



NEW ZEALAND
ARCHAEOLOGICAL
ASSOCIATION

**NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION HANDBOOK 1:
J. Golson and R.C. Green, *A Handbook to Field Recording in New
Zealand***



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A HANDBOOK TO FIELD RECORDING IN

NEW ZEALAND

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New Zealand Archaeological Association

Handbook No. 1

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1.0 INTRODUCTION

At its third annual conference, in Wanganui May 1958, the New Zealand Archaeological Association held preliminary discussions about the establishment of a scheme for recording archaeological sites throughout New Zealand.

The scheme was then planned in detail at a meeting of representatives held in July 1958 in Wellington and a pilot survey undertaken by the Auckland University Archaeological Society in October, on the South Kaipara Heads.

A report on the Auckland survey was brought before the Council of the Archaeological Association in November, for discussion. This handbook is based upon the Auckland report.

1.1 This Handbook is designed to help everyone participating in the scheme

Though based on the experience of a large, organised group well provided with equipment, it is addressed as much and more to the individuals and small groups provided with a minimum of equipment, who will form the bulk of the Association's recording team.

1.2 The Handbook is therefore divided into a number of sections

Section 2, Equipment and its Procurement, covers the whole range of useful equipment. Remember, however, that of the technical equipment

1. only the map is strictly essential;
2. map, tape and camera are a useful basic combination;
3. map, camera, tape and aerial photographs make a satisfactory combination;
4. the addition of a reliable compass to the above and the technical equipment is first class.

Section 3, Map Reading and Operation of the Prismatic Compass, is meant to serve as an introduction to the 1 inch to the mile map series and the national grid reference system by which all site recording is to be done. For those using a compass, its operation is explained in 3.6.

Section 4, Plotting Field Position on the Map, caters

1. for those who have map but no compass, and need only Sections 4.1, 4.2 (1st two pp.), 4.4, 4.5;
2. for those with both map and compass who will find all sections from 4.1 to 4.6 useful.

Section 5, Aerial Photography, is an introduction to the use and interpretation of aerial photographs, for those who will be employing them in the field. Everyone should read the chapter, however, in order to realise the advantages conferred by the use of aerial photographs in fieldwork.

Section 6, Site Maps from Aerial Photographs, is a somewhat specialised chapter describing the preparation of site plans by the use of an epidiascope or other device to enlarge aerial photographs.

Section 7, Preparations for Work in the Field, is largely designed for groups planning a survey in a new area, but the advice it contains is relevant to any survey work.

Section 8, Site Record and Site Survey Forms, the bulkiest chapter of all, is an essential section for all recorders. It is designed to guide the recorder in the completion of his record forms by describing the types of site he is likely to meet and setting out the information he is asked to record.

Section 9, Plans, Diagrams and Illustrations, deals with the drawings and photographs which ideally will be used to supplement the written descriptions.

Section 10, Processing the Records, describes

1. what the fieldworker does with his forms when he has filled them in;
2. what happens to his record material eventually.

Section 11, Evaluation of Techniques, summarises the experience of the Auckland group in its "pilot" survey and assesses the potentialities of the varied recording groups that will be taking the field.

1.3 How to use the Handbook

1. Sections 1-7, 10 and 11, or the portions of them relevant to any particular individual or group, are meant for study before taking

the field and reference at other times. They are therefore bound together as a single part.

2. Sections 8 and 9 are essentially field guides and recorders will probably find it valuable to take them out into the field. To this end the various parts within these sections are fastened together loose-leaf fashion, so that any desired part can be taken out.
3. It is suggested that Sections 8 and 9 be bound in some way between hard covers and index tabs affixed to each of the relevant sections for quick reference in the field.

1.4 Bibliographies

Short bibliographies are occasionally attached at the end of sections to enable readers to follow up any particular aspect of the work.

2.0 EQUIPMENT AND ITS PROCUREMENT

2.1 Essential Equipment

- 1. Maps - It has been agreed that the country-wide archaeological survey will use the Inch to the Mile set of maps and the national grid reference system for indicating the site location. However, this is not to say that other maps will not be useful in the field, but only that final reference should be made to this set of maps.
- 2. Site Record Forms - A standard cyclostyled form has been prepared for recording information from each site. (See sec. 8.0.)
- 3. Scrap paper - To be used for figuring angles, grid references, etc., before permanently recording them.
- 4. Stiff 5" x 8" card - On this a romer for determining grid references, scales for determining distances, and other information like the standard correction for magnetic deviation for the area under investigation should be placed. It should be made before taking the field. (See Fig. 2.2.)
- 5. One hard lead pencil, between 2 and 4H in hardness - The use of a hard lead pencil is essential to keeping clear and legible records and is standard practice among surveyors. Records kept in soft lead pencils tend to smudge, and records kept in ink (despite the claims of the ball point pen ads) are subject to water damage, especially in any field work.
- 6. Eraser - Not only for those who make mistakes, but also to keep the aerial photos and maps clear of miscellaneous information and lines.
- 7. Pocket knife or sandpaper - To be used in sharpening pencils.

2.2 Desirable Equipment, in addition to the above

- 1. Aerial photographs - These should be purchased and checked before going into the field. Information should always be obtained as to the altitude they were taken at and the focal length of the camera used, so that their scale may be determined. (See sec. 5.8.)
- 2. One soft lead pencil, 4B or more - For use on aerial photographs to mark site locations and outline features. Remember that hard

FIGURE 2.1 - Layout of Field Mapping Table

18" x 30" board

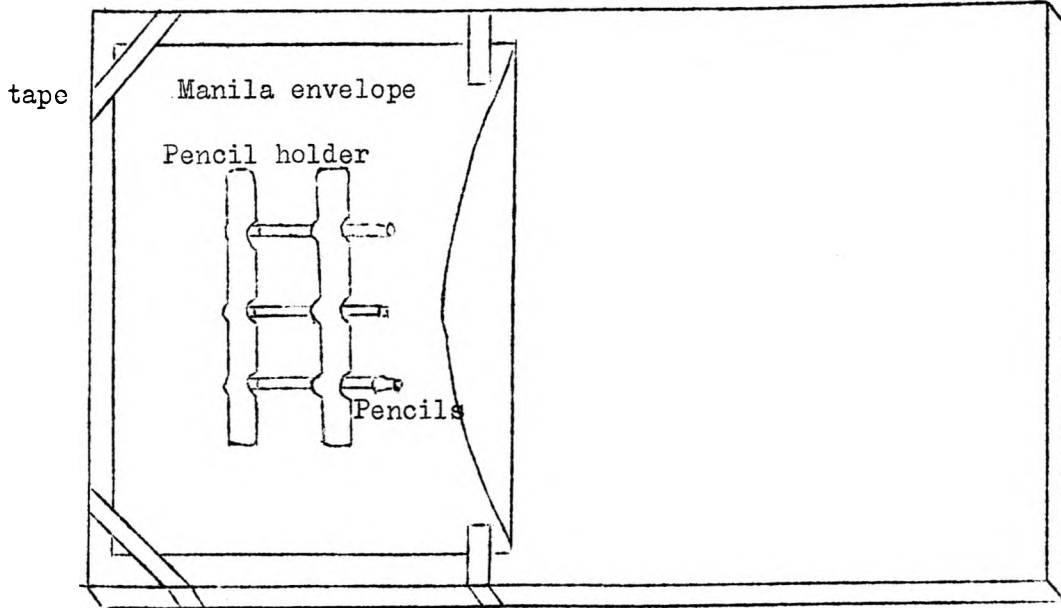
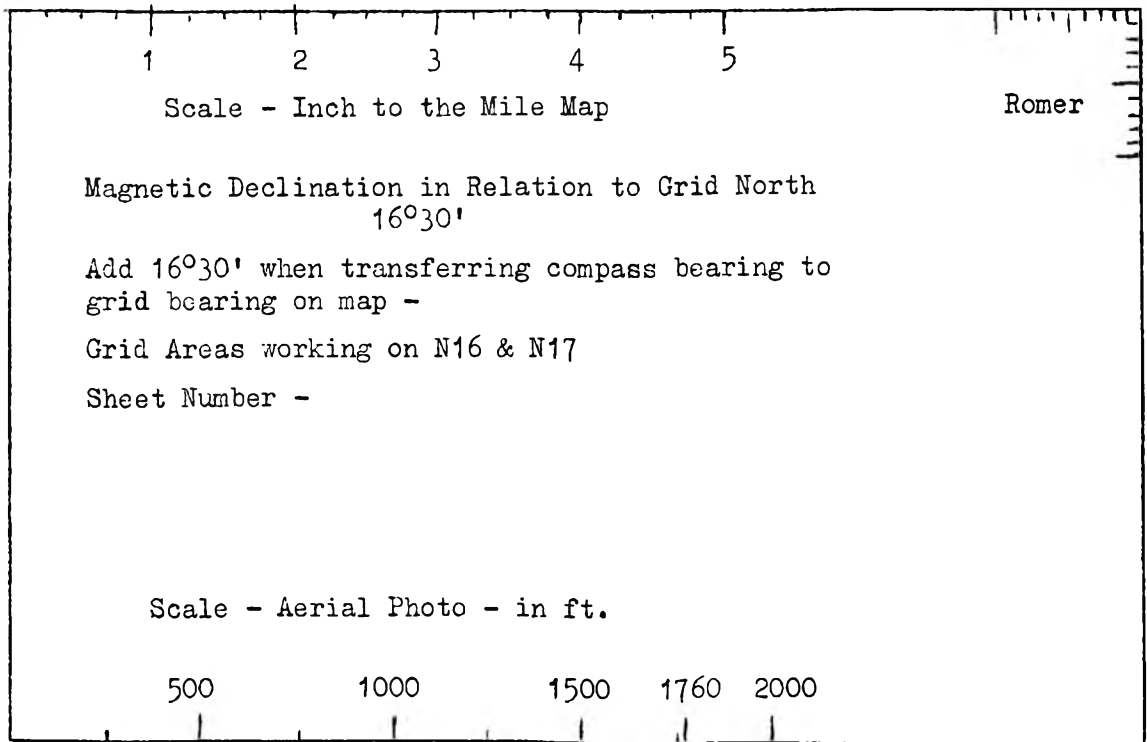


FIGURE 2.2 - Layout of 5" x 8" card



lead pencils are not to be used on aerial photographs.

3. Graph paper - A pad of this with a fairly wide grid is the best type of paper on which to sketch site plans quickly and accurately.
4. Mapping table - There are many varieties that can be made to suit the individual taste, but the best types are generally made of a light material with one smooth hard surface (fibre board) and are about 18 x 30 inches in size. At one end of the board a large brown envelope of sufficient size to hold a set of aerial photos, note paper, site record forms, cards and other flat objects is attached by tape. Many attach to the outside of the envelope a device to hold the pencils as well. (See Fig. 2.1.)
5. Spring clips - To be used in holding maps and photos to the mapping table (at least four).
6. Compass - The easiest to obtain and least expensive is probably the old army prismatic compass with which one can take excellent bearings. The Brunton compass we find is a more versatile instrument, however, because it can be converted to an open-sight alidade, and also contains a device for levelling, taking heights of slopes, and calculating their angle of inclination.
7. Protractor - There are many varieties of these, but a circular one is probably the most handy when using a prismatic compass.
8. Stiff 5" x 8" card - See 2.1.4 and Fig. 2.2.
9. Tape - A steel or linen reinforced tape for taking short measurements of pits, ditches, etc.
10. Camera - A good camera is an almost indispensable recording instrument. Theoretically, the larger the negative size the better, but modern cameras of 120 or 35 mm. size are extremely efficient.

2.3 Optional but Useful Equipment

1. Magnifying glass - A 2-4 power hand lens is very useful in picking up details from single aerial photos.
2. Pocket stereoscope - This is the field instrument used to view pairs of aerial photos in 3-D vision.
3. Engineer's scale - The handiest type of ruler for making scale drawings and measuring distances. It is available in a variety of shapes and sizes.

4. Abney Level - If you have a Brunton compass, this is not necessary, but otherwise it will help in calculating slopes, levelling and taking heights.

2.4 Laboratory Equipment

1. Epidiascope - this is merely a long name for a high powered magic lantern.
2. Projection screen - the typical home movie viewing screen.
3. Mirror-type stereoscope - this instrument allows one to examine the whole overlap of stereo-pairs of photos under high magnification.

2.5 Procurement of Equipment

1. Maps and Aerial Photographs

1. The Association has an agreement with Lands and Survey Department, Wellington, whereby both maps and aerial photographs are available to Association members at discount prices:
 - 1" to 1 mile maps at 3/4, instead of 5/-.
 - Aerial photographs at 11/10, instead of 17/9.
2. All orders must be made through the secretary of the recording scheme, Miss Winifred Mumford, 24 Buller St., Wellington, and a certification must be signed by the applicant that the maps and/or photographs are for his personal use.
3. The following particulars must be provided by the applicant:
 1. for maps, the map series, number and name,
 - e.g. NZMS 1 (= New Zealand Map Series 1:63360) N37, Helensville.
 2. for aerial photographs, survey number, name of run, Lands & Survey number(s) and serial number(s), together with specifications as to the number of copies of each print, size of print, and photographic finish (matt or glossy).
 - e.g. Specifications: one copy of each
 - matt finish
 - 9" x 7" size
1. Two photographs as follows:
 - Survey Number: 577
 - Name of Run: Kaipara Harbour - Cape Rodney - Helensville.

Lands & Survey Numbers: 1944/4-5

Serial Numbers: 92506-7.

2. One photograph as follows:

Survey Number: 143

Name of Run: South Kaipara - Hobsonville

Lands & Survey Number: 81/13

Serial Number: 70632

N.B. A matt finish is superior for study purposes. 9" x 7" is the standard size.

All the necessary information can be obtained from local Lands & Survey and Land District Offices, where maps and aerial photographs can be consulted.

2.5. 2. Stationery

1. Graph paper is generally available in a number of varieties. For the purposes of the site planning from aerial photographs before the field-trip itself, $\frac{1}{4}$ " graph paper was found suitable. This is available at 4d per sheet in sheets 27" x 17" (divisible into four handy sheets for working purposes).
2. Scrap paper is most convenient in the form of scribbling pads, which are easily procured in different sizes, e.g. 8" x 5", 8/6 per dozen or 9d each; 5" x 5", 5/6 per dozen or 6d each.
3. Stiff cards for the romer are easily made. Lined cards 5" x 8" are available at 8/6 per hundred packet.

2.5. 3. Circular Protractors are procurable in a number of sizes and at a variety of prices. A 6" or 8" protractor is the most suitable. 6" circular protractors cost 7/6, 8" a little more.

2.5. 4. Hardboard for the mapping table is available at any hardware store and comes in sheets 8 ft. x 4 ft. The $\frac{3}{16}$ " variety costs 25/3 ($\frac{33}{2}$ tempered).

2.5. 5. Surveying Equipment

1. Compasses. For survey work of the sort envisaged a good compass with efficient siting device is essential. These are apt to look expensive, but a cheap compass is worse than useless and good compasses are available secondhand.

1. Prismatic Compasses. Standard army oil bath prismatic compasses can be obtained

(1) new from reputable instrument firms at about £17.

(2) secondhand from dealers, Army surplus stores, instrument firms and the like for as little as £7.10. 0 and occasionally more cheaply.

2. So-called Engineers' Compasses from Japan, with sighting device, but if lacking stopping device are available in small numbers at 18/-. Their accuracy has not been tested by the authors.

3. The Brunton Compass, an American compass also manufactured in England, is available in New Zealand only through agents. It costs £21 - £24 new, but can sometimes be obtained secondhand.

4. The Bridge Site Clinometer is a cheaper instrument that does the same sort of work as the Brunton, but can only be obtained from England. It costs about £12.

2. Abney Level is available from instrument dealers over a considerable price range, from £3.10. 0 for an instrument with a straight-out Vernier scale to £70.10. 0 for instruments with lens type readers and other refinements.

3. Tapes and Scales

1. Tapes, generally available from hardware stores, are produced in 33 ft., 66 ft. and 100 ft. lengths and in metal reinforced linen, steel and plastic on metal. Representative prices are:

(1) Evans White Tapes (plastic on metal)

33 ft. 35/6

66 ft. 47/6

100 ft. 58/6

(2) Rabone Steel Tapes

100 ft. 78/6

(3) Rabone Reinforced Linen

66 ft. 45/-

2. Engineer's Scales are generally available and can be obtained for 22/9.

6. Pocket Stereoscopes, from instrument dealers, cost from £2.10. 0 to £3. 0. 0 but may sometimes be obtained secondhand.

7. Magnifying Glasses, of 2 - 4 times magnification, cost about 10/6 and are easily obtained.

8. Cameras. It is unnecessary to say anything in this respect beyond stressing the advisability of having a good one.

9. Laboratory Equipment

This equipment is in the main outside the individual purse.

1. Mirror-type Stereoscopes for reading aerial photographs are much superior to pocket ones but only people with access to institutions that might be expected to possess them, e.g. university geography departments, will be in a position to use them; many books on aerial photography however, tell how to make the more simple models of these with little difficulty.
2. Epidiascopes. The technique described in section 5 for compiling base plans from aerial photographs by the use of an epidiascope is so worthwhile that an effort should be made to search out an instrument that might be used. University departments, schools, museums, research units, national and local planning authorities, and societies which use slides and photographs extensively should possess one. And, if properly approached, they may be willing to allow a bona fide archaeological field worker use of the machine for survey purposes.
3. Projection Screens will undoubtedly be possessed by any institution with an epidiascope, but with the recent growth of home projection, screens will probably be in the possession of friends of the researchers, from whom they can be borrowed.

2.6 Bibliography

- Wraight, A.J. 1954. The Field Study of Place, a practical guide, Univ. Press of Washington D.C., Washington, D.C. (available in Auckland Univ. Library).

3.0 MAP READING, AND OPERATION OF THE PRISMATIC COMPASS

3.1 Introduction to Map Reading

Map reading is a subject requiring a little guidance and a lot of practice. It is a skill or art best learned with a map in hand and a number of problems on which one can practise. The first step then is to get a map of the region in which you are going to work. This, of course, does not mean any map, but rather one suited to your particular purpose. In this way you will familiarize yourself with the region in which you are going to work as you learn to use the map. In section 3.2 we will discuss the question of what map, but first let us pursue further the question of maps suited to a particular purpose.

That maps are constructed for a variety of purposes is only too evident from the names we give them, i.e., highway, geologic, topographic, or political maps etc. Each is a means of emphasizing some particular aspect of the actual picture on the ground. But the real point is that none of them ever presents the actual picture just as we see it. Some features are ignored, others lack various details. The only way to get all of them would be to take a coloured picture from the air, and even one of these would lack the three dimensional quality. Thus a map is only a representative drawing of certain selective features constructed for some particular purpose.

This may seem a minor and obvious point, but it is important that one think of maps in this way. It will save a lot of worry, especially when you are standing on a low hill beside some small gully, neither of which you can find on your map. At this point you may be ready to question the worth and accuracy of the map. Instead, remind yourself that the accuracy of a map with regard to specific features is related to the purpose for which it was constructed and the scale to which it was drawn. Your present difficulty merely represents a conflict of interest between you and the maker of the map. Unless you propose to re-do his work completely, you might better resign yourself to making the best use possible of the information already given. In most cases, if you have chosen your map well, you will find it sufficient for your purpose, which is of course to correct his bias by adding the particular information in which you are interested.

This conflict of interests is easily illustrated. The maps on which you are working indicate a number of recent man-made features, but only a few of the major pa sites. Your purpose is to construct a map which records all the archaeological sites, but neglects the more recent features like roads. fences.

farms and towns. Such a map, however, involves us in another problem. If all of these more recent features are removed from the map, how will someone in the future easily find their way back to those sites we have identified? To get there they would certainly want to use a map which has just those features we have omitted. Moreover, the landscape features so obvious at present, may have completely changed. Thus an unvarying system is needed to transfer data on our map to any other, very precisely and with a minimum of effort. For this purpose most maps contain a set of reference lines devised by man, not to be found at all on the ground.

Reference lines may be thought of as one of a number of imaginary systems of lines devised for our own convenience. In the same way that they allow someone to transfer information from our map to theirs, so we can transfer information from other maps to our own. The two main systems of this type we shall encounter are those of meridians and parallels; that is, lines that point north-south and east-west and grid references, that is, a system of lines that lie at a slight angle to them and divide the map into a series of rectangular boxes. Another system of imaginary lines you will have occasion to use are those called contours. They do not provide reference points, but rather assist in indicating the relief or three dimensional shape of the country.

By way of summary, then, we may divide the subject of mapping into three parts. One deals with the actual picture we see in the field. This is most closely approximated by the aerial photograph. A second deals with the map makers' drawing of that picture. It is constructed for a given purpose, so that certain features are given emphasis at the expense of others. In this sense a map is very much like any work of art. The third part deals with systems of imaginary lines. While they occur on the map, they are not to be found on the ground. Most of them provide us with a standard system for transferring information from one map to another; others aid in interpreting some aspect of the actual picture.

If the relationship between the three divisions are portrayed thus:

Actual picture _____ The map picture with only _____ The imaginary system
 or what we see _____ certain features emphasized _____ of reference lines

it is perhaps easier to visualize how one goes about locating an object on the map. The basic problem is to relate the actual picture you see as you stand on some archaeological site to the imaginary system of grid references found only on the map. To do this it is necessary to make use of the selected features

presented in the map drawing. The process of locating a site on a map is thus a two step process. First you identify your position with respect to those features on the map that you can also find in the field, then having located that position on the map, you work out its relationship to the grid system. As you go over each technique, keep this question in mind: ask how it helps to take the information you can see in the field and state it in terms of a grid system which exists only in the minds of men and on their maps.

3.2 The Inch to the Mile Map Series

Lacking maps constructed specifically for archaeological work, the association has chosen the Inch to the Mile map series for its countrywide survey. This readily available series they feel will provide not only a uniform coverage for all New Zealand, but also meets the majority of individual needs. At present, **unfortunately**, some districts are not yet covered by these maps although they are scheduled for production in the near future. Until then, however, it will be necessary for those working in these districts to use those maps that are available. Also the Inch to the Mile maps exist in two sets: **the** Provisional set, largely made in the 1940's, and the post-war New Zealand Mile Series 1, referred to as N.Z.M.S.1, Sheet No. such and such. There are certain differences in the two, to which the reader will have to adjust to depending on the particular map he has in hand. Information necessary to procuring these maps at reduced rates through the association can be found in Section 2.5.1, and as we remarked above, procuring one is the **first** step in map reading. The rest of this discussion assumes, therefore, that you have in your hands an Inch to the Mile map of the region in which you are particularly interested.

Because the association has decided to use the Inch to the Mile set of map sheets, this does not imply that other maps would not be useful or that they should not be used. Quite the contrary, especially in regions where these maps are not available. Remember only when using other maps that it is essential to have some means of transferring information placed on them to the Inch to the Mile set and check to be sure that some such system exists on other maps you may wish to use (i.e. grid references, or lines of latitude and longitude).

3.3 The Margin of the Map: Location and Scale

The margin of your map provides most of the technical information necessary for its interpretation and use. In general it is a good policy to spend some time going over this information before trying to work with the map itself.

The first question that usually leaps to most minds about a map is the region it covers and the relationship of this region to a larger surrounding area. In other words what is the relationship of the region covered by this map to some larger area of New Zealand? The answer on most of these maps is provided in a small box in the bottom margin. Here you will find an outline map of a larger area of New Zealand divided into a number (usually five or six) small rectangles. (NOTE: sometimes the outline map is missing, in which case it will be necessary to consult a larger map of New Zealand to see the exact region covered.) Each rectangle is numbered and one of them is shaded by diagonal lines. The shaded rectangle is the region covered by this map sheet. The numbers in the surrounding rectangles refer to the numbers of the sheets which cover the regions on each side of your map. When you find that something is located just off one edge of your map, you know from glancing at the Index to adjoining sheets, what sheet to look on next.

The question that generally follows the first is one about size. How big is the area covered and how far is it from here to there? A map looks like the ground it represents because it is a scale model of that region. In this case these maps are named for the scale to which they are drawn. One inch on the map equals a mile on the ground. Map scales are usually expressed, however, so that one of anything (feet, centimeters, or yards) on the map equals so many of the same thing on the ground. Thus on this map one inch equals 63,360 inches. As you may have guessed there

are that many inches in a mile. This ratio is generally given as 1 : 63,360 as in the top left hand margin, or as a fraction $1/63.360$ as stated just above the scale line in the centre of the bottom margin. The scale line itself, is a more practical device for our purposes, however. Using this scale line and a piece of paper or cards with a straight edge, you can quickly calculate the distance between any two points on the map. Just mark it off on the paper and then lay that alongside the scale line. In the same way it is possible to calculate the size and area covered by the map. A little work will show you that it is about 17 by $25\frac{1}{2}$ miles on the sides and covers approximately 430 square miles.

3.4 Direction

Another question we might raise is where is north. The answer is more complex than most people suspect. In a general way it is true that the top is north, the bottom south, and the right and left sides east and west respectively. But this is true only in a general way.

Actually there are three norths on these particular maps. One is true north, the second is magnetic north and the third grid north. They are usually indicated by the symbols TN, MN, and GN respectively. Since meridians are defined as lines running north and south between the poles, true north is always along a meridian. True north on these maps then is indicated by the meridian lines which are found along the top and bottom of the map and numbered by degrees and minutes referring to their longitude. In New Zealand these numbers range between 166° and 179° depending upon the particular region.

If you study the relationship between the meridian lines and the grid lines at the top and bottom of the map, you will find that they are not parallel, but rather than the meridians lie at a slight angle to the grid lines. This means, of course, that the grid is not exactly north-south, and east-west, but at a slight angle to it. This direction is usually designated as grid north. The reason for this angle between the meridian-parallel system and the grid system is found in the way these maps are made.

Reference to the bottom margin, again, tells you that this is a Transverse Mercator Projection. Without going into the types or theories of map projection, let us remind you that because the earth is round, any flat map will in some way distort that picture slightly. Also remember that meridians come closer together as one goes toward the north or south poles, so that to project them simply as parallel lines will cause too great a distortion of distances for topographical work. The Transverse Mercator Projection is a means of correcting this distortion over small areas like New Zealand by making only one meridian a straight line, and curving the others so that they converge slightly to the south (see Fig3.1). In this way the distances on these maps whose origin of projection lies within New Zealand are fairly accurate, but the reference grid of meridians and parallels no longer constitutes a series of parallel lines. Because most people find it simpler to work with a system of parallel lines, a second system of reference is imposed over the flat maps already projected in this manner. They form a rectangular grid system, but in it only one grid line, the one that lies along the single straight meridian, points north. All the rest lie at a slight angle to the meridians and parallels giving rise to the distinction between true north and grid north.

Fortunately for the type of work that you will be doing with a compass, the angle between TN and GN is not great enough to warrant exact calculation, so that the angle is usually estimated for the particular map in hand. This estimate is made by comparing the figures given for the convergence (or the angle between TN and GN) on the left and right hand margins ^{or in the bottom margin.} The practise is to choose whichever one of the following series of numbers: 0, $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2, etc.,

lies closest to the range between these two values. Thus if the angles given are 0° , $49'$ and $0^{\circ} 32'$, the angle is estimated at $0^{\circ} 30'$ or $\frac{1}{2}^{\circ}$.

For the most part true north will play little part in our calculations aside from this estimate which, once made, can be used over and over on the same map. While the distinction may frequently be ignored, all sketch maps or site plans should have some north marked on them, so it is usually well to indicate whether grid north or true north is intended, and always necessary to indicate when magnetic north is being used along with the year. For unlike the distinction between TN and GN, the distinction between magnetic north and either of these cannot be ignored in New Zealand.

What is magnetic north? In using the magnetic compass, the needle points not to the north pole, but to a constantly moving point in northern Canada called the magnetic pole. People along a certain meridian in the eastern United States are on a line which passes through both poles. In their case the compass points to TN and MN at the same time, but the rest of us are not so fortunate and in fact the angle can become fairly large. Thus a meridian that runs through New Zealand misses Canada entirely, so that a line drawn between here and northern Canada forms a considerable angle with a line running true north. Actually many other factors influence magnetic variation as well, so it has been necessary to work out on each map the exact amount of magnetic variation or declination. On these maps the necessary information for calculating this is given in the upper right hand margin or along the bottom margin.

To work out the present magnetic declination, first note the year in which the map was last printed with the variation for that year. Calculate the number of years that have passed since then and multiply the amount of annual increase given by this number. This will take into account the continual movement of the magnetic pole since the map was made. Then add this figure to the magnetic variation at the time the map was printed, rounding the total off to the nearest half degree. This will give you the present magnetic declination, or the present difference between TN and GN (see Fig 32).

Why go to all this trouble over the difference between the three norths? Well, you will discover that they are needed over and over again in using the compass with the map, and in giving bearings or directions for different objects. If they are not quite clear to you now, they will be as you begin to use your compass with the map.

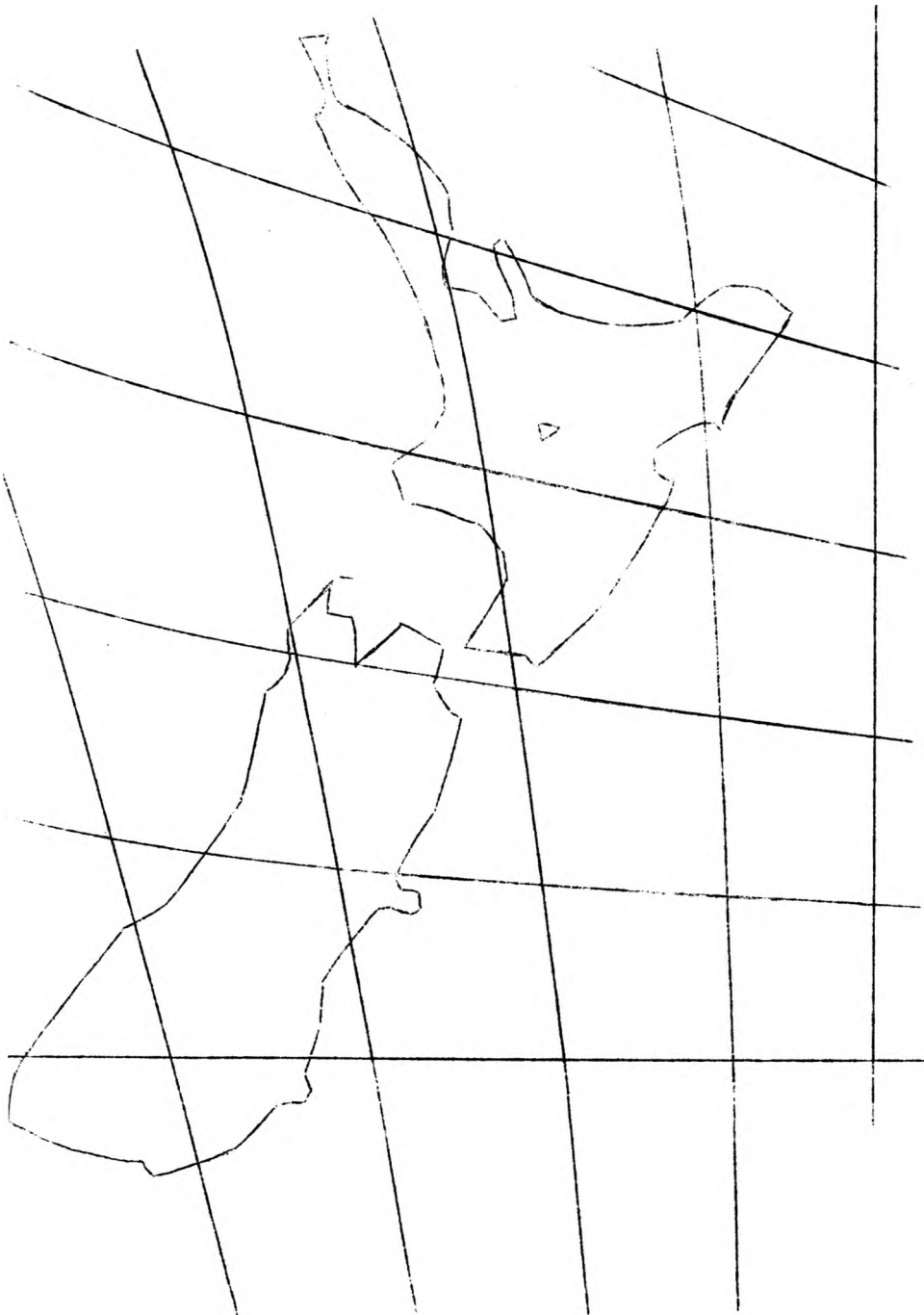


FIGURE 3.1

FIGURE 3.2

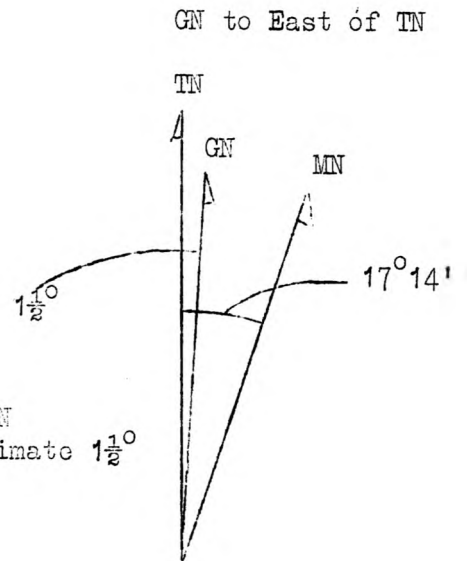
(a) $\frac{1958}{1943}$
15 yrs

(b) 04' Annual
 $\frac{15}{60}$ Increase
or 1°

(c) MO-1943 = 16°14'
Increase = 01°
MO-1958 = 17°14'

(d) convergence-TN from GN
1°49' - 1°32' = estimate 1½°

(e) Angle between GN and MN = Approx. 15°30'



3.5 The Grid Reference

We turn now from information in the margin of the map that aids in its interpretation, to marginal information that allows us to fill in the first three categories on the site record form. These are the 1 Mile Sheet No., the name of the sheet, and the grid reference. The 1 Mile Sheet No. or Sheet No. is found on the right hand side of the top margin. It also is found along with adjacent sheet numbers, you will recall, in the box in the center of the bottom margin. The name of the sheet is given in the center of the top margin. While these two categories are thus easily filled in, the grid reference for a site is more complex.

To give a grid reference for a site assumes you have already located its exact position on the map, or have completed the first step in the basic two step process. The problem now is to state the position in terms of a grid reference. A typical grid reference is a six figure number followed by the grid square: 879138 - G. Sq. N. 17. The principle of the grid system is the old one learned in school of locating a point using an x-y system of co-ordinates (see fig.3.3). The procedure here was to count the number of units at the x axis and then up the y axis which determined that point. The location was stated by saying x equals 6 and y equals 4, or similar figures. The present grid system works much the same way.

On every map the grid system and all the information relating to it are printed in one colour: purple.* Also every map has in the lower right hand margin a guide with an example already worked out to which you can refer whenever you are in doubt. At the top of this guide box is a statement to the effect that this sheet lies in certain grid squares. Since it is quite possible that different parts of the map lie in different grid squares it is essential that the grid square always follow the grid reference as in the example above. By referring to the index to

adjoining sheets, you will note that in purple it also shows which parts of the map are covered by the different grid squares/ ^{when more than one is involved.} On the map itself, the 00 lines always form the boundaries between the grid squares. With these two keys, it is possible to determine which areas of the map lie in different grid squares.

The six figure reference itself, 879138 for example, is actually composed of two major units. The first three numbers, 879, are one unit, and 138 is the second. The first unit always refers to lines running GN, the second

* NOTE: On all of the new maps the colour is blue.

unit to lines running grid east-west. In the first unit 879, the 87 refers to one of the printed N-S grid lines on the map numbered along the top and bottom margins. In the second unit, 138, the 13 again refers to one of the printed E-W grid lines numbered along the right and left hand sides of the map. Where the N-S, or in this case the 87 line, crosses the E-W or 13 line, indicates the SW corner or south and west sides of the particular square in question.

Reference to one of the squares on the map is thus made by four numbers, and always refers to the SW corner of the square. From either the last line of the guide box or from the line scale in the centre of the map divided into yards, you can learn that one of these squares is 1000 yards on a side, meaning that any object within that square is located within 1000 yards. We would like to locate our sites to within 100 yards, however, so it is necessary to divide each one of these squares again with nine lines in each direction. If these lines were drawn in as they are in figure 4, each square would be divided into 100 units each 100 yards on a side. But instead of drawing them in, it is easier to determine them by a device called a romer.

A romer is simply the corner of a card which is marked off to the size of square and then the two edges subdivided into ten units equal to 100 yards each. It can be quickly and easily made by placing the edge of the card under the left end of the yard scale line where it is divided into 100 yards divisions. Number each of the sides from 0 to 9 as in Figure 2.2 (see Section 2.1.4.). With this romer it is now possible to calculate where the lines would be if they were drawn in the square.

Reference within a square is made by the last two numbers in the six figure reference. Note however, that they are not the last two numbers, but the last number of each unit. Thus in our example, 879138, the 9 and the last 8 are the numbers which refer to the position in the square and not 38. In the same way that a square on the map is identified by the SW corner where the two lines cross, so one of these smaller squares is also identified, this time using numbers between 1 and 9. First using the romer, measure how many divisions there are from the west side of the square to the object or site. This will give you the last number in the first unit, or in our example the 9 of 879 unit. Then measure from the south side of the square up to the site with the other edge of the romer, and use the number of that division for the last number in the reference. (See Fig. 3.4.)

FIGURE 3.3

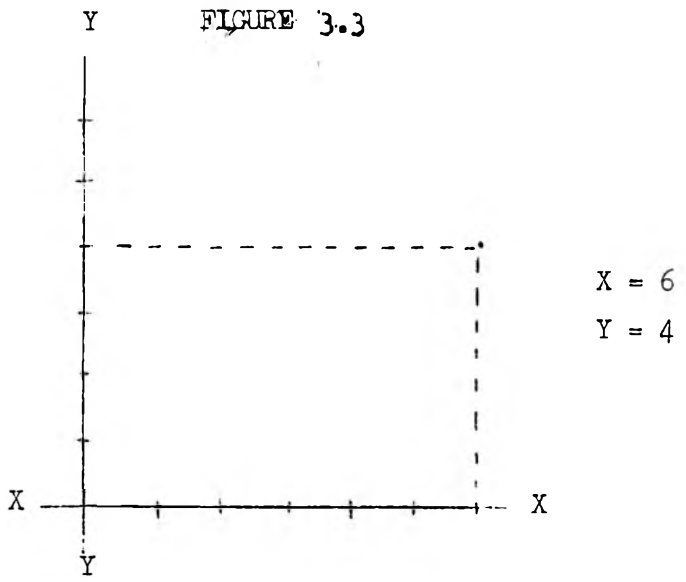
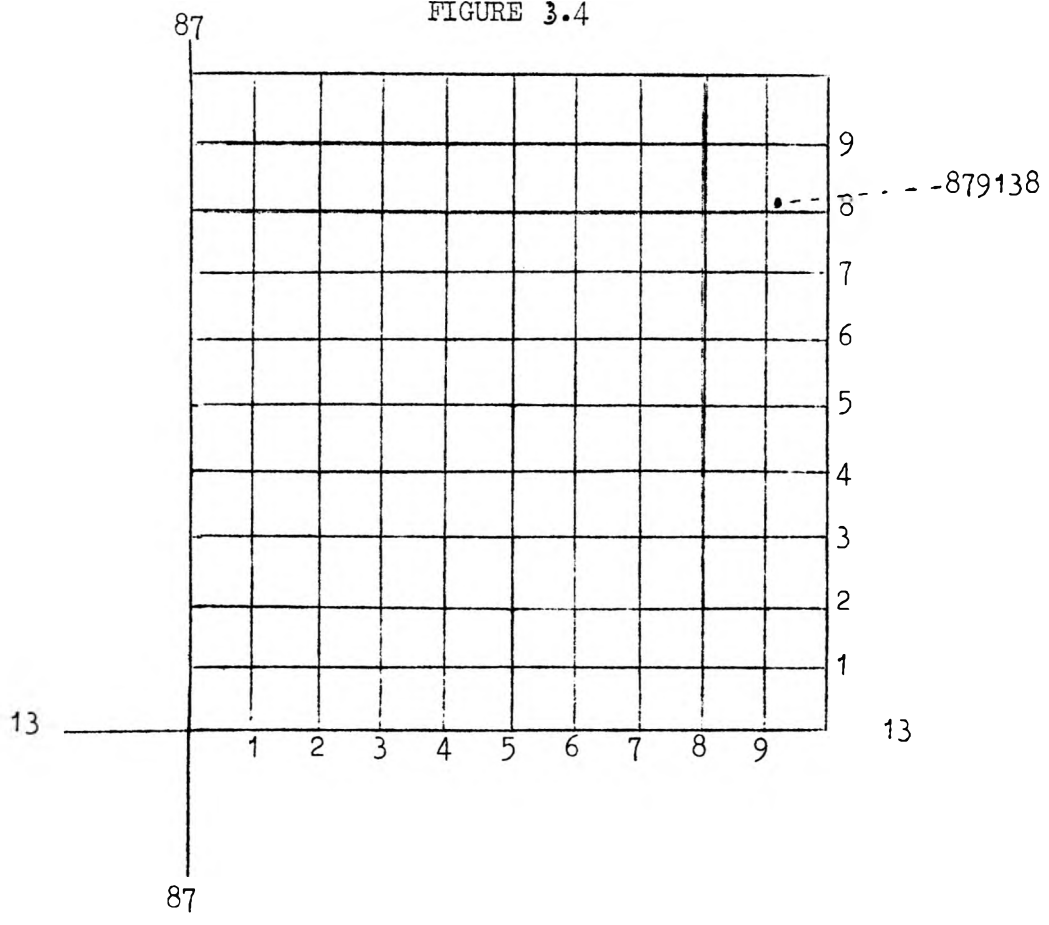


FIGURE 3.4



Where the site lies on one of the main square lines, the number 0 must be placed in the third figure space of each unit. Where the site covers more than one division two complete six figure reference numbers must be given for it, because an eight figure reference would mean you have redivided one of the small squares again. In fact it is a good habit to get into of placing six spaces _ _ , _ _ on the scrap paper when you go to make out a reference, with the comma between and then fill it in. This helps to remind you that the first two and fourth and fifth figures refer to the square, while the third and the last figures refer to position within the square. Finally check to be sure you have placed the grid square at the end of the reference.

A little practise with trig points, farm houses, and the like is the best way of learning to use the grid system of reference. Pick five objects and give the grid reference for them. Also run through the example given in the guide box in the lower right hand corner. With your romer you will discover that this is a very quick means of precisely locating any point with respect to the imaginary system. It is the easy step.

The only problem now is to learn to place that point on the map from the field evidence. This is the more difficult step and requires first learning to use a tool basic to that process, the compass.

3.6 The prismatic compass

Like a map, it is almost necessary to have a compass in your hand if you are to learn about its use, and we have written this portion making that assumption. Again, as with maps, there are several types of compass, each suited to a particular purpose. However, among them is one type that includes a number of varieties, all of which perform approximately the same task. That is, they allow one to sight on a distant object across the face of the compass, and at the same time read the angle that that line of sight is making with magnetic north. The prismatic compass is merely one of the many varieties of this type. Because they are accurate, common (a standard army issue), and frequently available through war surplus at a reasonable cost, most of the statements here apply specifically to that compass which we used, although with slight modifications the following statements hold equally for other compasses

of this type as well. In section 2.5.5.1 the information for procuring several varieties of compass, including the prismatic, will be found.

Descriptively it is not particularly useful to say a great deal about the prismatic compass. A little examination of one on your own part will reveal most of its features. The lid contains a hair line that is usually opened to the vertical position when the compass is in use. On the side opposite the hinge is a triangular metal sighting block which also contains a magnifying prism. It too is built with a hinge and slide so it can be folded up to a position over the face of the compass and then moved up and down to get a proper focus.

Using the eyehole and slit above it in the sighting block, one sights on any object by aligning the hair line in the lid with both the slit in the sight and the object on which you are taking the bearing. Then peering through the eyehole with the compass held steady in this position, it is possible to read the movable compass card inside. An examination of this compass card should have already shown you that the outer circle is divided clockwise into 360° , with each division being 1° and every ten degrees numbered. The bearing is read off in the eyehole at the point where the hair line, or line of sight, cuts across the compass and the degree markings. With a little practise bearings can be read to a half degree.

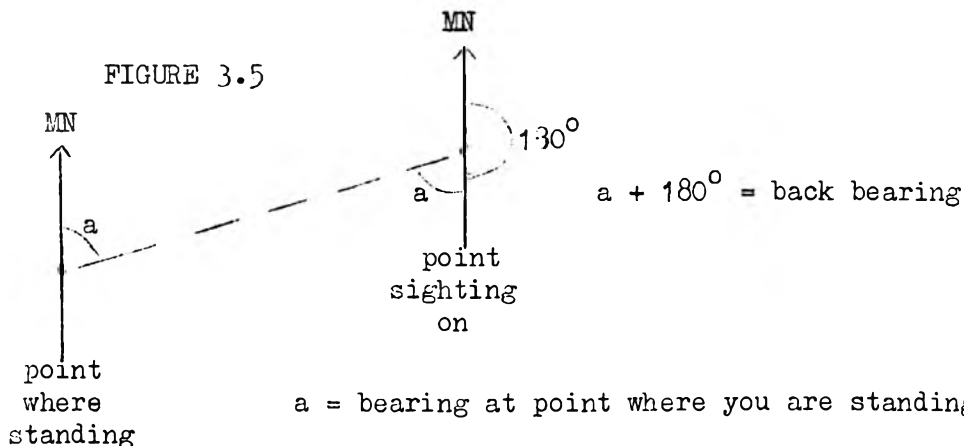
A bearing is then the angle measured clockwise that a line of sight makes with a fixed zero line. In all cases with which we deal this fixed line is north. But as noted above there are three norths, so it is possible to have three types of bearing: the true bearing where the fixed line is a meridian and thus true north, the grid bearing where the fixed line is parallel to a NS grid line and thus at a slight angle to true north, and a magnetic bearing, where the fixed line is magnetic north. All bearings measured with a prismatic compass therefore are magnetic bearings. In section 4.3 the process of converting them to grid bearings is outlined, but it might be well to emphasize here, once again the need for distinguishing between the three norths.

At this point, all we can suggest is that you take your compass out-of-doors, if you are not already there, and practise. Take a number of bearings on distant points working in a clockwise direction. Check to be sure they are consistent and increase as you turn clockwise.

If you give it some thought, you will soon realize that bearings you are measuring are not directly the ones you want. In fact, if you take a bearing on an object which you can also find on the map, what you really want is not the angle of the line from where you are standing to the object over there, but rather the angle of that line taken as if you were standing over there and looking back at the spot you wished to locate. It is, of course, possible to walk over there and look back and read that angle with your compass, but this would be rather time-consuming and inconvenient. Fortunately, it is not necessary. Instead it is possible with the use of a little geometry to convert a magnetic bearing to a back-bearing. The line between the two points is, of course, the same line and magnetic north lines drawn through the two points would also be parallel. Recalling a bit of geometry it is possible to show that the two opposite angles at each of these points are therefore equal. However, angles are always measured clockwise from magnetic north, so that if you were over there looking back, the angle you would read would include not only the angle you read here, but also another 180° or a straight angle. Study of fig. 3.5

should make this clear. The method then of converting a bearing for the point on which you are standing to a back bearing from the point on which you are sighting is simply to add 180° to that angle, when it is less than 180° and to subtract 180° when the bearing is more than 180° .

Try reading a bearing with your compass, then calculate the back bearing and see what object you now sight on. Find something on the ground which makes a fairly straight line (a curb, footpath, etc.) and take a bearing along it in one direction. Calculate the back bearing, sight along it and see if it coincides with the straight line on the ground. Once you have mastered the art of taking bearings and converting them into back bearing, you are ready to begin on the problem of finding your exact position on the map.



3.7 Bibliography

- The War Office 1957 Manual of Map Reading, Air Photo Reading and Field Sketching, Part I, Map Reading.
London (7/6d in England at Her Majesty's Stationery Office)

4.0 PLOTTING FIELD POSITION ON THE MAP

4.1 Introduction to major methods of Location

The previous section dealt with the method of describing a map position as a grid reference. It also considered some of the basic techniques needed in interpreting the Inch to the Mile set of maps. This section will outline the various methods whereby these techniques can be applied to plot your field position on a map. That is, we will consider here ways in which what you see in the field can be used to locate your exact map position. The methods may be divided into two major groups depending on whether or not an instrument is employed. When no instrument is employed it is generally referred to as working by inspection, while the methods using instruments usually have more specific names. Because discussion here is limited to a single instrument, the compass, most procedures may be grouped under either inspection or compass methods. Although it is well to remember that the more accurate compass methods are to be preferred whenever there is a choice, in practice both are generally applied to the solution of any problem and serve as a complementary check on each other. If the compass method says you are at a certain position, then the inspection method should give the same answer.

4.2 Orienting a map

Locating your position on a map is done more easily if the map and the ground have the same orientation. As noted above there are two ways of going about this: one by inspection, the other using the compass.

To orient a map by inspection, use prominent features you can readily see and find on the map as well. If there is a road, creek, river, or coast running in some direction, align that object on the map with the feature in the field. In the same way make sure that other prominent features lie on the same side of your position in the field as they do on the map. In this way a map is quickly oriented with reasonable accuracy.

For more precise orientation even when there are no prominent features nearby, a compass is generally employed. In section 3.4 we discussed the method of figuring the magnetic declination. After calculating the present declination as outlined there, it would be possible to draw a new declination line with a protractor correcting the old angle. To orient the map then involves simply laying the compass over that line and moving the map until the two are aligned. But this would mean unfolding the map each time to that margin, so the usual

practice is to calculate the angle between magnetic north and grid north, and set the compass on any grid line at that angle, turning the map until the two are parallel. Since it is necessary to determine this angle anyway, it is the procedure more frequently adopted.

4.3 Converting a magnetic bearing to a grid bearing

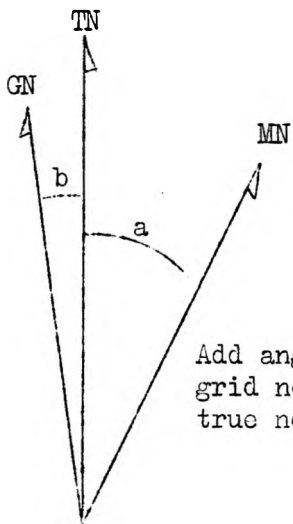
On each map, it is necessary to calculate at least once the angle which allows you to convert a magnetic bearing to a grid bearing or vice versa. Because bearings are measured from a north zero line, the difference between the different types of bearings is determined by the angles the three norths make with each other. Taking the knowledge gained in section 3.4, it is possible to calculate the present magnetic declination, or the angle between TN and MN. In the same section, the technique of estimating the angle between TN and GN was also learned. At this point, it might be wise to review them. The first step in converting a magnetic bearing to a grid bearing is to subtract the angle between TN and GN from the angle between TN and MN, if grid north lies to the east of TN, but to add this angle if grid north lies to the west of TN (see fig. 4.1). Thus in the first case, magnetic declination minus the angle between TN and GN gives you the angle between grid north and magnetic north (see fig. 4.2a).

To convert a magnetic bearing to a grid bearing, or to convert a compass reading to a grid bearing that you can plot on a map means that you add the angle between GN and MN to the compass reading. To go in the opposite direction, that is to take a grid bearing from the map with a protractor and convert it to a compass reading, means you subtract from the grid bearing the amount of the angle between GN and MN. If you are in doubt you should be able to determine which you should do by sitting down and drawing a picture of the angles involved (see figure 4.2).

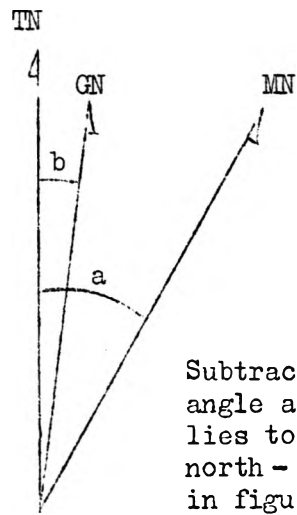
The reason for this is that in New Zealand MN always lies to the east of grid north. Thus a magnetic bearing that is to be plotted on a map will always be too small by the amount of the angle between magnetic north and grid north. In converting compass bearings to grid bearings you have to add in that extra little wedge. When you take a compass reading of 0° , or magnetic north, grid north lies off to the northwest some 16° to 21° in New Zealand. By swinging the compass, say 17° to the northwest, to point grid north, you should now read an angle of 343° on the compass. By adding the 17° to it, you get 360° or 0° and thus the grid bearing for north.

If you set the compass on a 343° bearing, however, and align a grid with

FIGURE 4.1



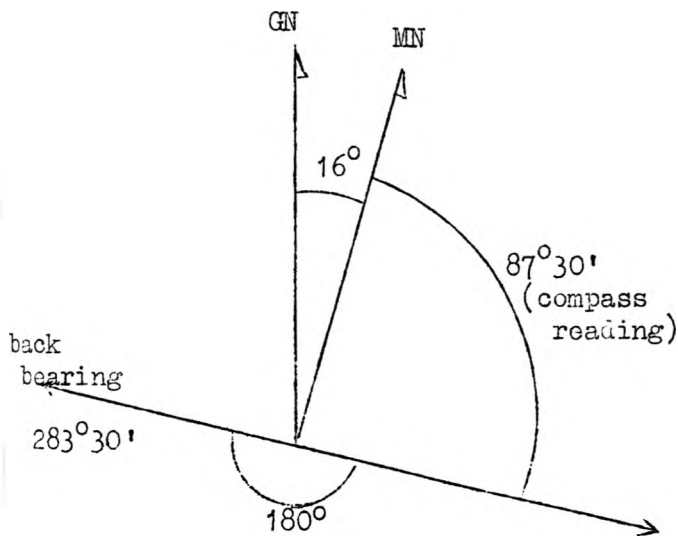
Add angle b to angle a when grid north lies to west of true north



Subtract angle b from angle a when grid north lies to east of true north - see (a) below in figure 2.2

FIGURE 4.2

- (a) Grid lies to east of true north
 angle between TN and MN - $17^{\circ}30'$
 angle between TN and GN - $1^{\circ}30'$
 angle between GN and MN - $16^{\circ}00'$
- (b) angle between GN and MN - $16^{\circ}00'$
 compass reading - $87^{\circ}30'$
 Grid bearing on map - $103^{\circ}30'$
- (c) Grid bearing on map - $103^{\circ}30'$
 back bearing on map - $180^{\circ}00'$
 angle to be used in plotting
 on map - $283^{\circ}30'$



Magnetic bearing converted to grid bearing $103^{\circ}30'$.

this bearing, it will orient the map, since magnetic north would now be 17° to the east of grid north. In this position, you may also notice that the inner circle of the compass card reads 17° . Thus you can orient a map, merely by taking the angle used in converting a magnetic bearing to a grid bearing. Reading the inner circle of the compass card (marked off counter-clockwise), set the compass on that angle, and orient the grid line on the map with it.

4.4 Location of Position by Inspection

Location of position by inspection is a process familiar to everyone who has ever used a map. It is the usual way of proceeding when trying to find yourself on a street map or in driving across the country. Using the surrounding objects which you can find on the map, you estimate your position with respect to them, narrowing the possibilities with each added feature. The only rule to remember, if you decide that a certain point is your position on the map, is that it should check out with all, not just some of the surrounding features. If the map calls for a feature at a certain point and it is not there, something is probably wrong. Location by inspection is always dangerous when depending on one or two points; the idea is to make use of as many features as possible.

4.5 Aids in Location by Inspection

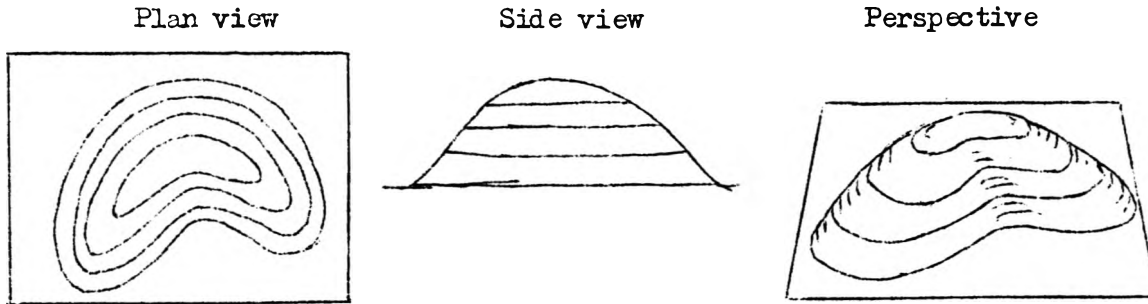
1. Scale - the distance between your position and some feature used to determine it, can be estimated and then checked for reasonableness by the line scale. Knowing where the last point is and how long you have been walking since leaving it, it is easy to make a radius within which your present position must be.

2. Conventional symbols - are found in the two reference boxes in the bottom margin, where the interpretation of symbol each is given. Green, orange, blue and black are the colors generally employed. Some time should be spent in learning at least the more common symbols so that constant reference to the boxes is not necessary.

3. Contours - the topography or shape of the ground is indicated by this system of imaginary lines. On the inch to mile set of maps each contour line represents the point on the ground 100 feet above the line below, starting from sea level. Thus a contour is a line of equal elevation or the line which you would walk on the side of a hill so that you went neither up nor down. What we have on the map is a plan view of such lines with numbers on them to indicate the height of one above the other and sea level. This height between the lines is

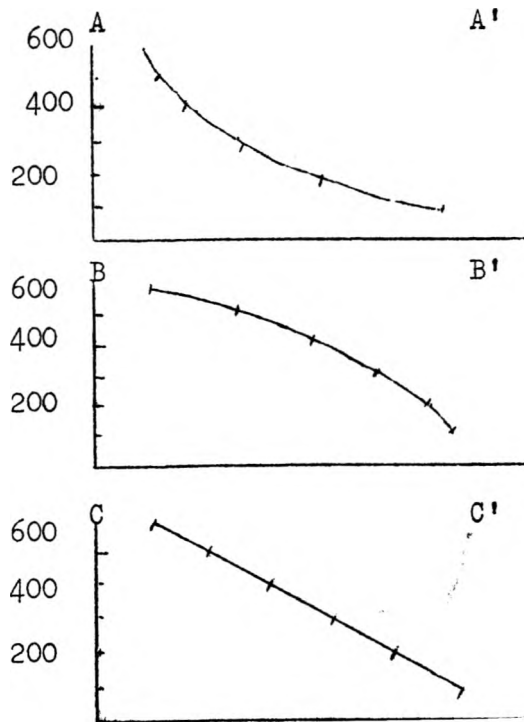
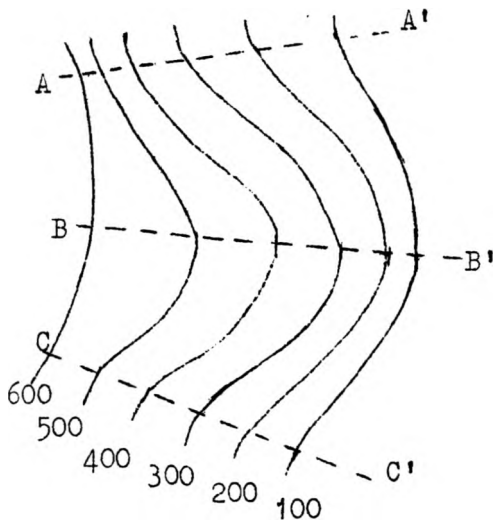
called the contour interval. It may vary from map to map, so it always is well to check this point. The drawings in figure 4.3, perhaps better than anything else, reveals the relationship between a map plan view of contours and what they represent.

Figure 4.3



The following are some useful hints that may be used in interpreting contours. Steep slopes on contour maps are indicated by lines close together, whereas gradual slopes have the contour lines wide apart. If the contour lines run across the country in long curves, it means the country is open and rolling, but if the contours twist about in short curves and bends, the country is more rugged. Finally where the contours at the top of hill are close together getting wider as they go down the hill, the slope is concave, ^(A-A') but if they are further apart at the top of the hill than at the bottom, the slope is convex. ^(B-B') When they are evenly spaced the slope is straight. The sections in fig. 4 should make this clear.

Figure 4.4



4.6 Location by compass bearing

The complementary method to location by inspection is location by bearing. While it is the more accurate of the two, it is dependent on the fact that you are able to find between one and three sharply defined objects in the field that are also on your map. Poorly defined objects like large round hills are not much use for taking a bearing and one frequently has to settle for less than three objects.

Location by bearing brings into play most of the techniques learned previously. Central to it is the ability to take a compass bearing and correctly convert it into a back grid bearing. To do this means that you have already figured out the present magnetic declination and the angle between true north and grid north as outlined in section 3.4, and mastered the art of converting compass readings to grid bearings as in section 4.3. Finally it means that having figured the grid bearing, you have calculated the back bearing from the object, because, as was discussed in section 3.6, it is the back bearing and not the direct grid bearing which you need to locate your position. The examples given in fig. 3.2 with section 3.4 and in fig. 4.2 with section 4.3 should serve as guides in making this series of calculations.

To work a location by bearing problem, however, requires one more instrument, the protractor. We are using a circular protractor, which reads exactly like the markings on the outer edge of the compass card. The zero point of the protractor always points grid north. To measure an angle or lay one out, the protractor is placed with its origin or center directly on the object on the map from which the angle is to be measured. Next one checks to be sure that the zero point lies exactly grid north, which means that a line through 0° and 180° dividing the protractor in half, is parallel to a N-S grid line. This can be achieved by a very simple procedure of adjustment. Wherever the nearest N-S grid line bisects the edges of the protractor at two points, read off the number of degrees between that point and zero on one edge, and between the other point and 180° on the other edge. If the number of degrees on both sides is the same, the protractor is correctly oriented. If not, a slight adjustment can be made until it is.

Once the protractor is in position, the edge of stiff card or ruler will serve to mark the angle of the bearing on the map. Any desired angle can be marked off by placing one edge of the card at the center of the protractor where it overlies the object on which you are sighting, while the other edge is rotated

to the degree mark for the desired angle. Mark a ray of this line lightly in hard pencil over the area where you think you are. Follow the same procedure with each bearing you plot on the map. The question now is how many bearings do you need?

One back bearing from a known point tells you that you are somewhere along that line. A second bearing at an angle to it, tells you that you are very near the point where the two lines cross, and in one of the four angles. A third bearing from another angle tells you that you are within the triangle formed by the three lines. (See fig. 4.5.) If the triangle is very large, it is likely that one of your measurements is wrong. But with three back bearing on three well defined objects done with reasonable accuracy, you should be able to locate your map position very precisely.

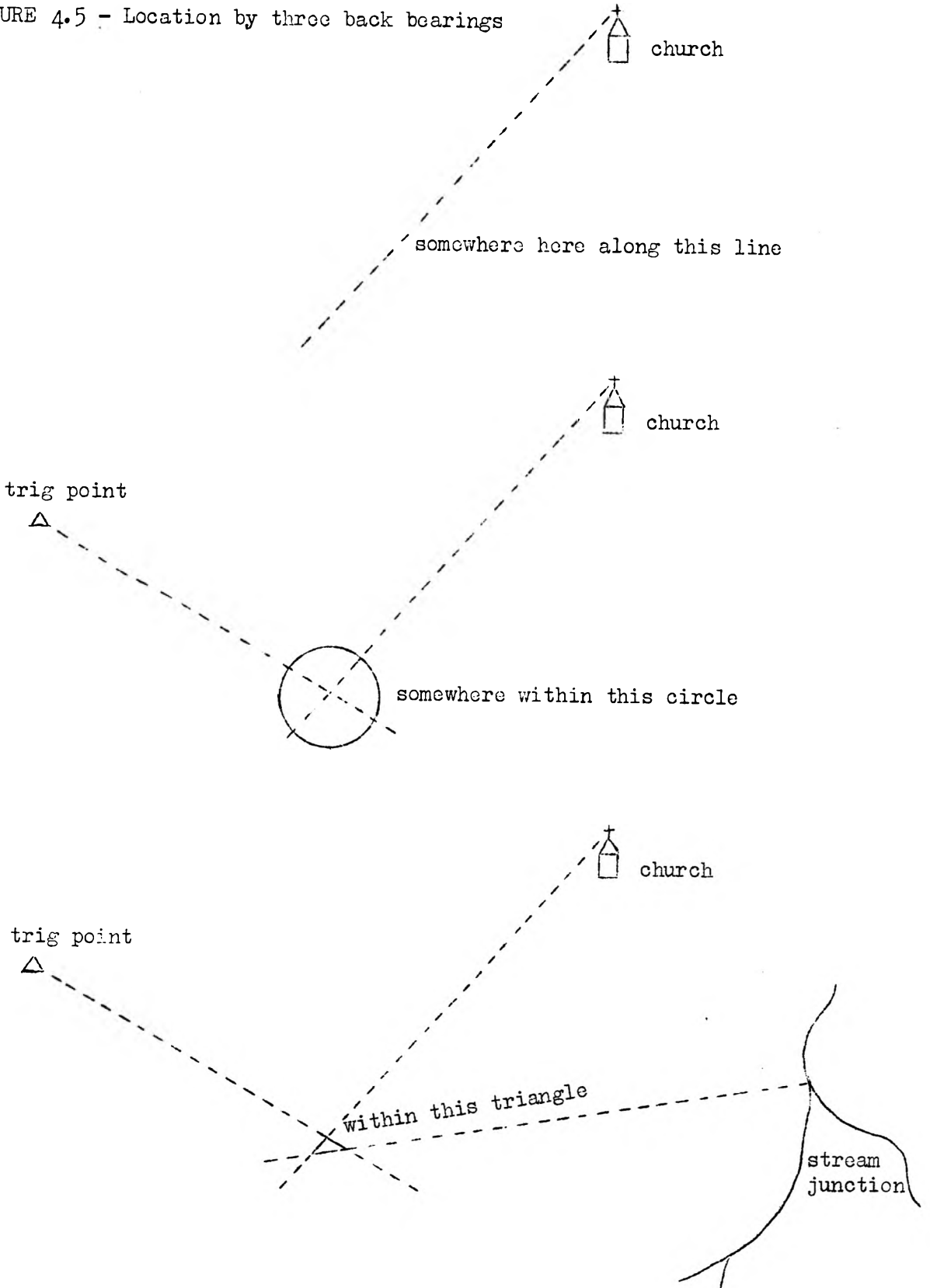
Each back bearing, of course, must first be read with a compass, then converted to a back bearing by the proper set of calculations, and finally plotted with a protractor on the map. The best way to learn this procedure is to go out into the field to some spot that provides a large number of objects to sight on, whose position you already know so you have a check on your results. While doing this it might be wise to work out the grid reference as well, since this will give you practice in going through the full procedure involved in locating a site.

The situation in the field, however, will not always meet this ideal of three points. If three well defined points are available they should be used, but if not try for two and determine the exact position in one of the four angles by inspection. Sometimes only a single bearing is possible and inspection will have to suffice as to where you place the site along that line. But even a single bearing can be a big help at times. What is evident here, which was noted at the beginning of this part, is that in practice various combinations of the inspection and compass methods are necessary, and the reasonableness of a position obtained by one method is open to checking by the other.

4.7 Bibliography

Atkinson, R.J.C. 1953 Field Archaeology. London, 2nd ed.

FIGURE 4.5 - Location by three back bearings



5.0 AERIAL PHOTOGRAPHY

5.1 Historical

While the use of aerial photography in archaeological field work goes back some thirty years, its widespread application is largely a post-war development. In part this derives from the extensive use made of aerial photography during World War II in the course of which a number of sites were accidentally "discovered". As a result, the attention of a number of archaeologists was directed to the development of this technique as a new and useful tool for a variety of purposes. For fields like geology, geography, and cartography, there is already an extensive bibliography discussing the adaptation of this technique to their particular problems, but the same does not apply to archaeology.

5.2 Interpreting Aerial Photographs

The art of interpreting aerial photographs is a complex subject, of which we consider here only the more important aspects. Since writing earlier drafts of this part, we have had the pleasure of reading Bradford's Ancient Landscapes: Studies in Field Archaeology. This book, published some 28 years after Crawford's Wessex from the Air, fills the gap mentioned above and provides a major reference book devoted to the archaeological interpretation of aerial photos. It is recommended to all whose interest will lead them to further inquiry in this subject.

5.3 The Actual Picture

Unlike maps, which are necessarily selective of the information they present, the aerial photo gives a wide variety of information in minute detail. For this reason, until one learns to distinguish among the varieties of data, and to interpret and transfer successfully to a map that information in which one is interested, aerial photos can be both confusing and misleading. Not infrequently archaeologists have marked sites on their photos, which on closer examination in a

lab, they have found to their horror to be on the steep side of a ridge, rather than in the valley or on the crest of the ridge as they expected. To all of you handling photos for the first time, let this serve as a warning. The first flush of optimism may be followed by some rude shocks. The checking of every point marked as a site location under the stereoscope in 3-dimensional relief for reasonableness of the site location and agreement with the surrounding terrain is essential.

5.4 Advantages of Aerial Photos

1. The amount of information they contain in comparison with most maps, especially about:
 - a. the minor feature of the country - the small hills, side streams, fence lines, etc.
 - b. the nature of the terrain - whether rocky, grass, brush covered.
2. The ability to view stereo-pairs in 3-dimensional relief
3. The ability to study the area before taking the field-
 - a. to plan routes of access and conditions that will be encountered
 - b. to make preliminary maps of the larger site to be visited which can then be checked in the field (see Sec. 5.13; 6.0)
4. The accuracy with which position can be located under the most extreme conditions - under suitable conditions correct positions to within 30 feet are possible.

5.5 Information to be obtained with the purchase of photos

1. Altitude taken from
2. Focal length of camera taking pictures
From a combination of 1 and 2 you can determine an approximate scale (see Sec. 5.8).
3. Time of day when picture taken - frequently from this and direction of shadows it is possible to determine directions, but see 5.5.4 below.
4. Direction in which run was made in taking photos. - In the case of New Zealand this is east-west.
5. General location of each run on the map indicating the numbers of the aerial photos which correspond to that run and the area they cover on the map. This, by the way, is one good check in attempting to relate you location on an aerial photo with that on a map. (See Sec. 5.9.3).

5.6 Kinds of Aerial Photos

1. Plain verticals - a series of separate photos made by a single-lens camera aimed straight down from a plane flying in a straight line across the country. These are the type of photos we are using and all discussion beyond section 5.7 applies only to them.
2. Composite - a series of separate photos as above, but made with a camera having several lenses working simultaneously, the results of which are printed as a single picture.
3. Obliques - separate photos taken at an angle, and divided into two types:
 1. high obliques - which include the horizon as a reference line
 2. low obliques - those without a horizon, and at some angle between the high oblique and the vertical

These are most useful for details of individual archaeological sites and for revealing crop, soil, and shadow marks.

4. Mosaics - a combination of a large number of vertical photos usual to make a map of a large area. They are divided into two types:
 1. controlled - a rare type used only when extreme accuracy is needed. They are made from specially projected negatives and so printed as to remove as many errors as possible.
 2. uncontrolled - the usual type in which the best photos are cut and fitted in the best manner possible.

Enlargements of mosaics are an excellent means of correlating the survey work over a large area, for site locations from the aerial photos are easily transferred to it with great accuracy.

5.7 Archaeological Information on Aerial Photos

One reason for the use of aerial photographs in archaeology has been the discovery that they show information not readily apparent on the ground. This information is usually divided into the following major categories: crop marks, soil marks, and shadow marks. Minor categories not considered here are damp marks, frost marks, and snow marks.

1. Crop marks - the visual difference in the growth of vegetation (grass, weed, crops) on a site as contrasted with its normal surroundings. They may be divided into two types:

- 1. positive crop marks - vegetation whose lushness indicates a soil nourishment higher than its natural surrounding environment.
- 2. negative crop mark - (rare) the visual difference marked by stunted or even dead vegetation due to something in the sub-surface geology inhibiting growth.

This is the most common form of evidence seen from the air, that is totally missed in surveys on the ground.

- 2. Soil marks - are indications in the bare earth of contrasts between soil and subsoil, or between ditch fillings and normal soils that occur especially in cleared areas like ploughed fields. Other examples are like the instances of "made" soils, where there are soil differences due to the addition of gravel, or changes in the forest covering of areas previously cleared.
- 3. Shadow marks or casts - are features of architectural relief casting a shadow, such as a ditch or bank on a pa. The position of the sun is most important in these, so that despite the fact that they are the most numerous archaeological features of vertical aerial photos, they are better studied on various oblique photos where it is possible to get a correct interpretation of many details. For this reason it is feasible only to mark the principal features of the larger sites on plan maps based on aerial photos alone; the additional details must be supplied by observations on the ground.

5.8 Scale on Vertical Photos

Without extensive work in the laboratory only an approximate scale can be determined for distances on a vertical aerial photo. This should not deter you, however, from making use of this approximate scale constantly in going from photo to map and back again. The error is too small for most of the work you will be doing, and it is the only way of accurately gauging distances on two maps of different sizes. This scale should appear on your 5 x 8 card, on the opposite edge from the map scale (see fig. 2.2). The scale as noted in 5.5 is determined from the following formula using focal length of camera and altitude of the plane:

$$\frac{\text{Size of picture}}{\text{Size of ground area}} = \frac{\text{Focal length of camera}}{\text{Height of plane}}$$

It is usually stated thus:

$$\text{Scale} = \frac{\text{Focal length of lens in inches}}{12 \times \text{Altitude in feet}}$$

With a camera having a focal length of 4 inches at an altitude of 10,000 ft

$$\frac{4 \text{ inches}}{12 \times 10,000} = \frac{1}{30,000} \quad \text{or 1 inch on photo}$$

equals 30,000 inches or 2500 ft. on the ground or approximately two and a half grids on an inch to the mile map.

NOTE: Most aerial photos in New Zealand are taken so that 4 inches on the photo is equal to a mile on the ground.

5.9 The Nature of Vertical Aerial Photo Coverage of the Ground

1. Vertical aerial photos are taken with sufficient overlap so that successive pairs of them in a single strip or run, or those from adjacent runs may be used as stereo-pairs. The overlap of successive pairs on each run is usually about 60 per cent, so that three photos will completely cover the area of the centre picture in two views and permit 3-dimensional viewing of the relief for the whole centre picture. In contrast, adjacent east-west runs, either to the north or the south of the center run, usually allow for a side lap of only 30 per cent. Also the conditions of lighting, altitude, tilt of camera, etc., usually vary more from run to run, so that adjacent stereo-pairs are much less used except to check minor points.

2. Because the aircraft generally flies at a given altitude, in rough country the high points are quite a bit nearer the airplane than the low points in the valley, and any calculation of scale is subject to greater error between the two. Also adjacent runs or strips, to save time, are frequently flown in opposite directions and numbers in adjacent strips often go in opposite directions (see sec. 5.8). These are practical points to remember, not to worry over, as they will not seriously affect your work.

3. More important to our purposes is the general location of the centre of each strip, or the line of the run made by the aircraft, as this is an easy means

of determining which photos cover the particular area of the map on which we are working. Unless you are to spend a good part of your time searching for the particular photos that you want, it is well to spend a few minutes determining what part of the map you are going to survey and determine which photos cover that area and in what order according to your proposed line of march. This can be said a number of times, but when you find yourself searching among your photos for the right one, you may be sure that the advantage which aerial photos give you in planning ahead has been lost and so momentarily are you.

5.10 Viewing Aerial Photographs

There is little except in the nature of helpful hints that may be said about viewing aerial photos. In large part it is a matter of practice. However, the same is not true about the interpretation of the wealth of data you can obtain from them with a minimum amount of crucial work in the field.* Helpful hints on viewing may be summarized as follows:

1. Until one has handled single photos for a long time, it is advisable that they are correctly illuminated. This means that the source of illumination falls across the print in the same direction as the sunlight fell across landscape at the time of exposure. Only in this way will you avoid interpreting hills as valleys. If you wish to check on this, view some valley in both ways and then in 3-D relief.
2. Do as much as possible of your viewing in 3-dimensional relief with the stereoscope. You will find the magnification provided by these allows you to see things you would miss with the naked eye, and also, of course, trains you to interpret correctly the relief. You will find a 2-4 power magnifying glass a great aid in examining details on a single photo. (See sec. 2.3.1).
3. With practice it is possible to view small areas of stereo-pairs in 3-dimensional relief without the aid of the stereoscope. However, most people find they have sufficient difficulty at first even with one.
4. To view east-west runs, the northern edge of each print should be to the top and the most westerly print to the left. By examining the two photos it is always possible to discover which one goes to the left and in what portion of each photo the overlap occurs.
5. Next pick two prominent features on each photo, and place the index

* This aspect of the subject receives extensive treatment in Bradford's book referred to in 5.2 and 5.14.

finger of each hand on the two points. Now under the stereoscope slide the two prints and fingers towards each other until the two fingers overlap. Then remove the fingers and make final adjustments using various features of landscape until your eyes feel at ease while viewing the landscape in 3-dimensional relief. Now look away and then back through the viewer. If the two images do not fuse instantly, further adjustment is required.

6. Because the distance between the two points at which the pictures forming a stereo-pair were taken is greater than the distance between the human eyes, the relief in the 3-dimensional picture that you see under a stereoscope is greatly exaggerated. Everything appears much steeper than it actually is.
7. In the lab a mirror type stereoscope will permit you to view the entire area of overlap in a pair of photos, but with the pocket model you will be restricted to a much smaller area. Inevitably this means that the two prints will overlap each other restricting the area that can be seen if both are kept flat. But by rolling up the top print between the eye-pieces of the pocket stereoscope, it is possible to extend the area that can be seen.

5.11 Some Practical Hints on Locating Yourself

1. On what general area of the map are you? This should let you decide what within no more than three or four photos as to which pair you want.
2. What is the most prominent feature within a mile that you can see? Can you find it on the photo? Since you can tell which way is north on the photo and also on the ground by using your compass (remember to allow for an approximate correction from magnetic north), you should be able to orient your photo with the surrounding country, using the prominent landmark and north.
3. Where are the nearest side streams, and the major valleys? There are probably no better means than valleys, stream courses, and stream junctures for locating yourself exactly. Bearings on the junctures of streams, and roads are usually taken quite accurately, and the course of streams and the most insignificant roads are generally easy to follow on

the aerial photos, the maps, as well as in the area which you can see. On most of the aerial photos you will also find fence lines an easy point of reference to find in the field.

4. Does the position I think I am at on the aerial photo check in all details with the surroundings that I can see on the photo and from where I sit. Remember this is an actual picture, and unless things have been radically altered since the picture was taken (always a possibility), the two must correspond in all details, not just some of them.
5. Even if you are unsure of your position on the map, you should always be able to mark your location on the aerial photos, even if it means climbing to a nearby hill to check it on some prominent feature. Always mark either in soft pencil on the front or by a pin hole on the back the number of each site. In the lab you can then work out the correct grid reference, and map location by more exact means.

5.12 Locating Sites on Aerial Photos

1. The pin hole method - a pin hole is made at the centre of the site on the aerial photo and is circled on the back by pencil and the site number placed next to it. This has the advantage of being more permanent than the second method, but does in part at least damage the photo, though not seriously.
2. The soft pencil method - a dot is placed on the site, and a line leading to but not touching the dot is extended to some nearby portion of the photo where no sites occur. Here the number is recorded at the other end of the line. Done in soft pencil, this has the advantage that it can be erased, but it means that greater care must be taken with the photos in the field so as not to accidentally rub off information. The same is true of their use in the lab. However, this is in part offset where the information is to be transferred immediately or recorded in ink on the photo, because all the information is on one side of the photo.

5.13 Aerial Photographs as Aids to making Plan Maps of Sites

With the aid of graph paper, and an aerial photo, while sitting on a site one can make a rough but accurate plan map of its principal features. Using proportions given by the aerial photo to lay out its major dimensions to some scale on the graph paper, it is then possible to fill in most of the details fairly rapidly. In this a standard set of symbols is desirable and one is given below (see sec. 9.1.3). Remember, even the best map is not much good without north on it, and take care that whatever north you use, you mark it as either MN, TN, or GN.

In the lab., as a part of the planning which aerial photos make possible before taking the field, it is usual to enlarge and project with an epidiascope some of the larger sites and trace off to scale their major features. These can then be checked in the field as to accuracy and further details added. This technique is described by Willey (1953: 2-6; see also section 6.0).

5.14 Bibliography

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|---------------|------|--|
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<u>American Antiquity</u> , v. 22, no. 4, p. 337-351. |
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<u>Bull. No. 155 of the Bureau of Amer. Ethnol.</u> ,
Smithsonian Inst., especially pp. 2-6. |

6.0 PLAN MAPS FROM AERIAL PHOTOS

6.1 Introduction

The technique of projecting aerial photos on a screen with an epidiascope in order to trace the visible features of a site and the surrounding terrain was in large part developed for archaeological use by Willey (1953) in his Viru Valley Settlement Pattern study in Peru. Aside from this it has received little application in site survey work. It appeared to the authors, however, to have possible application in New Zealand as well, and although neither of us had tried it before, we decided to test it out. But this meant that we were in large part dependent on the short description of it given in Willey (1953: 2-6) and our unfamiliarity with the process cost us some time in trial and error before satisfactory results were obtained. In the evaluation section 11.0, on the basis of our experience, we have put forward further suggestions for the improvement of the methods outlined here.

The practical aspect of making site maps by this technique lies primarily in the surprising amount of accuracy that can be achieved with a minimum amount of time and equipment, and advantage that a scale plan map of this sort frequently gives to elaboration with a minimum amount of effort in the field. Willey found that his maps made in this way were less accurate than those made by plane table or with instruments, but a great deal more accurate than those made only by sketching, or with chain and compass. Under good conditions we found that our error was like his: less than two yards along a fosse 60 or 70 yards in length. As Willey has pointed out, the success of this technique is best with large sites that have prominent features which show to advantage on the aerial photo. Where the sites are covered in scrub or trees, where the features fail to show to advantage on the photo, or where sites are too small or lack distinctive features, the method is almost useless and the photos serve only to help locate the site. Even where the features show to an advantage though, distortion on the photo itself of a technical nature can sometimes give trouble. Nonetheless, there are many pa sites on which this method appears capable of giving excellent results. With these preliminary remarks, let us turn to procedure followed.

6.2 Setting up the Epidiascope

An epidiascope is simply the name for one of the modern high powered magic lanterns in use today. With it one can project the image from flat opaque surfaces on to a screen. An epidiascope was borrowed from one of the University departments in our case (see section 2.5.9.2 for further details on procurement) and set up in a large darkened room with a projection screen. The machine was installed on an easily moved table, so that by moving the table we could adjust the scale of the photo on the screen.

A single photo was selected with a large area of low flat land where the scale was as close as possible to four inches to the mile. A line scale was drawn in soft pencil on the surface of this photo, with each quarter mile (or inch) marked off. It was then placed in the machine and projected. In this way by moving the machine, we could adjust the scale very quickly merely by measuring the distance covered by the projected scale line on the screen. Because the grid paper on which we were to trace the site maps contained four grids to the inch, it was decided after some experimentation that scale of forty feet to the grid square or 160 feet to the inch best suited our purposes. This meant that a quarter mile containing 1320 feet should cover distance of 8.25 inches on the projected line scale on the screen ($8.25 \text{ inches} \times 160 \text{ feet per inch} = 1320 \text{ feet}$). The machine was then moved back and forth until each of the quarter miles on the projected line scale measured as close to 8.25 inches as was possible. Once the machine was set, we were ready to project. We had to assume, of course, that the scale on all the other photos was the same, or close enough not to make any great difference.

6.3 Preparation of Aerial Photos

In the meanwhile, three people with some experience in interpreting aerial photos went over the whole set stereoscopically. Unfortunately the mirror-type stereoscope with high power magnification for use in the lab was not available, so that the pocket stereoscopes had to be used. There is no doubt that the amount of time that would have been saved and the increased amount of detail that would have been recovered more than warrants the use of the mirror-type of stereoscope whenever possible for this type of work. Nevertheless, the prominent features

of each site were lightly outlined in pencil to give them emphasis and make accurate interpretation and tracing possible. At the same time, the topographical features immediately surrounding the site were also blocked out in pencil. Finally, each site was located permanently on the photo by puncturing the photo with a small pin hole in the centre of the site. The hole was circled on the back in hard pencil and assigned a site number.

6.4 Production of Plan Maps of Sites

When the whole set of photos were thus prepared, each of the sites was projected. The photos were rotated in the machine to the position where each best fitted the pre-cut pieces of grid paper. The size of these grid sheets, incidentally, was purposely kept small, so that they could easily be fitted into the envelope on the mapping table. No north was marked on these maps, the decision being that it was better determined in the field. Using the appropriate symbols (see sec.9.1.3.1) each was then traced off on a piece of grid paper in hard pencil. Where the nature of any features was in doubt they were merely left as lines. In this way some thirty site maps were made which could then be carried into the field for checking and the addition of details.

6.5 Other Instruments

Bradford describes a Multiscope as a type of instrument that archaeologists would find of great use with vertical aerial photos as a means of quickly producing accurate but cheap maps. The machine combines a mirror stereoscope, a camera lucida, and a stereoscopic plotting transfer device with which the scale can be enlarged or reduced three times. Similar instruments are produced in several countries.

6.6 Bibliography

See Bibliography, Sec. 5.14.

7.0 PREPARATIONS FOR WORK IN THE FIELD

7.1 Preliminary Investigations

The selection of an area for investigation obviously depends on a number of factors, the time and manpower available, and the distance from base.

The actual planning of operations within the chosen area involves additional factors, such as the nature of the terrain and the number of sites to be recorded. Preliminary investigations ideally would involve therefore:

1. Study of the maps and aerial photographs of the region to be investigated. This can be done, as mentioned in Section 2.5.1.3, at local Lands & Survey and Land District offices.
2. Knowledge of published information about the locality; largely to be found in local histories and publications of the Polynesian Society.
3. Ground reconnaissance of a limited nature, supplemented if possible by an aerial reconnaissance.
4. Making of local contacts. This is such an important aspect of the work that it deserves a section to itself.

7.2 Local Contacts

It will be rare to find any region for which some local person with archaeological interests and knowledge is lacking, and it should be one of the investigators main aims to seek out, consult and associate with his work such people.

The value of these local contacts in a multitude of ways, cannot be overestimated.

1. Their personal knowledge of the sites in a locality, their number and complexity, and the nature of the terrain in which they are situated is essential to any sober assessment of the work which it would be possible to do with the time and labour available.
2. Their knowledge of smaller sites unlikely to be picked up on aerial photographs and in some cases liable to be missed by however thorough a ground survey can cut down the time of search and increase its effectiveness.
3. Their local knowledge, e.g., of local traditional history or of the existence and provenance of collections of artefacts can provide archaeological inform-

ation not immediately accessible to the Survey teams.

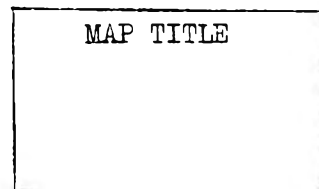
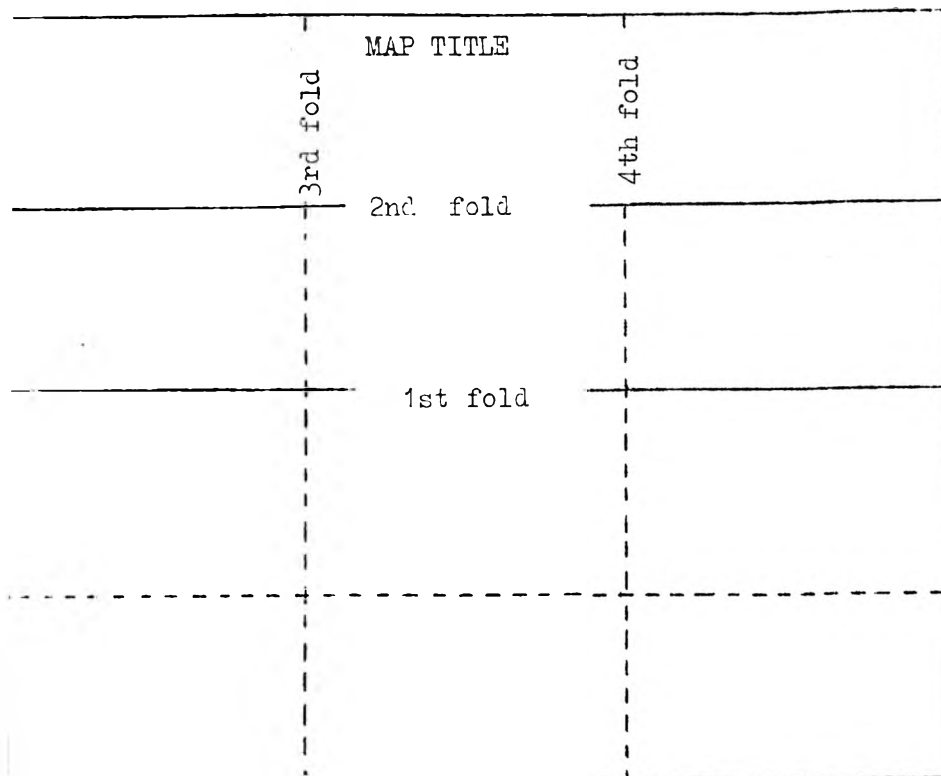
4. Their good offices can and must be employed in explaining the purpose of the investigations to local farmers and property holders and obtaining the permission of such people for searches of their property.

It goes without saying that the most scrupulous regard should be paid to the interests of property holders in the surveying schemes envisaged. It is on their interest and co-operation that the success of such schemes depends. They can provide assistance of the most practical kind in the ground surveys and, their interest once won, they become channels for further information of archaeological value.

7.3 Survey Parties

1. The number and size of survey parties is dependent not only on the amount of manpower available, but the amount of basic equipment and the number of people sufficiently skilled in its use to act as team leaders and be responsible for the activities of their team.
2. For the trial survey on the South Kaipara Head 20 people were available, of whom all had participated in the preparatory classes and seven or eight had achieved sufficient familiarity with instruments and procedure to be qualified for team leaders. The possible number of teams was further reduced, however, by the availability of only five prismatic compasses, one of the basic items of equipment.
3. Around the five best qualified people, five teams were drawn up to accommodate the group. Though this theoretically should have resulted in five teams of four, in fact there were chosen three teams of four, one of five and one of three, because questions of personal preferences and compatibilities arose and there was need to strengthen leadership in one or two cases.
4. Each team took with it into the field:
 1. A prismatic compass.
 2. Four spring clips.
 3. A hardboard mapping table in the pocket of which were carried:

1. A copy of the relevant map folded in the approved manner, thus:



Folded map
should be
approx. 10" x 6"

2. A full set of the aerial photographs relevant to the team's survey area. On these, discovered sites had already been pinpricked and provisionally numbered (See sections 5.12 and 6.3).
3. A pocket stereoscope for reading them.
4. A stiff 5" x 8" card, on which the following information was entered:

On one side

1. the number of the 1" map sheet in use, e.g. N33;
2. the number of the grid square in which the area of operations fell, e.g. N17;
3. a reminder of the method of reading grid references;
4. a romer for calculating grid references;
5. the magnetic variation from true north;
6. the deviation of grid north from true north.

On the other side

7. a one inch to the mile scale for 1" map calculations;
8. a four inches to the mile scale for aerial photo calculations;
9. a note that distances on the aerial photographs used are four times those on 1" to the mile maps.

5. A second stiff 5" x 8" card with the symbols to be used in sketching sites. The symbols described in 9.1.3.1 are an amplification of the ones used on the Kaipara pilot project.
 6. A number of sheets of $\frac{1}{4}$ " graph paper, approximately 12" x 8", on which sites located by inspection of aerial photographs had been copied by the method described in 5, at a scale of 160 ft. to 1 inch. These were to serve as base plans for further recording on the spot.
 7. A number of blank sheets of $\frac{1}{4}$ " graph paper for planning sites not discovered in the field itself.
 8. A number of Site Record and Site Survey forms, see section 8.0.
 9. A pad of scrap paper.
 10. A 6" circular protractor.
 11. A number of 2H and 4B pencils, with fitted erasers.
 12. A razor blade, sandpaper block, or pencil sharpener.
4. Some teams were equipped with a camera.
 5. Some teams were equipped with reinforced linen tapes.
5. Each team was allocated an area for its day's activities. The areas themselves were worked out, after the initial field reconnaissance, by study of the aerial photographs to determine major topographical divisions, the nature of the terrain and the density and complexity of sites.

Since a single copy of each aerial photograph only was available, the survey areas had to be chosen to fall within the limits of a particular run, so that no team should lack stereo-pairs of photos of any part of the area it had to cover.

Finally the areas selected were allocated in the light of assessments of the strength of the various teams in surveying proficiency, archaeological experience and sheer walking ability.

8.0 SITE RECORD AND SITE SURVEY FORMS

The Site Record and Site Survey Forms, examples of which are attached hereto, are meant to provide a standardised system of verbal descriptions of archaeological sites for use throughout New Zealand.

The Site Record Form is designed to put on record the existence of a site and the nature of its major features.

The Site Survey Form is designed as the record of any fuller investigation of the site that may be made.

The Site Record Form should aim at a broad coverage of the points discussed below. However,

1. a person may come across a site when not on a regular research trip;
2. his time on such a site may be limited and his equipment meagre.

Therefore, since a site is better recorded incompletely than not at all, the Site Record Form should be used for the purposes of

1. localising;
2. recording the presence of and
3. generally describing a site;

provided that the limitations and incompleteness of the original survey are fully acknowledged.

Remember that you are not limited to the space available on a single form. Attach as many sheets of additional description as you like, provided it is set out under the headings and in the terms required on the form itself.

The usefulness of the written description depends on its standardisation. This section therefore reviews the categories of information required under the different headings of both forms.

8.1 SITE NUMBER

In the course of recording the investigator will find it essential to give his sites numbers for purposes of identification.

These numbers will be purely provisional, since the permanent numbers will be allocated by the local filekeeper.

However, both temporary and, later, permanent site numbers, will be entered in section 1 of the Site Record Form.

By the time the Site Survey Form is being used, the permanent site number should be known.

8.2 MAP REFERENCE

At the top of both forms are spaces for the 1 inch to the mile map number and name, NZMS 1 (= New Zealand Map Series 1:63360), and the grid reference (Section 3.5).

1. NZMS 1 needs completing with map number and name: thus N37, Helensville.
2. Grid Reference is described in 6 numbers with the vital addition of the grid square number: thus 867855 Grid Sq. N.16.

8.3 DETAILS OF LOCALITY

This is meant to elicit fine points of position to supplement the grid reference. It is essentially an aid to relocation. Description may be therefore made in terms of some permanent feature of the landscape, a stream, a rock outcrop and the like, or of some reasonably permanent cultural feature, such as a road or a second recorded archaeological site.

8.4 TYPE AND DESCRIPTION OF SITE

The site is the unit of recording. It may be a single feature or a complex arrangement of many and different features. But whether simple or complex, it will be generally recognisable as a unit by its physical separation from other sites. The recognition of these units is all that concerns the investigator in the field. Since the archaeological site is the record of past activities, we may expect that certain sites in an area will prove to be functionally interrelated and some functionally dependent on others. But these are the end products of research and not matters of immediate concern.

The following list contains the major site types likely to be met with in New Zealand and describes the features it is desirable to record for each, firstly on the Site Record Form, secondly on the Site Survey Form.

8.4.1 PA SITES

The Site Record Form should give general information about

1. the type and size of pa;
2. the general nature, scope and complexity of defences;
3. the general nature and intensity of the habitation evidence.

The Site Survey Form should give more detailed information about similar points, with

1. measurements, e.g. dimensions and areas of platforms and terraces, size of ditches, height of scarps, size of pits;
2. counts, e.g. of pits to terraces or platforms.

For amplification and illustration of the points made below see Golson, J., 1957 "Field Archaeology in New Zealand", Journal of the Polynesian Society, 66, no. 1: 64-109.

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8.4.1 PA SITES

1.0 Aspects of Defence

Aspects of Defence:

1. A broad division is between flat land and upland sites. The following categories can be employed:
 1. hill pa, isolated hills surrounded by flat or lower country where nature provides some protection on all sides;
 2. ridge peak pa, isolated peaks on or at the end of ridges, where, as in 1, nature provides some protection on all sides;
 3. island pa in sea, river or lake. There may be flat (i.e. strong only because of encirclement by water) or upland (i.e. defended also by steep slopes or cliffs rising from the water);
 4. swamp pa, being islands in swamp;
 5. headland pa, where nature provides defense on three sides, but not on the fourth. These may be:
 1. of upland type, i.e. spurs or ridges into sea, lake, river, river-bend, swamp, or flat land and characterised by steep slopes, cliffs or bluffs;
 2. of flatland type, e.g. in oxbow bends of rivers, at confluence of two rivers, etc.;
 6. ridge pa, where nature provides defence in way of steep slopes or bluffs on two sides, but access is easy on the other two;
 7. open pa on flat land, where little natural defence is present and the majority of the perimeter has to be artificially defended.

Aspects of Defence:

2. The nature of the artificial defences provided to supplement the natural defences next needs description. These artificial defences are ditch, bank and scarp. Scarps are sometimes faced with stones. The following combinations are possible:
 1. ditch;
 2. ditch and inner bank;
 3. ditch, inner bank and outer bank;
 4. ditch and scarp;

5. ditch, scarp and inner bank (in form of earth parapet on top of scarp);
6. ditch, scarp and outer bank;
7. ditch, scarp, inner bank and outer bank;
8. scarp;
9. scarp combined with terrace (an artificially levelled area for living purposes);
10. scarp and bank;
11. scarp, terrace and bank.

Aspects of Defence:

3. The disposition of these artificial defences in relation to the natural features of the site as set out in the section on pa types above (8.4.1.1) and to each other is the next essential:

1. in respect of hill pa, ridge peak pa and island pa of the upland variety, the site may be surrounded wholly—or for as large a part of the circumference as it was necessary to fortify—by:

1. ditch and scarp;
2. ditch, scarp and inner bank;
3. ditch, outer bank and scarp;
4. ditch, outer bank, scarp and inner bank;
5. scarp;
6. scarp and bank;
7. scarp and terrace;
8. scarp, terrace and bank;
9. scarps and terraces continuously aligned;
10. scarps and terraces continuously aligned, some or all with banks;
11. scarps and terraces irregularly arranged;
12. scarps and terraces irregularly arranged some or all with banks;
13. forms where one of the above forms changes into another, e.g. ditch into terrace.

2. in respect of headland pa of upland type and ridge pa there is likely to be a distinction between transverse and lateral defences:

1. transverse defences:
 1. nature:
 1. ditch;
 2. ditch and scarp;

3. ditch, scarp and outer bank;
 4. ditch, scarp and inner bank;
 5. ditch, scarp, inner bank and outer bank;
- and less commonly
6. scarp;
 7. scarp and bank;
 8. scarp and terrace;
 9. scarp, terrace and bank.
2. arrangement:
- these elements may appear
1. singly
 2. in dual, treble, etc., series, with the same or different elements. And if in series
 1. contiguously, with no interval between them;
 2. spaced, with some interval between;
 3. staggered, so arranged that the site is divided into discrete areas separately defended;
 4. combinations of the above.

N.B. Often the inner defence lines of a spaced or staggered series are much more massive than the outer ones.

2. lateral defences:

Commonly these are:

1. scarp or scarps;
 2. scarp and terrace;
 3. scarps and terraces continuously aligned;
 4. scarps and terraces irregularly arranged;
- All with or without banks;
5. ditch and scarp;
 6. ditch, scarp and outer bank;
 7. ditch, scarp and inner bank;
 8. ditch, scarp, outer bank and inner bank;
 9. combinations of two or more of the above, e.g. presence of ditches where side spurs give easy access to the ridge.

3. junction of transverse and lateral defences:

1. Transverse ditches and banks may be extended in a straight line in such a way that the lateral features abut at right angles against them.
2. Transverse ditches and scarps may meet the lateral features at right angles.
3. Transverse ditches may turn through a right angle to become lateral ditches for a short distance, giving on to terrace or terrace with bank.
4. Combinations of these elements may be present on the same site.
5. Other practices may be discovered.

3. in respect of headland pa of flat land type and open pa on flat land

the defences may consist of ditch usually, with inner bank and very occasionally an outer one spanning the undefended area between the naturally defended perimeter.

These defences may be contiguous, spaced or staggered as described above.

4. in respect of island pa of lowland type and swamp pa artificial defences of the types described may not have been used and recognition of the site as a pa may depend upon the preservation of palisade timbers or be suggested by traditional evidence, in association with definite signs of habitation (see 8.4.1.2 below). If traditional evidence is used to suggest the status of a site as pa rather than kainga, this should be specified.

5. entrance and access

The following features have been noted in the field, but may not exhaust the possibilities:

1. undug causeways across ditches;
2. gaps in banks, sometimes opposite undug causeways;
3. gaps in the outer rim of ditches, particularly at angles; sometimes covered by a flanking bank;
4. sunken pathways through scarps;
5. graded causeways over low scarps;
6. slanting pathways up high scarps;

Defensive elements may also have been used for access purposes, viz.

7. sloping terraces;
8. ditches, especially transverse ditches turning through a right angle at one or both ends and giving access on to lateral terraces.

8.4.1 PA SITES

2. Aspects of Habitation

Aspects of Habitation:

1. Areas of Habitation

Habitation takes place within the pa proper and sometimes outside. Where the perimeter of the pa is clearly defined, e.g. by a ditch, it is possible to distinguish between the two. Where the perimeter is uncertain, it is obviously impossible to decide whether certain areas are outside the defences or not. In any case the practice of staggering defence areas in pa means that outside areas are much less strongly defended than inner ones.

On most flat land and some upland pa sufficient level ground was available for habitation and associated purposes. On the majority of upland pa, however, level ground was severely limited and had to be provided by artificially levelling hill tops and slopes.

The levelling of hill and ridge tops gives rise to platforms, generally irregularly square or rectangular in shape, levelling of hill or ridge slopes to terraces. Sometimes both have earth banks at the outer rim, above the scarp.

1. Artificial platforms, irregularly square or rectangular shape, on top of hills or ridges.

Generally these are so disposed that they contribute to the defence system, i.e. not only are they areas of habitation they are also units of defence, separated from their neighbours

1. by scarps;
2. by ditches with or without banks, generally part of a staggered system of transverse ditches.

2. Artificial terraces, on hill or ridge slopes. These vary considerably in size and form:

1. long and continuous, sometimes with irregularities of level and width;
2. shorter and discontinuous, making a broken, irregular arrangement on the hillside;
3. short and discrete terraces, not noticeably part of any arrangement, regular or irregular.

1. and 2 are presumed to be units of defence, 3 not necessarily so.

Aspects of Habitation:

2. Signs of Habitation

These consist of readily visible features like pits and occasionally visible occupational features like hearths, ovens, shell middens, and the like.

1. Pits, more fully discussed in 8.4.2 below, are of two main types, rectangular semi-subterranean, also with two varieties:

- 1. semi-subterranean pits are common on all types of living area, artificial and natural, inside and sometimes outside the pa;
- 2. subterranean pits are found
 - 1. on the naturally level or artificially levelled tops of pa;
 - 2. on levelled terraces, particularly at the foot of the scarp at the back of the terrace;
 - 3. at the base of the inner scarp of ditches.

With a feature as common as the pit, it is of importance to record the non-occurrence as well as the occurrence of pits for

- a) whole sites
- b) sections of sites
- c) particular terraces etc. on a site - e.g. number of terraces without pits as against number with, then position of such terraces, including compass position, etc.

- 2. Hearths will be only occasionally visible as the top of a rectangular slab setting. Their position should be clearly noted, in relationship for example to pits.
- 3. Ovens will be visible generally only through erosion. Their positions should be clearly noted.
- 4. Shell Middens, more fully discussed below, 8.4.7, are most likely to occur on the scarps below terraces. They are liable to be visible only through natural or animal erosion.

8.4.2 PITS

Pits are of two kinds, rectangular to square semi-subterranean, and bell-shaped fully subterranean.

8.4.2 PITS

1. Rectangular to Square Semi-Subterranean Pits

These are the type loosely referred to as housepits. Actually there is very little evidence that they were for living and much more than they were for storage. Their function, however, does not concern the recorder, although his work will help to find the answer.

There are two types: level rim and raised rim.

1. Level Rim

Here the rim of the pit is flush with the surrounding ground surface, or virtually so, although where the pit is dug on sloping ground, the downhill side may appear to have been built up. The following points should be noted:

1. Size

There are variations in size:

1. Large pits up to and sometimes exceeding 40 ft in dimension, often squarish in shape.
2. Medium pits, generally with length twice the breadth, often 16 ft - 20 ft long, 8-10 ft wide, with depths (only approximate because of silting) from 2 ft-6 ft.
3. Small pits, 5 ft-6 ft long.

2. Location

They are found on present evidence

1. in connection with pa

1. on terraces, platforms or naturally level living areas;
2. outside the main defences but continuous with the defended site;

2. remote from and unconnected with pa

1. on natural platforms on spurs
2. on artificial terraces unconnected with defence;
3. on ridge tops;
4. often singly in positions on hills or ridges with extensive views, sometimes the most extensive view;
5. occasionally on flats.

3. Disposition

1. singly;
2. end to end, often strung out in a line;
3. side by side with undug baulks between.

2. Raised Rim

Here the rim of the pit is defined, generally on all four sides, by a size-able bank built presumably from the earth dug from the pit. Where the pit is dug on a slope, however, the uphill side may lack the bank.

Circumstances of

1. size;
2. location;
3. disposition;

need recording as illustrated in 8.4.2.1.1 (level rim pit).

8.4.2 PITS

2. Bell-shaped, Fully Subterranean Pits

These are possibly more common than the recorded instances of their occurrence would suggest. Since they are a danger to stock, they have often been filled in by farmers, while the nature of their construction renders them liable to collapse.

There are two varieties:

1. Bell type

The domed chamber of the pit has its narrow circular or square entrance at the top. The type is found on the level areas of pa, sometimes in rows with connections from one to the other underground.

2. Cave type

The domed chamber has its entrance to the side and is thus adapted for the base of scarps or ditches where it is commonly found with underground communication. The entrance is sometimes elaborated into a doorway with rebates for the fitting of a wooden door.

8.4.2 PITS3. Recording1. Site Record Form

Important are

1. type of pit;
2. particulars of features, e.g. form of entrance to bellshaped pits;
3. general size;
4. location;
5. disposition;
6. number.

2. Site Survey Form

Additional details, particularly measurements:

1. length, breadth, depth of pit;
 1. these measurements are best taken at the corners where less destruction through stock etc. is likely to have occurred;
 2. where it is a raised rim pit in question, pit measurements should be taken at the level of the bottom of the bank/top of the pit;
2. breadth and height of bank of raised rim pit;
3. form and size of entrance to bellshaped pits.

8.4.3 QUARRY PITS AND "MADE" SOILS

1. This term quarry pit serves to define a specialised type of site in the archaeological record—the pit sunk for subsoil gravel for the purpose of "making" soils for kumara cultivation.
 1. The pits involved are irregular affairs, varying greatly in size and sometimes of considerable extent.
 2. The gravel won from such pits is sometimes laid in the immediate vicinity, a feature occasionally visible in the special circumstances of ploughing or discing or discoverable by probing.
 3. Other areas of "made" gravel soils may be noted as a result of ploughing or erosion, or by the exposure of a section through ditch digging etc., which are unconnected with quarry pits and where the gravel may be beach gravel.
 4. Non-defensive terraces have occasionally been noted as covered by a thin spread of gravel. *
2. The obvious features to record in such cases are:
 1. re quarry pits
for the Site Record Form
 1. the number of pits;
 2. the area covered by them;
 3. the presence or absence of contiguous areas of "made" soil;
 4. the soil type of the area where they are dug;
 supplement for the Site Survey Form by:
 5. the quantity of overburden removed;
 6. the quantity of gravel quarried.
 2. re "made" soils
for the Site Record Form
 1. their location in respect of possible sources of supply, viz. quarry pits, beaches;
 2. their position, e.g. on river or coastal flats, on terraces levelled into hillsides;
 3. the type of soil over which they are spread;
 4. the general size and area of distribution of the patches, if this is possible to obtain from field evidence;

supplement for the Site Survey Form by

5. more detailed description of size and area.

8.4.4 NON-DEFENSIVE TERRACES

1. It might be valuable at this stage to summarise the features to look for and record, when artificial terraces are discovered in the field, which are obviously not part of a pa system.

Such terraces may

1. prove to be covered with a gravel spread (8.4.3.1.4 above);
 2. be equipped with occupational features like pits (8.4.2 above);
 3. be devoid of any obvious features whatsoever;
2. These features would be noted on the Site Record Form, together with the number of terraces and their disposition.
 3. On the Site Survey Form additional details of
 1. size;
 2. area;of features should be included.

8.4.5 STRUCTURES IN STONE

These consist of stone walls, stone rows, stone heaps, stone alignments and stone revetment of scarps on pa. Stone walls, rows and heaps appear in the majority of cases to be connected with clearing ground for agriculture and may be found together on the same site.

1. Stone Walls. These are where stone has been definitely laid in courses to build up a regular wall.
 1. for the Site Record Form purposes it is desirable to note
 1. the height, width and construction of the walls;
 2. their alignment—are they straight, crooked* what directions do they run in, regular, haphazard?
 3. their arrangement—do they enclose areas, or is their arrangement apparently without purpose?
 4. presence and relationship of stone rows and/or heaps;
 5. the nature of the ground over which the walls are built—is it normally stone or not? steep or flat?
 2. for the Site Survey Form the following details should be given in addition
 1. the area covered by the stone wall complex;
 2. the number of enclosures, if present;
 3. the size of enclosures, if present.
2. Stone Rows. The distinction between walls and rows is that in the latter case no deliberate attempt seems to have been made to lay regular courses for a true wall. They are apt to be haphazard arrangements of stones in lines. The same type of information needs recording as for stone walls, see section 8.4.5.1 above.
3. Stone Heaps. These are piles of stones of varying size. Points to be recorded are:
 1. on the Site Record Form
 1. number of heaps;
 2. shape of heaps;
 3. general size of heaps: large, with typical dimensions; small, with typical dimensions; mixture of the two sizes.
 4. general arrangement—aligned or haphazard; closely clustered or scattered;

5. presence and relationship of stone walls and/or rows;
 6. size of area covered;
 7. nature of ground—whether naturally stony, steep, sloping or flat.
2. on the Site Survey Form in addition to the above
1. details of size and volume of heaps;
 2. details of area covered;
 3. details of distribution pattern of heaps over the area.
4. Stone Alignments. The term covers sites of which few examples have been recorded. For an example of a site that would fall into this category see Best, Maori Religion and Mythology (Dominion Museum Bulletin No. 10), opposite page 171. This is a broken line of slabs on end. Recording would therefore require:
1. on the Site Record Form a description of the features of the site and its associations;
 2. on the Site Survey Form detailed measurements.
5. Stone Revetments of Scarps. These features are occasionally found on pa as mentioned in 8.4.1.1.2 and the form of the revetment, waterworn boulders, rough stones etc., should be noted.

8.4.6 DRAINS OR "CANALS"

These are uncommon items in the field record and little has been recorded about them, but may be very evident on the aerial photos.

1. Basic recording on the Site Record Form would instance
 1. the layout of the drainage pattern, e.g. main drain with tributary drains, series of parallel drains, etc.
 2. the course of the individual drains, straight, curved, sinuous, running N etc.;
 3. the width of representative drains and the present and, if possible, the former depth;
 4. the size of the general area drained;
 5. the nature of the area drained—topographically, in point of view of soil, etc.
2. Further recording on the Site Investigation Form would in addition to the above include
 1. detailed description of the drainage plan;
 2. measurements of individual drains;
 3. area of the region drained.

8.4.7-9 MIDDENS, OVENS, WORKING FLOORS

These types are put together, because although they often occur singly, they often occur also in combination. When they occur together, the complex becomes one site, with the different features individual elements within it.

8.4.7 MIDDENS

Middens are exposed in the course of erosion or disturbance on pa sites, at spots where no surface indications are present to lead one to suspect an archaeological site, and especially on sand hills.

1. On the Site Record Form should be recorded

1. general composition of midden, e.g.
 1. much shell, mainly cockle, but with mussel, paua.
 2. little fishbone;
 3. rare birdbone;
 4. no moabone;
 5. large quantities of oven stones;
 6. a little charcoal;
 7. a few struck flakes;
 8. no obsidian;
 9. a little pumice.

N.B. If you are unsure of shell or bone identifications, it is best to make no identification, rather than a false one.

2. state of midden, packed or loose, deposits bedded or not bedded, shells broken or unbroken;
 3. area of midden;
 4. depth of midden;
 5. stratification of deposits;
 6. details of stratification
 1. composition of layers;
 2. state of layers;
 3. depth of layers.
2. On the Site Survey Form in amplification of the above there would need to be proper identification of bone and shell remains, e.g. by submission of samples to those qualified to identify.

8.4.8 OVENS

Ovens are sometimes exposed by erosion:

1. their size;
 2. their state;
 3. their number;
 4. the presence of shell, flakes, in the vicinity;
- need recording in general on the Site Record Form, in detail on the Site Survey Form.

8.4.9 WORKING FLOORS

Working Floors are sometimes exposed on pa, at odd places where no surface indications exist, and commonly on sandhills. Recording follows closely the pattern for middens, see 7.4.7. above, viz.

1. Site Record Form

1. general composition of floor
 1. proportion of stone working to working in, for example, bone
 2. amongst stonework
 1. amount of waste flakes;
 2. amount of worked flakes, if any;
 3. amount and character of unfinished and broken tools if any;
 4. varieties and proportions of stone present, including obsidian, chert etc.
 3. character of bonework;
 4. type of bone worked;
2. area of the floor;
3. depth of the deposit;
4. presence of stratification;
5. details of stratification;
 1. composition of layers;
 2. depth of layers;

N.B. No identifications of material should be attempted, unless there is complete certainty.

2. Site Survey Form

In amplification of the above correct identification of stone and bone should be obtained from those qualified to give it, by the collection of samples.

8.4.10 QUARRIES

1. The Site Record Form should note
 1. the type of rock being quarried;
 2. the byproducts of quarrying, lumps and flakes, the area they cover and the depth they attain;
 3. evidence for quarrying methods and tools like large hammerstones;
 4. evidence for stone tool manufacture, on the spot-rough-outs and broken artefacts.

2. The Site Survey Form might amplify the general observations made above, as a result of longer and more intensive investigation.

8.4.11 CAVES AND ROCK SHELTERS

Caves and rock shelters should be described for size and shape.

They may give evidence of

1. habitation. The evidences of habitation should be particularised:
 1. midden;
 2. ovens;
 3. hearths;
 4. burnt patches;
 5. working floors;
2. burial. The circumstances of burial should be noted without interference with the remains
 1. remains articulated or disarticulated;
 2. presence of mainly long bones, skulls, etc.
 3. placement of remains;
3. artistic activity
 1. paintings;
 2. carvings;
 3. paintings and carvings.

The Site Record Form should give general information under these heads, the Site Survey Form detailed descriptions.

8.4.12 BOTANICAL EVIDENCES

These are apt to be more numerous than the examples quoted below:

1. Karaka.
Groves of Karaka are often present on Maori sites, e.g. pa and should be noted for number and distribution.
2. Areas of Cleared Bush may be sometimes recognised as islands of secondary vegetation. See McKelvey, 195 .
3. Mutilated Totara. Examples have been reported of totara partially stripped in antiquity of bark to make containers and the like. The stripped portion dies and decay affects the heart of the tree. But the unstripped portion continues to grow and a characteristic scar is left.
 1. The dimensions and area of the stripping;
 2. the amount of growth since stripping;
 3. any special features;
 are worth noting. For details see Batley, 1956.

Batley, R.A.L. 1956. "Some Practical Aspects of Dendrochronology in New Zealand." *Journal of the Polynesian Society*, 65, no. 3: 232-244.

McKelvey, P.J. 1958. "Forest History and New Zealand Prehistory." *N.Z. Science Review*, 16, nos. 3-4: 29-32.

8.4.13 MISCELLANEOUS SITES

It is certain that types of site other than the ones described here remain to be found. One of the aims of archaeological survey is to find them. Thus recently near Rotorua one of the authors was shown examples of a feature consisting of a ring ditch with low outer bank and largely unmodified circular area within, of unknown age or use.

The fact that a site is of a new type should be mentioned specifically on the Site Record Form.

This is meant to elicit topographical details such as might explain presence or purpose of a particular site and supply information about its natural context.

1. Of general importance and such therefore as would appear on the Site Record Form are

1. the direction in which a site faces or trends. Position towards or away from the sun is often of crucial importance.
2. the particular position it occupies, on hill or ridge top, on slopes steep or gentle, on flat ground, and the immediate topography are important. With them are linked questions of
 1. altitude. This can be estimated from map contours when once the position of the site is fixed;
 2. outlook: how much country is visible from the site and in what directions.
3. the distance from water is another factor of significance that needs noting.

2. Each type of site has particular factors of environment of importance to it that may not be covered by 7.5.1. above and may need special additional mention on the Site Record Form. Thus with

1. Pa Sites

1. The natural strength of the site needs particularisation in order to explain the choice of the site and the disposition of the artificial defences.
2. The presence of areas of level land, elevated or low lying, considerable, limited or absent, in the immediate vicinity of the pa should be mentioned to illustrate possibilities for alternative settlement, cultivations and the like.

2. Pits. The exact position they occupy

1. topographically;
 2. in respect of outlook;
 3. in respect of drainage;
- is often crucial.

3. Quarry Pits and "Made" Soils. The following points should be noted:

1. The topography of the areas of "made" soils, flat, sloping gently, steep;
2. The direction the areas face.
3. The nature of the gravels exploited, e.g. river gravels at a

certain depth, extensive or limited in area, or beach gravels found at such a distance from the site.

4. Especially the nature of the soil which has had to be treated in this particular way.

4. Non-defensive Terraces. Particulars of

1. direction;
2. topographical position;
3. distance from water and
4. if gravel strewn from beach or river gravels should be noted.

5. Stone Walls, Rows, and Heaps. To be noted are

1. the topographical features of the area over which the walls, rows and/or heaps are distributed - flat land, sloping areas or steep slopes;
2. the direction in which the sites face;
3. altitude;
4. particularly whether the area on which the site stands is naturally stony;

6. Stone Alignments. So little is known of these features that any environmental data is valuable.

u. Drains or "Canals".

1. The general nature of the area drained, e.g.
 1. swampy valley bordered by hills;
 2. basin completely surrounded by hills;
 3. flat land swamp of extensive nature;
2. The outlet for the drainage, such as
 1. lake;
 2. river or stream;
 3. beach
3. The nature of the soil.

8. Middens, Ovens, Working Floors.

1. If found on sandhills
 1. whether associated with
 1. foredunes;
 2. inner dune series;
 3. if latter
 1. how many dunes from the beach

2. what distance?

2. relationship to the dune series

1. on top

2. on lee slope

3. at foot of lee slope

3. the potentialities of the immediate environment in respect of

1. shell fish

2. fresh water

3. swamps

4. rock outcrops or boulder banks for stoneworking

2. If found elsewhere

1. topographical conditions

2. proximity of water

3. if sea shells are present proximity of the coast

4. availability of stone

1. for stoneworking

2. for oven stones

9. Quarries

1. Altitude

2. Accessibility

3. Factors governing original discovery, such as prevalence of outcrops

10. Caves and Rock Shelters

1. The nature of the parent rock

2. The type of formation, e.g.

1. sea-worn

2. river-worn

3. water-worn

3. details of topographical position

4. Direction in which the entrance faces.

5. Availability of light in respect of

1. different parts of the cave or shelter;

2. different times of the day.

6. Whether sheltered or unsheltered.

3. The Site Survey Form would require

1. Particularisation of many of the features asked for above. under the various site headings

8.6 STATE OF SITE AND POSSIBILITY OF DESTRUCTION OR DAMAGE

This is designed to warn of the possibilities of damage or destruction to important or interesting sites so that appropriate action in the way of thorough recording can be undertaken in time.

1. The state of the site can be reported as follows:
 1. earthworks in good, indifferent, bad preservation;
 2. site (apparently) ploughed or disced;
 3. site in bush, scrub, trees, grass.
2. The possibility of destruction or damage would cover
 1. erosion by sea, creek, slips and the like;
 2. trampling by stock;
 3. proposed ploughing or discing;
 4. total destruction by agricultural or industrial development, including afforestation.

8.7 DETAILS OF INVESTIGATION

This section is designed to assess the accuracy and thoroughness of the report. The information is important, since a decision may be made because of it to carry out more extended investigations of an important site.

The information should be given under the following heads:

1. the nature of preparations before going out into the field, if any;
2. the number of people engaged on the site;
3. the length of time spent at the site;
4. the nature of the equipment used, thus:
 1. map and tape;
 2. map, tape, compass, aerial photographs etc.

8.8 OWNER AND TENANT: ATTITUDE TO ARCHAEOLOGICAL WORK

These are important if further investigations of particular sites are to be carried out.

8.9 DOCUMENTATION OF SITE

1. Maori Name (if known). This is a useful item that can often be obtained
 1. often from local contacts, Maori and European;
 2. sometimes from old maps and property records in the archives of Lands and Survey, Maori Land Courts and the like.Knowledge of the name may permit identification of the site with a site mentioned in Maori traditions or early European records.
2. Source of Name. It is essential, however, to give this, since misunderstandings may occur, or identifications be made on too slender evidence.
3. Map, Book and Manuscript References are included as an item on the Site Survey Form to be filled in as advanced investigations are pursued into a site, as outlined above in 8.9.1.

8.10 ARCHAEOLOGICAL COLLECTIONS MADE AT SITE

(Site Survey Form only)

1. In certain instances the researcher himself will be lucky enough to make discoveries of artefacts on a site he is recording.
2. More often he will discover from his local contacts that artefacts have been picked up on a site he is investigating and are in the hands of
 1. the owner of the site;
 2. a local collector;
 3. a museum.
3. He should endeavour for purposes of the fuller investigations of the Site Survey Form attempt to see the artefacts in question and
 1. record their number and nature: adzes, fishhooks and the like;
 2. if possible sketch them;
 3. note their present whereabouts.

8.11 NAME AND ADDRESS OF RESEARCHER

The need for this is too obvious to need mention.

9.0 PLANS, DIAGRAMS AND ILLUSTRATIONS

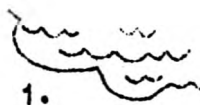
These are not only a valuable addition to verban descriptions of sites but an indispensable record in themselves.

9.1 PLANS

1. Mention has already been made in Section 5.13 of the possibility of making a rough but accurate plan of the major features of a site from an aerial photograph in the field and,
2. A method has been described in section 6 of preparing base plans of sites from aerial photographs using an epidiascope in the laboratory before ever the field is taken.
3. The base plans produced by both these methods can then be filled out by sketching in detailed features and by drawing a cross-section or cross-sections of the site.

1. Sketching in Detailed Features

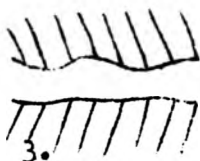
1. A standard set of symbols is desirable and the following may be used:



water



swamp



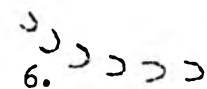
ridge and natural slopes: the hatching is wider, longer and light.



terrace and artificial scarps: hatching short, close set and heavy.



bank

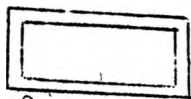


ditch



rectangular semi-subterranean pit with level rim.

7.



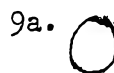
8.

rectangular semi-subterranean pit
with raised rim



9.

bellshaped subterranean pit



9a.

Circular pit—
examples apparently
known.



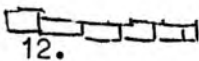
10.

quarry pit for subsoil gravel



11.

area of "made" soil



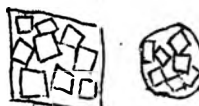
12.

stone walls



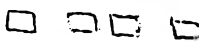
13.

stone rows



14

stone heaps



15.

stone alignments



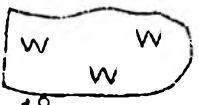
16.

middens



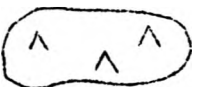
17.

ovens



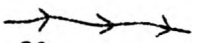
18.

working floors



19.

quarry sites



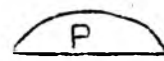
20.

drains, showing direction of flow



21.

habitation caves
and shelters



23.

painted caves
and shelters



22.

burial caves
and shelters



24.

carved caves
and shelters

2. These symbols can sometimes be drawn to scale where the features they represent are sufficiently large. But accuracy of scale with some of the smaller features could lead to lack of clarity. Accuracy of measurement should be sacrificed to clarity of understanding.
3. In general specific features, like pits, where this doubt is likely to arise, should be numbered on the plan and have their dimensions recorded on the plan margins.
4. Similarly on complex sites like pa where the drawing of a symbol to indicate midden or working floor could create confusion, a number or arrow could refer to a marginal description of the feature.

2. Drawing Cross Sections

1. Ideally two cross-sections of sites, longitudinal and transverse, are required, but in practice the number, the position and sometimes even the need depends on the nature of the site itself.
2. A Brunton type compass or Abney level are the requisite instruments for this type of work, though the result may not be totally accurate.

9.2 DIAGRAMS

These are drawings which lay claim to no accuracy of measurement, but serve to illustrate particular points:

1. They can be used to good effect:
 1. to indicate the layout of a site for which no plans have or can be prepared from aerial photographs;
 2. to illustrate certain features of a site, e.g. a stratigraphic sequence, the relationship of a ditch and a terrace, as a supplement not only to verbal descriptions but also drawn plans.
2. The following points should be noted:
 1. the standard symbols outlined above in 9.1.3.1 should be employed;
 2. dimensions should be indicated by measurements written on the diagram;
 3. most important, there should be adequate cross references from the diagram to the feature in:
 1. the verbal description or
 2. the drawn planthat it is designed to elucidate.

9.3 PHOTOGRAPHS

1. It would not be too much to say that you cannot take too many photographs as a record of a site. They can be used to illustrate
 1. the layout of a site;
 2. selected features;
 3. general setting.
2. The following points should be noted:
 1. Unintelligently taken photographs tell nothing. Use must be made of light and shadow to bring out the features you want to illustrate.
 2. Always include a scale of some sort in photographs: from a trowel, to a human being depending on the size of subject.
 3. A photographic notebook must be kept to record the pictures taken:
 1. the frames of the film are numbered consecutively 1-12, 1-20, 1-35, depending on the type of film. As soon as a shot is taken, a description of the subject should be written against the appropriate frame number in the notebook.
 2. the reels should be numbered in the notebook and the appropriate number written on the cover of the reel when it is completed .
 3. Description of the subject should always include a note as to the direction from which the shot was taken.
 4. There should be cross references between photographic subjects and the same feature in the verbal description and in plans and diagrams.

10.0 PROCESSING THE RECORDS

10.1 Filling in the Forms

1. Each site must have a Site Record Form completed for it. The Site Record Form is the basic record and the Site Survey Form is only an extension of it.
2. The Site Record Form must be completed in triplicate
 1. one copy for the researcher;
 2. one for the local filekeeper;
 3. one for the central files.A researcher may sometimes want to give a copy to some local contact, in which case the form must be completed in quadruplicate.
3. A number of points arise in connection with this:
 1. a fairly sturdy form is needed for use in the field;
 2. it is highly unsatisfactory to use two, let alone three carbons with paper of such thickness;
 3. it is also inconvenient to manipulate carbons in the field.
4. Therefore
 1. a single form of heavy paper is used in the field;
 2. triplicate copies are made of this at home on forms of lighter paper.
5. If possible at least the major plans, diagrams and photographs should be reproduced in triplicate to accompany the forms.
6. Site Survey Forms are completed in the same way: in triplicate on thin paper after a single form of heavy paper is actually used in the field.

10.2 Sending Off the Forms

1. The Site Record Form in triplicate (or quadruplicate) with accompanying plans, diagrams and photographs, ordinary and aerial, is sent off to the local filekeeper.
2. The same procedure is followed with the Site Survey Forms and their accompanying plans and photographs.

10.3 The Local Filekeeper.

1. During his work the researcher will have written in a provisional site number of his own in the space in the top left hand corner of the Site Record Form: see 8.1. This provisional number will appear
 1. on the back of the relevant aerial photograph, if this has been used: see 5.12.
 2. on any plans, diagrams and descriptions attaching to the site.
2. The local filekeeper will on receipt of the Site Record Form from the researcher
 1. allocate a permanent number to the site in question, which he will substitute for the provisional site number
 1. on all the Site Record Forms in the relevant place in the top right hand corner;
 2. on all aerial photographs, plans, diagrams and descriptions accompanying the particular Site Record Form.

This number will consist of the relevant 1 inch sheet number and a serial number; thus N37/103.
 2. enter this permanent site number on the relevant 1 inch sheet in his file of record maps;
 3. if possible obtain the relevant aerial photograph serial number and Lands and Survey number from the recorder and enter this at the bottom of the Site Record Form in the section marked Office Use.
 4. sign the three site Record Forms;
 5. file one copy of the Form and accompanying plans and photographs;
 6. return one copy of the form and accompanying plans and photographs to the researcher;
 7. send on the other copy to the central files at the Dominion Museum in Wellington in the charge of Miss Winifred Mumford.
3. The same procedure is followed with the Site Survey Form, except that, since the Survey Form follows the Record Form in time, the permanent site number should already be appearing on it. If
 1. it does not, due to oversight, or
 2. a second record form appears recording the site as a new one the local filekeeper will make the necessary alterations and inform the people in question.

10.4 The Central Files

The Dominion Museum authorities have generously offered facilities for the storage of the central files and Miss Winifred Mumford has agreed to be central filekeeper. The centralised results of archaeological recording work over the whole country will, under certain safeguards, be accessible for consultation and research, on application to the Council of the Archaeological Association.

The records will therefore play an important part in providing detailed, comprehensive and comparative material for many aspects of the New Zealand prehistoric scene.

10.5 Recording Areas and Local Filekeepers

1. The following recording areas have been agreed upon, their boundaries based upon the boundaries of the 1" sheets on which recording is based, and the following filekeepers have been appointed:

1. Otago-Southland-Stewart Island:

Filekeeper: P.W. Gathercole, Otago Museum, Dunedin.

This area covers sheets:

Published: S127, S136, S146, S154, S155, S159-164, S167-172,
S175-180, S182-184.

UnPublished: S86-87, S96-99, S104-108, S112-117, S120-126, S129-135,
S138-145, S147-153, S156-158, S165-166, S173-174, S181,
S185-191.

2. Canterbury-Westland-Chatham Is.:

Filekeeper: Anthony Fomison, 154 Tancred Street, Linwood, Christchurch.

This area covers sheets:

Published: S30-32, S37-40, S42-51, S53-55, S61-62, S68-69, S74-76,
S81-85, S91-95, S102-103, S111, S118-119, S128.

Unpublished: S52, S57-60, S63-67, S70-73, S77-80, S88-90, S100-101,
S109-110,
and Chatham Island.

3. Blenheim-Nelson:

Filekeeper: J.R. Eyles, Box 225, Blenheim.

Published: S1, S3-6, S8-11, S13-16, S19-29, S33-36, S41.

Unpublished: S2, S7, S8-12, S18-18.

4. Wellington:

Filekeeper: Not yet appointed.

This area covers sheets:

Published: N152-155, part N156, N157-169,

Unpublished: part N156.

5. Wanganui-Inland Patea:

Filekeeper: M.J.G. Smart, Museum, Wanganui.

This area covers sheets:

Published: N137-138, N143-144, N148-149.

Unpublished N101, N111-112, N121-122, N130-132, N139.

6. Taranaki:

Filekeeper: not yet appointed.

This area covers sheets:

Published: N91-92, N99-100, N108-109, N118-119, N129, N136.

Unpublished: N110, N120.

7. Hawkes Bay:

Filekeeper: not yet appointed.

This area covers sheets:

Published: N115, N124-125, N134-135, N141-142, N145-146, N150-151.

Unpublished: N113-114, N123, N133, N140.

8. Poverty Bay - East Cape:

Filekeeper: A. Pullar, 152 Clifford St, Gisborne.

This area covers sheets:

Published: N98, N106-107, N116 and part 117.

Unpublished: N61-63, N70-72, N79-81, N88-90, N96-97, N105,
part N117, N126-127.

9. Rotorua-Bay of Plenty:

Filekeeper: D.M. Stafford, 151 Ranolf St., Rotorua.

This area covers sheets:

Published: N58, N67-68, N76-77, N85.

Unpublished: N59-60, N69, N78, N86-87, N93-95, N102-104.

10. Waikato:

Filekeeper: not yet appointed. Any files to be sent to Auckland filekeep

This area covers sheets:

Published: N51-52, N55-57, N64-66, N73-75.

Unpublished: N82-84.

11. Auckland:

Filekeeper: T.L. Birks, 50 Empire Road, Epsom, Auckland, S.e.3.

This area covers sheets:

Published: N1-11, N13-16, N18-20, N22-24, N27-44, N46-49, N53 and part N54.

Unpublished: N12, N17, N21, N25-26, N45, N50, part N54.

2. All forms must be sent to the local filekeeper of the area in which fall the sites to which they refer.
3. Forms can be obtained from central and local filekeepers.

11.0 EVALUATION OF TECHNIQUES

The aim of this handbook has been not only to stimulate and guide group activity where time, equipment and labour are available, but also to show what can be achieved by the individual worker with a minimum of equipment and how best it can be achieved.

11.1 Four Possible Types of Survey and their Limitations

1. Technical Equipment: map only, possibly camera and tape

1. This is likely to be the type of survey carried out by
 1. interested person working alone and with no access to equipment;
 2. interested but untrained person only sporadically involved;
 3. enthusiasts to whose attention sites present themselves in the midst of other activities or concerns.

2. Possibilities

1. general site location by inspection: see sections 3.2 to 3.5 and 4.4 and 4.5.
2. completion of Site Record Form
 1. in bare essentials if time is very short;
 2. in a general fashion if time is limited;
 3. fully, with diagrams and perhaps photographs if a fair time is available.

3. Limitations

1. not detailed enough recording possible in most instances to complete a Site Survey Form.
2. lack of drawn plans;
3. needs a return visit with more equipment and possibly time.

2. Technical Equipment: map and compass, small supplies necessary for compass work, tape, camera.

1. This is likely to be the sort of survey carried out by an interested individual in an area which he knows very well.

2. Possibilities

1. excellent site location both by inspection and by compass: see sections 3.2 to 3.6 and 4.1 to 4.6.
2. satisfactory completion of Site Record Forms, with diagrams and

photographs.

3. completion of Site Survey Form dependent upon the amount of time and interest given by the individual concerned to a site.

3. Limitations

1. a long time required to cover an extensive area or a complex site;
2. likely deficiency in drawn plans and cross sections.

3. Technical equipment: map, compass, aerial photographs and small supplies necessary for compass and aerial photographic work, tape, camera.

1. With the general limitations of equipment, time and manpower that will make method 4 below an uncommon type, this is the sort of survey to be aimed at by

1. the enthusiastic individual;
2. the small group;

willing to devote a little time and money to the task.

2. Possibilities

1. excellent site location by inspection, compass and interpretation of aerial photographs: see sections 3.2 to 3.6 and all of 4.0 and 5.0.
2. excellent completion of Site Record Forms with diagrams, photographs. Given sufficient preparation before and time in the survey, adequate base plans can be drawn up (5.0 and 6.0).
3. completion of Site Record Forms can be excellent if sufficient time and help is available.

3. Limitations

1. Unless the number of participants is large, a long time is needed to cover an area with a number of sites.
2. site plans are liable to be only fair, with amplification by compass and tape possible.

4. Technical Equipment: as listed in section 2.0.

1. This is certainly only available to institutions like universities or museums, which can muster large teams for the project.

2. Possibilities

1. Excellent surveys of individual sites over small periods and
2. Fullscale coverage of entire regions over more extended field trips

possible because of the time that can be spent on preparation and technical training.

3. Limitations

These are inherent in the problems of supervision of a large group and can be overcome by selection of dependable team leaders.

11.2 Important Points for All Recorders

Points driven home by the Auckland group's experience are

1. Preparations

1. the need for familiarity with map reading and instrument use.

This saved time and increased accuracy in the field. And proficiency could be achieved at the cost of very little time and effort before taking the field.

2. the desirability of familiarity with the region to be explored from maps and aerial photographs before taking the field.

3. the desirability of familiarity with the sites to be recorded from study of stereopairs of aerial photographs before taking the field.

If base plans are to be prepared by the epidiascope technique:

1. the pencilled lines must be very thin;

2. the terrain surrounding any particular site should be pencilled in together with the visible site features themselves, since it was invariably found that sites extended beyond what was visible on aerial photographs and ridge lines and the like provided handy reference points for drawing in the features discovered on the ground.

4. the need for familiarity with the requirements of the Site Record and Site Survey Forms, particularly the categories of noteworthy information and the standard terminology to describe them. To meet this need sections 8.0 and 9.0 are designed for use in the field.

5. the desirability of local contacts before and the need for friendly

approaches to local property owners during the survey. In this way

1. permission for access to all parts of the region of study can be obtained;
2. information about the presence of sites not found during study of aerial photographs will be forthcoming;
3. Maori names of sites may be obtained;
4. information about artefacts and artefact collections may be gained;
5. the names of owners and tenants of property can be easily obtained for inclusion on the recording forms.

2. In the Field

1. the desirability of taking aerial photographs into the field. The advantages of this for planning the progress of the survey, locating positions and studying sites were stressed by all participants in the Auckland group survey.
2. the need for supplementing written descriptions with diagrams and photographs:
 1. in regard to specific features of sites;
 2. especially where no base plan of the site can be prepared beforehand or drawn from the aerial photograph on the spot, because the site in question is poorly visible or not visible at all on the aerial photograph.
3. the importance of small equipment items like pencil sharpeners or razor blades.
4. the necessity of not attempting too much. This was the mistake of the Auckland group which planned its team activities in terms of area instead of the number of sites.
 1. roughly as many sites again were discovered in the area as had been picked up on the aerial photographs. There admittedly were in the main small and uncomplicated sites but recording them took time;
 2. the larger, more complex sites had almost without exception been located on aerial photographs, but in many cases it was found that they extended further than had been suspected;
 3. the proper completion of the recording forms took longer than

expected.

To skimp or hurry the recording is to waste the time devoted to the survey and results in inadequate and sometimes misleading recording. The Auckland teams found that three complex sites were towards the limit of their abilities in a day's fieldwork.