COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

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MAGNETIC SURVEY OF COMPASS-SWINGING SITE R.A.A.F. AIRFIELD, LAVERTON, VICTORIA.

by

F.W. WOOD AND P.M. McGREGOR

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CONTENTS

ILLUSTRATIONS

ABSTRACT

A declinometer survey was made over three sites at the R.A.A.F. Airfield at Laverton, Victoria, in January 1952, to determine their suitability as compass-swinging bases.

The results show that at all three sites there are local magnetic disturbances which cause deviations in excess of the permissible maximum of one quarter of a degree.

None of the sites is suitable.

1. INTRODUCTION

Previous surveys at this station (Ervin, 1951) had indicated that, over the area required for a compass-swinging base (i.e. a radius of 200 feet), there were likely to be magnetic disturbances producing errors in declination of more than the one-quarter degree which is the upper limit permissible under R.A.A.F. standards.

However, a suitable base was still sought and in January 1952, at the request of the Department of Air, a further survey was made. Preliminary tests were carried out over three possible sites selected in collaboration with the Navigation Officer at Laverton. One of these appeared to be a suitable site. A grid of closely-spaced stations was set up over this area and measurements were made of the departures from normal magnetic declination within the area. The magnetic measurements were made with Cooke, Troughton and Sims theodolite - declinometer No. V 012025 with compass attachment No. 155. This instrument had previously been tested for accuracy at the Toolangi Magnetic Observatory and found to have an error not exceeding two minutes of arc. For laying out the grid of observation stations, the theodolite of C.I.W. magnetometer No. 18 was used.

The observations were made between 23rd and 25th January, 1952 by P.M. McGregor and J.A. Brooks, geophysicists. Acknowledgement is made of the very appreciable assistance given by the R.A.A.F. and by members of the staff at the Laverton Airfield, particularly S/Ldr. Harvey and W/O Warlow, in arranging accommodation for the observers and assisting in laying down the grid.

2. METHODS

(a) Preliminary tests.

The preliminary tests consisted of taking three readings along each of several lines set up in different directions so as to sample the area. The theodolite was first placed at a point near the outer edge of the area where it served as one end of a line. Pegs were then placed at two other points along the line at distances of approximately two hundred and four hundred feet from the theodolite. Sighting along this line gave a "mark" reading, or "true" direction, which was subtracted from the "compass" reading obtained when the compass attachment was set up and observed over each of the points in turn. The three differences thus obtained at the three points would be equal if there were no sources of magnetic disturbance near them.

Three possible compass-swinging bases were examined in this way. They are sites A, B, and C shown on Plate 1. The outcome of the preliminary tests was as follows:-

Site A: This is along runway 23, from its intersection with the perimeter track. Observations showed a difference of two and one-half degrees between two of the test points and further testing of the site was discontinued.

Site B: A series of observations was made in line with the north end of the radar building. These showed a range of about forty minutes but the readings obtained at the western end of the line were within the permissible range of one-quarter degree. This indicated that there might be a suitable area farther out from the perimeter track. The site was returned to subsequently and a complete survey was made over it.

Site C: This site comprised a large area in front of the three hangars on the southern side of the airfield. Several lines of test stations consistently gave a range of about one degree in declination. In general, the most northerly station showed the greatest departure and this station coincided with a slight rise in the ground. The tests showed the site to be unsuitable.

(b) Layout of grid.

From the preliminary tests it seemed possible that a suitable area might be found around site B, and it was decided to carry out a complete survey there.

For this purpose a grid, or network of observing stations, was set up. A plan of this grid is given in Plate 2. It consisted of eight lines (A to H) each of eight stations (1 to 8) marked by pegs.

The lines were sixty feet apart and the stations were spaced at intervals of sixty feet along each line. A reference station was set up at the centre of the grid. Eight azimuth pegs were placed on the extensions of the eight lines at a distance of about 150 yards beyond each of the eight end pegs. A ninth azimuth peg was placed midway between the azimuth pegs D and E, for sightings from the reference station.

(c) Observations.

In order that an appropriate correction could be made to the reading at each station for the effect of the diurnal variation of declination, observations were made at the reference station both before and after each line was surveyed. The time of each observation at the reference station was noted and a curve was plotted showing the changes in the observed direction of the compass during the period. From this curve it was possible to determine the necessary correction to apply to each observation at the grid stations.

Each station observation consisted of:-

(i) a "mark" reading, obtained by sighting on the appropriate azimuth peg;

(ii) a "compass" reading, obtained by sighting on the end of the freely-swinging magnet;

(iii) a record of the time of the compass reading.

The difference between "compass" and "mark" readings at any one station represents the angle between the magnetic meridian at that station at the time of observation and the direction of the lines of the grid. This difference angle, D (see Plate 2), corrected for diurnal variation is, for convenience, called the "relative declination" at the station.

If the whole of the area surveyed consisted of uniformly magnetized or non-magnetic rocks, the relative declination at all grid stations would be the same and would be equal to that at the reference point. The deviation of the value obtained at each grid station from that obtained at the reference station would then be zero. The degree of uniformity of an area is, therefore, conveniently expressed as the amount of this deviation in minutes of arc at each station.

3. RESULTS

The deviations obtained at all sixty-four stations over site B are shown on Plate 2. The number alongside each grid point represents the compass deviation in minutes of arc, positive indicating easterly deviation and negative indicating westerly deviation.

The portions of the area within which the deviation exceeds one-quarter degree are enclosed in contour lines and hachured. Deviations of as much as $+1\frac{1}{4}$ and $-1\frac{1}{4}$ degrees were recorded in the south-eastern part of the site.

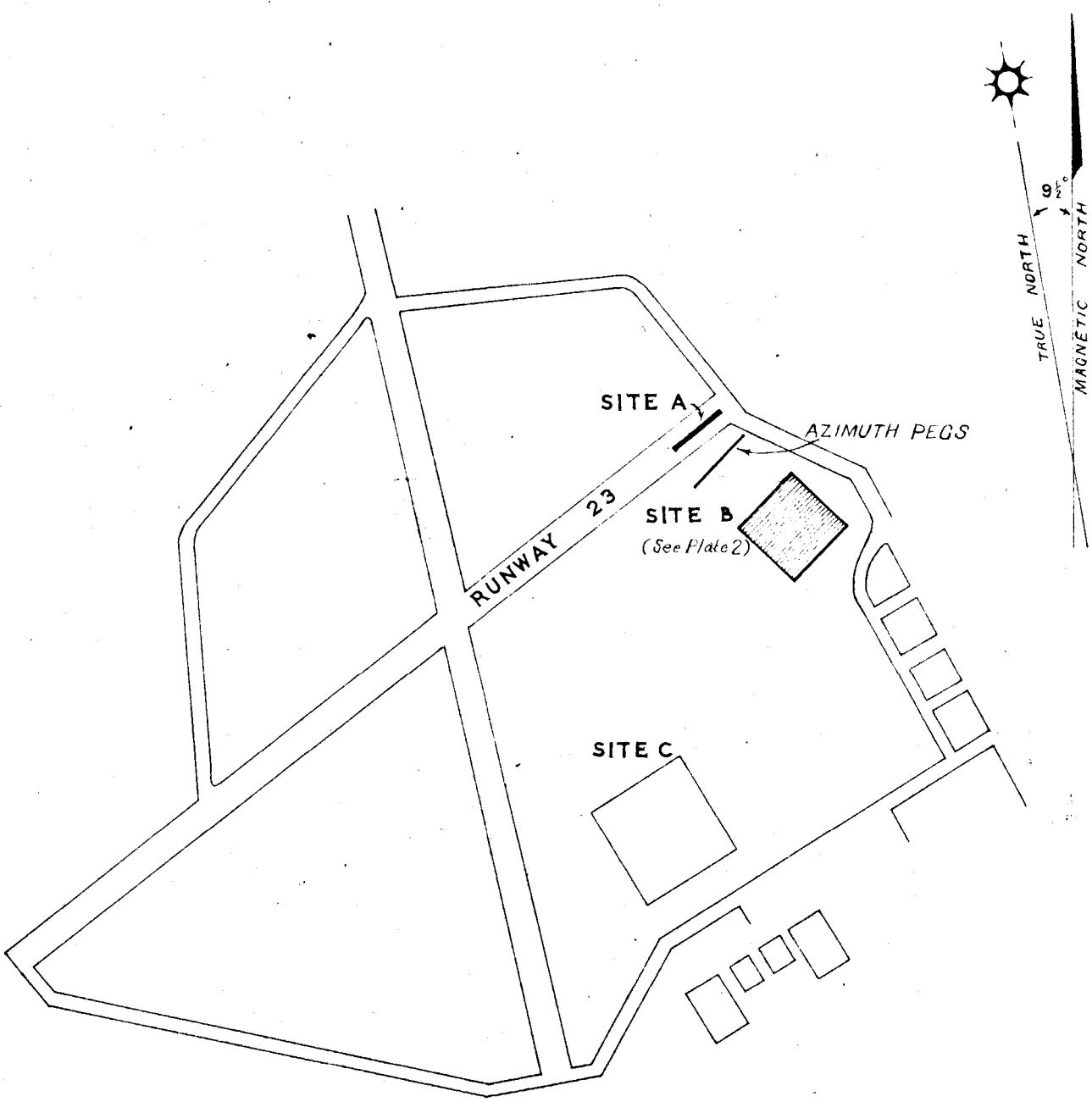
4. CONCLUSIONS

The three sites tested are unsuitable as compass-swinging bases because deviations over much of their area exceed one-quarter degree. The small deviations observed at the northern corner of site B may possibly indicate that a suitable area could be found nearby in that direction. However, specimens of the local basalt, which covers much of the Laverton district, show quite strong magnetic polarization and it seems probable that almost any site of the required size in this area would include pockets of magnetic disturbance.

5. REFERENCE

Ervin, R.E., 1951 - Magnetic investigations of compass swinging sites at the R.A.A.F. Aerodrome, Laverton, Victoria. Bur.Min.Res., Records 1951, No.19.

PLATE I



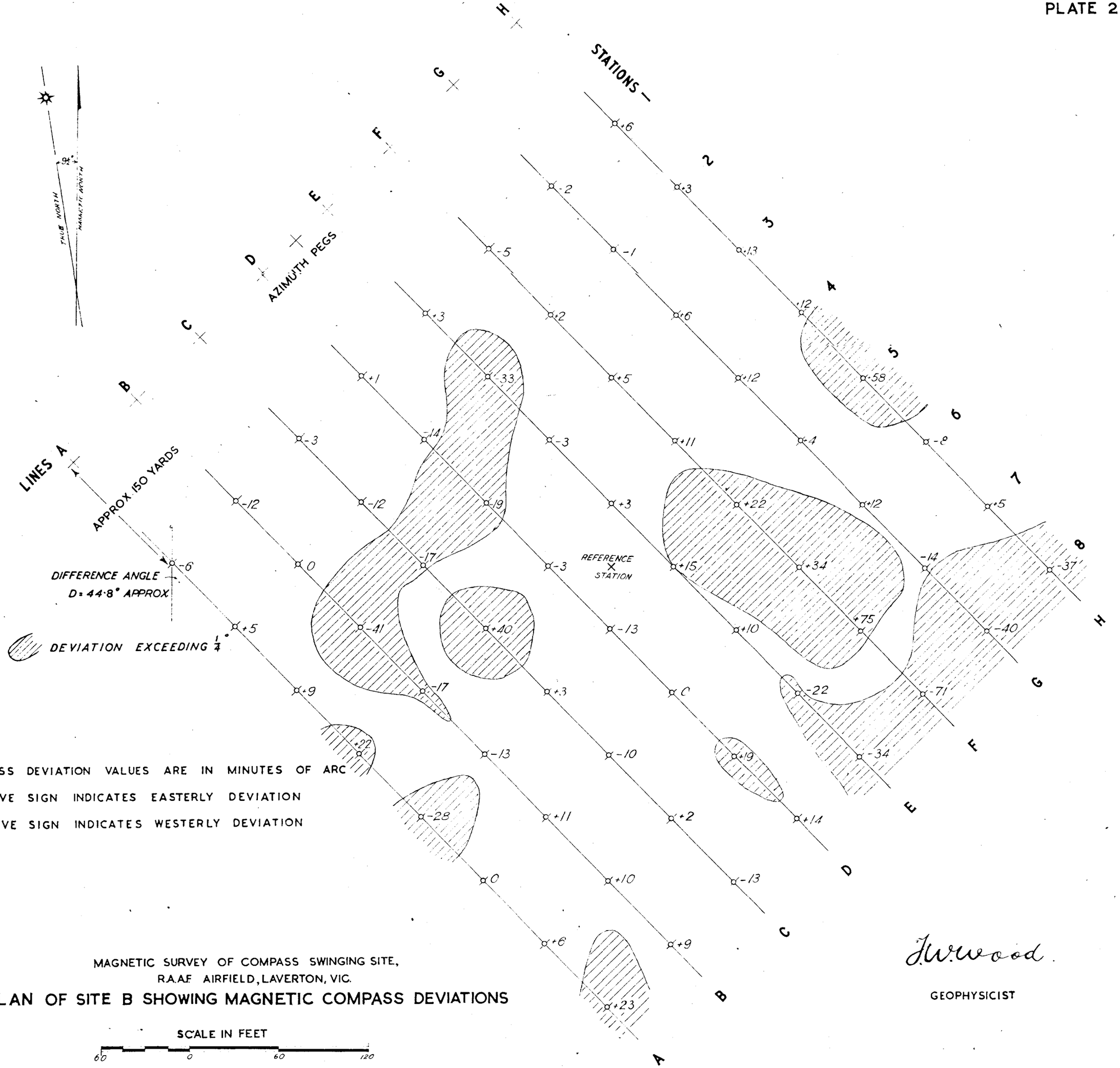
SCALE IN FEET

0 1000 2000 3000 4000 5000

MAGNETIC SURVEY OF COMPASS SWINGING SITE
R.A.A.F AIRFIELD, LAVERTON, VICTORIA

PLAN OF AIRFIELD SHOWING SITES A, B & C

Geophysical Section, Bureau of Mineral Resources, Geology & Geophysics G 97-12



COMPASS DEVIATION VALUES ARE IN MINUTES OF ARC

POSITIVE SIGN INDICATES EASTERLY DEVIATION

NEGATIVE SIGN INDICATES WESTERLY DEVIATION

MAGNETIC SURVEY OF COMPASS SWINGING SITE,
R.A.A.F. AIRFIELD, LAVERTON, VIC.

PLAN OF SITE B SHOWING MAGNETIC COMPASS DEVIATIONS

SCALE IN FEET

60 0 60 120

J.W. Wood

GEOPHYSICIST

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