COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

RECORDS

1956, No.146

SUMMARY OF CAR-BORNE RADIOMETRIC SURVEYS, 1953-54

by

A.J. BARLOW

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ILLUSTRATIONS

ABSTRACT

Car-borne radiometric surveys were introduced by the Bureau in 1953 to enable a more rapid inspection to be made of anomalies detected by airborne scintillograph. Reconnaissance surveys were made in the Hundred of Waterhouse, N.T. and at Edith River, N.T. Results showed that the aerial anomalies were generally broad and of low intensity and could be satisfactorily located by the vehicle-borne unit.

In 1954, improved equipment and the addition of an Odograph enabled the method to be used for detailed surveys of smaller areas. As the Odograph automatically plots the traverse of the vehicle, a close check on aerial photographs is unnecessary and the time required for a survey is considerably reduced. Twenty to thirty line miles can be traversed per day on a detailed survey and possibly up to fifty line miles could be traversed on a reconnaissance survey.

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1. INTRODUCTION

Car-borne radiometric equipment was first tested by the Bureau of Mineral Resources, Geology and Geophysics in 1952, but no extensive use was made of it at that time.

In 1953, it was considered that the method would be suitable for checking the location of anomalies detected by previous air-borne scintillograph surveys, as well as for general reconnaissance work. The programme carried out in 1953 included the inspection of such anomalies in the Hundred of Waterhouse and in the Edith River area, and some general reconnaissance work in the Coronation Hill area. Where necessary, areas were gridded in close detail. It was found that at least half of the anomalies from air-borne surveys were in areas easily accessible to a motor vehicle. The field party in 1953 comprised A.J. Barlow and L.V. Hawkins, geophysicists.

In 1954, detailed surveys were made around the A.B.C. Prospect near Katherine, and over the Manton Dam Reserve. The field party in 1954 comprised A.J. Barlow, geophysicist, M. Stevens, geophysical assistant, and a field assistant.

2. EQUIPMENT

A ratemeter for mobile operations must satisfy several special requirements. Briefly, these are :-

(i) A high count rate, thus enabling a low time constant to be used. The high count rate can be achieved by using several large geiger tubes in parallel or by using a scintillation probe. The geiger tubes require less critical ratemeter circuits, but the scintillation unit has a higher efficiency, which is preferable when small radiometric anomalies are to be mapped.

(ii) High stability. The stability of the equipment can be improved by means of voltage regulation and by the use of balanced circuits where possible.

(iii) A continuous recorder which is not susceptible to vehicle shocks and which can be driven from the vehicle speedometer drive. The Kelvin-Hughes single-channel recorder is ideal for mobile use, as it has a fast response and a high restoring torque in the movement. The recorder uses teledeltos paper and no troubles are therefore experienced through ink being spilled or failing to flow evenly. It is easily modified to be driven by a flexible cable from the speedometer take-off, the motor being replaced by a small flange and key.

In the Waterhouse survey a modified version of the ratemeter used in the 1952 tests was employed, the probe unit consisting of six G.24H geiger tubes. The unit was built in the field, without proper facilities, and considerable time was therefore required to put the equipment into satisfactory operation. The background count was approximately 10 counts per second and a time constant of about four seconds was used.

Midway through the 1953 season a scintillation unit was built at the Bureau's laboratory in Melbourne. After a few minor troubles had been rectified, and a new E.H.T. unit built in the field, this equipment was used at Edith River and Coronation Hill where it gave satisfactory service.

Towards the end of 1953, the Bureau purchased a set of

type 1181B equipment, designed by A.E.R.E., Harwell, U.K. This set uses six G60H geiger tubes in parallel and has a background of about 30 counts per second. The type 1181B had been extensively tested in Africa and proved to be very reliable in operation.

Between the 1953 and 1954 field seasons, the scintillation unit was rebuilt and installed in a Land-Rover, together with an odograph. The latter automatically plots the traverse of the vehicle and thus speeds up the rate of coverage, as no time is lost in checking the location of the vehicle. This equipment was used in the Manton Dam survey in the later part of 1954.

3. APPLICATION OF METHOD

The vehicle-borne equipment can be used for reconnaissance purposes or for detailed mapping. In both types of survey the accurate location of the vehicle is important if a permanent record of the results is to be kept.

The surveys made in 1953 were of a reconnaissance nature, and the location of the vehicle was checked by aerial photographs and by the use of the speedometer and compass. This method necessitated the running of irregular traverses along creek beds or between points which cound be easily identified. The method is relatively slow, as the vehicle had to be stopped every time a close stereoscopic inspection of photographs was required.

The above method was also used for surveying an area by means of traverses 100 feet apart. However, in the area where this method was used, identifiable landmarks were numerous, particularly at the end of each traverse. In general, detailed car-borne surveying is not practicable using aerial photographs.

The odograph automatically plots the position of the moving vehicle from any given base point. The operation is based on a magnetic compass and a distance input derived from the speedometer take-off. The compass requires daily compensation, which takes about half-an-hour. In surveying with the odograph it is found most satisfactory to first lay out with the odograph a closed rectangle about 3000 feet by 2000 feet, placing numbered range poles at 200-foot intervals along the longer sides of the rectangle. The grid lines at any convenient interval can then be checked at each end by means of the range poles, and the odograph adjusted if necessary. Using this method and with an average vehicle speed of 5 miles per hour, 20 to 25 line miles per day can be traversed.

4. AREAS SURVEYED.

(a) Hundred of Waterhouse

Plate 1 shows the areas surveyed in detail to locate on the ground the anomalies recorded by air-borne scintillograph. A ratemeter (type 1011C) was carried in the vehicle to check the operation of the car-borne unit.

Of all the aerial anomalies inspected only one, in Area 7, exceeded three times background. Most of the anomalies inspected are due to outcropping areas of granites or slates, particularly the former. The radiometric count on these outcrops ranged from 1½ to 3 times background. Some laterites gave readings to 2½ times background and where these covered a large area they gave first order aerial scintillometer anomalies.

The actual surface count varies with seasonal conditions, and Areas 1 and 3, which were reflown at the time the ground surveys were in progress, showed much smaller anomalies than in the first airborne survey.

A few of the anomalies could not be located on the ground but this was probably because the map used was plotted in the field and was inaccurate. Some of the anomalies were replotted, correcting errors of up to half a mile.

No attempt was made to outline the anomalies on the ground as they were found to be very broad, with more or less indefinite boundaries which could not be accurately determined by the reconnaissance type of inspection which was carried out.

A small part of Area 7 was the only place where significant radiometric counts were obtained and some detailed gridding and geological mapping of that area were done by another field party.

(b) Edith River

Plate 2 shows the actual vehicle tracks as plotted on the aerial photographs. Almost all the aerial scintillograph anomalies in the area were examined, and most of them were found to be due to prominent granite outcrops; these outcrops had a count rate of up to four times that of the soil-covered granite. One anomaly was shown to be caused by a radioactive concentrate in the humus in a watercourse.

The line of anomalies to the east of the granite was shown to be due to a prominent ridge of slates reading up to twice background. Several reconnaissance surveys over structures within the Brock's Creek Group failed to show any evidence of radioactivity.

During the inspection of anomalies within the granite, three shears were located which gave counts up to 20 times background. The shears proved to be too short to contain ore of economic value. They were not detected by the airborne scintillograph.

(c) Coronation Hill

Other geophysical commitments (Barlow and de Groot, 1956) prevented any systematic survey with the car-borne equipment in the Coronation Hill area but two or three days were spent in the South Alligator River valley to the east of Coronation Hill. The highly radioactive sand in Middle Creek was followed for some distance and counts up to six times background were recorded. Some of the volcanics exposed near Coronation Hill gave counts up to three times background. The results of the first airborne survey in the area were not available at the time of the vehicle-borne survey.

(d) A.B.C. Reserve, Katherine

Three months were spent in completing a detailed radiometric survey of this area, using the Harwell type 1181D equipment. The details and results of this survey are described by Barlow (1956a).

(e) Manton Dam Reserve

About two square miles of this area were surveyed in detail with the car-borne scintillation equipment and odograph, in conjunction with a self-potential survey. Results of this survey are described by Barlow (1956b).

5. CONCLUSIONS.

The vehicle-borne radiometric equipment is capable of covering rapidly an area accessible to vehicles either by reconnaissance survey or by gridding on lines as close as 50 feet apart. Several minor difficulties were encountered, but the equipment now in use is reliable in operation, and satisfactory operating techniques have been developed.

The method is particularly suitable for the ground location of aerial scintillograph anomalies, particularly where, as in some areas, they are generally broad and often of weak intensity.

6. REFERENCES

Barlow, A.J., 1956a - Car-borne Radiometric Survey of the A.B.C. Prospect, N.T. Bur. Min. Resour. Aust., Records 1956, No.141.

Barlow, A.J., 1956b - Geophysical Survey in the Manton Dam Catchment Area, N.T. Bur. Min Resour. Aust., Records 1956, No.24.

Barlow, A.J. and de Groot R.J., 1956 - Geophysical Survey at Coronation Hill, N.T. Bur. Min. Resour. Aust., Records 1956, No.154.

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PLATE I

MT. FITCH WORKINGS

RUM JUNGLE WORKINGS

RUM JUNGLE S.DIG.

BATCHELOR

AIRFIELD

SDG

GOULD AIRFIELD

COOMALIE AIRFIELD

PELL AIRFIELD

STAPLETON SDG.

ADELAIDE RIVER SDG AIRFIELD

TOLMER BEACON

Finniss River

Finniss River (East Branch)

Fitch Creek

Rum Jungle Creek

Coomalie Creek

Glen Lucia Creek

Stapleton Creek

AUSTHALIAN RAILWAY

STUART HIGHWAY

NORTH

F I N N I S S

G O Y D E R

U N N A M E D

W A T E R H O U S E

1 2 3 4 5 6 6A 7

True North
Magnetic North

LEGEND

AIRBORNE SCINTILLOGRAPH ANOMALY DATA

- 1st order anomaly
- 2nd " "
- 3rd " "
- Anomaly sharp along the line of flight
- Plateau: Region of continuous radioactivity with average of 2nd order anomaly

CARBORNE SURVEY DATA

- 2 Areas surveyed by vehicle (approx)
- Hundred boundary (approx)

SCALE IN MILES 1 0 1 2 3

1953 CARBORNE RADIOMETRIC SURVEYS

AREAS SURVEYED

Portion of Rum Jungle District Radioactive Anomalies Map (G 71-92) used as Base map

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics G 71-131

PLATE 2

Mt Todd Workings

River

Edith

EDITH RIVER SIDING

TRACK

Areas of known activity

STUART HIGHWAY

LEGEND

- Vehicle traverse
- Closely detailed coverage
- Railway
- Highway
- Track
- River or creek
- Scarp

SCALE IN MILES
APPROX.

1953 CARBORNE RADIOMETRIC SURVEYS

EDITH RIVER

This map has been prepared from controlled RAAF aerial photo mosaic at approximate scale 1:29 000

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