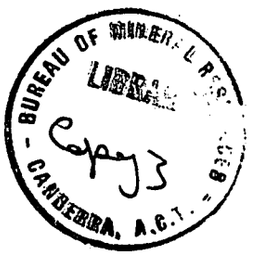
COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS



RECORD 1961 No. 77

MT. ISA AREA AIRBORNE RADIOMETRIC SURVEY, QUEENSLAND 1960

by

J.M. Mulder

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ILLUSTRATIONS

ABSTRACT

A radiometric survey, using a Cessna aircraft, was conducted by the Bureau of Mineral Resources in the Mt. Isa area of North Queensland from August to October 1960.

Eight hundred and thirty square miles were surveyed and eight anomalies were recorded.

1. INTRODUCTION

The airborne radiometric survey in the Mt. Isa area was resumed by the Bureau of Mineral Resources from August to October 1960. Plate 1 shows the area surveyed, and also the areas surveyed in 1959 (Mulder, 1961) and 1958 (Gardener, 1961) as part of the same programme.

Particular attention has been paid to the Eastern Creek Volcanics in which several uranium prospects are known to occur. Radiometric anomalies have been found in this formation and also in other rocks in the area.

A Cessna-180B aircraft equipped with a scintillograph and radio-altimeter was used. Operations were based on Mt. Isa which was centrally situated in the area.

Bureau officers who took part were J. M. Mulder, geophysicist in charge; A. Crowder, drafting officer; and C. J. Braybrook, geophysical assistant. The pilot of the aircraft was First Officer K. Dodds of Trans-Australia Airlines.

In accordance with established policy the results of the survey were released for public display at the Mining Warden's office at Mt. Isa during the course of the survey. Where anomalies were located in areas over which a company held an authority to prospect, the results were released direct to the company concerned. The map showing the results of this survey, which appears as Plate 1 of this Record, is also being issued separately.

2. GEOLOGY

The geology of the Mt. Isa 4-mile area has been described by Opik, Carter, and Noakes (1959) and is considered applicable to the area radiometrically surveyed. This area lies in the Isa Highlands which range in height from 1200 to 1500 ft above sea level and contain rock types ranging from Precambrian to Cainozoic age, although the most common rocks are those of Lower Proterozoic age. The following is a resume of their compositions and probable relationship.

The Leichhardt and Yaringa Metamorphics are probably of Archaean Age; they comprise recrystallised dacite with some basalt, schist, gneiss, and migmatite. The Leichhardt Metamorphics are extensively intruded by granite.

The oldest Lower Proterozoic rocks are the Undifferentiated Quartzites and the Leander Quartzites. The latter are contemporaneous with the Mt. Guide Quartzites and conformably underlie the Eastern Creek Volcanics. These Quartzites comprise quartzite, some meta-basalt, tuff, and slate and they crop out as rough hills with strong relief.

The Eastern Creek Volcanics are a formation of interbedded meta-basalt, quartzite and epidote quartzite, some limestone, siltstone, and tuff. They are strongly folded and faulted and crop out as very rough hills with strong relief. Of the many occurrences of uranium minerals in this formation, none has yet been of economic importance (Carter, 1955 a and b).

The Myally Beds and the Judenan Beds generally overlie the Eastern Creek Volcanics conformably. The Judenan Beds comprise sandstone, siltstone, shale, and some acid tuff and differ from the Myally Beds in that they have a greater proportion of silty material. The Myally Beds crop out as very rough hills with strong relief, while the Judenan Beds are hilly but with a more moderate relief.

The Surprise Creek Beds, which appear to overlie the Myally and Judenan sediments, comprise siltstone and sandstone; they are regarded as contemporaneous with the Gunpowder Creek and the Paradise Creek Formations jointly. The last formation is richer in dolomite than the Surprise Creek Beds or their underlying Gunpowder Creek Formation. The Gunpowder Creek and Paradise Creek Formations generally crop out with a moderate relief and in parts underlie the Mt. Isa Shale which in places is lithologically similar to these beds and to the younger Maringa Beds. The Mt. Isa Shale consists of clay shale, shale, siltstone, dolomite, and quartzite; it crops out as hills with low to moderate relief.

The Upper Proterozoic is represented by the Pilpah sandstone, which is a quartz sandstone with some conglomerate and appears to overlie the Maringa Beds. It crops out as hills with moderate relief.

Igneous activity is represented by the Sybella and Kaladoon granites which are of several types and ages, and by dolerite and amphibolite. They have a complex intrusive history.

3. EQUIPMENT

An Austronic Engineering Laboratories scintillograph type AS-1 consisting of a detector head and ratemeter was used on the survey.

The detecting element of the scintillograph was a thallium-activated sodium iodide crystal 4½ in. in diameter and 2 in. thick. The crystal was optically coupled to a photo-multiplier tube, Dumont type 6364. The output of this multiplier is fed to a ratemeter which produced an output current proportional to the count rate input. This output current was registered on an RD-47A dual-channel recording milliammeter to provide a continuous trace of the gamma-ray intensity at the detecting crystal.

An AN/APN-1 radio altimeter was used to indicate the height of the aircraft above the ground. The output of this instrument was fed to the second channel of the recording milliammeter. A set of limit lights is incorporated in this altimeter, to provide the pilot with an indication that he is within pre-determined height limits, i.e. 180-210 feet above ground level.

4. OPERATIONS

Survey operations were frequently interrupted by unsuitable weather.

The nominal aircraft height was 200 feet above ground level. At this altitude the lane scanned is approximately 500 feet wide, but it depends partly on the nature of the terrain; in rugged country it varies when the nominal height cannot always be maintained.

Where possible, flight lines were flown at right angles to the strike of geological formations, but where high ridges intersected the flight path, it was necessary to fly in a direction parallel to the ridges. The line separation was chosen according to geology, and ranged from 1/3 mile over granites, shales, and quartzites to 1/5 mile over the Eastern Creek Volcanics. The aircraft speed was maintained at approximately 120 m.p.h.

K-17 aerial photographs, at a scale of approximately 1.3 inches to one mile, were used for navigation. Flight lines and check points were plotted by the observer on these photographs during flight. Anomalies which were considered significant were re-flown at a separation of 6 lines to one mile.

Before and after each survey flight the response of the scintillograph equipment was checked by measuring the signal due to a standard radioactive source placed at a predetermined distance from the detector head. This test was done at an altitude of 2000 feet, where ground radiation is effectively zero. In addition, regular checks on the operation of the radio altimeter were made by flying at 200 feet over the airstrip and comparing the radio altimeter and barometric altimeter indications.

5. METHOD OF INTERPRETATION

The records were first analysed to determine the background level of the gamma radiation of all the rock-types and formations scanned during the flight. Such changes in intensity are usually broad and indicate that their sources are of large areal extent. Next, the records were inspected for any increases in gamma-ray intensity which could not be regarded as part of the background radiation. Such increases were considered to be anomalies. For a count rate to be anomalous its amplitude must be several times larger than the standard deviation of the background count rate; in this report a count rate is classed as anomalous when its amplitude is at least 1½ times the background count.

It is not only the amplitude of an anomaly which is of importance, but also its shape. The amplitude depends on the gamma-ray intensity and varies with the concentration of radioactive minerals on the surface, and also with the distance from the source to the detector; the width depends on the extent of the deposit, the altitude of the aircraft, and the time constant of the scintillograph equipment. Anomalies of most interest in the search for uranium are those which arise from localised sources and for this reason, only those anomalies with widths not greater than 8 seconds at half-rise have been accepted in this survey (i.e. a flying time of 8 seconds between points half way up and half way down the anomaly curves. 8 seconds corresponds to about 1400 feet of distance travelled). It is interesting to note that over the known radioactive deposits at the Counter, Skal, and Pile leases the recorded amplitudes were $3\frac{1}{2}$ times the background intensity and widths at half-rise were 500 feet (Mulder, 1961).

All anomalies which satisfied the above criteria were further examined to determine whether they were caused by changes in altitude or topographical features. This was done by inspection of the relevant portion of the radio altimeter record and the aerial photographs. If such a cause could be established, the anomalies were discarded.

Anomalies caused by outcrops of granite or other rocks known to be radioactive were also discarded. These anomalies could usually be identified because they occurred in large numbers and exhibited a characteristic amplitude and shape. The remaining anomalies were plotted on K-17 photos and geological maps and re-flown at closer line spacing. These re-flown records were analysed in a similar manner to the original records, and anomalies left still unexplained were plotted on maps and photographs for investigation on the ground.

6. SURVEY RESULTS

Below is a list of anomalies that warrant further examination on the ground. The numbers correspond to those shown on the accompanying plates. For each anomaly profile shown on Plate 2 the relevant portion of the radio-altimeter record is also shown. The direction of flight is indicated in each case.

No. 1	The anomaly extends from a 70-ft hill along a low ridge to the Gidya Creek. It occurs in the Eastern Creek Volcanics.
No. 2	The anomaly occurs on a ridge in the undifferentiated Lower Proterozoic quartzite, siltstone, shale, and conglomerate.
No. 3	The anomaly occurs at the foot of a ridge in the Leander Quartzites.
No. 4	The anomaly occurs in hilly country in the Surprise Creek Beds.
No. 5	The anomaly occurs near an outcrop on or east of a projected north-south fault in the Surprise Creek Beds.

No. 6 The anomaly occurs on or near an outcropping hill in the Leichhardt Metamorphics.

No. 7 The anomaly occurs in hilly country also in the Leichhardt Metamorphics.

No. 8 The anomaly occurs in the Leichhardt Metamorphics.

Anomaly No. 1 was checked on the ground by the writer. A PRM-200 portable geiger counter was used to find the area of highest count rate, which appeared to be 1½ to 2 times the background count. No mineralisation was observed in the area.

7. CONCLUSIONS

The survey resulted in the recording of 8 anomalies. One anomaly is situated in the Eastern Creek Volcanics, a formation thought to be the most favourable for uranium minerals in the area. However, in a preliminary ground follow-up of this anomaly no mineralisation was found.

Although there is no certainty that any of the anomalies are associated with radioactive ore deposits, a ground investigation should be made. At the time of writing this Record, no ground investigation has been made by the Bureau.

8. REFERENCES

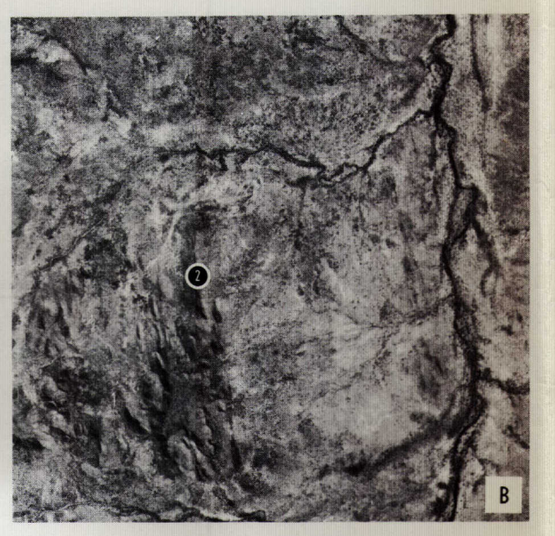
CARTER, E. K. 1955a Radioactive occurrences, Cloncurry mineral field, Queensland. Bur. Min. Resour. Aust. Rec. 1955/26.

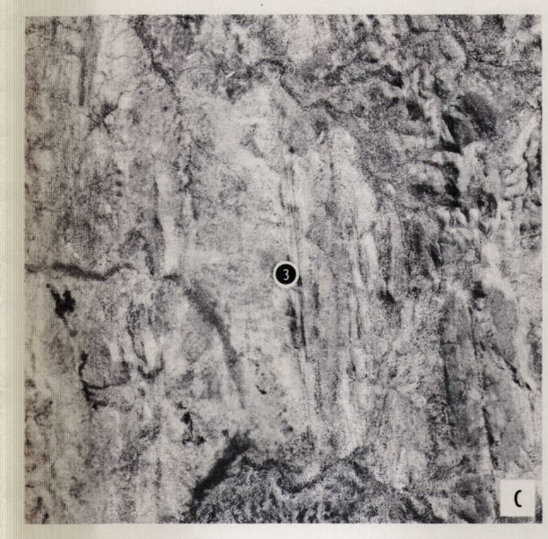
CARTER, E. K. 1955b Supplementary report on radioactive occurrences, Cloncurry mineral field, Queensland. Bur. Min. Resour. Aust. Rec. 1955/111.

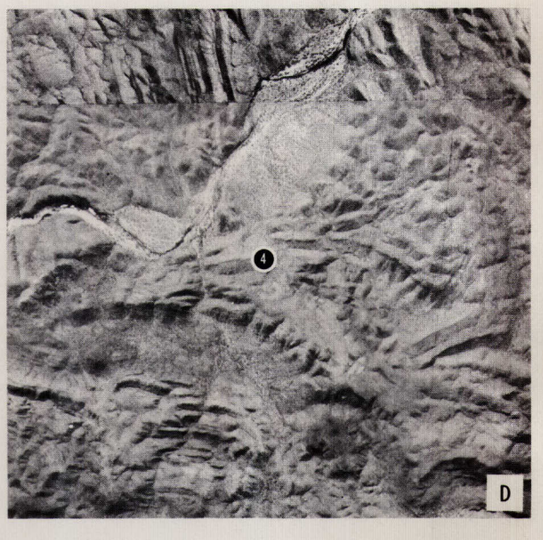
GARDENER, J. E. F. 1961 Mt. Isa area airborne radiometric survey, Queensland 1958. Bur. Min. Resour. Aust. Rec. 1961/21.

OPIK, A. A., CARTER, E. K. and NOAKES, L. C. 1959 Mt. Isa 4-mile Geological Series, Sheet F54/1. Explanatory Notes. Bur. Min. Resour. Aust. Rec. 1959/140.

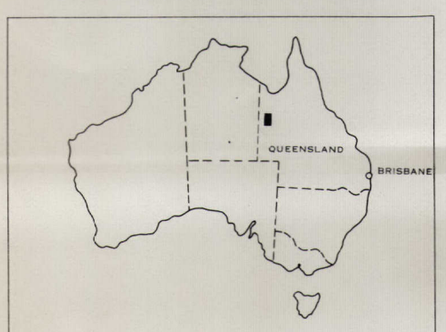
MULDER, J. M. 1961 Mt. Isa area airborne radiometric survey, Queensland 1959. Bur. Min. Resour. Aust. Rec. 1961/74.



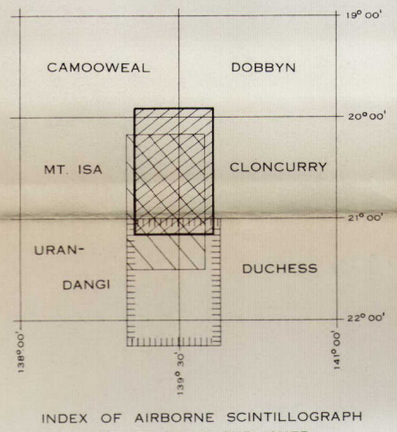




LOCATION DIAGRAM



REFERENCE TO 4-MILE AUSTRALIAN NATIONAL MAP SERIES



INDEX OF AIRBORNE SCINTILLOGRAPH SURVEY MAPS PUBLISHED

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MT. ISA REGION. (1959 SURVEY) G 181-10

MT. ISA REGION. (1960 SURVEY)

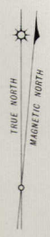
MAP DATA

PROJECTION: TRANSVERSE MERCATOR. AUSTRALIAN SERIES

DETAIL: PLANIMETRIC DETAIL WAS COMPILED FROM QUEENSLAND 4-MILE MAP SERIES 4M. 84 AND 4M. 92. PRODUCED BY SURVEY OFFICE. DEPARTMENT OF PUBLIC LANDS. BRISBANE

RELIABILITY: RELIABLE SKETCH

NOTE: IMPERFECTIONS ON AIR PHOTO MAPS ARE DUE TO FAULTS ON ORIGINAL NEGATIVES



LEGEND

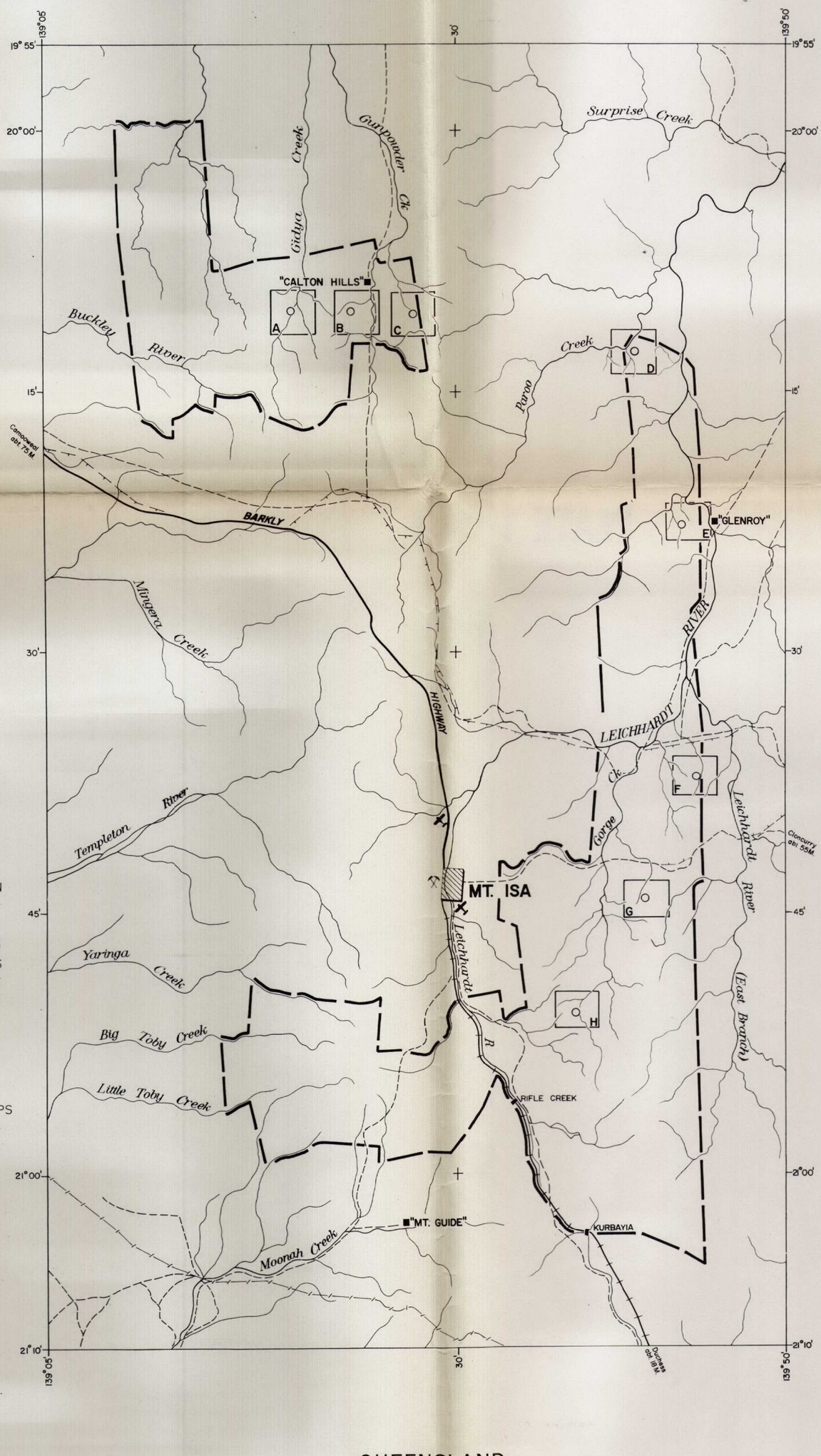
TOPOGRAPHICAL DATA

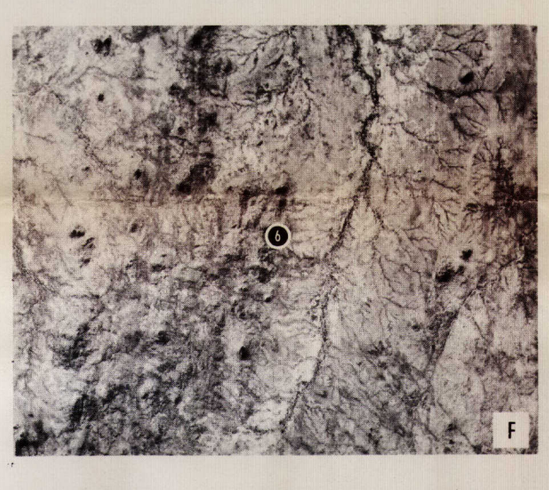
- RIVER OR CREEK
- RAILWAY WITH STATION OR SIDING
- HIGHWAY
- ROAD OR TRACK
- TELEGRAPH LINE
- FENCE
- AERODROME OR LANDING GROUND
- TOWN
- HOMESTEAD
- SHED OR HUT
- MINE

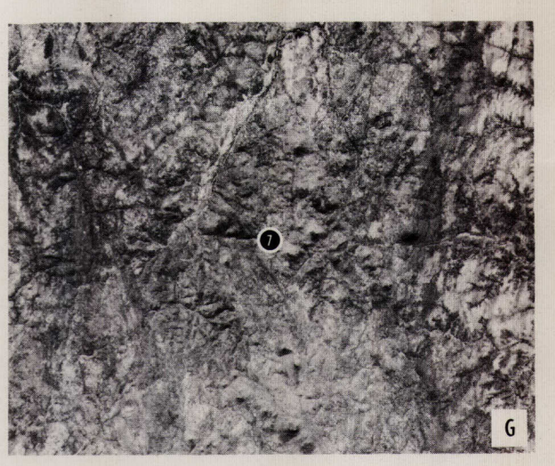
SCINTILLOGRAPH DATA

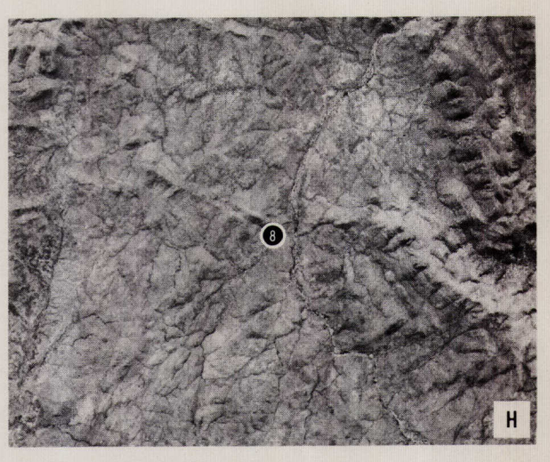
- ANOMALY (ANOMALIES ARE NUMBERED FOR REFERENCE ONLY)
- LIMIT OF THE 1960 AIRBORNE SURVEY

Department of National Development
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
Compiled and drawn in the Geophysical Branch









QUEENSLAND

MT. ISA REGION

MAP SHOWING

RADIOMETRIC ANOMALIES

DETECTED BY AIRBORNE SCINTILLOGRAPH

AUG.-OCT., 1960

APPROXIMATE SCALE OF PHOTO MAPS

MILES 1 0 1 2 3 MILES

SCALE OF PLANIMETRIC MAP

MILES 8 4 0 8 16 24 32 MILES

EXPLANATORY NOTES

The airborne scintillograph continuously records the intensity of gamma radiation from the ground over which the aircraft flies. On this survey the scintillograph was carried in a Cessna aircraft flown at an average altitude of 200 ft above the ground. At that height it effectively scanned a strip of ground approximately 500 ft wide.

The gamma-ray intensity over an area may show considerable variations, depending on the geology and topography of the area. Anomalies of gamma-ray intensity have been plotted on the map where the intensity showed a significant and localised increase.

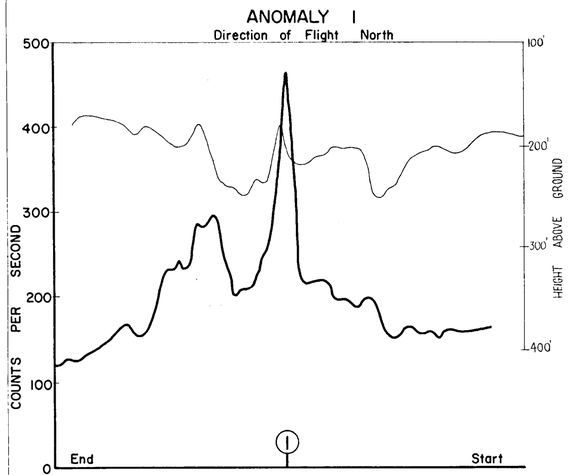
The map shows the positions and grouping of the anomalies. To assist in making investigation on the ground, all the anomalies have been reproduced on aerial photographs. The position of these anomalies is considered to be accurate to within 300 ft.

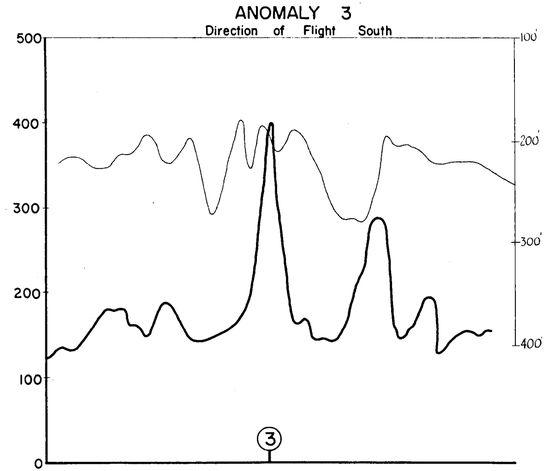
No claim is made that the anomalies are due to uranium deposits. Some anomalies may be due to igneous rocks, which contain a slightly higher concentration of radioactive elements than other rocks. Investigation on the ground would be necessary to determine the significance of the anomalies.

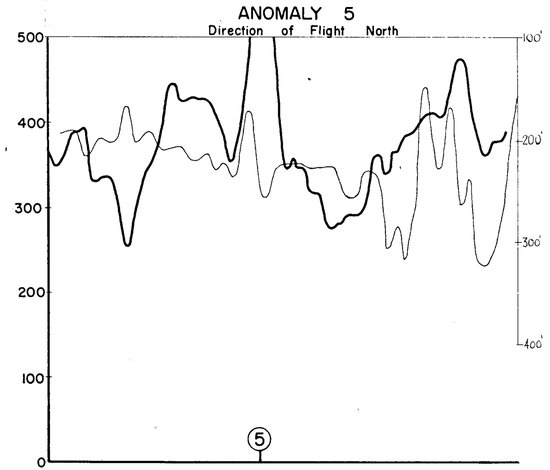
It should be noted that it is virtually only the radioactivity of the surface of the ground that has been recorded, because the radiation from any buried deposit is substantially reduced by a few inches of soil or rock cover.

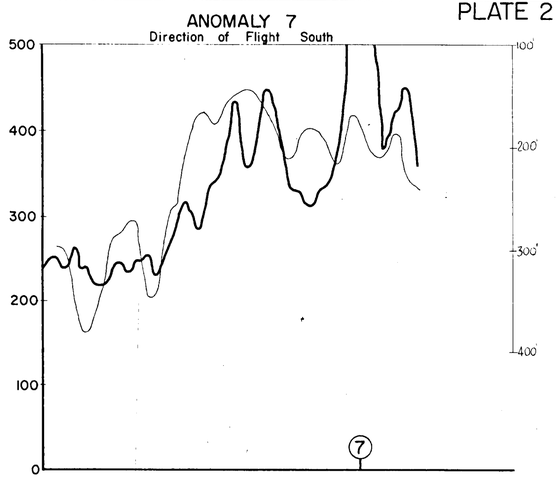
G 181-14

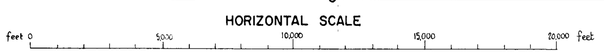
PLATE 2

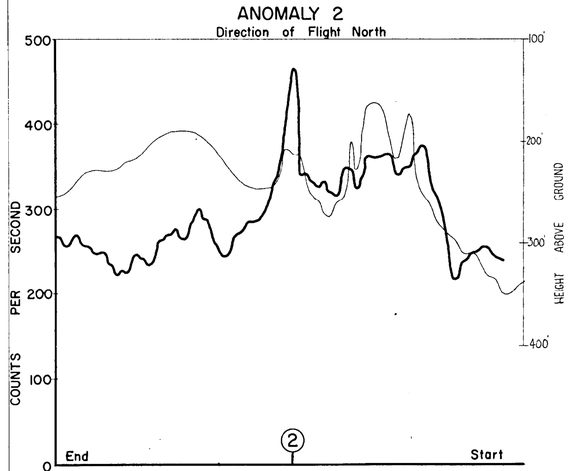


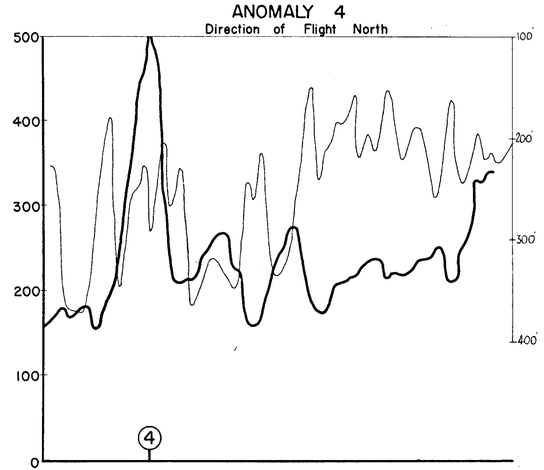


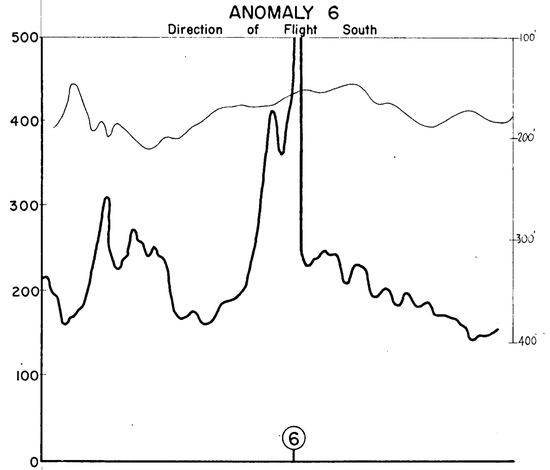


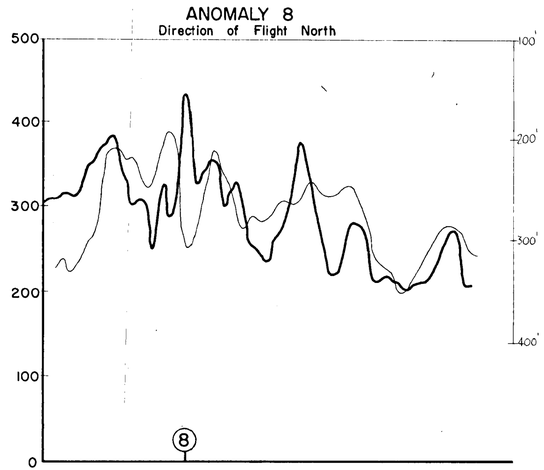












MT. ISA REGION 1960

RADIOMETRIC ANOMALY PROFILES

G 181-16

TO ACCOMPANY RECORD 1961 No 77