or on parade they are most satisfactory.

On the other hand they are not recruited from the artisan class, are not educated and must be kept up to the mark in matters of hygiene, etc.

Accordingly it is of exceptional importance for the efficiency of these units, that high standards of discipline be imposed and maintained at every point and that every opportunity of continuing training, including tuition in English, be seized and exploited.

There is no doubt that this can best be achieved by holding them as a group of units under their own H.Q. They would thus be subject to continual internal supervision and the objects set out in para 4 (*a*), (*b*) and (*c*) would be attained. Works supervision and control would be a normal function save as to units detached under a Works C.R.E.

DOCUMENT "B"

A Letter from a Subaltern Who was Chosen for his Ability and Character to Take Charge of an Early Party of Syrian-Lebanese in 1943

Commanding Officer,
R.E.T.D., M.E.F.

February, 1944.

Sir,

I wish to refer to the circumstances of my attachment to the Palestine Depot Coy. for duties, which took place in early December of last year.

At that time I had expressed my interest in the formation of an Airfield Construction Group from personnel in that depot, and in consideration of your outline of the possible course of events in that direction, expressed my willingness to be considered for a position in the formation.

Since that time I have been engaged with a section in the supervision of training and discipline and have discharged the duties associated with my position as Section Officer, to the best of my ability.

In this experience, I have found these men to be extremely difficult to handle; in the majority, unintelligent; very inconsiderate about their personal hygiene; and what is to me a very important failing, quite incapable of being entrusted with the type of work in which I am most qualified to serve in the Army.

I have considered this matter very carefully and conclude by stating that I have no further desire to be embraced in the formation of this Syrian-Lebanese Unit, and respectfully request you to make me available for posting to a more suitable appointment.

Should you consider it desirable, I shall be very willing to see you personally, and to amplify my viewpoint in this matter.

Note.—This officer was persuaded to remain with his company and eighteen months later was thought not to regret his decision—much.

DOCUMENT "C"

A REPORT FROM THE DEPUTY E.-IN-C. M.E.F., AFTER INSPECTING THE UNITS ON PARADE AND ON WORKS ON 7TH APRIL, 1944

I went down yesterday to see the three units which have now completed their training and are waiting transfer to you. I saw them both on parade and at work. I also had a look at their G.1098 and vehicles. I must say I was very agreeably surprised at their turn-out and general bearing. Mind you, the officers and B.O.Rs. which are the backbone of the units have been carefully picked and at the moment are full of enthusiasm. They have not had an easy job as the Cypriots and Syrian-Lebanese are very temperamental and are rather apt to stage a form of "strike" if they think that their grievances (usually entirely imaginary) are not receiving sympathetic consideration. The most usual form of "strike" is to refuse all food! There has been no real difficulty in dealing with these incidents but the Company Commanders have needed the assistance and support of the O.C., R.E.T.D. under whom they have been working during training. I feel therefore that the Cs.R.E. under whom they are going to work should be briefed as to their peculiarities and should be asked to keep a very fatherly eye on these units until they are really settled down.

As I say, they are all full of enthusiasm at the moment and all, that is, British, Cypriots and Syrian-Lebanese, are working well together.

Although in the Artisan Works Companies the Cypriots and the Syrian-Lebanese are organized in different sections, in the Road Construction Coy. they are mixed up. They sleep separately and they mess separately, although they use a common cookhouse, and eat the same food, except that the Syrian-Lebanese won't eat bacon. It was hinted to me three months ago when we started to form up these units that the Cypriots considered themselves superior to the Syrian-Lebanese and took a poor view of being mixed up in the same unit with them. This hasn't been borne out in fact so far but it might be used as a complaint if a unit is allowed to get browned off and discipline relaxed.

I hope I don't sound depressing about these units; they are an experiment and so far I think the experiment is a success and I should hate to think of any of them coming a cropper through lack of understanding by their Commander.

DOCUMENT "D"

A Report from an Officer after Visiting the Units

8th June, 1944.

Very many thanks for your letters and for the copies of the formation authorities for the three new companies.

I just returned last night from a tour of the area they are in, and am wondering whether they are not going to be almost as much trouble as my old Palestine A.W. Coy. Your R.S.M. will tell you about that one.

1226 on the whole are fairly happy. The O.Cs. chief troubles were due to lack of efficient cooks. The Cypriots and Lebanese complain that the full-scale British rations are insufficient. I think they all need a course of anti-worm treatment.

1227 is most unhappy. A section (Cypriots) revolted at the port of disembarkation in sympathy with some Greek sailors who had been arrested. They beat up their N.C.Os. and threatened neighbouring troops with firearms. Four are up for F.G.C.M. now.

In all three Companies, the Cypriots are trying the old dodge of refusing the O.C's. award and electing F.G.C.M. on every possible occasion. I have told the Company Commanders to choose several ringleaders and at the next opportunity ask for F.G.C.M. without giving the man the option.

One Lebanese O.R. in 1227 was missing at roll call. The rest of his section decided he was drowned and have downed tools and stopped work pending the recovery of the body.

Note.—Upon investigation these turned out to be somewhat tangled tales. The "revolt" was not very serious and arose out of an incident where two men were found in the street playing cards, improperly dressed. An N.C.O. was somewhat tactless and was struck! Greek sailors were in no way concerned.

In all no more than six men in all companies refused to accept the O.C's. award at any time.

A Lebanese O.R. was indeed drowned. He bathed in a place where bathing had been forbidden. There was little sympathy shown by his co-nationals and no vestige of a strike.

DOCUMENT "E"

Expression of Appreciation

2nd December, 1944.

A Sub-Area Commander

S/Captain "A" tells me you are preceding the main body and are not likely to come this way again.

We say good-bye to you with much regret and shall certainly miss seeing your fellows in this area.

The splendid work recently carried out by all ranks under your command and at such short notice has been greatly appreciated by the incoming troops, to which I would add my own personal word of thanks.

Good luck to you all.

A Report from a Works C.R.E., Regarding the Fusion of the Units into a Battalion

29th November, 1944.

I was instructed to report on the success of this experiment.

It has certainly been successful from my point of view, by relieving me of the mental gymnastics required to administer such a mixed lot of nationalities.

The three companies, transport and plant are more flexible and interchangeable under battalion control.

Any apparent success is overshadowed perhaps by the enthusiasm of the present (and the original) C.O., who understands these composite M.E. companies to a much higher degree than the average officer would.

I have to report therefore, that the experiment has been a success and has resulted in better administration and *esprit de corps* and in an increase of efficiency and output on the works side.

DOCUMENT "F"

Letter From a Chief Engineer

4th April, 1945.

I should like to thank you very much for your keen co-operation in the construction of "Lammie" Camp.

I would also like to congratulate all ranks of your battalion who were engaged in the work. It is the best camp in Italy.

I hope you will all like your new work and have the best of luck.

MEMOIRS

BRIGADIER-GENERAL A. E. PANET, C.B., C.M.G., D.S.O.

ALPHONSE EUGENE PANET was born on the 13th December, 1867, the son of the Honourable C. E. Panet of Quebec. From school at Ottawa he passed into the Royal Military College, Kingston, and was given a commission in the Royal Engineers on the 28th July, 1888.

On completion of the Chatham course, Panet was appointed to the Public Works Department (Irrigation) in the Punjab and spent some time on deputation to Burma. In 1894 he first saw active service during the Waziristan expedition, where he was employed on Telegraphs. Return to the Army seems to have aroused his military instincts and he got transferred to the Military Engineer Services, wherein he spent the rest of his career. Prior to the first Great War, he served as Garrison Engineer Lahore, Ambala and Quetta : P.A. to the C.E., Punjab, and P.A. to the C.R.E., Quetta : also a period with the Sirmoor Sappers at Roorkee.

In 1915 Panet was placed at the disposal of Lord Derby to raise the County Palatine Engineers, now the 123rd Field Regiment R.E., T.A., Manchester, which unit he took to France with the 30th Division, in his capacity as C.R.E. In 1917 he was appointed Chief Engineer, 2nd Anzac (later XXII) Corps, with the rank of Brigadier-General. His staff officer, Major G. Fraser, M.C., writes :—

" It was indeed a great privilege to have been associated with so distinguished a soldier. His treatment of Field Company Commanders was always very drastic, although tempered with that kindly calm, which never deserted him, however difficult the situation appeared to be."

For his services in the War he received six mentions in despatches : brevet of Colonel on the 3rd June, 1918 : the C.B., C.M.G., D.S.O. : the French and Belgian Croix de Guerre, as well as the War medals.

On return to India, Panet served as A.C.R.E., Lahore, and on promotion to substantive Colonel on the 1st January, 1921, as C.R.E., Lahore District, and finally as Chief Engineer Northern Command (Colonel Commandant) from 1922 until he attained the age limit on the 12th December, 1924.

On retirement Panet settled down at Crowthorne and devoted his energies to gardening and golf. During the late war he served as an Air Raid Warden. Hardening of the arteries led up to his death on the 30th March, 1950.

Panet was married in 1895 to Corrinne, daughter of Sir H. E. Taschereau, P.C., a very distinguished Canadian : she pre-deceased him in 1936. They have left a son, Brigadier H. de L. Panet, C.B.E., recently retired from the R.E., and a daughter, Mrs. W. Yuile, residing in Canada.

Panet was very popular with everyone who had the privilege of knowing him. In his youth he was very active and a good shot : towards the end of his service he suffered a great deal from rheumatism. He was strong-minded, but everything he did had the hall-mark of conscientious hard work. But for the unbreakable law of the age limit, he would certainly have risen to be Engineer-in-Chief, India, and no one could have filled that office more efficiently.

H.de L. P. adds :—

He set himself a high standard in his games and hobbies as well as in his work. In his youth he had a local reputation as a trainer of ponies. He was a good shot, a skilled and ardent fisherman, and played golf regularly until he was over 80 ; a keen gardener, he was the author of the Quetta Horticultural Society's pamphlet on roses.

W.H.E.

Brigadier-General A. E. Panet, C.B., C.M.G., D.S.O.

Portrait by Mark E. Mitchell & Co. Harrogate.

Brigadier Sir Eric E. B. Holt-Wilson, Kt., C.M.G., D.S.O.

As Commandant, War Department Constabulary

BRIGADIER SIR ERIC E. B. HOLT-WILSON, Kt., C.M.G., D.S.O.

ERIC EDWARD BOKETON HOLT-WILSON, who died on the 26th March at the age of 74, did the greater part of his life's work outside the Corps, serving seventeen years in it and twenty-eight years in the M.I.5. branch of the General Staff and duties connected therewith. In the Corps he was a marked man and selected for a variety of jobs. In height 6 ft. 3½ in., possessed of an attractive personality which ensured him nothing but friends, he not only excelled at every kind of work which he undertook, but also enjoyed that all-round proficiency in sports and games which is evidence of a well-balanced mind: cricket, soccer, shooting, riding, acting, landscape drawing, piano playing and skiing (he was President of the Ski Club of Great Britain in 1932) all being in his repertoire.

Born on 26th August, 1875, the son of the Rev. Thomas Holt Wilson of Redgrave, Suffolk—he later added the name of Holt to his surname to fulfil a promise, never carried out, made by an ancestor in 1754 when he married an heiress, Lucinda Holt. He remained a Son of Suffolk and a county man all his life.

Considered an athelete at his "prep" school, he was in Bosworth-Smith's House at Harrow, 1887–93, winning the House mile and ½ mile, and the school high jump (under 16). In February, 1893, he passed direct from the Upper Sixth (Army Class), into the Royal Military Academy. There he was in the cricket eleven, both as batsman and fast bowler in 1894 and 1895, in the soccer eleven, and captain of the Revolver IV. Handicapped by lack of language marks he passed out only seventh, but was first in fortification, topography and landscape drawing. At Chatham he played cricket both for the Corps and S.M.E., and for the Suffolk Borderers (achieving 103 not out). He was elected a Free Forester in 1897 and wherever he went it may be said he was good for thirty to sixty runs and a couple of wickets. He also played soccer for the S.M.E. and the Old Harrovians.

On leaving Chatham, Wilson was posted to the 7th Field Company at the Curragh, and in 1899 proceeded with it to the Cape. He served throughout the 1899–1902 war without wound or sickness, was in some twenty engagements, including Modder River, Magersfontein and Paardeberg, was twice mentioned in despatches for gallantry and awarded the D.S.O.

On return home he was selected for the appointment of Assistant Instructor in Building Construction at the S.M.E. which he held for 3½ years to July, 1906, when, having been promoted Captain in August, 1904, he was again posted to a field company at the

Curragh, but in November, 1907, he was ordered abroad to command the 41st Fortress Company at Singapore. There he was mainly employed in renovating the defences built rather more than twenty years earlier. After two years' stay he travelled home on leave via Port Arthur and the Trans-Siberian railway, and whilst in England was offered, and accepted, the appointment of company commander and instructor in military engineering at the R.M.A. Woolwich, where he found himself under Major (later Major-General Sir Ernest) Swinton, who, in some of his stories, used Wilson as one of the characters.

Now came the great change in Wilson's life. In 1909 owing to the activities of German agents in the United Kingdom and Ireland, the Cabinet, on the advice of the Committee of Imperial Defence, decided to authorize a counter-espionage branch of the Directorate of Operations and Intelligence, as it was then called. This branch began in a very small way with one officer under M.O.5. (later called M.I.5.), but it found so much work to do that, at the end of 1912, sanction was obtained to enlarge it to four officers. The R.E. officer who, as M.O.5., had selected the first officer, Captain (Sir Vernon) Kell who held the post for thirty years, now suggested the employment of Wilson, on whom he had had his eye for some time. Wilson accepted and was transferred to the Reserve of Officers.

The factor which decided him to leave the Corps was that he did not like the prospect of serving in the tropics again : his wife, whom he had married in 1903, had been ill in Singapore and they had lost a child whilst there.

Wilson's duty as deputy to Kell, graded as G.S.O.3, was defined as " to investigate on behalf of the War Office into certain confidential matters in connection with the alien population," and later " to expose and frustrate the clandestine activities of enemy aliens under whatever form they may be encountered." The actual division of duties was that Wilson superintended the police work, Kell the detective.

The activities of M.I.5. are no longer a secret ; as indeed an account of them was published in *The Times* and other newspapers, 2nd January, 1919. Besides the special German agents, all but one of whom—who was on leave—were arrested on the declaration of war in 1914, it was calculated that there were in the United Kingdom 400,000 aliens, of whom 25,000 were potential enemies, so work did not fail ; 16,000 of them were card-indexed.

After declaration of war the duties of the counter-espionage bureau immensely increased. Its efficiency may be gauged by the fact that no act of destruction or incendiarism was committed in the United Kingdom by enemy agents ; but some dummy fires and explosions were staged and photographed for the benefit of

the enemy in Berlin, that he might believe his men were doing their duty. Of spies forty-three were captured and fourteen executed. Wilson meantime had been promoted step by step to Lieut.-Colonel and G.S.O.I., and awarded a C.M.G., a Legion of Honour (Chevalier), and an Officer of the Crown of Belgium for his services during the war.

It must be interpolated that in 1914 he published a small book on *Field Entrenchments*, of which more than 70,000 copies were sold, had earlier tied for the Montgomerie Prize for an essay " Field Engineers in our Next War," was employed on the preparation of a new edition of the *Field Fortification Manual, Part III*, and had been much in request as a lecturer, and that in 1932 it was officially reported of him that :—

" All the books and pamphlets of confidential instructions, and all the official publications, on the subject of defence and public security work, which are in use throughout the Defence Services and in every British Dominion and Colony, have been prepared by him."

He served twice on the Council of the Institution of Royal Engineers.

During the occupation of Germany (1919–29), Wilson was Chief of the Civil Police Commission and was responsible for security measures at the many international conferences ; but he returned to duty in London in 1924. In 1929 and 1938, on behalf of the Secretary of State for War, he made tours of inspection of the security precautions of the whole British Empire.

In 1931 the Civil Security Service was amalgamated with the Defence Security Service under Kell and Wilson, the military organization having been found the more efficient, and in 1933 Wilson was knighted.

It is almost incredible that, regardless of efficiency, both Kell and Wilson were placed on the retired list in 1940 on reaching the regulation age of 65. Kell's successor, a civilian, held office for just six months. Wilson, not having made a written agreement with the Treasury as to pension, was awarded that of a Major, R.E.—£440. It is a warning to officers who accept employment on the retired list.

Wilson's first wife died in 1927 and he married again in 1931. To his great grief his second son, in the R.A., was killed in India by a fall from his horse in 1930. He is survived by his elder son, a commander in the Navy, and a daughter by his first marriage, as well as his wife and two daughters by this second marriage.

J.E.E.

SIR JAMES S. PITKEATHLY, K.C.I.E., C.M.G., C.V.O., C.B.E., D.S.O.

THERE are probably few civilians who had more friends in the Corps in India than James Scott Pitkeathly, who died on 26th June, 1949.

Born in 1882, he was educated at Edinburgh University, and went to India on electrical engineering work in 1903. He was appointed Electrical Inspector to the Government of the United Provinces in 1909, and in 1911 was put in charge of the electrical installation for the Delhi Coronation Durbar, where his staff for the better part of a year included four R.E. officers and several mechanists and British N.C.Os. from the ex-Submarine Mining units of the Sappers and Miners.

After the Durbar, for his work at which he was given the C.V.O., Pitkeathly remained at Delhi in charge of the electrical and some of the other engineering schemes for the new Capital, until 1916, when he went to Mesopotamia to organize, in circumstances of great difficulty, the Electrical and Mechanical Section, R.E., of the Works Directorate. This unit, at the armistice, comprised about eighty British officers and some 4,000 other ranks, a few British but mostly Indian, with a sprinkling of craftsmen of many other races, operating water supply, electrical, refrigeration and other installations all over the country, and Pitkeathly was in command as Deputy Director of Works, with the rank of Colonel.

He returned to Delhi in 1919, his services in Mesopotamia having been recognized by a D.S.O. and later by a C.B.E., but was called up again for similar E. and M. improvisation in the short Afghan war of 1919, for which he received the C.I.E.

In 1922 he was appointed the first Chief Controller of the new Stores Department in India, until the outbreak of war in 1939, after which he was employed on special duty in connexion with aircraft production, later returning to India as Director-General. He was knighted in 1934, and received the K.C.I.E. in 1939.

He married first in 1913, his wife dying in 1938 ; he married again in 1945 and leaves a widow and a son.

P.K., as he was known among a very wide circle of friends, was not only an untiring and brilliant engineer and organizer, but also a chief who was quickly recognized as a friend by all ranks. His success was the more remarkable in view of the handicap of his deafness, a failing which he sometimes used to advantage when he wanted to gain a moment for reflection. He could always be relied upon for shrewd advice and he was as generous personally as he was economical of government money.

He was elected an Honorary Member of the Institution of Royal Engineers in 1939, in view of his many contacts with the Corps. His death will be much regretted by his many friends.

A.C.T.

BOOK REVIEWS

MOUNTAIN AND FLOOD—HISTORY OF THE 52ND (LOWLAND) DIVISION

By GEORGE BLAKE

(Published by Jackson. Price 12s. 6d.)

It is difficult to write a divisional history. There will never be a wide public for it at the best, and even that may be limited by the historian's approach. If he gives too much detail his work becomes a military treatise of interest only to professional soldiers ; and a war-time division—particularly a territorial one—contains only a few professional soldiers. If the historian goes to the other end of the scale and paints the scene with a broad brush, individuals feel hurt because their exploits are not mentioned. And finally the writing must come between the two extremes of expression : the beloved pincer-movements of the Press on the one hand, and the technical jargon of military manuals on the other.

In *Mountain and Flood* the author, a professional writer, strikes a good balance. He describes in simple language how the 52 (Lowland) Division kept the flame of tradition burning between the wars ; how it mobilized for war in 1939 ; how it went to France in 1940 after Dunkirk, to fight in a hopeless cause ; how it trained in England for mountain warfare, for combined operations and for air transported action ; and how it finally went into battle below sea level in the islands of the Scheldt in October, 1944, and fought most of the major battles from then until the collapse of the " Third Reich."

Throughout, one discerns a fervent love of Scotland and an enthusiasm for the exploits of her sons—including those Englishmen whom Scotland so skilfully adopted.

Mr. Blake has delved into regimental histories and has taken counsel of many of the personalities of the division. He has made a good job of his task ; and those who want to know how the division fared from 1939 to 1945 may turn confidently to this book to find what they seek.

M.C.A.H.

ORGANISATION AND EQUIPMENT FOR WAR

By LIEUT.-GENERAL SIR RONALD M. WEEKS, K.C.B., C.B.E., D.S.O., M.C., T.D., LL.D.

(Published by Cambridge University Press. Price 7s. 6d.)

In his foreword to General Weeks' book on *Organisation and Equipment for War*, Field-Marshal Montgomery says : " There is no one better qualified to describe the organisational and equipment problems . . . during the War . . ." Certainly they were complicated problems, and the urgency of the one compelled the solution of the other. As one reads this book, which comprises three Lees Knowles Lectures given by the author to Cambridge University, one feels like a man looking for the first time through a powerful telescope at the moon. Ordinarily one takes it all for granted. It is not till one has the structure explained piece by piece that one sees how vast it is.

The author describes the growth of the central machine from the beginning of the century: through the South African War; under the expert guidance of Lord Haldane and Lord Hankey; and through two great wars. He then tells us of the problems of equipment, supply and movements; of the application of science; and of the effect of supply upon tactics and strategy. He describes the Army of to-day and the question of preparedness for the future.

A thing that strikes the reader is the incredible grasp of affairs and the mental alertness needed by the top-notch soldiers and civilians in war. Even their physical endurance is highly tested. There is no room for the red-faced, peppery general of fiction, nor the smooth politician who opens bazaars. They must be real men who serve the Central Machine.

Indeed, unless the reader possesses some sternness of purpose himself he will find difficulty in reading this book. There is so much interest in the subject, and the author is so much an expert, that short cuts in the argument and abbreviations are inevitable if the chapters (or the lectures on which they are founded) were not to exceed the allotted span. It is therefore not a book for those who have no knowledge of the workings of Whitehall. Rather does it complete the picture possessed by a reader acquainted with the Central Machine, but who wants to know more about it.

M.C.A.H.

DEFENCE OF THE WEST

By B. H. LIDDELL HART

(Published by Cassell and Company Ltd. Price 12s. 6d.)

Captain Liddell Hart's *Defence of the West* is divided, as he says formations and units should be divided, into five parts. The purpose of this division is "to get a projection from the past through the present into the future," and he names his parts: Yesterday, To-morrow, To-day, The Time Factor and Timeless. And if the reader thinks that the sequence of these parts is not exactly in the order of the projection he will have hit on the defects of the book. Reading it, one feels that it has been put together from existing papers and that this process has not been done with much care. There is a tremendous amount of repetition; and if the book were properly pruned it would only be half as long—and much more readable. This, however, is not a very serious defect in what is a valuable work. He points out that if both sides have atomic bombs it is conceivable that, like gas which was held by both sides, neither will use it; and he argues that it is folly for the West to threaten the use of atomic bombs and far worse to *begin* their use. In atomic bombing Russia can do more damage to the West than she can herself suffer. It is only a matter of geography to see that; and if the Russians were (say) to deport the people of Brussels to Moscow as soon as they had overrun Belgium, and were to move their own essential people to Brussels, the West would be in a difficult dilemma—to bomb or not to bomb.

He also makes out an excellent case for the abolition of conscription in Britain, a case that will be applauded by regular soldiers. There are two arguments, however, that should be answered:—(1) Would the other Western nations doubt our intentions if we abolished conscription? and (2) Would the raising of the pay of the regular soldiers (which is

necessary to get enough of them) have an ill effect in the labour market of Britain? Most soldiers would be prepared to run a risk here, but the questions deserve study.

The author shows the advantages that might follow from abandoning our traditional interests in the Middle East and from entrenching ourselves more firmly in Africa. In the last war we put immense effort into the defence of Egypt before being able to use the Suez Canal, and perhaps next time we might manage without it altogether.

The part of the book in which both author and services reader will be treading familiar ground is in Part Four. Here he discusses "Some Current Military Problems." He makes many novel suggestions. Everyone who reads what the Germans thought of our army must be impressed with their criticism of our slowness of reaction. And every thoughtful soldier will want to put that right. One of the author's ideas is to substitute "fives" for "threes." Have five smaller platoons in an infantry company and five battalions (not nine) in a division; abolish brigades and do without army corps till you get five divisions in each. Then an Army H.Q. could manage all the divisions Britain is ever likely to put into the field and you save the manpower of an Army Group H.Q. You also get a more handy division and a more flexible army. Put thus baldly it is easy to turn the suggestion aside as fantasy—particularly the abolition of brigades—but the case is convincingly written, and one reader at any rate has fallen under the spell.

The author also makes some suggestions in Part Four for improving the tempo of Army Administration and has another "crack" at Conscription.

No book ever seems to appear nowadays without a misprint—perhaps they never did—but there only seem to be two in this one (pages 189 and 296) which reflects credit on the distinguished friends and wife of the author who checked the proofs.

There is no doubt that although there is much in this book that will rub the professional soldier up the wrong way, there is also a lot of sense in it; and regular officers should find time to read it—particularly Parts Three and Four.

M.C.A.H.

CONCRETE SIMPLY EXPLAINED

By VICTOR S. WIGMORE, F.S.E.

(Published by The Society of Engineers (Incorporated). Price 2s.)

This short book is written primarily for Concrete Operatives and not for the Engineer. It has five short chapters, the first four of which deal with the ingredients used in making concrete, the cement, sand, coarse aggregate and the water, the last chapter covers the mixing, placing and curing of the finished product.

As the book is for the operative it has been written in simple language and in conversational style so that it may be easily understood.

Instructions are included in the text for sampling materials and making test specimens and for the carrying out of some of the routine tests. Though these are hardly the responsibility of the operative, they may be of use to the young engineer.

The book should be of value to tradesmen who are of an inquisitive turn of mind, but is of little practical value to the engineer.

E.E.P.

BRITISH INVENTIONS

By F. SHERWOOD-TAYLOR

(Published by Longmans, Green & Co., Ltd. Price 1s.)

This booklet is one of a series dealing with "British Life and Thought," and in forty-four pages it surveys inventions from the thirteenth century ideas of Roger Bacon to television and radiolocation. Such limitations of space obviously presented the author with formidable problems of condensation, but he has managed to preserve a sense of proportion. He deals with the interplay of research in pursuit of scientific knowledge and the inventive genius which put new knowledge to practical effect. He also brings out the necessarily progressive stages of invention arising from the development of new materials coupled with the evolution of "machines to make machines."

In places there appear terms with which only those with some engineering knowledge are likely to be familiar ; lack of space for further explanation has made this unavoidable. Broadly speaking, however, the writing is, as claimed by the publishers, appropriate to the ordinary reader.

There are twenty-seven well produced illustrations, and nearly all are well chosen, but it would have been better if they had all been of inventions rather than including three portraits of inventors.

Some may regard surveys such as this as falling irritatingly between two stools, by dealing with everything without dealing satisfactorily with anything, but this should not obscure the fact that this one is certainly good of its kind.

Readers of this journal should find it a worth-while companion for a railway journey—its company can be secured for a mere shilling.

R.E.B.

PHENOMENA, ATOMS AND MOLECULES

By IRVING LANGMUIR

(Published by New York Philosophical Library. Price $10.)

To a reader whose technical education has led him to expect the laws of Physics to be essentially those of "Cause and Effect," the reading of this book is a stimulating experience. The world of individual molecules is seen to be very different from that of the prodigious aggregations with which we habitually deal. The "average atom" is as unlikely as that statistical improbability the "average man." In the society of infinitesimal particles as many unpredictable occurrences are found as amongst human beings.

The author had the valuable experience of visiting the U.S.S.R. shortly after the conclusion of the war against Germany. His views of the probable nature and rapidity of scientific research in the Soviet Union are clearly stated. He adduces certain reasons for the pace of this progress and gives as one of them the value of the incentives offered to the individual scientific worker. To the pure research scientist these incentives would have to be of a subtle and highly refined nature. Of these no mention is made.

From a series of observations upon such subjects as "World Control of Atomic Energy" and "Science Legislation" the author proceeds to the main bulk of this volume. This is a series of twenty deeply interesting papers upon phenomena, of which he has made a particular study, in the field of physical chemistry.

H.H-B.

INSTRUCTIONAL TECHNIQUE

By LIEUT.-COLONEL J. M. HAYCRAFT

(Published by Gale & Polden, Ltd. Price 3s. 6d.)

The object of this booklet is to present in simple terms suggestions for the preparation and presentation of instruction in accordance with the acknowledged, but often neglected, principles of sound instructional technique. The booklet has obviously been prepared to fill in the gaps and to condense much of the information already available in the present official pamphlet.

In several short sections the author deals with the principles of instruction, the preparation and presentation of the Lecture, Lesson and Discussion ; the use of visual aids including the training film and film strip. Short notes on the conduct of conferences and cloth model exercises are included.

The booklet is definitely written in " note form," this, and a certain confusion in layout, may cause irritation to some. Until the official shortened version of *Principles and Practice of Good Instruction*, Part I, is published this little booklet should be of great value to officer and N.C.O. instructors, whatever their instructional experience may be.

J.B.S.

THE LAWS OF CRICKET : THEIR HISTORY AND GROWTH

By R. S. RAIT KERR

(Published by Longmans, Green and Co. Price 12s. 6d.)

There must be something in the nature and training of Royal Engineer officers—logic, accuracy, orderliness, call it what you will—that makes the study of law and legal processes a congenial and stimulating exercise. Many may recall in old *R.E. Lists*, opposite the name of the late Sir George Macdonogh, perhaps the greatest Intelligence officer of all time, the legend "barr.-at-law." Then there is Sir James Edmonds, famous historian, who figures in the *Manual of Military Law* as part-author of Chapter XIV, " The Laws and Usages of War on Land " (6th edition, Feb., 1914). And now comes Colonel R. S. Rait Kerr to elucidate and codify the Laws of the National Game.

As Secretary of the M.C.C. his position *vis-à-vis* the Cricket Cabinet, i.e., the M.C.C. Committee, is comparable with that of Secretary of the British Cabinet, formerly held by another Old Rugbeian, Lord Hankey ; none, therefore, can speak with greater authority. In passing it might be mentioned that the President of the M.C.C. (the Prime Minister of the Cricket Cabinet), Sir Pelham Warner, gave Lord Hankey his XXII colours at Rugby, a broken finger probably preventing him getting into the XI. (The writer of this review, by the way, is not a Rugbeian.) England and cricket are in fact so closely interwoven that they are almost synonymous ; Edmund Blunden's *Cricket Country* perpetuates and enshrines this fact. " Football Country," " Golf Country," " Tennis Country " are meaningless expressions.

The outstanding impression left on your reviewer by Colonel Rait Kerr's book is the comparative absence of the names of famous cricketers : there is no mention of Maclaren or Palairet, Hirst or Rhodes, Tyldesley or Abel, Richardson, Lockwood, J. T. Hearne, or William Gunn, or Jack Hobbs—as none of these affected the development of the Laws of the game. The name of W. G. Grace occurs, as an author ; and of F. S. Jackson as an administrator. But the only cricketer, *qua* cricketer, of our

day who secures a place is Arthur Shrewsbury ; for it was the great Nottinghamshire professional whose " new gospel of defensive batsmanship " made the reform of the L.B.W. Law the question of the day. This and other problems, like the " follow-on " and " bodyline bowling " (what a word), caused as much excitement and controversy in the cricket world as the Repeal of the Corn Laws and the Parliament Act in the political world.

The Author emphasizes another English characteristic—the " strict constitutionalism," which provided a sheet-anchor for the game in later years. Cricket even has its own (unwritten) Statute of Westminster ; for although the M.C.C's. " dependency spanned the globe," important alterations in the law, notably in the preparation of the 1947 Code, were always preceded by consultations with the Boards of Control in Australia South Africa, New Zealand, India and the West Indies. Do we all know that Code? What about the right of the captain of the batting side to forbid a substitute fielding at, say, cover-point ; few of us can have ever exercised that right, or even seen it exercised.

No review, however short, can omit reference to the wholly delightful Foreword by the eminent lawyer, Sir Norman Birkett ; nor to the illustrations of old times that reveal the antiquity of the game. The pavilion of every ground in the Kingdom should have a copy of this book chained to the scoring-box, in addition to the one in the possession of every club secretary.

F.S.G.P.

NOTE.—Colonel Rait Kerr is also the author of *A History of Royal Engineer Cricket, 1862–1924,* published by the Institution of R.E., Chatham. The reviewer takes this opportunity of drawing the attention of young officers of the Corps, desirous of learning something of the past, to this work. It is packed with information, and will bring back nostalgic memories to the older generation, both cricketers and non-cricketers.

POCKET ENCYCLOPEDIA OF ATOMIC ENERGY

By FRANK GAYNOR

(Philosophical Library N.Y. Price $7.50)

This small book is intended as a guide for the instructed layman making his first excursion into the realm of Nuclear Physics. Its entries cover a bewildering range—from a simple definition of the term " Horse-power " at one extreme to some fine-drawn expositions in quantum theory at the other—but given patience, and a reasonable familiarity with the terms and findings of atomic theory as understood between the wars, most of the definitions will be intelligible.

Diagrams and tables abound. We achieve birds-eye glimpses into the " hot " laboratories, and into the strange equipment they contain. Even the atomic energy commission, and our own GLEEP are touched upon, and for humanity's sake we are given short biographies of Madame Curie and her many famous successors in the field of Nuclear research. Finally, the veil of secrecy which surrounds the H-bomb is drawn aside, and the doubtless comforting prediction vouchsafed : " However, practical considerations seem . . . to permit the manufacture of a bomb of only 10–100 times the devastation effects of the nuclear fission bombs of World War II ! "

W.G.H.B.

TECHNICAL NOTES

THE MILITARY ENGINEER

(Published by the Society of American Military Engineers)

March–April, 1950. "Rehabilitating Philippine Ports." LIEUT-COLONEL JOHN S. SHAPLAND, Corps of Engineers.

An interesting and well illustrated account of about twenty major engineer projects to repair the Philippine port facilities destroyed during the last war. The reconstruction programme started in 1944 is timed to finish in September, 1950. Based on a report by Colonel C. L. Hall, Corps of Engineers, an Act was passed by Congress authorizing the Corps of Engineers to carry out a programme for the rehabilitation, improvement and construction of port and harbour facilities in the Philippines, by contract in so far as practicable, under the supervision of the Chief of Engineers. A total of nearly $18 million was made available.

The three main problems encountered were :—

(*a*) Communications over the great distances involved. The average air-line distance from Manilla to the active projects outside Manilla is about 375 miles. Davao is over 600 miles from Manilla by air ; about 1,000 miles by ship.

(*b*) Shortage of materials. Port and harbour rehabilitation is but a small part of Philippine Rehabilitation, public and private, as a whole. As a consequence competition for the available materials is brisk.

(*c*) Contractors in the Philippines at the end of the war had little or no equipment and much of that now available is surplus Army and Navy equipment, far from new and not ideally suited to the work to be done.

May–June, 1950. "Industry-Army Partnership." MAJOR-GENERAL LEWIS A. PICK, Chief of Engineers.

The article is adapted from an address delivered by General Pick in February, 1950, at the fourth "Industry-Army Conference." After stressing the importance of continuous co-operation in peace between the Corps of Engineers and industry, details are given of the current Corps of Engineers military procurement programme, the largest ever undertaken in peace-time, and the advance planning being done for the provisioning of all engineer equipment and supplies needed under future emergency conditions.

Approximately $150 million will be spent by the Corps of Engineers on engineer stores during the current year. About one-third of this will be for timber and the remaining two-thirds for other supplies including construction and maintenance equipment and materials, and equipment for fire fighting, surveying, map reproduction, utilities, and bridges and boats.

Chicago is the central stores procurement office of the Corps of Engineers with branch offices in engineer districts. All stores and equipment are obtained from the trade by competitive tender from responsible firms.

Advance planning for engineer stores provisioning in the event of war covers items substantially the same as those now being bought, but on a much larger scale. The Corps of Engineers has established a new nation-wide organization to develop the plans necessary for an immediate and continuous flow of engineer stores and equipment in the event of war. This comprises eleven procurement offices established in eleven geographical areas. The five principal offices, already functioning for current requirements, would be responsible for all purchasing, the remaining six will act as service units only. It is estimated that 25,000 items of engineer stores would be required and that about 5,000 principal contractors, not including sub-contractors, would be needed to supply these items. These items are divided broadly into five groups which roughly parallel five major types of American industry, and the five principal procurement offices. Planning includes the completion in peace of "predicted" contracts. These contracts will go into effect immediately war or an emergency makes them necessary. Industry's co-operation is considered and it should be feasible to complete these emergency plans and to execute them when the emergency arises.

The work of the Engineer Research and Development Laboratories at Fort Belvoir is described. There is no co-operative work between Army Engineers and industry more important to the nation, in peace or war, than the Engineer research and development programme. Work falls under two main heads. To determine by testing which commercially available items will best meet military requirements and secondly to design and develop those special items for which there is only a military demand. In the latter case such equipment, as often as not, subsequently finds its way into civilian use and develops into a commercially available item, e.g., stabilized soil road technique using calcium acrylate is of value to farmers, quarry companies and logging mills. Mass civilian demand rapidly reduces the cost of any such process.

"Operation Portrex." COMMANDER HENRY E. FINNIGAN.

An account of the Puerto Rican Exercises held in March, 1950, and described as the most elaborate joint Army, Navy, Marine and Air Force manœuvres ever attempted in peace-time. About 80,000 personnel were engaged. Approximately 160 ships of the Navy's Atlantic Fleet participated.

Briefly the problem of "Portrex" required that airborne and amphibious forces of the United States invade and secure Vieques Island, which was held by the "enemy" aggressor forces. The part of the island used for the manœuvres was considered to be a peninsula of a large continental land mass.

ISELIN BRIDGE, PENNSYLVANIA RAILROAD

(*Railway Gazette*, dated 2nd June, 1950)

The New Jersey State Highway Department recently built a two-span girder bridge under the quadruple main line of the Pennsylvania Railroad. The railway formation was approximately at ground level, and its heavy high-speed traffic could only be interrupted on two tracks at a time on Sundays.

The tracks were supported on temporary timber trestles, erected under traffic, while the abutments were built and the new spans erected on falsework before rolling into place.

The most interesting feature of the work was the method of excavation for the temporary trestles and the abutments. Normally 1 yd. crescent scrapers pulled backward or forward across the work by two-drum pneumatic winches were used. Where headroom was limited, in some cases to as little as 20 in., open bottom ⅜ yd. scrapers were used.

RAILWAY CONSTRUCTION AND OPERATION

The Ministry of Transport "Requirements for Passenger Lines and Recommendations for Goods Lines in regard to Railway Construction and Operation" have recently been revised and are now being issued in handy booklet form.

These Requirements, which were last revised in 1925, have been brought into line with up-to-date practice, and the main revisions will be found under signalling, bridges and viaducts, permanent way, level crossings, and electric railways. They relate to new construction or reconstruction and alterations or additions to existing lines, but do not apply retrospectively.

The document has no statutory force in itself, but is issued for the guidance of engineers and others engaged on the construction and operation of railways in Great Britain and is in effect a code of practice which experience has shown is desirable to maintain a high level of safety. While it may be said generally that compliance with the Requirements is insisted upon before the Inspecting Officer will recommend the Minister to approve new railway works, provision is made for modification where appropriate to meet special circumstances, and for relaxation or variation for light railways.

The first issue of "Requirements" was made in 1858 and consisted merely of fourteen items on a page and a half of copperplate script; it was sent to the secretaries of seventy-nine railway companies. From that date the revisions issued from time to time increased in size and in the number and variety of subjects dealt with, resulting from progressive improvement in engineering and signalling technique and in methods of working. The new edition is a reminder of the diverse and complicated problems involved in modern railway construction and operation.

Copies of the new Requirements can be obtained from H.M. Stationery Office, price 1s. 6d.

CONCRETE FILLED STEEL TUBE BENTS

(*Engineering News Record*, dated 9th March, 1950)

A 2-mile pile causeway is being driven across Corpus Christi Bay in the Gulf of New Mexico for the Texas Highway Department. The pile shells are driven in 4-pile bents of 50-ft. centres then filled with concrete. A pile-driven traveller, 165 ft. long, sinks the piles. It rests on three driven bents and cantilevers 50 ft. ahead to drive the next. The causeway structure is made up of a series of units 225 ft. long, consisting of four continuous 50-ft. spans and a 25-ft. single span. The latter are designed to collapse and prevent progressive wrecking should barges or other floating objects crash into the structure. Four beams wide and welded, the spans are supported on bents of four 18-in. piles spaced at 9-ft. centres. The deck

will be reinforced concrete carrying 28 ft. clear roadway, 18 in. wide kerbs and laminated pipe railings. The Highway Department's plan calls for two identical parallel causeways giving four lanes of divided traffic. The first structure is now under contract and its completion is forecast for early 1951.

Several factors influenced the selection of the vertically fluted steel shell piling for the substructure.

(*i*) Extreme difficulty was anticipated in operating barges and other marine equipment in the shallow bay waters. Throughout most of the causeway the bottom lies only up to 2 ft. below mean low water, so the comparatively lightweight shells were attractive for economical handling.

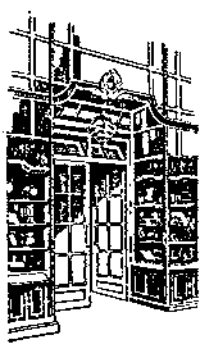
(*ii*) Because the Corpus Christi section of the Gulf Coast is frequented by tropical storms, the causeway roadway was placed 24 ft. above water. This design feature was splendid as a precaution against wave action, but it placed a considerable length of slender piling above water, where it would be exposed to battering by floating objects during storms, therefore it was important that the piles have considerable resilience to take thrust and rebound without permanent injury.

(*iii*) Foundation soil consists chiefly of alternating layers of oyster reefs and then packed sand. Uncertain depth of a satisfactory bearing stratum, and variations in the penetration necessary, made desirable a pile that could be quickly cut off or built up. Piles range from 70 to 120 ft. in length. They are 18 in. in diameter with the bottom 40 ft. tapered to an 8-in. tip. The top 30 ft. of pile shell is alloy steel with a high tensile strength and somewhat more corrosion resistance than the mild steel that constitutes the rest of the pile. The rig is 165 ft. long, weighs 150 tons fully equipped, it handles a double-acting steel hammer (16,000 lb. of energy at 120 blows per minute in 90-ft. leads). Required pile bearing is 46½ tons. This has been easily obtained, principally through skin friction. Three piles were test loaded, using one 200-ton hydraulic jack and a beam tied down to adjacent piles. All the piles so tested withstood a load of 160 tons without failure.

We at "112"...

Gold £44·10·0

THERE is little doubt that the Automatic winding watch is the watch of the future. When one considers the following facts concerning this most ingenious development of the wrist watch one realises the sound possibilities of this claim made by us at "112".

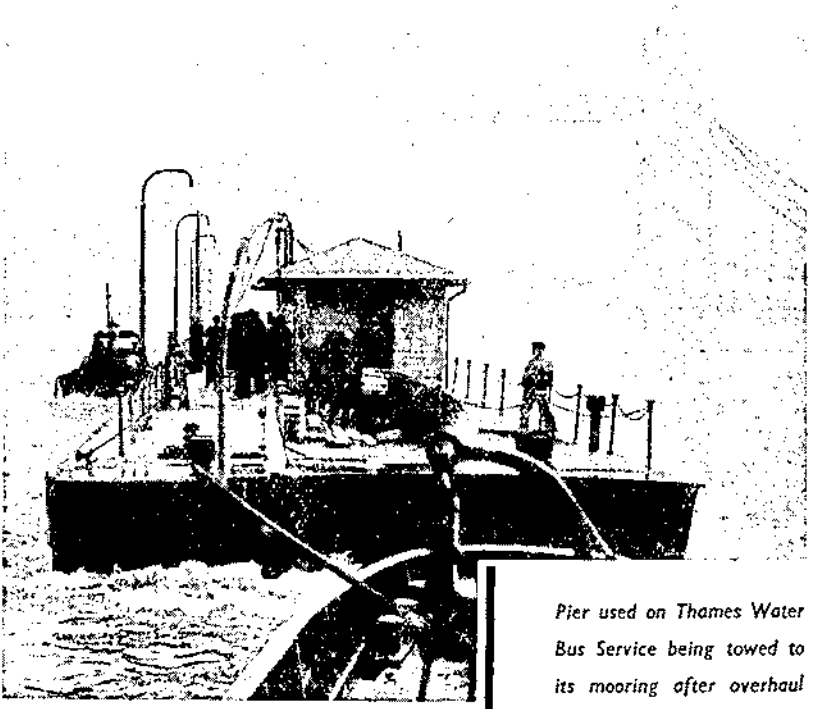


Entrance to '112'

- *Never needs winding*
- *When in wear always fully wound*
- *Constant power of mainspring makes for regular and consistent time keeping*
- *Goes for 36 hours when not worn*

The GOLDSMITHS & SILVERSMITHS COMPANY LTD
112 REGENT STREET · LONDON · W1

NUMBER **112** IS OUR ONLY ADDRESS · TELEPHONE : REGENT 3021



Pier used on Thames Water Bus Service being towed to its mooring after overhaul and painting of roofs with Ruberine Paint.

Permanent Features

Quality is the secret of permanence ; only the best materials will stand up to the test of time. That is what has made the Tower Bridge a permanent feature of the Thames waterway.

And high quality makes Ruberine Bituminous paint a permanent feature of buildings and structures in all climates and under all weather conditions. Resistant to time, weather, acids and alkalis, it gives equally good service above or below ground or in water.

Builders, architects and engineers, the world over, use Ruberine the original Bituminous Paint for the protection of wood, metals and bituminous roofings, particularly where periodical maintenance must be reduced to a minimum. *Write for Brochure No.* 699.

Pioneers of P.B.S. (Prefabricated Bitumen Sheeting)

Ruberine

Bituminous

PAINT

A product of THE RUBEROID COMPANY LIMITED

173 COMMONWEALTH HOUSE, 1-19 NEW OXFORD STREET, LONDON, W.C.1

R.E.
Kitchener Scholarships
Fund

This fund exists for the purpose of assisting with the education of the children of officers or other ranks of the Corps of Royal Engineers who have been killed or died on service.

Demands have recently increased and donations are urgently needed to provide the necessary funds required for these scholarships, and will be gratefully acknowledged by :—

The Secretary
The Institution of Royal Engineers
Chatham, Kent

ROYAL ENGINEERS BENEVOLENT FUND

This fund helps other ranks and their families (Regulars and Non-Regulars).

If you are not a subscriber, why not become one, or send a donation? Demands on this Fund are very heavy.

Particulars obtainable from :

The Secretary,
R.E. Benevolent Fund,
29 Thurloe Street,
London, S.W.1