COMBINED OPERATIONS PAMPHLET No. 24

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CLIFF ASSAULTS 1945

Prepared under the direction of The Chief of Combined Operations

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CLIFF ASSAULTS

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PLATES

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CLIFF ASSAULTS

SECTION 1—GENERAL

1. A number of Combined Operations have included cliff assaults as part of the assault plan. These assaults have had such objects as the seizure of coast defence batteries, turning the enemy's flank, and cutting in to his communications. The element of surprise which has been achieved in these assaults has contributed to the success of the operations at a small cost in lives.

2. It must be remembered, however, that the enemy also use this technique. He must be credited, therefore, both with a knowledge of the problems of cliff assault and with an ever improving system of counter-measures.

The technique of cliff assaults must be regarded as fluid, and subject always to revision and improvement with regard both to our own development of technical resources and to the enemy's awareness of his danger from this form of attack.

3. Only bold and skilful troops, who have had long and careful training, should undertake cliff assaults, especially against strongly defended coasts. Their leaders must be resolute and must combine a courageous spirit with ability to take infinite pains over minor details.

4. The maintenance aspect of cliff assaults is not dealt with in this pamphlet as the cliff assault party will normally link up with the main force. If, however, cliff assault parties are likely to have to be maintained for a number of days, special provision will have to be made in the planning stage. In such cases the possibility of air maintenance should be considered.

The advantages of cliff assaults

5. A study of an average coast, especially one exposed to the prevailing wind, reveals that only a small part of the coast line is suitable for beach exits. Along much of the remaining part, the beaches are either backed by cliffs which vary from the low and sloping to the high and vertical, or are absent altogether, the cliffs rising straight from the sea.

6. A coastline of this type generally allows the enemy to economize his forces on the assumption that an attack is unlikely to be made along those sectors of the coast which are devoid of beach exits. Batteries and other vital installations are placed on the cliffs, and the enemy is able to concentrate his field forces for the defence of those beaches where an easy landing can be made. The knowledge that a cliff assault can and may be made at any place along the coastline, however, will be an inducement to the defender to disperse his force and to try to protect the entire length of his coastline.

7. The threat of cliff assaults, therefore, either alone, or in conjunction with a major landing, is of strategic advantage to the attacker. If the enemy attempts to guard the cliffs, he may have to weaken the defences on the main beaches. If he leaves the cliffs undefended, a bridgehead can be established over the cliffs by specially trained troops. The installation of cliff scaling apparatus will then enable non-specialist troops to pass through the cliff bridgehead in sufficient numbers to capture the main beach from the flank.

Cliff defences

8. Although cliff areas will be less strongly defended than those parts of the coast which are more accessible from the sea and which provide good beach exits, some form of cliff defence must be expected. Enemy defence measures will vary in strength according to the tactical significance of the area, and will almost certainly include patrols, operating between strong points, especially at night and during conditions of fog and low visibility.

Types of fixed defences which may be encountered on the cliff tops include wire fences, varying from a few strands of wire to a double apron type fence; anti-personnel mines; and, in important areas, shells or other explosive charges fixed so that they can be released on top of ascending troops, or detonated by wires on the cliff face.

Cliff faces, especially when these are sloping, may be sown with mines of all types, including anti-personnel mines, concrete and wooden mines, sometimes detonated by trip wires; and gullies, or any places where climbing is easy, are likely to be filled with a tangled mass of wire.

Obstacles may also be encountered on the beach, even at the foot of the most formidable cliffs.

Warning devices may be found on any part of the cliff area, and may include alarm lights, small explosive charges, and bonfires, all actuated by trip wires.

Two main types of cliff from the tactical point of view

9. Each cliff assault presents a different problem to the attacker and must be studied as such. Regarded as obstacles to be surmounted, and irrespective of geological classification, cliffs can be divided into two types :—

(*a*) Cliffs which are vertical or overhanging. These are usually formed of soft rock.

(*b*) Cliffs which slope at an angle of not less than 75 degrees to the horizontal. These are usually formed of hard rock.

The technique for the assault of these two types of cliff is different, and throughout this pamphlet a distinction is made between scaling and climbing. Scaling involves the use of mechanical aids necessary to overcome vertical cliffs; climbing requires few and simple forms of apparatus, and is the method for ascending hard sloping cliffs.

This distinction is arbitrary and is made to simplify the subject. Although the technique applicable to each type of cliff has been

discussed separately in separate sections, much in either part applies equally to the whole subject. A further section, Section 9, deals with the technique of rocky landings which is often an integral part of a cliff assault.

Cliff conformation

10. The following paragraphs give a brief outline of the various types of cliff. Cliff conformation depends on three factors :—

(*a*) The nature of the rock, *i.e.* whether it is hard or soft, sedimentary or volcanic.

(*b*) The nature of the sea action to which it is exposed, *i.e.* whether on an open surf coast or the lee of an island or protected inlet.

(*c*) Whether the sea level has risen or fallen appreciably in the last few thousand years.

11. The same type of cliff may be produced by different combinations of these factors. On soft rock coasts an imposing cliff may be formed relatively quickly under mild sea conditions, while on hard rock coasts the most violent exposures are necessary to produce a cliff.

12. The term " cliff " is usually applied to a cliff formation when it has reached what is called " the mature stage " ; that is a more or less vertical wall of rock rising from a wave-cut beach, which is exposed at low tide and only just covered at high tide. This kind of cliff is produced when the sea has been cutting into fairly flat country for a long time.

13. Where the rock is soft, or where the cliff is shielded from the under-cutting of the sea by sandbanks or by a slight elevation in the ground, more of the cliff falls down than the sea is able to wash away. The whole bottom of the cliff is then protected by an immense pile of fallen rocks (talus) in the case of hard rock, and in the case of soft rock, by mud. Under these conditions the vertical part of the cliff is subject only to ordinary weathering and will usually be overgrown and much softer than a mature cliff. These cliffs are sometimes called " dead " cliffs. (Diagram 1.)

14. A third general type of cliff formation occurs when the rise in the level of the sea has been greater than the distance it has been able to cut into the land. In this case the cliff may drop straight into deep water without a beach. This occurs particularly where the rocks are hard. A type of cliff similar to this is produced in earthquake country.

Geological classification of cliffs

15. In paragraph 9 above cliffs were divided arbitrarily into two categories according to the technique required for surmounting them. In the following paragraphs they are classified according to their geological nature. They fall into two main groups, stratified and unstratified cliffs.

16. **Stratified cliffs**—Stratified cliffs may be formed of limestone, sandstone, slate or, in some cases, volcanic ash ; but all formations are alike in consisting of a series of parallel layers, and all have a tendency,

when they break up, to form blocks like blocks of laid masonry. Stratified cliffs can be further subdivided according to the slope of the strata :—

(*a*) *Cliffs with horizontal, or nearly horizontal strata*—These are usually vertical or nearly vertical, and apart from landslides or talus, are either easy or difficult to climb in relation to their uniformity. Extremely uniform materials, such as chalk, give a very smooth cliff which is practically unclimbable. (Diagram 2 and Plate 1.) Banded limestone, with alternating patches of hard and soft rock gives a staircase effect which is climbable unless the rock is so soft that it falls away. The lower part of a cliff which is beaten by the waves is always smoother than the rest, and often undercut. Stretches of cliff, uninterrupted by landslides which provide a way over this undercut part, are rare. (Diagram 3.)

If a cliff is formed of two beds of rock of very different hardness the cliff profile will be uneven. If soft beds overlie hard beds, the lower part of the cliff will be vertical, the upper sloping. (Diagram 4.) If the hard bed is on top, the lower bed will be undercut and the beach will be littered with enormous blocks due to landslides. (Diagram 5.)

(*b*) *Cliffs whose strata dip steeply towards the sea*—These are not usually vertical, but consist of long smooth slabs. They can usually be climbed by making use of the cracks and the joins. In the more vertical sections, however, the outward dip of the strata makes climbing extremely difficult. (Diagram 6.)

(*c*) *Cliffs whose strata dip towards inland*—These consist of jagged rocks. They will usually be the easiest to climb, as every seam gives a good foothold. (Diagram 7.)

17. **Unstratified cliffs**—Unstratified cliffs are normally of volcanic origin or produced under volcanic influences. The commonest is granite, but they also include basalt, gneiss and quartzite. All these rocks are very hard and, in exposed positions, form high cliffs. The cliffs, however, are never as even as the vertical stratified cliffs, but are usually diversified by pinnacles and clefts.

(*a*) *Granite*—Granite gives characteristic cliffs of rounded convex outline. These tend to break up into enormous boulders separated by flared cracks. (Diagram 8.)

(*b*) *Basalt cliffs*—Basalt, which is an ancient volcanic lava, cracks vertically and is usually in the form of piles or columns. Recent volcanic lava is often cut into cliffs. These are excessively jagged but otherwise easy to climb. (Diagram 9.)

(*c*) *Gneiss and quartzite cliffs*—The other hard unstratified rocks such as gneiss or quartzite, which were originally sedimentary, form cliffs of intermediate character.

18. The different types of rocks, and the difference in degree of exposure, produce a different alignment of cliff along the coast. Stratified rocks usually present a straight line of cliff, only broken up by boulders and stacks, and undercut by natural arches and caves. (Diagram 10.) Unstratified rocks give very much more irregular coast lines of which the characteristic features are the narrow coves at the flanks of the cliffs leading to small valleys, and numerous points and skerries.

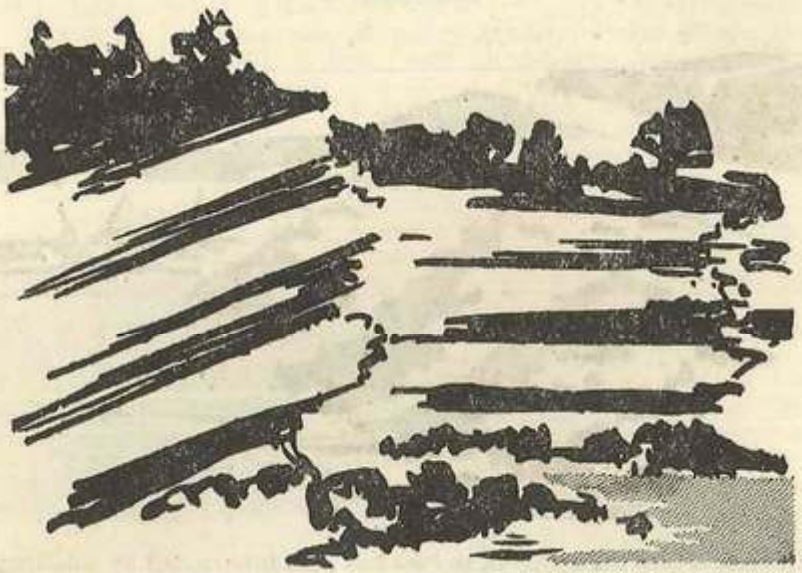
DIAGRAM 1.

Soft rock, where the action of the sea has been interrupted by shielding.

DIAGRAM 2.

Chalk, uniform material, layers horizontal.

DIAGRAM 3.



Banded limestone, the lower part often undercut.

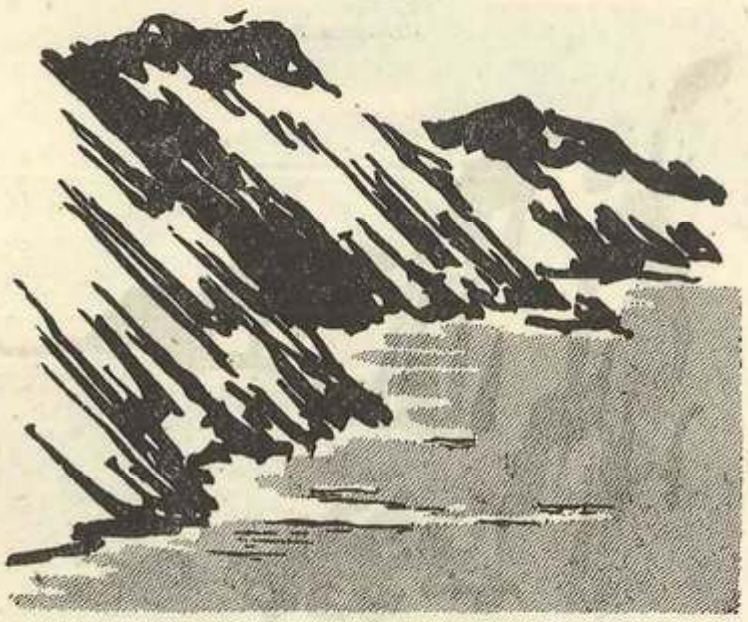
DIAGRAM 4.

Cliff of two beds of rock of different hardness ; the soft bed overlaying the hard bed.

DIAGRAM 5.

Cliff of two beds of rock of different hardness ; the hard bed overlaying the soft bed.

DIAGRAM 6.

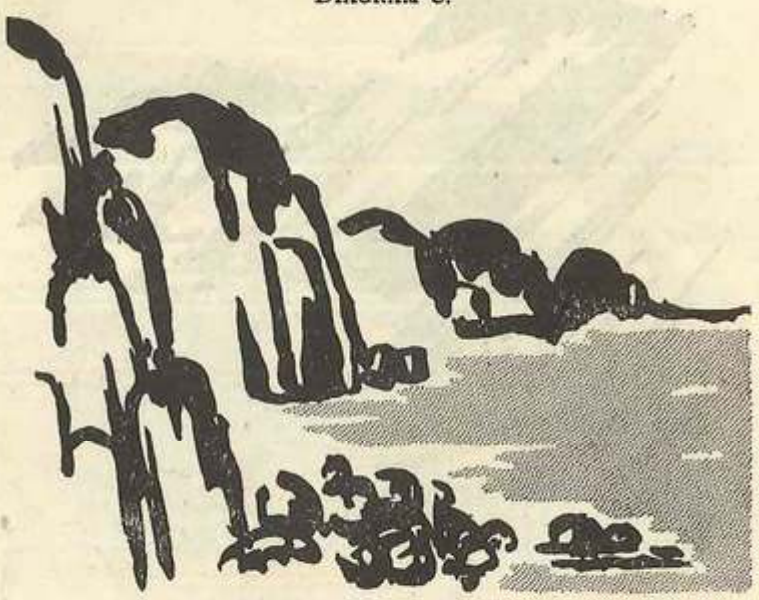


Strata dipping towards the sea.

DIAGRAM 7.

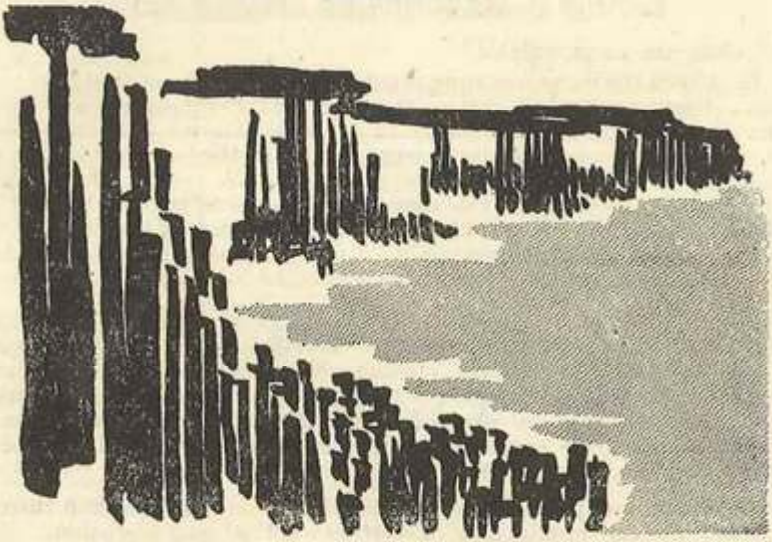
Strata dipping towards the land.

DIAGRAM 8.



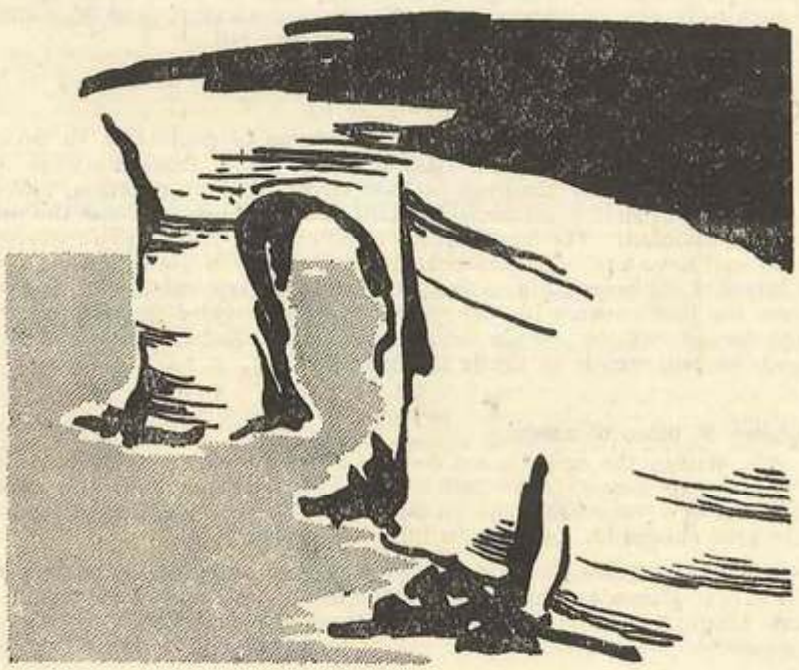
Granite.

DIAGRAM 9.



Basalt cliff.

DIAGRAM 10.



Stratified rocks, undercut with arches and caves.

SECTION 2—SELECTION OF ASSAULT AREAS

All cliffs are surmountable

19. Given the necessary equipment, no cliffs are insurmountable. All cliffs, however, are obstacles, their height, composition and slope dictating the methods necessary to overcome them. The time taken to surmount them will depend more on the method employed and the standard of training of the troops than on the nature of the cliffs. The selection of the point of assault should, therefore, be dictated by tactical considerations and not by the conformation of the cliffs. Care must be taken that planning is not unduly influenced by the obvious and easy routes.

Factors in the choice of the place of ascent

20. The suitability of the cliff should not be taken into account until the attack on the objective has been considered from the tactical point of view, and the plan of attack prepared. On completion of this plan, it will be apparent where the units are required to land to enable the plan to be put into effect.

21. The actual place where the cliff should be assaulted can then be selected by the application of certain tactical considerations. The first is the degree of cover from fire from the cliff top, and the degree of concealment from the enemy either at the cliff top or on the flanks. The second is the suitability of the ground in the immediate vicinity of the cliff top for forming and holding the initial bridgehead against counter-attacks. If these requirements are lacking, and if serious opposition is encountered, the cliff assault may fail.

Cover from fire and view

22. All cliffs provide a considerable degree of protection to troops at their base, or on the cliff face, from fire either from the flanks or from inland. Their shadows provide cover from observation, and, if clothing is of similar colour to the cliff, it will greatly increase the protection afforded. The least cover is given by cliffs that run in a straight line, and have a smooth surface inclined at a large angle to the vertical. Cliffs that are irregular in outline, and are either vertical or overhanging, give the best cover. In such cases cover is provided not only during the ascent but also on the beach or sea immediately below the cliff, and this will greatly facilitate the operation.

Choice of place of ascent

23. Within the area chosen for the assault it is desirable to select for the cliff ascent parts that are rugged, well indented, and either vertical or even overhanging; and, above all, the ascent must lead to the area chosen for forming the initial bridgehead.

24. The cliff so selected is likely to be very different to that chosen at a first glance as being the most suitable, and unless the planners are familiar with the necessary technique, such cliffs may appear impossible.

SECTION 3—TIMING THE ASSAULT

Choice of H hour

25. The choice of H hour for the assault must be considered from the wider tactical aspect. The method employed must suit the timing, and not the timing the method, which will be dictated by the characteristics of the cliff and the time of the assault.

26. When the cliff assault is part of a major amphibious operation, H hour will be fixed to suit the main landings. The danger of the loss of tactical surprise, and the additional naval dispositions required, will usually prohibit the cliff assault being made before H hour.

27. Such is the complexity of major amphibious operations against a heavily defended coast that it is probable that such an assault can only be made during daylight hours. In a cliff assault, the actual ascent will be easier by day than by night, but against a heavily defended coast it will be most difficult to get tactical surprise and the initial resistance will be greater.

Further considerations

28. When a degree of latitude in the timing exists, the ideal plan would probably allow the landing and the withdrawal of the craft to be made before first light, thereby confusing the enemy as to the exact spot selected for the cliff assault. Further, it will enable the apparatus to be set up and the first man to go up at first light. The main party can then ascend with the growing light.

29. When a cliff assault is carried out under cover of bombardment, it is important that the assault troops go in immediately behind their covering fire. The landing craft or amphibians carrying the assault troops should wait as close inshore as possible, until the bombardment lifts, to ensure that the troops are landed at the earliest possible moment. This pause in the final approach of the craft may appear undesirable, but it has been found that without it the timing of the run in cannot be adhered to accurately enough to ensure a touch down immediately the bombardment lifts.

30. The period between the lifting of the bombardment and the time when enough men are up to establish an initial bridgehead on the cliff top is the most vital period in the whole operation. The period between the moment when the first man of the assault force lands and the moment when he is on top of the cliff must not exceed five minutes per hundred foot of cliff and every effort should be made to reduce this time. Under favourable conditions it can be reduced to three minutes.

31. The whole of the cliff assault party must follow fast after the leading men, and the last men should be up within 15 minutes of the landing.

32. The second wave should not be brought in until the necessary apparatus for their easy ascent is in position and, since it has to be placed to a flank (for reasons explained in paragraphs 38 and 39) this probably cannot be done before H plus 30, and may be later. Both the

apparatus and the troops should, therefore, remain waterborne until called in by the cliff assault party commander. He will call in each craft or amphibian separately as required.

In cases, however, where the follow up troops will be using the same means of ascent as the initial party—either when the initial party have already ascended by ladders or when the follow up troops are to ascend ropes fixed by the leaders—it will be possible to call in the second wave earlier than H plus 30 minutes.

33. In a cliff assault, it is essential that the assault troops are landed at the correct place, and special attention must be paid to navigational devices including the use of silhouettes.

SECTION 4—FIRE SUPPORT

34. The existence of cliffs imposes no special consideration on the fire plan which can be made as for a normal assault, except that it may be more simple, because of the considerations described in paragraph 35 below. It is of course desirable that enemy posts capable of covering the beach, cliff, and cliff top should be neutralized during the assault, but owing to the cover provided by the cliffs, it is not so important as for an assault across open ground.

Neutralizing and covering fire

35. The fire support plan for any amphibious assault will contain the following two tasks :—

(*a*) *Neutralizing fire*—The neutralizing of the beach defences, the coast defence batteries, and such inland batteries as may bring fire to bear upon the naval ships and assault craft during the final approach.

(*b*) *Covering fire*—The provision of covering fire for the touch down of the assault troops, and for the establishment of the covering position.

36. In a normal assault, where there are coast defence batteries to be neutralized, the neutralization programme against the batteries will constitute a different target to the covering fire laid down on the assault beaches. In a cliff assault which has a coast defence battery as its objective, both these tasks can be combined. The neutralization of the battery in the first task ((*a*) above), and the provision of covering fire for the touch down in the second task ((*b*) above), can be treated as a single task, and will constitute a single target on to which all available fire can be concentrated.

Fire support from within the assaulting unit

37. High trajectory weapons (*e.g.* mortars), fired from the beach, can also effectively support the assault on the cliff, the establishment of the bridgehead, and the assault on the objective. This form of fire support will be limited only by the maximum high trajectory range of the weapon. This is an important consideration, since the whole

operation will become much easier if these heavy weapons with their ammunition do not have to be hoisted up the cliff during the initial phases of the assault. To enable the supporting fire to be effective, it is essential that an observation post should be established on the cliff top at the earliest moment. Consequently, one of the first men up the cliff should, if possible, form an observation post and control this fire.

Mortar fire can be brought down on the cliff top by light naval support craft in addition to, or in place of, the mortars of the assaulting unit fired from the beach.

Effect of heavy bombardment

38. Heavy bombing, or an intense naval bombardment with large calibre shells, may produce large craters. This has several results which must be allowed for during planning.

39. A percentage of both bombs and shells will fall on the beach. While the craters will provide excellent cover for infantry, they may make the beach unusable for any amphibians, such as DUKWs, which are required on the beaches at an early stage for the erection of ladders. These would then have to come in to a flank.

40. An additional result of the bombardment may be the destruction of certain features which will make the ground inland of the cliff difficult to recognize; and, although from an infantry point of view the cover will be improved, it may not be easy to identify objectives and the routes to them.

41. In spite of the apparent destruction caused by the bombardment, it is unlikely to have achieved more than the temporary neutralization of the enemy defences. Moreover, the bombardment is also unlikely to have ramped the cliff, although a few falls may occur which may produce a mound. These mounds will not often exceed a third of the height of the cliff, and being of a loose composition are more of a hindrance than a help to the assault.

42. Lastly, underwater craters may cause some of the craft to ground further out than was predicted in planning. In a cliff assault, these predictions are important, since the angle and the height at which grapnels can be fired must be worked out as from the anticipated touchdown position of the craft. If craft ground further out, these calculations are upset, and grapnels fired from them may not reach the cliff top.

SECTION 5—ESTABLISHING THE BRIDGEHEAD

Speed

43. Success or failure in cliff assaults usually depend on the speed with which enough men can be established on the cliff top to form the initial bridgehead. Once this has been done the remainder of the operation consists of ensuring a steady build-up of men and material until a force has been assembled strong enough for the task in hand.

44. All cliff assault apparatus has been developed primarily to assist the rapid establishment of the initial bridgehead. After the supporting fire has lifted, there may be a period in the assault when the assault

troops have not yet reached the cliff top, and the enemy still control the edge of the cliff and can dominate the beach. If the enemy are allowed to establish themselves firmly and in strength on the cliff edge it may become impossible to scale the cliff. It is essential, therefore, that all other considerations should be subordinated to speed in getting the first men on the cliff top.

45. As described in paragraph 37, mortars on the beach and light naval support craft can bring fire to bear on the cliff top to drive the defenders back from the edge and so assist the final stages of the assault. The most certain way, however, of ensuring success is to retain surprise by speed of execution, and to get the assault party on to the cliff edge before the defenders can reorganize after the bombardment.

Diversions

46. The attainment of surprise is facilitated by the use of diversions. If the cliff assault is mounted in conjunction with a main assault, the enemy's full attention is likely to be engaged by the main landing and the defenders on the cliffs may fail to appreciate the significance of the craft carrying the cliff assault party.

47. Other diversions may be staged against the more obvious lines of approach to the objective, at places where a study of the enemy defences show that he has anticipated an attack. These diversions can be expanded into secondary assaults. Their success, however, will depend on the success of the cliff assault and, therefore, they should not be pushed home at too great a cost during the initial stages. They should await the successful outflanking of the position by the cliff assault party before exerting their main effort. If the cliff assault is successfully executed, this will not be long delayed.

Weather

48. The weather may assist in attaining surprise. In a daylight attack, mist or driving rain will restrict observation by the defenders. Rough seas may put the enemy off their guard, as they will consider a landing unlikely under such circumstances. High wind and rain may delay the ascent, but with suitable equipment it will not render it impossible. The limiting factor is the height of the surf in which landing craft can operate. LCP(L) with good crews can land troops successfully in very heavy weather, even on rocky coasts.

Value of parachute troops

49. The use of parachute troops to establish the initial bridgehead has a double advantage. It speeds up the operation, and prevents the possibility of a small force of the defenders successfully disputing the establishment of the bridgehead and thereby preventing the deployment of the main cliff assault party.

50. The terrain inland of cliffs is often of an open nature particularly suitable for dropping. Cliffs are usually visible even on a dark night and form an excellent aid to the identification of the dropping zone

The paucity of defences in cliff areas will often allow the parachute troops to be dropped, and to reorganize, unmolested and even unobserved. It will also allow the dropping zone to be located near the objective, thereby saving much time.

51. The parachute force used in conjunction with a cliff assault should be strong enough to establish the initial bridgehead—one or two "sticks" will often be enough. The operation must be most carefully timed, however, and, since unfavourable weather and the difficulty of establishing contact may prevent the parachute parties reaching their objective, the plan must not depend for success on the parachute landings.

Normal method of establishing the bridgehead

52. Where no assistance is available from parachute troops, the assault force must establish its own initial bridgehead. This must be regarded as the normal procedure.

53. The assault must be made on as wide a front as possible with a large number of alternative aids to climbing. The proportion of aids should be one to each six men in the assault force. Bunching around the easy places of ascent must be avoided, as this will enable the enemy to concentrate against the few routes in use.

54. Past operations have shown that resolute men with the necessary equipment, assaulting on a broad front and supported by naval and air bombardment, can establish themselves, even against strong opposition, with few casualties to themselves.

SECTION 6—CLIFF SCALING METHODS

Methods of scaling vertical cliffs

55. The methods of scaling vertical cliffs can be divided into two categories :—

(*a*) Methods using ladders.

(*b*) Methods using ropes.

Ladders

56. The use of ladders is limited by the height of the cliff. At present the highest ladders, equipped with power operation and working at the optimum angle of 75 degrees, have a vertical height of 100 feet. This height is seldom attainable, since debris at the foot of the cliff, and the angle of the cliff itself, alter the working angle and consequently the height. Even operating in almost ideal conditions this method cannot be relied upon to surmount cliffs of more than 75 to 80 feet in height. Subject to this limitation, however, ladders are the best method.

57. Sixty-foot hand operated ladders are subject to similar limitations, but are a good method for ascending vertical cliffs not exceeding 40 feet.

Ropes

58. Ropes—including rope carrying rocket apparatus, rope ladders, toggle, and rock-climbing ropes—are more transportable and flexible than ladders. Whereas ladders are best used against vertical cliffs with no debris at the foot, ropes are more suitable on inclined cliffs with debris. Ropes do not suffer from the same height limitations as ladders.

The steel 4-foot sectional ladder should be included in the rope category, since it is virtually a rigid rope ladder.

Choice of method

59. All the available methods of ascent can be divided into two phases :—

(*a*) The initial assault—that is, getting the first men on to the cliff top.

(*b*) The follow-up of the remainder of the force.

60. The methods used for the initial assault are given at Appendix A and the methods used for the follow-up at Appendix B. All the ladder methods of initial assault provide also the method of ascent for their own follow-up.

61. Appendix C gives in tabulated form details of the weights and performance of the various apparatus. Most items of special apparatus, including all those described in Appendix C, are only obtainable from special sources, and there will probably be considerable delay in obtaining them, a delay which may extend to several months where equipment has to be manufactured to order.

62. A study of the factors governing the employment of the various methods shows that while each has its own merits, each has limitations peculiar to itself. The angle of the cliff to the horizontal will largely determine the method to be employed. Unfortunately no sector of cliff has a uniform gradient, but the minimum and maximum angles can be accurately established by photography.

63. No method need be used alone ; a series of complementary methods should be employed so that where the gradient is unsuitable for one means, an alternative method will be available which is suited to the circumstances.

64. Where the average angle is less than 75 degrees, and the composition of the cliff is hard, straight climbing without elaborate apparatus is the best method. Most cliffs are in this category, a fact which gives this technique great importance. It has, therefore, been treated as a separate subject and is dealt with in detail in Section 7.

SECTION 7—CLIFF CLIMBING METHODS AND DRILLS

General considerations

65. The cliff should be assaulted on as broad a front as possible. Besides the reasons detailed in paragraph 53 above, the fact that there will be handlines available over a wide front will help the speed and

efficiency with which follow-up troops can clear the beaches. In the case of a rocky landing, handlines will be led up from a series of distinct points, and craft containing follow-up troops must be directed to such points only.

66. On a variable cliff, some parts of which appear to be surmountable by climbing methods while other parts necessitate mechanical aids, the ropes placed by the rocket throwers may not always be in the most convenient positions. Where, however, the cliff has been climbed without aids, the handlines running down will be at easy angles, and trained troops using them will clear from the beach rapidly.

67. If the time of landing is at night, and there is a possibility of achieving surprise, pure climbing methods are quiet, and can be performed quickly by the drill outlined in paragraphs 69–91.

68. Climbing requires a higher degree of individual and sub-unit training than does scaling with mechanical aids. The latter does mechanically much of that which in climbing has to be done by the individual. The following climbing methods and drills, modified as required, will consequently also be found suitable for scaling.

Assault wave organization

69. The troops should be organized as follows :—

(*a*) Climbing leaders who will be sufficient in number to ensure that the selected cliff is covered on a wide enough front.

(*b*) Climbing " seconds," who also take up ropes once the leaders are up.

(*c*) A party to provide early covering fire to protect the actual rope heads.

(*d*) The main body of assault troops to form the main bridgehead.

(*e*) Signal personnel to establish communications on the beach.

(*f*) Signal personnel to establish communications from the main bridgehead.

(*g*) Liaison men from follow-up troops. These will be equipped with rollers, etc. if the follow-up troops include heavily laden personnel who will require assistance in getting up the cliff.

Assault wave climbing equipment

70. **Climbing leaders**—Climbing leaders will land with a gripfast strapped round their waists. A 1½ inch alpine rope will already have been secured to the gripfast, the rest of the rope being handcoiled in baskets on their backs. They will wear climbing boots. If the cliff is not hard rock, they will carry cut-down ice axes. If there is a lip, or a short patch of vertical earth or gravel at the cliff top, they will also carry hand grapnels or hand grapnel carriers which will help them over this. They will be armed with pistols.

71. **Climbing "seconds"**—Climbing "seconds" will land with a gripfast strapped round their waist and a 2½ inch rope coiled in baskets and secured to the gripfast ring. They will wear climbing boots and carry pistols and machine carbines.

72. **Party providing covering fire**—The party providing covering fire will wear climbing boots for speed, and will carry machine carbines and hand grenades.

73. **Main body**—The main body will carry normal infantry platoon weapons and equipment unless particular obstacles are expected inland. Climbing boots will usually be worn.

74. **Signals on the bridgehead**—Signal equipment required on the bridgehead will be :—

(*a*) Wireless sets SCR 536.

(*b*) Light telephone Mark M, or sound power telephone. Twisted cable on light rollers and W 130. This will provide a telephone link between the bridgehead and the beach.

75. **Signals on the beach**—Signal equipment required on the beach will be :—

(*a*) Wireless sets No. 38 or No. 68.

(*b*) Beach markings, with lights for use at night.

(*c*) Morse torches.

76. **Liaison men**—Liaison men will carry rollers, gripfasts and coiled ropes to assist follow-up troops in climbing the cliff.

Day or night assault drill

77. **Landing drill**—

(*a*) On touching down, the leaders will land first, followed by the "seconds" and the party providing covering fire. These parties will be split up among the first wave of landing craft.

(*b*) The main body will fan out at the cliff foot following the leader's general direction from each landing craft.

(*c*) A party from the main body will guard the beach flanks and will also take up a position from which they can keep the cliff head under observation in order to protect the leaders while climbing.

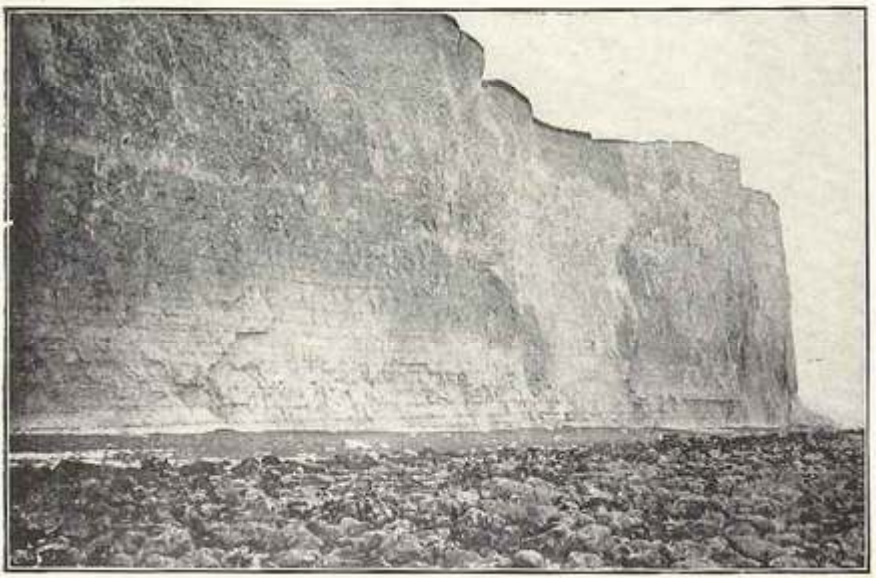
78. **Climbing drill**—

(*a*) The leaders will discard their baskets containing the coiled 1½ inch rope at the cliff foot, and with the end of the rope already fastened to their gripfasts, will climb the cliff by the quickest routes they can find.

(*b*) The "seconds" will pay out the leaders' ropes from the basket. 1½ inch rope is used as heavier rope would impede climbing.

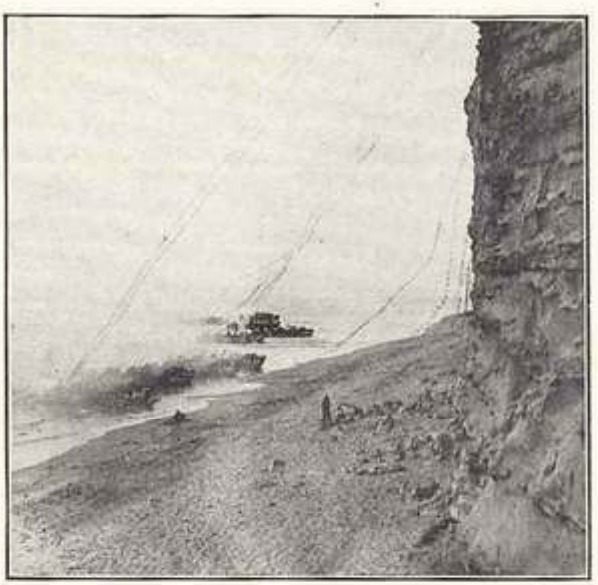
(*c*) The leaders on reaching the top will crawl over, unhitch their gripfasts and will push the prongs in the ground. They will then give two heaves on the rope as a signal.

PLATE 1



No cliff is unscalable.

PLATE 2

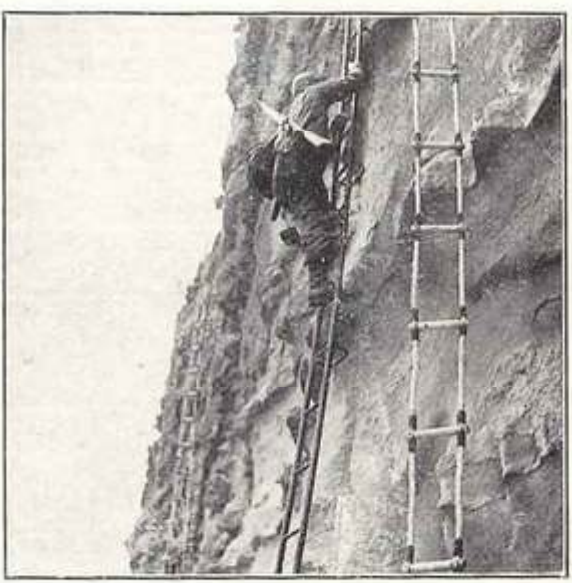


Landing craft firing ropes and ladders.

PLATE 3

Rope ladder.

PLATE 4

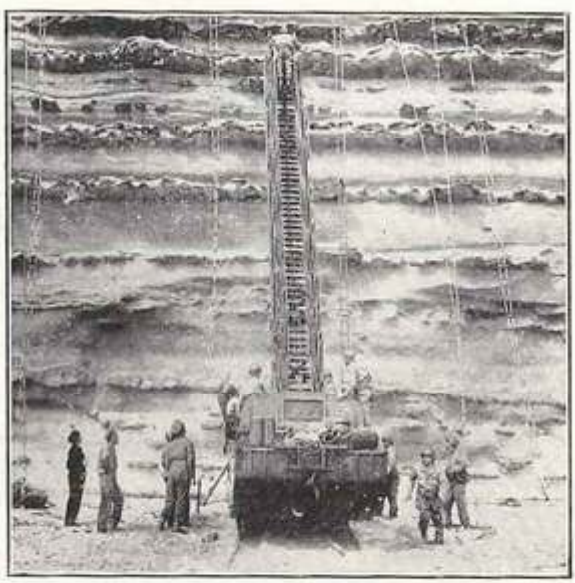


Rope and steel ladders.

PLATE 5

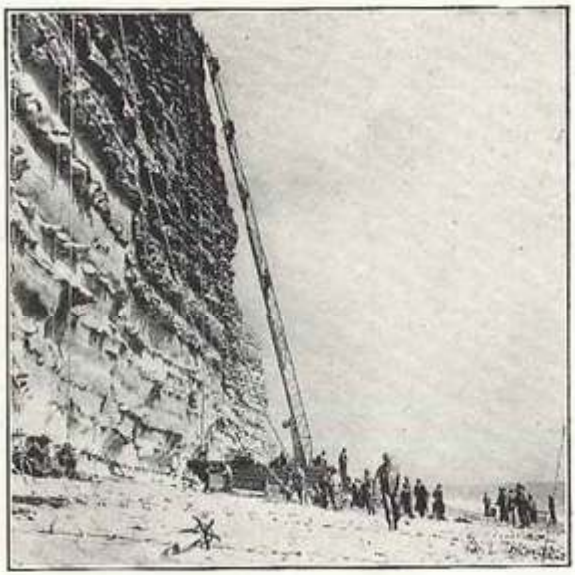
Ladder comes ashore.

PLATE 6



Ladder put into position.

PLATE 7

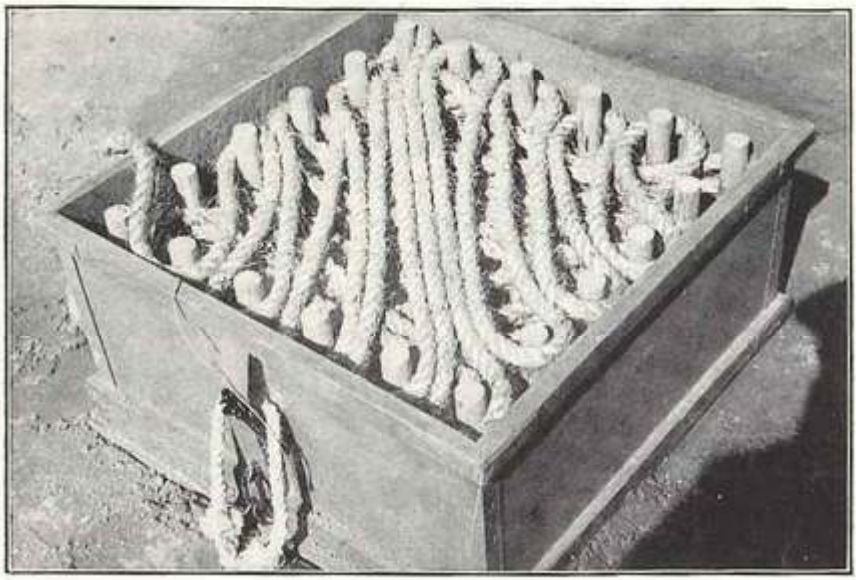


Ladders and ropes.

PLATE 8

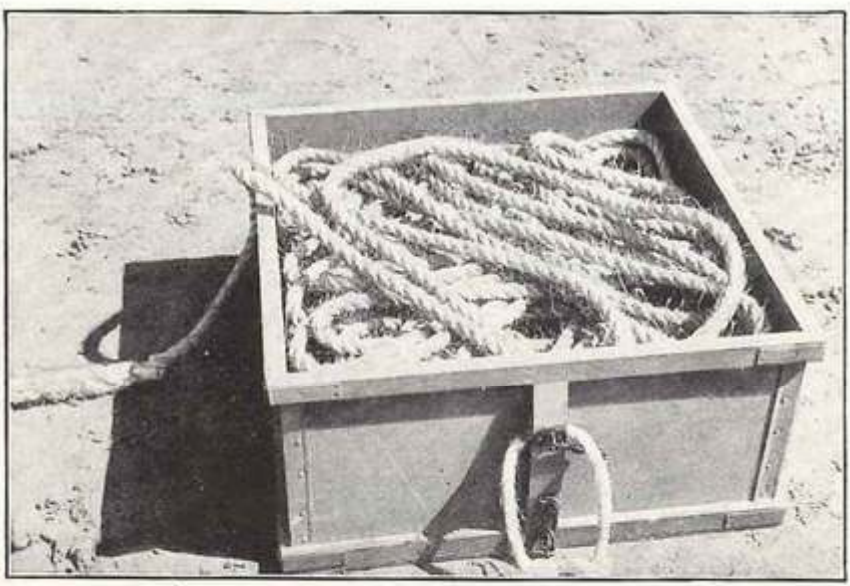
Lowering a casualty in a Niel Robertson stretcher.

PLATE 9



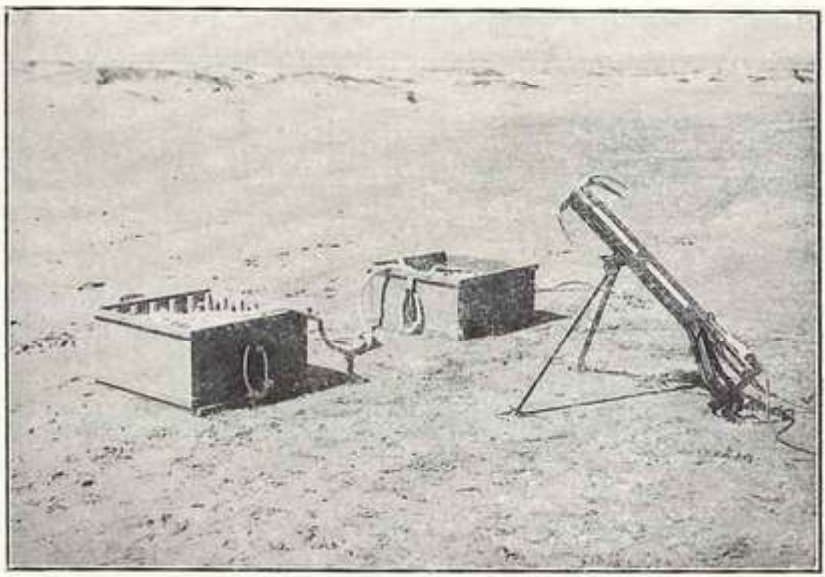
Rope in box in pin board.

PLATE 10



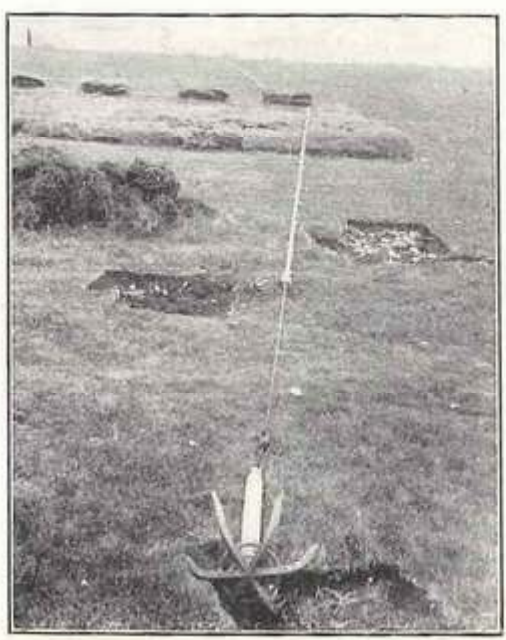
Rope in box with pin board removed.

PLATE 11



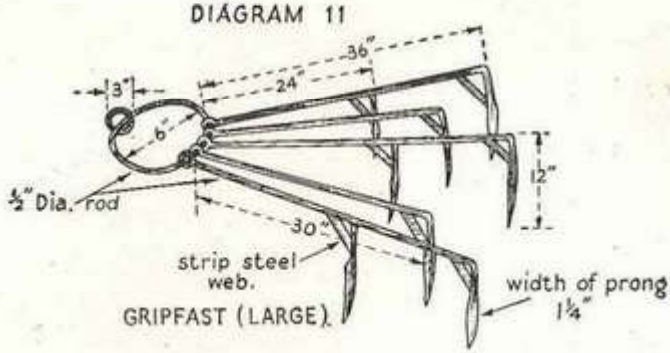
Rocket projector and grapnel ready to fire; one box has the pinboard to be removed.

PLATE 12



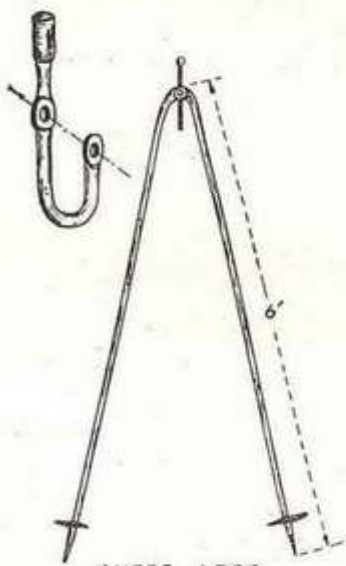
Grapnel after surmounting cliff shown in Plate I.

DIAGRAM 11



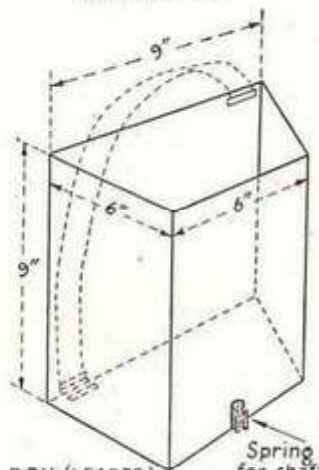
GRIPFAST (LARGE)

DIAGRAM 12



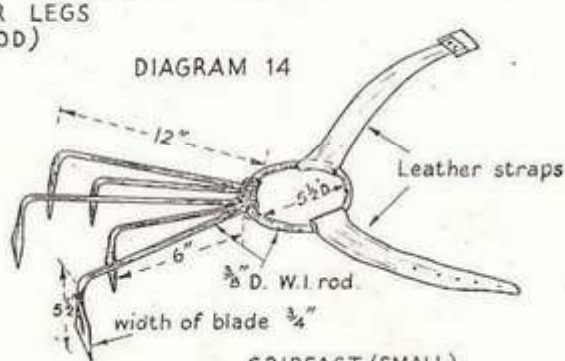
SHEER LEGS (BIPOD)

DIAGRAM 13



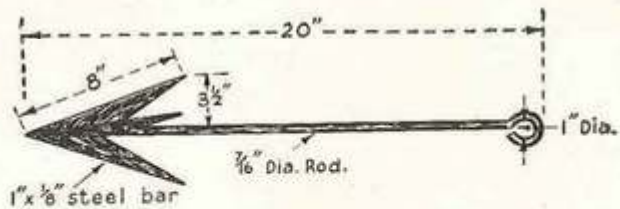
BOX (LEADER) for carrying grapnel and rope

DIAGRAM 14



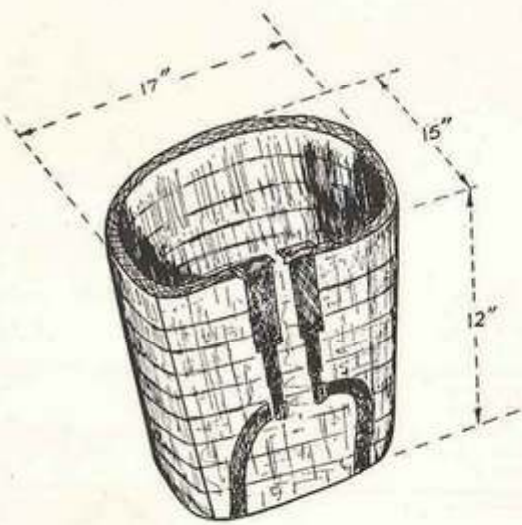
GRIPFAST (SMALL)

DIAGRAM 15



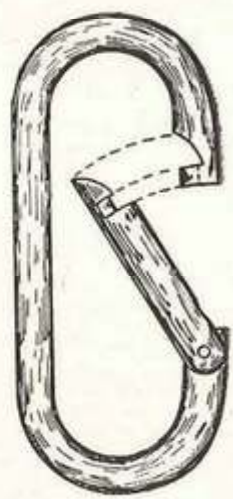
LIGHT THROWING GRAPNEL WITH FIVE PRONGS

DIAGRAM 16



ROPE CARRIER BASKET
FITTED WITH EQUIPMENT
SHOULDER STRAPS

DIAGRAM 17



SPRING LINK (KARABINER)

(*d*) The " seconds," on receiving the signal, will climb the cliff, using the leaders' ropes as handlines. Their rope will also be run up as they climb, being paid out from the basket by a man at the bottom. On reaching the cliff top, or any point where the angle becomes easy, they will give two heaves on the rope as a signal for the leading members of the covering fire party to ascend the leaders' ropes.

(*e*) Each " second " will then crawl to his leader, unhitch his gripfast (which will then be fastened in the ground by the leader) and will move forward to give the leader cover with his machine carbine.

(*f*) The leader, when the " second's " gripfast is in, will give two heaves on the " second's " rope, which will then be ready for use. This rope being thicker will be easier to climb. The leader will look after both ropes.

(*g*) After the initial men of the covering party are on the cliff top, they will be followed by the bridgehead commander, the signal party with the telephone and the main assault party to form the bridgehead in accordance with the plan.

(*h*) The personnel carrying rollers, etc. will place them in suitable positions, reporting these positions to the beachmaster.

(*j*) If the cliff is steep, only one man will be able to use a handline at one time. When he has finished using it, he will give two heaves on it as a signal to the next man, who will be holding the lower end, to ascend the cliff, his place at the bottom of the handline being taken by another man.

(*k*) The order of climbing for the various parts of the main body with each set of ropes must be worked out beforehand.

(*l*) Certain rope positions always prove much easier for ascent than others. It is the beachmaster's responsibility to ensure that bodies of men are directed to the easier places as soon as they disembark from the landing craft.

Formation of assault bridgehead at night

79. (*a*) A drill for the formation of a bridgehead at night is necessary to ensure a steady flow of men up the cliff.

(*b*) The bridgehead commander will select a control point in the centre of the bridgehead and if possible under cover. White tapes will be run to the control point from the outermost gripfasts on either flank. The main body proceeding up any rope will follow the tapes and pass through the control point.

(*c*) White tapes will be run out from the control points to :—

(i) The right and left flanks, where sub-units will be forming the bridgehead perimeter.

(ii) The bridgehead headquarters. This must not be too close to the edge of the cliff.

(*d*) The main body will pass through the control point, follow the appropriate tapes, and form up in its correct position on the outer perimeter, not too close to the cliff head.

(*e*) The parties on the left and right flanks will report when they are in position, and the bridgehead commander will call in the initial covering fire party by signal. This party will move up to bridgehead headquarters to form a small reserve with high fire power. They will usually take up a position just forward of this headquarters, as the final link-up of the two flanks may take a long time in the dark.

(*f*) The use of a password and countersign is essential.

Follow-up wave—link up with the initial assault

80. The bridgehead commander, when he considers the situation suitable, will call in the follow-up troops by R/T, using codewords.

81. At night, it is often difficult to direct men quickly to the rope positions, particularly if there is a wide beach to be crossed. A transverse white tape should, therefore, be laid by the beachmaster between port and starboard lights, and white tapes run out from each pair of ropes in use to the transverse tape. The men will then be guided to the end of the ropes and will avoid going into gullies, etc. up which no ropes have been led. This procedure is necessary, particularly for deeply indentated cliffs.

Climbing personnel within the follow-up troops

82. There should be some climbers with rope baskets and gripfasts amongst the follow-up troops in case :—

(*a*) The initial assault has heavy casualties and there are not enough ropes in position.

(*b*) The initial assault lands on the wrong beach and the cliff assault force commander, coming in later with the follow-up troops, decides to assault the correct beach.

83. If the initial assault is successful, and the ropes are in position, climbers of the follow-up troops will ascend the cliff carrying their ropes and gripfasts, and dump them with the leaders at the top. The latter can then put in the gripfasts and throw the ropes down. These extra ropes will enable the beach to be cleared quicker, and will provide more means for withdrawal in cases where the cliff assault is a raiding operation only, terminated by re-embarkation.

Reorganization of the follow-up troops at the cliff top

84. Parties going up the handlines are liable to get split up and mixed, and must re-form into their sub-units before the force can move out of the bridgehead. In daylight sub-unit commanders will lead their sub-units to particular ropes and the sub-units will reform at the top. At night, particularly if the landing is opposed on the beaches, such organization may be impossible. Personnel of one sub-unit may go up different rope groups, and sometimes individuals or sub-units will be shifted by the beachmaster to easier places.

The following procedure, therefore, will be adopted to reform mixed bodies as quickly as possible into sub-units. In addition to the white tapes already laid by the initial assault party from the outer flank gripfast to the control point, more white tapes will be laid from the control point to areas within the bridgehead which have been allotted to each of the main units taking part. In the case of a commando with, for instance, A and B troops used as the initial wave, tapes would be run out for C, D and E troops, the heavy weapons troop and headquarters troop. A liaison officer or NCO will be posted at the control point to ensure that personnel follow along the correct tape. Phosphorescent signs will make the routes more easily visible. In this way, whatever ropes are used, all personnel will pass through the control point and thence to their correct forming up area. Medical personnel will remain near the control point and will carry out cliff evacuation from there.

A diagrammatic layout of the bridgehead, showing the guiding tapes diverging from the control point, is shown at Appendix D.

Heavily laden personnel

85. Personnel of the medium machine gun or 3 inch mortar sections may have difficulty in getting up steep handlines. Such men can be helped up by a hauling team at the cliff top, equipped with rollers and a looped rope. The hauling team with their equipment should be landed with the assault wave. They should choose a suitable area and get their apparatus erected as soon as possible. The beachmaster must be informed of the position of this area and in daylight it should be indicated by a sign on the beach. At night, all heavily laden personnel should report to the beach centre light where a guide will direct them to the places where the rollers have been erected.

Heavy stores

86. Heavy stores in addition to the equipment referred to in paragraph 85 above, will probably have to be hauled up the cliff. Trained haulage teams will be required for this task. They will be equipped with a bipod, from which a stay (usually the end of the hauling rope) is attached to a gripfast. A second rope, attached to gripfasts at the cliff top, will be stretched taut and passed through a spring link clipped on the bipod, and made fast to a boulder or sand hook at the bottom of the cliff. Stores are tied on the haulage rope with simple non-jamming hitches, and suspended from the stretched rope with light snatch pulleys or spring links. A simple system of heaves on the hauling line serves for signalling. Stores can be raised at greater speed by use of a haulage bag, consisting of a large canvas bag on a metal rod with fittings for suspending it to the stretched rope. When the load reaches the top of the cliff, the bipod is swung back. The load lands on the cliff top, where it is undone (or taken out of the bag), and removed to a dump in a central position within the bridgehead.

Casualty evacuation

87. There are two main problems in casualty evacuation —

(*a*) Getting casualties down a cliff to be evacuated by sea.

(*b*) Getting casualties up a cliff to a regimental aid post forward.

88. The casualty to be lowered down a cliff is strapped in a naval "Neil Robertson" stretcher, which is suspended from the stretched rope of a haulage apparatus by spring links at either end of the stretcher. The stretcher is then lowered away from above. Besides the loops at either end of the stretcher a central suspension is needed. This is obtained by threading a line through the four carrying handles, bringing together the four loops so formed, and clipping them in a spring link. This spring link is clipped to the stretched rope with another spring link. Nine-inch diameter rope loops should be attached to either end of the stretcher to facilitate clipping on.

89 Where cliff surfaces are irregular or their gradients not steep enough to allow of good "air clearance" for the stretched rope as described in paragraph 88, an alternative method is as follows.

A haulage team is used and a stretcher bearer escorts the "Neil Robertson" stretcher. A line loop is passed through the stretcher's lower pair of rope handles and across the escort's back and over one shoulder.

The stretcher is supported in this way at hip level and allows complete freedom of manœuvre for the escort who holds his stretcher with one hand at either end, leans well back at right angles to the cliff face and so can choose his route up or down.

Almost the whole weight of the stretcher is taken by the haulage rope. This rope is tied to the stretcher head leaving 12 feet of slack end; the escort ties himself on to this free end with a bowline round his waist.

In a cliff ascent, when the stretcher head reaches the cliff top the haulage pull at once becomes horizontal instead of vertical. At this point the escort detaches the line loop from across his shoulder and, still belayed through the head of the stretcher to the haulage rope, takes his stand immediately below the cliff top and assists the haulage team in passing the stretcher over the cliff edge.

A roller is used for ascents, but not for descents.

90. When a casualty is being raised up a cliff, the stretcher is suspended on the stretched rope as above, and the hauling rope is taken over a roller between the bipod legs. The roller eases the friction, and the casualty is hauled up and landed at the top in the usual way.

Using a roller at the cliff edge, the bearer and stretcher are hauled up, the bearer again leaning outwards from the cliff. If the extreme top portion of the cliff is vertical, this method demands considerable strength on the part of the bearer.

Cliff withdrawals

91. Cliff withdrawals are difficult to do smoothly. A carefully prepared timetable will have to be made, and considerable individual training will have to be done in the technique of roping down a cliff, particularly in the dark.

92. The withdrawal should take place in three main stages:—

(*a*) Returning troops will form up inside the bridgehead, and sub-unit commanders will report to the bridgehead commander when they are ready. The bridgehead commander will give

the order for the withdrawal by sub-units, and will give orders for the appropriate craft to be called in. If it is dark, beach lights must be turned on.

(*b*) All outlying troops having been withdrawn, a close-support party on an inner perimeter will be put out covering the rope heads. The main body of the bridgehead will then withdraw on orders from the bridgehead commander. The bridgehead commander will withdraw his headquarters to the control point, and each sub-unit will report to the control point as it passes through.

(*c*) Finally a "crash" withdrawal will be carried out by the close-support party and the leaders. These men should be selected for their speed in roping down.

In the dark, such withdrawals will be greatly facilitated if subsidiary white tapes are run to the heads of the ropes from the two main tapes which lead from the outermost gripfasts to the control point. (*See* diagram at Appendix D.) Also confusion will be avoided if such ropes are previously grouped in groups of four.

If there is a sandy beach, such withdrawals can be speeded up by erecting several bipods at the top, with a stretched rope leading down from them to a sand hook securely buried at the bottom. All men will carry a toggle rope, or a rope loop with a spring link, and either pass it over the stretched rope, or clip on and go down on a "death slide." Men trained in this method of roping down will be able to carry out a very fast withdrawal.

SECTION 8—ROCKY LANDINGS

General

93. Rocky landings may be made on two types of coast; one where a considerable cliff leads straight down into the water, and the other where the cliff has fallen away and may even be practically non-existent. Landings in considerable swells are possible on the former type of coast, but calmer water is needed for the latter.

94. If other tactical considerations allow, the best place to land is on the leeward side of a headland. Usually there are many awkward underwater rocks continuing the line of the headland itself, and there may also be a tidal stream which causes a lop. By first picking out a headland it is often easy to find a suitable landing to its flank.

Suitable craft for rocky landings

95. Normal flat bottomed landing craft are unsuitable for rocky landings. The most suitable craft are LCP(L) with a ribbed reinforced bow. These craft draw very little water, and the water line at the bow is well aft of the place where the craft usually touches the rock at deck level. LCP(L) will require a strong belaying post aft for holding the kedge warp. Each LCP(L) can carry 20 fully equipped soldiers with the necessary equipment. The flat deck level, which extends right forward, is the most suitable platform from which men can run off and jump on to the rocks.

Any boat with a strong curved stem post may be used, such as a dory, but dories lack the advantage of a deck from which to disembark.

Selecting the landing point

96. Vertical aerial photographs, taken at low water, should be studied ; and any areas of cliff edge without outlying swirling patches of foam should be considered as possible landing places. At high tides such places will be clear of underwater obstruction.

Oblique photographs, giving silhouettes from which bearings can be taken, should also be used.

Identification of landing point

97. In a night landing, distance judging and picking out of sudden obstacles will be very difficult without favourable moonlight. The ideal conditions of moonlight are when the moon, which should never be less than quarter full, shines from the sea on to the cliff, though not, of course, along the selected line of approach.

Making the landing

98. When the boats are opposite the correct landing place, the leading boat or boats will go in at " dead slow." They should be provided with a kedge anchor and, in the case of LCP(L), 30 or 40 fathoms of kedge warp. It is advisable for all LCP(L) to have the same length of warp, otherwise, when flotilla officers use different craft they may misjudge the length. Two soldier bowmen wearing climbing boots should lie in the bow, one holding the end and the other holding the coils of a long bow warp. Not more than three men on either side should be lying on deck. At a suitable distance from the cliff, the kedge is dropped on a hand signal from the officer in charge (or the leading hand in later boats). The kedge warp is then allowed to run free for several fathoms before a turn is taken round the wooden belaying post. This ensures that the kedge holds the ground and is not dragged along with the flukes not gripping.

Personnel in craft, and calling in rest of assault wave

99. If there is a cliff to be climbed after the landing, the leading boat or boats should contain the following parties :—

(*a*) Two leaders and " seconds."

(*b*) The initial covering party.

(*c*) The bridgehead commander.

(*d*) A beachmaster and party for each landing point.

The later assault waves must each contain a leader and a " second," in case of accident to the first craft. They should be signalled in by light, as soon as it is clear that the cliff can be climbed at that point. The beachmaster should have two beach transit lights placed about 12 feet off the ground, also a morse light for calling in craft. As the incoming craft nears the cliffs, the beachmaster shines his light on to the rock edge, but not out to sea, to enable the craft commander to judge his distance.

Follow-up troops

100. Follow-up troops are called inshore by wireless, and are signalled in to the beach by signal. This signal will be the beachmaster's light if it is dark. If the cliff is difficult, the craft following the assault wave will land where the ropes are already in position, *i.e.* direct on to the area of the initial landing point. If the cliff is easy, a suitable area of rocks is chosen. This landing area will be marked by beach marks by day, and by beach lights at night. Craft will come in between these beach marks. The whole process is slower than with a beach landing as there are less men to each craft. The navigational difficulties are also greater, although opposition is likely to be less. Follow-up craft should carry climbers in case they fail to link up with the assault wave. In general, the number of men taking part in a rocky landing will be limited by the number of trained craft and craft crews available.

Haulage of heavy stores

101. For the haulage of heavy stores, bipod (sheer leg) teams can be landed, and ropes can be run out from the craft. When the bipod and upper gripfasts are in position, the craft is warped on its kedge, and the stretched rope is passed through a ring bolt on the forward deck. The boat is thus moored to the kedge aft, and to the cliff top over a bipod. Stores are run up this rope in the usual way. This method, however, cannot be used in a big swell.

SECTION 9—PRELIMINARY TRAINING

The object of training

102. The object of training for cliff assaults is to be able to reduce a cliff to the status of an incidental obstacle, the act of scaling being constantly subordinated to the tactical requirements necessary to capture the objective.

Time required

103. The time required for training troops and boats' crews in cliff and rock climbing and landing will normally be eight weeks. By the end of the sixth week of training, the object—that is to reduce the cliffs to the status of an incidental obstacle—must have been attained, to allow adequate time to prepare in detail the actual assault on the objective.

Location

104. The place chosen for training must resemble the scene of the operation although the cliffs should, if possible, be more severe. The exact geological composition of the cliffs to be assaulted in the operation should be matched if possible.

The matching of the assault cliffs can only be carried out accurately by geological experts. Such experts are normally available at army and higher headquarters, and should be consulted early in the planning of any cliff assault.

Outline plan

105. The commander's plan should be made before the training starts, since the equipment required depends on the method chosen and the method depends on the exact section of the cliff chosen for the assault. The danger of a breach in security may have to be accepted unless the whole operation is to be jeopardised by faulty training.

Safety precautions

106. In the early stages of training men must not be unduly rushed or accidents may occur. Accidents, before the men are accustomed to climbing, can retard progress indefinitely. Cliff and rock climbing is difficult, and plenty of time must be given to the instruction of the individual soldier. Safety ropes must always be used during training.

Attached units

107. Joint training of the craft crews, and of the army unit detailed for the cliff assault, should be begun as soon as the individual phase of training has been finished.

108. In addition, if parachute troops are to be employed, they should carry out their training in close conjunction with the seaborne force so that co-operation may be complete, for on this may depend the success of the operation. All other attached troops must also be nominated early, and must undergo the full training if they are required to land with the assault force.

Training of officers

109. During training all officers should carry out a careful study of the problem of cliff assaults Sketch maps of the main topographical features and layout, and of the present relative position of enemy defences will be required. These need not disclose the location of the objective. Oblique aerial photographs of the actual cliffs can be used if the hinterland is first removed since one area of sea and cliff face looks remarkably like another.

110. Vertical and oblique photographs of the practice cliffs, as well as of the assault area, should be taken. The latter are valuable if taken under the same conditions as the photographs of the assault cliffs, and on the same scale. A study of these training photographs stereoscopically, and a comparison of them with photographs of the practice cliffs, will enable many deductions to be made from the photographs of the assault cliffs. It must, however, be remembered that the detailed interpretation of cliffs should only be undertaken by expert air photo interpreters, as in the hands of a layman such photographs may be misleading. Some of the inferences that may be made from such photographs are :—

(*a*) Whether the steep sections of the cliff are rocky or composed of steep earth and grass.

(*b*) Whether the cliff has a lip at the top which can be surmounted with hand grapnels and ice axe.

(*c*) Whether the geological formation is such that it requires mechanical aids to climb it.

(*d*) The length of the ropes and/or ladders required.

(*e*) Whether there are any obvious strongpoints from which the climbers can be defiladed.

(*f*) Where there are fewest underwater obstructions if a rocky landing is necessary.

If available, the best stereoscope for use by untrained officers is the adjustable pocket American Pattern Type B3.

111. When studying aerial photographs of cliffs the following points should be remembered :—

(*a*) In comparing vertical photographs with the ground, the cliffs should be observed from both the seaward and landward side, if a true impression of their relative steepness is to be obtained.

(*b*) Oblique photographs, if taken parallel to the coast, make headlands and the rocks off headlands appear disproportionately large and steep. Conversely the coves and indentations appear deceptively easy. This false perspective does not affect portions of the cliff which lie at a considerable angle to the line of flight, and the gradient of these portions can be most accurately measured from such obliques.

(*c*) An estimate of the height of cliffs can be arrived at with fair accuracy, provided there is in the photographs one known height. Maps can usually be relied upon to provide at least one spot height. Failing this, there will usually be in the picture objects of a known height, such as houses, telegraph poles or trees. By relation to known objects in general, and in particular by the comparison of shadows, the height of the cliff can be estimated ; but no plan should be based on a precise estimate of the height unless this is established beyond all doubt ; it is as well to plan on an error of at least 10 per cent.

Training of climbing leaders

112. Climbing leaders require considerable training, both by day and night. They should be picked NCOs and men, selected mainly from those sub-units which have been chosen to be assault wave sub-units. They should be trained by qualified instructors, first on easy boulders to gain confidence in using nailed boots, later on harder boulders to acquire technique, then on easy exposed climbs to overcome dislike of heights, and finally on difficult exposed climbs. The standard aimed at should be " very difficult " according to peace-time rock climbing standards. Both climbing problems and rock should be as varied as possible.

113. At first these climbers should be allowed to gain confidence by being put only on hard, firm rock such as granite, but later, varying rocks, particularly loose, poor rock, should be introduced. Weapons and equipment should not be carried until the later stages, when the drills for sub-units are introduced. Leaders must be taught sound rope management and knots, as they will have to instruct the rest of their sub-units. They must be capable of climbing steep earth and grass with the use of cut down ice axes, and patches of vertical and overhanging gravel at the tops of cliffs with the use of hand grapnels.

114. Not less than a fortnight should be spent on leaders' courses on a scale of two or three students per instructor, and practising on varied rock. Climbing leaders will gain further confidence in themselves by instructing their own sub-unit afterwards.

115. In the assault, the " seconds " should also be men who have done these preliminary leaders' courses. The climbing leaders for the assault should be the fastest climbers in the unit.

Training of assault troops

116. Assault troops, once their leaders are trained, should undergo similar, though not quite such difficult training for at least one week without equipment, so that all members become fairly quick on steep ground. All personnel should be capable of climbing " moderately difficult " rock unaided and with weapons and equipment. They should be specially trained in moving up handlines quickly, and in roping down quickly.

117. These troops, after this first stage has been reached, should be practised over and over again at cliff sub-unit assaults, withdrawals, and bridgehead formation both by day and night, until all are clear about their respective roles whatever the character of the terrain. All personnel likely to be with this assault, such as signallers, medical orderlies, etc., must be included in this training. Besides handline training, such troops must be well practised in climbing rope ladders fired up by rockets.

Training of follow-up troops

118. Follow-up troops must be trained to move up handlines and rope ladders quickly, and to rope down. They should be taught the general formation of the bridgehead, and be given several schemes in which they form up within that bridgehead. In the case of a raid, if opposition in strength is expected, withdrawal practice will also be needed.

119. Heavily laden troops must be used to operate with rollers. Stretcher bearers need careful training in their roles.

Summary

120. Although the technique of cliff assaults has been the subject of considerable experiment, it is still in the development stage. The technique described above is far enough advanced to be used, but both teaching and practice are still fluid and capable of improvement.

121. The technical aspect of the cliff ascent must be kept in proper proportion relative to the tactical requirements of the plan. No cliff is unsurmountable, but poor planning may result in failure.

122. A cliff assault can be carried out only by troops who have undergone suitable training and who have been well rehearsed. With suitable equipment the ascent of the largest cliffs is only routine. Without suitable equipment a 20-foot cliff can be a great obstacle.

Type	How employed	Factors	
		For.	*Against.*
1. Parachute troops.	Small parachute force drops before H hour inland of selected spot, re-organises and moves to cliff edge and there establishes initial bridgehead to prevent hostile interference with cliff scalings. At H hour, parachute force lowers light well marked lines over the cliff. To these are attached the ropes, ladders, etc. which have been landed by the sea-borne force, and up which the follow-up force climbs.	(*a*) Enables small enemy posts to be dealt with. (*b*) Speeds up operation. (*c*) Provides protection in early stages of the cliff climb. (*d*) Silent.	(*a*) Dependent on weather. (*b*) Dependent on correct landing. (*c*) Difficult to establish contact with seaborne force even if point of contact well defined. (*d*) May alarm enemy.
2. Rocket and grapnel. *See* note below.	Rocket projector set up on beach or landing craft, consisting of rocket stand, rocket and grapnel, specially coiled 2½-inch rope in special box and electrical firing device. For the rope a small rope ladder or a combination of a tackle and ladder may be substituted. First man climbs up and helps to raise the remainder of the follow-up force and/or the apparatus for their use.	(*a*) Height, 200 feet. (*b*) Certain method. Grapnel grips well. (*c*) Equipment is easily transportable. (*d*) Can be fired from shore or boat. (*e*) Speediest method of getting line to cliff top.	(*a*) Rocket makes a flash and roar during flight. (*b*) Grapnel can be interfered with by enemy before first man is up.

Note.—The 3-inch mortar, using standard equipment and bomb has also been used. The bomb has a harpoon fixed to the nose and a rope attached centrally, so that the pull is taken in such a position that the flight of the bomb is not upset.

3. Schermuly 6 pr rocket. (A) Multiple shot. (B) Single shot.	This equipment works in the same manner as a Schermuly pistol. It fires a small rocket with light grapnel head attached to a line. The line is coiled in a waterproof paper box by the manufacturers. It is used to assist the initial men to scale the cliff either alone or in conjunction with other apparatus. It can be carried and fired by one man. Type (A) can be reloaded and is used for training. Type (B) cannot be reloaded and is the operational model.	(*a*) Very light. (*b*) Can be rapidly set up and fired. (*c*) Can be fired to fall on any selected part of the cliff. (*d*) Requires little storage space. (*e*) Expendable and cheap.	(*a*) The grapnel cannot support heavy weights. (*b*) The line is too thin to be climbed. Thus can only be used as aid or safety line. (*c*) Difficult to fire with accuracy. (*d*) Extra thin line necessary for heights over 100 feet.
4. Ladders—extending power operated.	A power operated fire ladder or water tower, mounted on an amphibious vehicle, swims ashore, takes up position and extends with leader in position at top of ladder. A MMG can be mounted on top of the ladder. Remainder of force run up ladder which provides broad treads and hand rails.	(*a*) Needs no special training except for operator. (*b*) Provides covering fire early. (*c*) Very rapid. (*d*) Relatively silent. (*e*) At its best on over-hanging cliffs. (*f*) Carries up with it the telephone connecting beach to cliff top.	(*a*) A 100-feet ladder with operational limit of 80 feet. (*b*) Needs suitable beach, free from obstructions and solid enough to take the vehicle. (*d*) Ceiling drops rapidly as angle of cliff from vertical increases.

Type	How employed	Factors	
		For.	*Against.*
5. Ladders—extendable, hand operated.	As for power operated, except leader is not raised with the ladder and MMG cannot be mounted on it. Rungs instead of treads and no handrails.	(*a*) Lighter than ladders, extending, power operated. (*b*) Quite silent in operation.	(*a*) A 60-foot ladder, operational limit 40 feet. (*b*) Needs suitable beach free from obstructions and solid enough to take the vehicle. (*c*) Ceiling drops rapidly as angle of cliff from vertical increases. (*d*) Has to be manhandled into position.
6. Balloons.	Naval kite balloons are flown off shore at a suitable operational height (500 feet), the leader is attached to the cable by a parachute harness at a height slightly greater than the height of the cliff. One to three balloons are used to give the necessary lift, depending on wind force. The balloons are flown ashore attached to a power winch in a boat or amphibious vehicle. Leader drops off on to cliff top, balloon is then used to lift remainder.	(*a*) Silent. (*b*) First man quickly up. (*c*) Virtually no ceiling.	(*a*) Balloon is vulnerable to small arms fire. (*b*) Can be easily picked up by enemy radar. (*c*) Difficult to handle. (*d*) Can only operate with onshore winds.
7. Cross bow grapnel.	Not at present available. Attempts are being made to develop this grapnel in order to get the advantage of a rocket without its flash or roar.		

FOLLOW-UP METHODS — APPENDIX B

Type	How employed	Factors	
		For.	*Against.*
1. Steel tubular 4-foot sectional ladders.	Each section is carried by one man. The first section is attached to the line or rope and hauled up by the leader, sections being added till the necessary height is obtained. The ladder then hangs vertically like a rope ladder. Wharf hooks on the top of the ladder grip the cliff edge, and a line with grip fast is used in addition.	(*a*) Light and handy. (*b*) Easy to climb. (*c*) Quickly erected. (*d*) In good supply. (*e*) Has not been tried beyond 88 feet, but works well at that height. (*f*) Very suitable for overhangs.	(*a*) Liable to come apart in the middle through faulty assembly.
2. Light rope ladders.	Hauled up and attached by leader and secured.	(*a*) Light. (*b*) Can overcome overhang.	(*a*) Difficult to climb.
3. Knotted or toggle rope.	Taken up by second man and then climbed by the remainder with assistance of foot work against the rock face. Alternatively may be fired attached to 2 inch rocket and grapnel, in which case it may be used to assist up the leader and thus becomes an initial assault method.	(*a*) Simple and straightforward. (*b*) Particularly suitable for sloping cliffs.	(*a*) Tiring and can only be used up to about 100 feet, depending on the slope. (*b*) Impracticable for big overhangs.

Type	How employed	Factors	
		For	*Against*
4. Block tackle and sheer legs.	Sheer legs placed on the edge of vertical cliff, and used to haul up heavy weapons and stores.	(*a*) The best way of getting stores up a cliff and for evacuation of casualties.	(*a*) Hauling party at the top may be exposed to enemy fire.
5. Rollers.	A special roller is placed on the cliff edge and a bight of rope dropped over it to the bottom. Each man then runs up the cliff, assisted by haulers pulling on the bight, which he has placed under his armpits.	(*a*) Very rapid. (*b*) Simple. (*c*) Suitable for heavily laden men. (*d*) Most of the weight taken by the climber's legs.	(*a*) If the cliff is vertical or over-hanging, all the weight comes on the haulers and the method becomes slow and dangerous. (*b*) The haulers are exposed to enemy fire.

APPENDIX C

DETAILS OF THE WEIGHT AND PERFORMANCE OF APPARATUS USED IN CLIFF ASSAULTS

1. Rocket and grapnel (projected grapnel)

(*a*) *Description of parts and weights*

(i) Projector ..	Modified PAC, Type J. Length 4 feet 3 inches.	Weight 38 lbs.
(ii) Rocket ..	Standard 2 inch, Type J ..	Weight 9 lbs.
(iii) Rope box with pin base.	Size, 2 feet 5½ inches square by 1 foot 3½ inches deep.	Weight 49 lbs. (no rope).
	Box without pin base ..	Weight 34 lbs.
(iv) Rope, 2½ inches in diameter.	45 fathoms in each box ..	Weight 58 lbs.
(v) Grapnel ..	15 inch overall diameter ..	Weight 9 lbs.
(vi) Wire strop ..	8 inch flexible wire (1 ton) with brass thimble each end.	
(vii) Flame protector.	Connects strop to tail of rocket.	
(viii) Firing battery and key.	4-volt dry battery in water-tight container combining firing key and socket to take firing lead plus.	

(*b*) *Performance*

	Rope size and type.	*Approximate vertical height.*	*Elevation*
(i) Standard 2 inch rocket grapnel.	1 inch plain	600 feet	80 degrees
(ii) Standard 2 inch rocket grapnel.	2½ inch plain	300 feet	80 degrees

2. Schermuly 6 pr rocket (light weight grapnel equipment)

(*a*) *Description of parts and weights*

(i) Schermuly rocket, 27 inches by 3 inches diameter	Weight 5½ lbs.
(ii) Grapnel head	Weight 4 lbs.
(iii) Projector, 27 inches by 3 inches diameter ..	Weight 4½ lbs.
Total weight ..	14 lbs.
(iv) Rope box, 23 inches by 23 inches by 6 inches deep.	Weight 10 lbs.
(v) Approximately 200 feet of 1 inch rope ..	Weight 25 lbs.

(*b*) *Performance*

	Rope size and type.	*Approximate vertical height.*	*Elevation*
(i) Light Schermuly equipment.	1 inch rope	200 feet	80 degrees
(ii) Light Schermuly equipment.	1½ inch rope	150 feet	80 degrees

3. Ladders—extending, power operated (100 feet power operated ladder on DUKW)

(*a*) *Description of parts and weights*

(i) Weight of ladder (standard 100 ft Merryweather).	22 cwt.
(ii) Weight of frame and mechanism (frames duralumin).	33 cwt.
Total weight ..	55 cwt.
(iii) Maximum length of ladder	100 feet
(iv) Height of bottom of ladder from ground ..	5 feet
(v) Distance of ladder fulcrum from bow of DUKW	20feet 6inches
(vi) Overhang of ladder when horizontal	7 feet
(vii) Maximum elevation	75 degrees

Power to drive ladder is taken off winch drive on DUKW.

(*b*) *Performance*

(i) Time to elevate from horizontal to 75 degrees (maximum elevation).	50 seconds
(ii) Time to extend to 100 feet	90 seconds
(iii) Time for man to climb	45 seconds

(*c*) *For a vertical cliff*

	A *Angle of elevation.*	*B* *Loss of height for full extension.*	*C* *Height of ladder above ground.*	*D* *Distance of DUKW's bow from cliff bottom.*
(i)	75 degrees	3 feet 6 inches.	101 feet 6 inches	7 feet
(ii)	70 degrees	6 feet 0 inches.	99 feet 0 inches	16 feet
(iii)	65 degrees	9 feet 6 inches.	95 feet 6 inches	25 feet
(iv)	60 degrees	13 feet 6 inches.	91 feet 6 inches	34 feet

Column D has taken into account the sag of the ladder due to the weight at the top and these distances are therefore a minimum.

(*d*) *Alteration of elevation will move ladder top*

	Vertically up.	*Horizontally out.*
(i) From 60 degrees to 65 degrees.	4 feet approx.	7 feet 6 inches approx.
(ii) From 65 degrees to 70 degrees.	3 feet 6 inches approx.	8 feet approx.
(iii) From 70 degrees to 75 degrees.	3 feet approx.	8 feet 3 inches approx.

4. Rope ladders

(*a*) *Description of parts and weights*

(i) Two 1 inch manilla ropes with wooden rungs 1 inch diameter by 9 inches long spaced 18 inches apart.	
(ii) 200 feet length of ladder	Weight 48 lbs.
(iii) Box to hold ladder 50 inches by 10½ inches by 19 inches high.	Weight 30 lbs.
(iv) 30 feet of 2½ inch rope between rocket and ladder	Weight 5 lbs.
Total weight ..	83 lbs.

(*b*) *Performance*

	Rope size and type.	*Approximate vertical height.*	*Elevation.*
(i) Standard 2 inch rocket grapnel.	Rope ladder (light).	250 feet	80 degrees
(ii) Standard 2 inch rocket grapnel.	Rope ladder (heavy).	200 feet	80 degrees

5. Toggle rope

(*a*) *Description of parts and weights*

(i) 5 inch wooden toggles spaced every 3 feet 220 foot length.	Weight 45 lbs.
(ii) Box as for plain rope	Weight 35 lbs. without pin base.

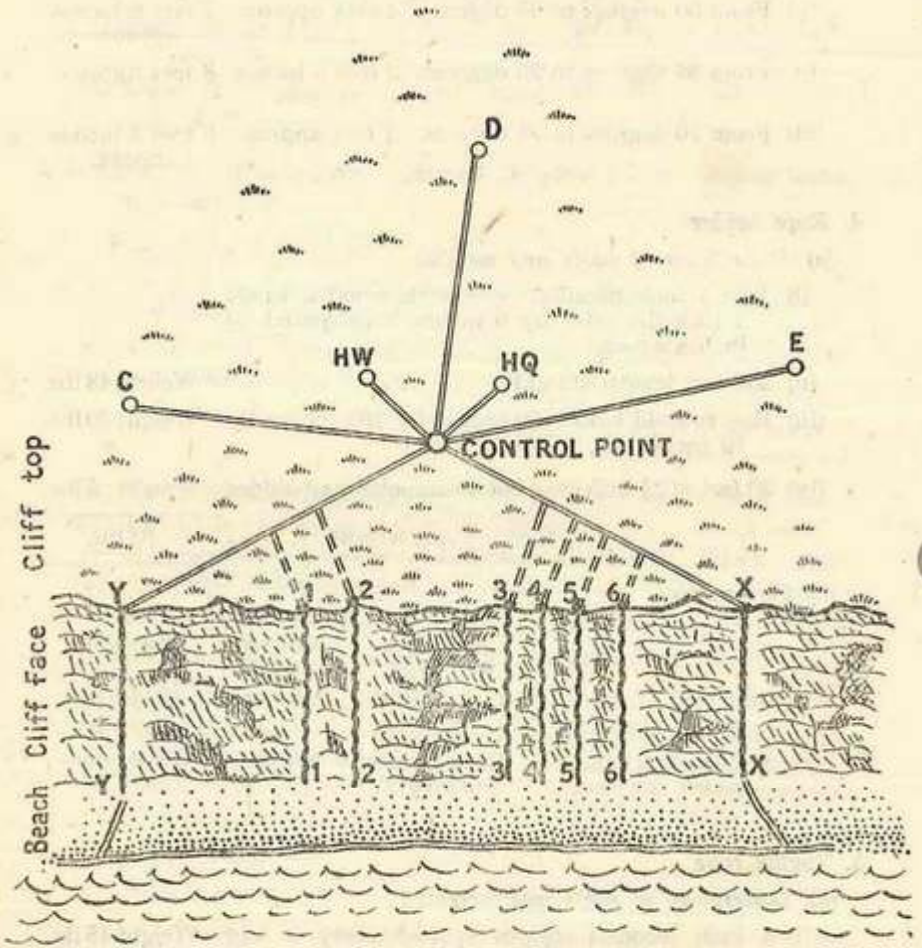
(*b*) *Performance*

	Rope size and type.	*Approximate vertical height.*	*Elevation.*
Standard 2 inch rocket grapnel.	2½ inch toggle. 3 feet spacing.	275 feet	80 degrees

APPENDIX D

DIAGRAMMATIC LAYOUT OF A CLIFF BRIDGEHEAD

Showing the position of guiding tapes



REFERENCE

C, D, E = C, D and E Troop forming up positions.
HW = Heavy Weapon Troop forming up position.
HQ = Headquarter Troop forming up position.
═══ = Main guiding tapes both on beach and cliff top.
= = = = = = Subsidiary guiding tapes, for use in withdrawal.
Y, X = Outermost ropes on each flank.
1, 2, 3, 4, 5, 6 = Climbing ropes, preferably grouped in pairs of fours.

(C54296) 37,730 2/45

76
+52
~~204~~

~~1020~~
~~500~~
250

38
76

250
225