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REPORT 1944/16

RE NAVAL DEGAUSSING OPERATIONS
REPORT ON MAGNETIC INVESTIGATIONS IN THE VICINITY OF SYDNEY
HARBOUR OPEN MAGNETIC PROVING RANGE

by

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MINERAL RESOURCES SURVEY BRANCH.

Report No. 1944/16.

RE NAVAL DEGAUSSING OPERATIONS.

REPORT ON MAGNETIC INVESTIGATIONS IN THE VICINITY OF SYDNEY

HARBOUR OPEN MAGNETIC PROVING RANGE.

The Sydney Harbour Degaussing Range is situated opposite Bradley Head. The positions of the sets of coils for the shallow and deep ranges are shown on the accompanying plan.

The purpose of the survey was:-

1. To determine the average normal values of the vertical (Z) and Horizontal (H) force components of the Earth's magnetic field in that part of the harbour which would be occupied by a ship in passing over the coils.
2. To measure the magnetic elements, i.e. the Declination, Inclination and Horizontal Intensity of the Earth's field at a base station conveniently situated for use by naval personnel for the purpose of calibrating Pot Magnetometers, etc.

The equipment used for the survey consisted of:-

1. Theodolite-Magnetometer and Earth Inductor No. 18 (obtained from the Carnegie Institution of Washington) for absolute determinations of the magnetic elements.
2. Vertical force Variometer No. 15977 (made by Watts & Company, London) for measurement of variations in the vertical force component.
3. Horizontal Force Variometer No. 16165 (Watts) for measurement of variations in the horizontal force component.

These instruments are designed for accurate measurement of the magnetic elements on land.

As shown on the accompanying plan the survey to test the homogeneity of the magnetic field in the vicinity of the Range was carried out along the foreshores of Bradley Head and Nielson Park and on Shark Island and Clark Island. For this work the variometers were used to determine differences in Z and H relative to the main Base Station on Bradley Head. Using the Theodolite-Magnetometer and Earth Inductor the absolute values of the magnetic elements were determined at the Base Station and these values were used in placing the variometer work on an absolute basis.

Particulars of this absolute determination and of another made on Shark Island are given below. Throughout the area surveyed the transient magnetic disturbances due to tramway and electric-railway power circuits were observed to range up to 30 gammas in Z and 10 gammas in H, (100 gammas equals 1 milligauss). It is possible that stronger effects would be observed at time of peak traffic in trains and trams.

On the accompanying plan the position of the stations on Bradley Head and Shark Island where absolute determinations of the magnetic elements were made, are indicated, and the small circles represent stations where variometer observations were

The figures alongside the variometer stations represent the Z and H differences in gammas between the values at the main Base Station on Bradley Head and the variometer station. The upper figure represents the difference in Z and the lower figure the difference in H, e.g., -30 means that the value of Z at the variometer station alongside is 30 gammas numerically greater than the value of Z at the Bradley Head Base Station and the value of H is 40 gammas numerically less than that of H at the Base Station.

It will be noted that at a few points only is there local magnetic disturbance while at most stations the figures are fairly constant. Over the area surveyed, the variometer figures have an average of about 25 for Z and -40 for H, and it is considered that such figures are applicable to the vicinity of the Range coils. The values of Z and H at the Bradley Head Base Station, given in detail below, are Z = 522.7 milligauss and H = 257.6 milligauss. Applying the above figures of 25 gammas and -40 gammas to these absolute values, it is found that the normal mean of day values of the force components over the coils are:-

Z = 523.0 milligauss, and
H = 257.2 milligauss.

The survey shows that the area is undisturbed by rock magnetism for most practical purposes. This is due to the fact that the rocks underlying the area are sandstones and shales with very low magnetic susceptibilities.

The main base station at Bradley Head was selected (following discussions with naval officers) to serve also as a station for the calibration of navy magnetometers (induction type). In addition to the determination of the magnetic elements, magnetic cardinal points were determined (based on the "mean of day" declination value) for the alignment of navy magnetometers. Particulars of this work and also of the absolute determinations at Shark Island are given below.

BRADLEY HEAD STATION.

Description of Station. On grassed flat near water's edge at eastern side of Bradley Head, Sydney Harbour, 92.0 feet southeast of centre of small Norfolk Island pine tree, 91.5 feet north of near corner of high fence around building, marked by a 4 x 2 inch peg sunk flush with surface. True bearings from station - Centre of tower on Manly Monastery, $39^{\circ} 00'.6$; light tower on Sow & Pigs, $50^{\circ} 24'.6$; lighthouse on Outer South Head, $94^{\circ} 04'.9$; Trig beacon on Vaucluse Water Reservoir tower, $113^{\circ} 15'.1$; light tower near Shark Island, $120^{\circ} 51'.1$.

Observation Results Reduced to International Magnetic Standard By Provisional Corrections Determined at Watheroo Magnetic Observatory, February, 1940.

<u>Element</u>	<u>Date</u>	<u>Local-Mean Time</u>		<u>Value</u>	<u>Mean of Day Value</u>
		<u>h.</u>	<u>m.</u>		
Declination (D)	17/3/44	9	10	+10° 01'.4	10° 05'.5
		10	32	03.4	
		13	02	08.2	
		14	18	09.1	
Inclination (I)	"	8	47	-63° 46.1	63° 46'.1
		10	52	46.4	
		12	44	46.0	
		14	41	45.8	
Hor. Intensity (H)	"	9	31	0.25748 Gauss	0.25757 Gauss
		10	11	53	
		13	21	54	
		14	00	75	

Vertical Intensity (Z) calculated from mean of day values of I and H

$$Z = 0.52272 \text{ Gauss.}$$

Total Intensity (T) calculated from mean of day values I and H

$$T = 0.58275 \text{ Gauss.}$$

Magnetic cardinal points and marks are described below.

Magnetic north mark: About 4 feet to west of chimney on blue roofed house at Taylor Bay.

Magnetic east mark: About 50 feet to north of most northern of two pine trees on skyline near Outer South Head light-house.

Magnetic south mark: Peg 84'.3 from station.

Magnetic west mark: Peg 77'.5 from station.

SHARK ISLAND STATION.

Description of Station. At northern tip of Shark Island, near palm tree, and marked by a 3 x 3 inch peg protruding 4 inches above surface. True bearings - Light tower near Shark Island, $347^{\circ} 40'.9$; flagpole on St. Georges Heights, $1^{\circ} 35'.0$; Trig beacon on Vaucluse Water tower, $104^{\circ} 49'.9$; church spire near city, $226^{\circ} 07'.5$.

Observation Results Reduced to International Magnetic Standard By Provisional Corrections Determined at Watheroo Magnetic Observatory, February, 1940.

<u>Element</u>	<u>Date</u>	<u>Local Mean Time</u>		<u>Value</u>
		<u>h.</u>	<u>m.</u>	
Declination (D)	8/3/44	13	09	$+10^{\circ} 13'.2$
		14	30	$+10^{\circ} 14'.0$
Inclination (I)	"	12	54	$-63^{\circ} 49'.1$
		14	48	$-63^{\circ} 50'.5$
Hor. Intensity (H)	"	13	50	0.25733 Gauss

Vertical Intensity (Z) calculated from means of I and H

$$Z = 0.52365 \text{ Gauss.}$$

Total Intensity (T) calculated from means of I and H

$$T = 0.58347 \text{ Gauss.}$$

CANBERRA, A.C.T.
26th April, 1944.

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SYDNEY HARBOUR D. G. RANGE

PLAN TO ACCOMPANY MAGNETIC INVESTIGATIONS REPORT
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