COMMONWEALTH OF AUSTRALIA

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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORDS 1960 No. 132

CARNARVON BASIN AIRBORNE MAGNETIC AND RADIOMETRIC SURVEY, W.A. 1957

by

W.A.L. Forsyth

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ABSTRACT

Between August and November 1957, a DC.3 aircraft of the Bureau of Mineral Resources carried out an airborne magnetic and radiometric survey over portions of the Carnarvon Basin in Western Australia. The survey was the continuation of a similar survey carried out by the Bureau in 1956.

The magnetic results show clearly the contact between Precambrian and more recent rocks.

No radiometric results of interest were obtained.

1. INTRODUCTION

During the periods 5th August to 18th September and 3rd October to 11th November 1957, the Bureau of Mineral Resources carried out an airborne magnetic and radiometric survey over portions of the Carnarvon Basin in Western Australia, using the DC.3 aircraft VH-MIN. This survey was the continuation of a similar survey carried out by the Bureau in 1956.

The areas surveyed in 1957 are shown on Plate 1 and consist of two separate areas both extending from Precambrian exposures in the east to the coast in the west. To avoid confusion with 1-mile and 4-mile military map areas the areas surveyed have been named as follows:-

(a) Corkscrew Well area, extending from 24° 15'S. to 24° 45'S. and from 116° 15'E. to the west coast.

(b) Redcliff area, extending from 25° 15'S. to 26° 15'S. and from 116° 30'E. to the west coasts of Dirk Hartog Island and Dorre Island. This area includes part of Shark Bay.

The total area surveyed was approximately 20,000 square miles. Flight lines were spaced one mile apart and a total of 21,350 survey miles were flown, including 1340 miles of tie lines.

Personnel of the Bureau of Mineral Resources who took part in the survey were Miss C.O. Leary, Messrs. J.K. Newmann, W.A.L. Forsyth, F.J. Merrick, C.L. Cookson, R. Wells, W.J. Bresser, F.S. Clements, J.P. Pigott, and F.P. Fraser. Personnel of Trans-Australia Airlines who assisted in the survey were Captain D.K. Duffield, Captain P.J. Norris, First Officer J.D. Bartlett, and Messrs. R. Lunniss and R. McNamee.

2. OPERATIONS

Flight lines were flown heading either east or west (at right angles to the general strike) and at a spacing of 1 mile.

Both areas were also crossed by north-south tie lines at an approximate separation of 30 miles. These tie lines were flown in both directions without interruption, so that magnetic data could be corrected for instrumental drift and diurnal variation. In this way, only non-linear variations occurring in less than 10 to 15 minutes can create errors in the magnetic contours of the final map.

Except when flying over the sea, navigation was carried out by reference to vertical air photographs. A vertical strip camera was used to record continuously the position of the aircraft; flight lines were plotted by comparing the strip record with the vertical photographs.

Off-shore flight lines were plotted from co-ordinates produced by the ground position indicator, which integrated air speed, heading, and a wind vector. The ground position indicator co-ordinates were also used as an auxiliary method of flight line plotting in areas where vertical air photographs showed poor detail.

3. EQUIPMENT

Magnetometer

A modified AN/ASQ-1 fluxgate magnetometer was used to record the variations in the total intensity of the earth's magnetic field. To reduce the effect of the permanent and induced magnetic fields associated with the aircraft, the detector head was mounted in a boom extending 9 ft behind the aircraft's tail. In this position the maximum heading error recorded by the magnetometer as the aircraft turned through 360° was 15 gammas, without compensation. Compensation of the aircraft's permanent magnetic field reduced this heading error to 7 gammas. Compensation of the induced field was not attempted, as a heading error of 7 gammas is insignificant on a survey in which all lines are flown on the same heading.

A Leeds and Northrup potentiometric chart recorder recorded the magnetometer output. The full-scale sensitivity of the 10-inch record was nominally 600 gammas; by means of an antomatic switching device this range was extended in 16 steps to 5900 gammas.

Scintillograph

The scintillograph was an M.E.L. radiation detector recording on an Esterline-Angus chart recorder. The output from two detector heads was fed into a modified ratemeter with a full-scale sensitivity of 1000 counts per second. To handle this count rate the output time-constant was set to one second. No attempt was made to restrict the angle of view of the detector heads by shielding.

Survey flights were made at 500 ft above ground level. The relative sensitivity of the scintillograph was determined at the beginning and end of each survey flight by placing a gamma ray source at a standard distance from the detector heads while the aircraft was flying at 2000 ft above ground level. Only slight variations in sensitivity were experienced.

Vertical Camera

When flying over land an Aero Service Corporation 35-mm strip camera made a continuous record of the aircraft's position. The strip negative was printed in Melbourne and the print returned to the survey party in the field and plotted on vertical air photographs.

Radio Altimeter

The radio altimeter was an STR-30A frequency modulated microwave type which provided a continuous record of the aircraft's altitude above ground level on an Esterline-Angus chart recorder. The calibration of the radio altimeter was checked periodically against a barometric altimeter.

Ground Position Indicator

The ground position indicator continuously integrates a calculated wind vector with data from an air speed indicator and a Sperry CL2 gyrosyn compass. Wind vectors are calculated periodically from the aircraft's air speed, ground speed, and drift, and are fed manually to the ground position indicator.

The survey operating height of 500 ft above ground level was too low to allow accurate measurement of the aircraft's ground speed, and often made it difficult to measure the drift. Wind corrections were therefore limited to the beam wind component, which resulted in the ground position indicator co-ordinates being subject to longitudinal distortion. This distortion was subsequently corrected by comparing the co-ordinates with selected photographic check points on the strip film and the vertical air photographs. The overall accuracy of this method of plotting flight lines over areas of poor topographic detail appeared adequate. Subsequent analysis of the method showed that the same accuracy in flight line plotting could be obtained by using indicated air positions only, and that the correction for beam wind components was not necessary.

4. RESULTS

Radiometric Results

A preliminary examination of the scintillograph records showed two anomalies in the Redcliff area; they are approximately ten miles south of Byro homestead, in Precambrian igneous rocks. These anomalies were re-flown at 200 ft above ground level but proved too broad to be of further interest. No other anomalies of interest were recorded.

Magnetic Results

In general the magnetic profiles resembled those recorded during the 1956 survey over adjacent areas (Parkinson, 1957). Near the eastern edge of the survey area the contact between the Precambrian igneous and metamorphic rocks and younger sedimentary rocks continued to be marked by changes in magnetic profiles. Farther west, over the sedimentary basin and over Shark Bay, the profiles were smooth with only small variations in amplitude. These profiles were consistent with a thickness of sediment in excess of 10,000 ft.

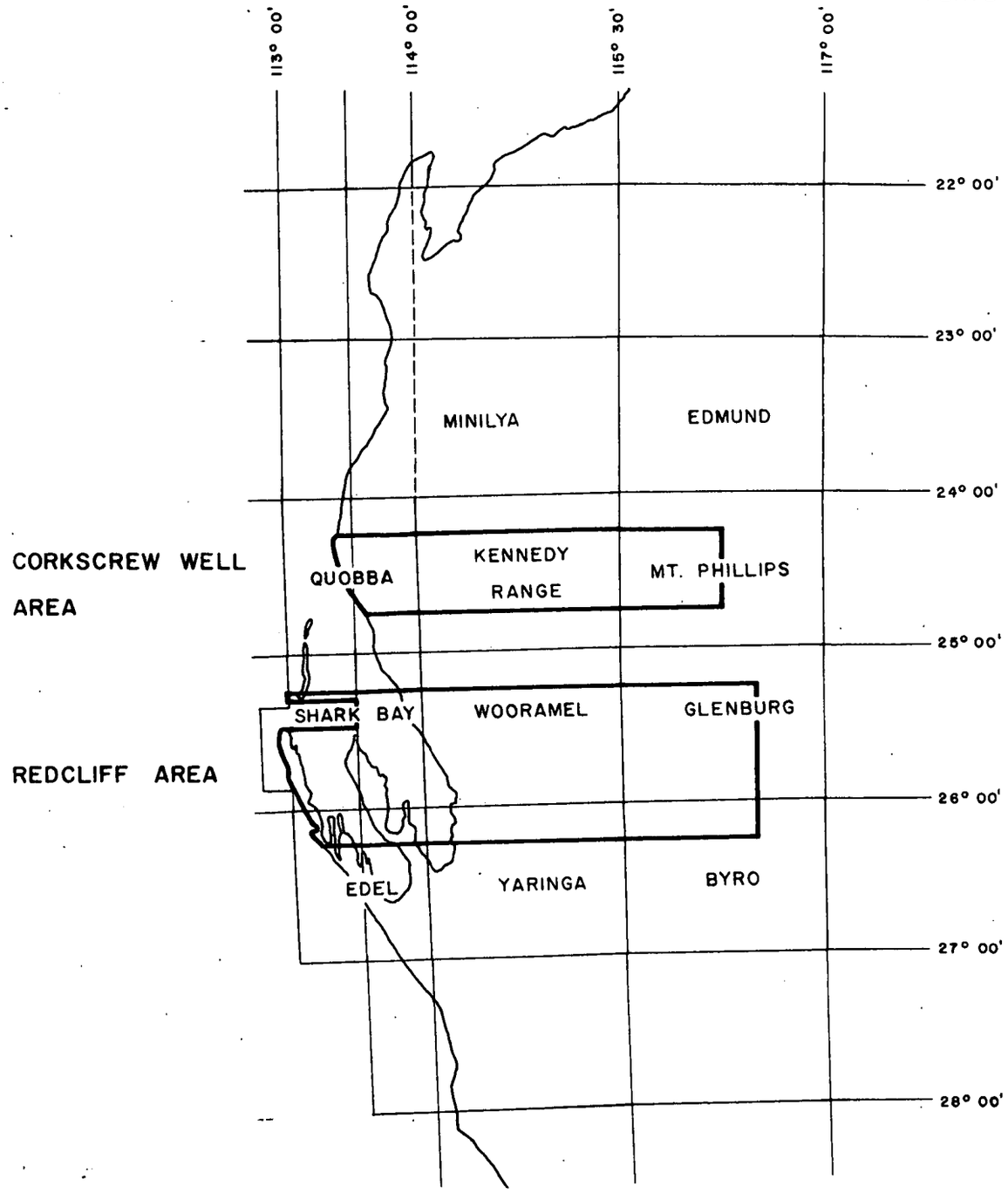
There is evidence of an area of Precambrian outcrop in the Glenburg 4-mile military map area. An anomaly was recorded west of the magnetic change marking the eastern Precambrian contact, and is visible on all profiles from the northern limit of the Redcliff area to as far as 44 miles south of this limit. The axis of the anomaly is approximately 15 miles west of the contact on the northern limit of the Redcliff area and approximately 55 miles west of the contact at its southernmost appearance. The anomaly therefore has a north-east axis, and it can probably be correlated with the isolated Precambrian outcrop within the Basin, shown on the geological map of Western Australia published by the Geological Survey of Western Australia.

A detailed interpretation of the magnetic results of the survey must await the production of magnetic contour maps.

5. REFERENCE

PARKINSON, W.D., 1957 Preliminary report on airborne surveys (scintillograph and magnetometer) of Geraldton - Onslow region, W.A., 1956. Bur. Min. Resour. Aust. Records 1957/9.

PLATE I



LOCALITY MAP

CARNARVON BASIN W.A. 1957

AIRBORNE MAGNETOMETER AND RECONNAISSANCE SCINTILLOGRAPH SURVEY

SCALE

MILES 50 0 50 100 150 200 250 MILES

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