COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD 1961 No. 74

MT. ISA AREA AIRBORNE RADIOMETRIC SURVEY, QUEENSLAND 1959

by

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ABSTRACT

During the months April to July 1959, an Auster aircraft of the Bureau of Mineral Resources carried out a low-level radiometric survey of the Mount Isa region in North Queensland.

1920 square miles were surveyed and 14 radiometric anomalies were recorded. At least three of these anomalies coincide with known occurrences of uranium mineralisation.

1. INTRODUCTION

Upon the discovery of radioactive minerals in the Mt. Isa district in 1954 an intensive search for these minerals began by prospectors, including both private individuals and companies. The results of these searches indicated that uranium mineralisation occurred mainly in the Eastern Creek Volcanics, a formation of Lower Proterozoic age. On the basis of these results and of the Bureau's regional geological mapping the Geological Branch of the Bureau selected an area for airborne surveying which was designed mainly to cover these rocks. This area is approximately 46 miles wide in an east-west direction and extends approximately 95 miles south and 130 miles north of Mt. Isa. The programme is expected to take several field seasons to complete. The first survey was commenced in 1958 and concentrated on an area around Dajarra (Gardener, 1961). The investigation described in the present Record is a northerly continuation of the 1958 survey.

A high-wing Auster aircraft, fitted with a scintillograph and ancillary equipment, was used. Survey flying commenced during the first week in April and continued until 20th July 1959.

The officers taking part in this survey were : J.M. Mulder, party leader, assisted by H. Herzog, geophysical assistant and A. Crowder, draftsman. The aircraft was piloted by 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 the survey, which appears as Plate 1 of the Record, was issued in April 1960.

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 outcrop 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 outcrop with a moderate relief and in parts underlie the Mt. Isa Shale which is in places 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 outcrops 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

The scintillograph used in this survey consisted of an Austronic Engineering Laboratories ratemeter and detector head, type AS-1, coupled to one channel of an RD-47A dual-channel recording milliammeter.

The detecting element was a thallium-activated sodium iodide crystal, 4½ inches in diameter and 2 inches thick. This was optically coupled to a photomultiplier tube, Dumont type 6364, whose output was fed to a ratemeter which produced a current proportional to the count rate. This current was registered on the recording milliammeter and represented a continuous record of the intensity of the gamma radiation at the detecting crystal.

The second channel of the recorder was coupled to an AN/APN-1 radio altimeter which provided a continuous indication of the ground clearance along the flight line. 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

The survey party was based at Mt. Isa. Except for April, when flying conditions were excellent, the period was marred by seasonal winds which curtailed operations on many occasions.

The nominal aircraft height was 200 feet above ground level and at this altitude a lane width of approximately 500 feet was scanned. This width is related to the nature of the terrain and varies in rugged country 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 closely maintained at 80-90 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 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 withs 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 curve. 8 seconds corresponds to about 1000 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 3½ times the background intensity and widths at half-rise were 4 seconds, or 500 ft on the surface.

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 section 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 originals records, and anomalies left still unexplained were plotted on maps and photographs for investigation on the ground.

6. SURVEY RESULTS

Fourteen anomalies were recorded. Their locations are shown on Plate 1 and their profiles on Plates 2 and 3. Three anomalies represent the areas of known radioactive mineralisation occurring on the Counter, Skal, and Pile leases. Another anomaly, shown as No. 8 on Plate 3, may also correspond to a known occurrence, as aerial inspection disclosed that some costeaning had been done on the site.

Anomalies 4, 5, 6, 7, 8, and 9 occur in the Judenan Beds, a formation of sandstone and siltstone with some lavas. In this group Anomalies 8 and 9 appear to be the most important.

Anomaly 3 occurs in the Pilpah sandstone, a formation of quartz-sandstone. It has a wide base with a sharp peak, suggesting outcropping rocks.

Anomaly 2 occurs in the Leander Quartzite. It is a small but pronounced anomaly of 1.8 x background.

Anomalies 1 and 13 are in an area of Mt. Isa Shale. Two profiles (a and b) are shown for each anomaly. Profiles 1a and 1b were recorded on adjacent flight lines in a wide gorge close to an escarpment, and are believed to be due to the same source. Profile 1a represents an anomaly with an intensity of 2.3 x background.

Profiles 13a and 13b were recorded south of an east-west fault line in the Mt. Isa Shales and are also believed to be due to a single source. Profile 13a represents a wide anomaly of 2.3 x background.

Anomalies 10, 11 and 14 are due to the Counter, Skal, and Pile deposits respectively.

Anomaly 12 occurs in the Eastern Creek Volcanics east of a north-south fault line. It is a small anomaly of 1.5 x background.

7. CONCLUSIONS

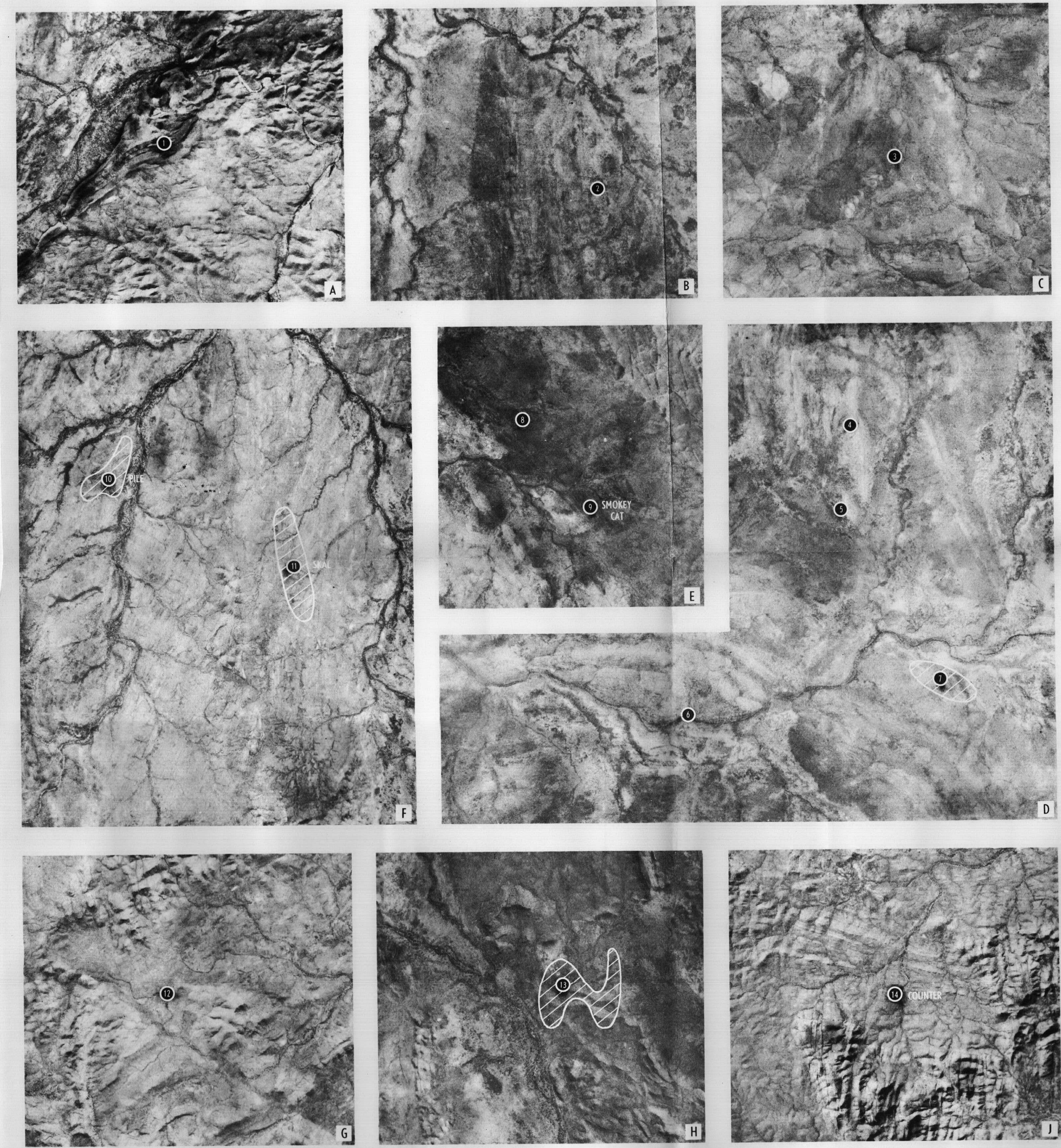
Valhalla dep. Occurs in Judenan Bds. + assoc with lateritic material

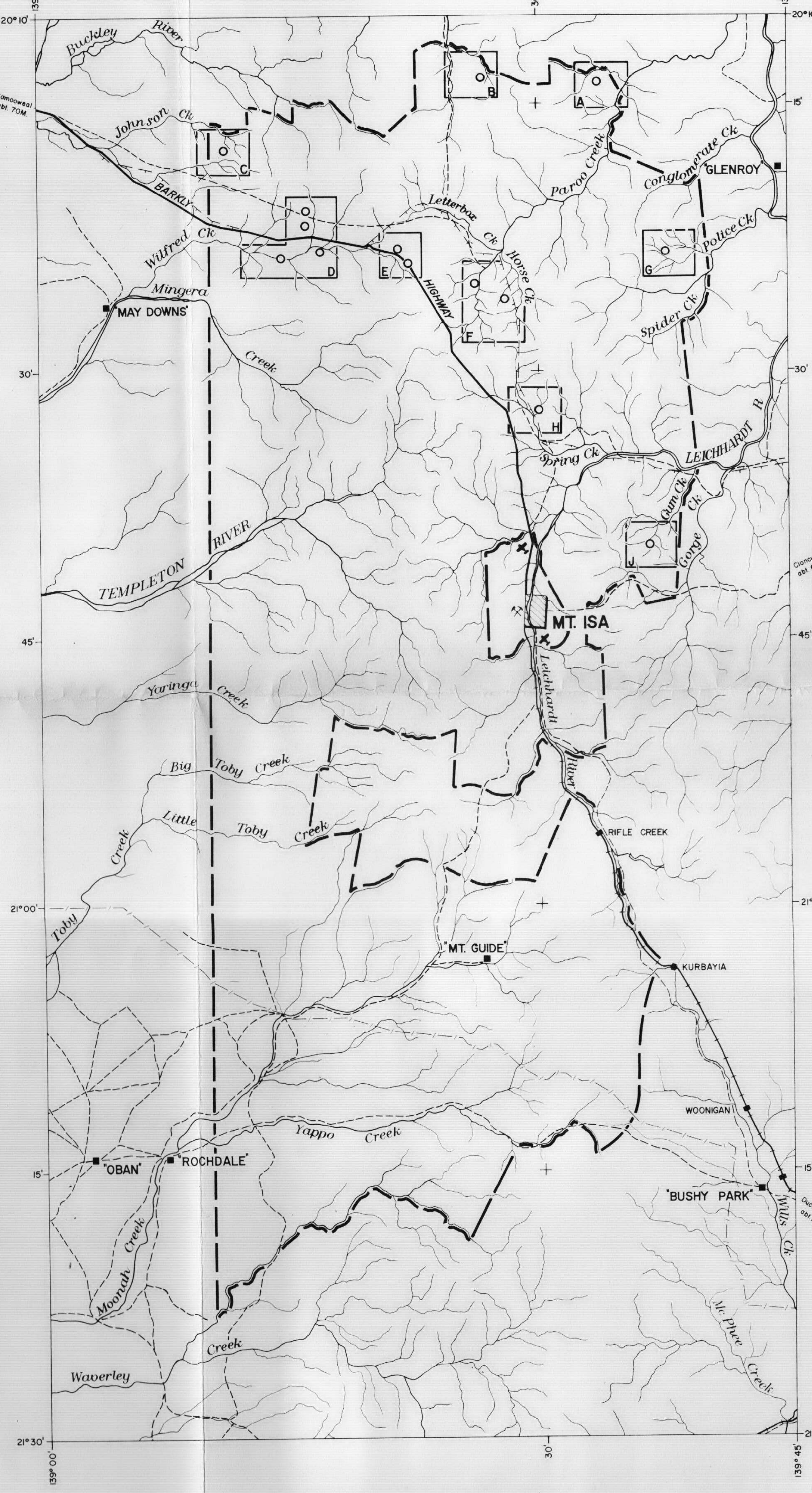
Eleven anomalies were detected in addition to the known occurrences at the Counter, Skal, and Pile leases. One of these, Anomaly 8, may be due to a known occurrence; however, the author was unable to obtain any definite information on this. Of the remaining anomalies one was detected over the Eastern Creek Volcanics.

It cannot be said at this stage whether any of these anomalies correspond to radioactive ore deposits, but such a possibility is not excluded. It is therefore recommended that these anomalies be further investigated on the ground. At the time of writing this Record no ground investigation has been made by the Bureau.

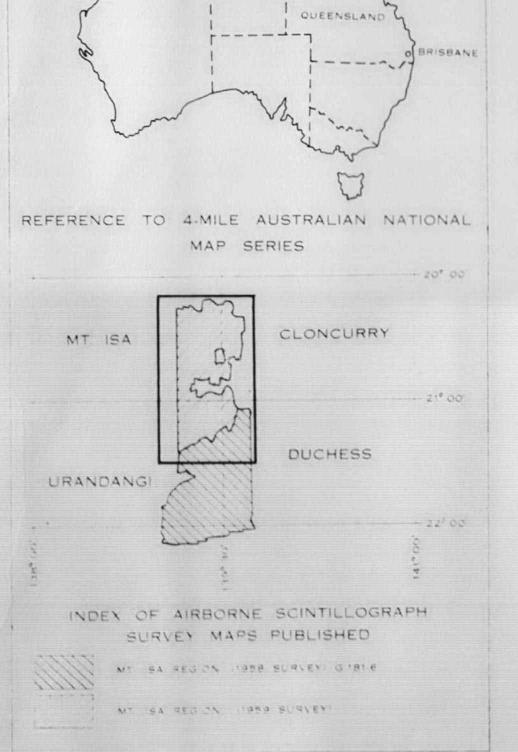
8. REFERENCES

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.





LOCATION DIAGRAM



MAP DATA

PROJECTION: TRANSVERSE MERCATOR. AUSTRALIAN SERIES

DETAIL: PLANIMETRIC DETAIL WAS COMPILED FROM QUEENSLAND FOUR MILE MAP SERIES 4M. 76. 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.

QUEENSLAND

MT. ISA REGION

MAP SHOWING

RADIOMETRIC ANOMALIES

DETECTED BY AIRBORNE SCINTILLOGRAPH

APRIL-JULY, 1959

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

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 1959 AIRBORNE SURVEY

EXPLANATORY NOTES

The airborne scintillograph records continuously the intensity of gamma radiation from the ground over which the aircraft flies. This radiation is due to the presence of the naturally occurring radioactive elements, radium and thorium and their decay products, and to a lesser extent potassium.

The scintillograph was carried in an AUSTER aircraft which was flown at an average altitude of 200 feet above the ground. The scintillograph effectively scanned a strip of ground approximately 500 feet 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 position and grouping of the anomalies. To assist in making investigations on the ground, all the anomalies have been reproduced singly or in small groups on aerial photographs. The positioning of these anomalies is considered to be accurate to within 300 feet.

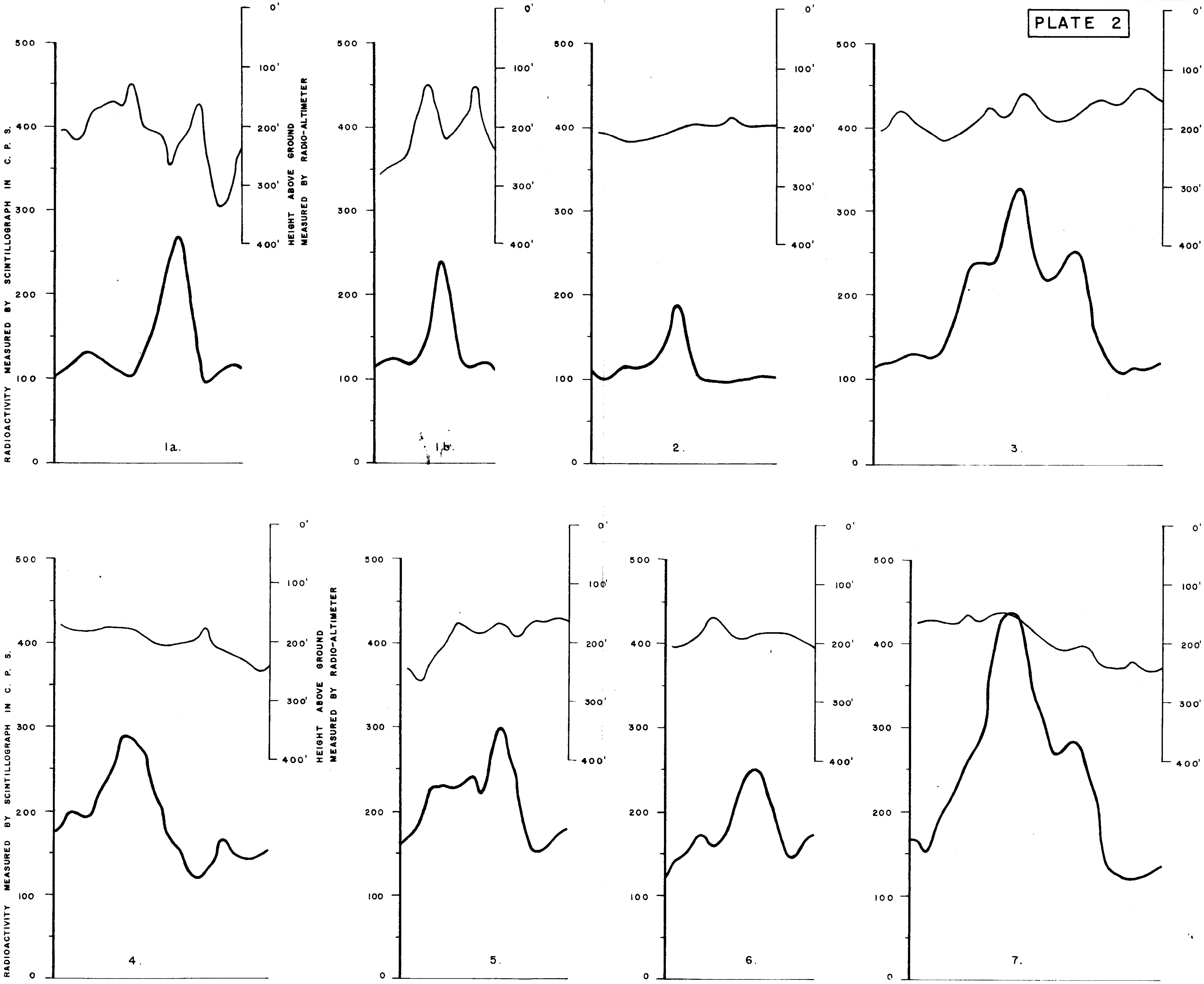
The higher intensities recorded by the scintillograph are not necessarily due to the presence of uranium deposits. Some of the higher intensities may be due to igneous rocks, which contain a slightly higher concentration of the radioactive elements, uranium, thorium and potassium, than other rocks. No claim is made that all, or even any, of the higher intensities correspond to uranium deposits of economic significance, but it is possible that some do.

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.

COMPILED AND DRAWN BY GEOPHYSICAL SECTION, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS, DEPARTMENT OF NATIONAL DEVELOPMENT, MELBOURNE

G 181-10

PLATE 2



MT. ISA REGION, AIRBORNE SURVEY 1959.

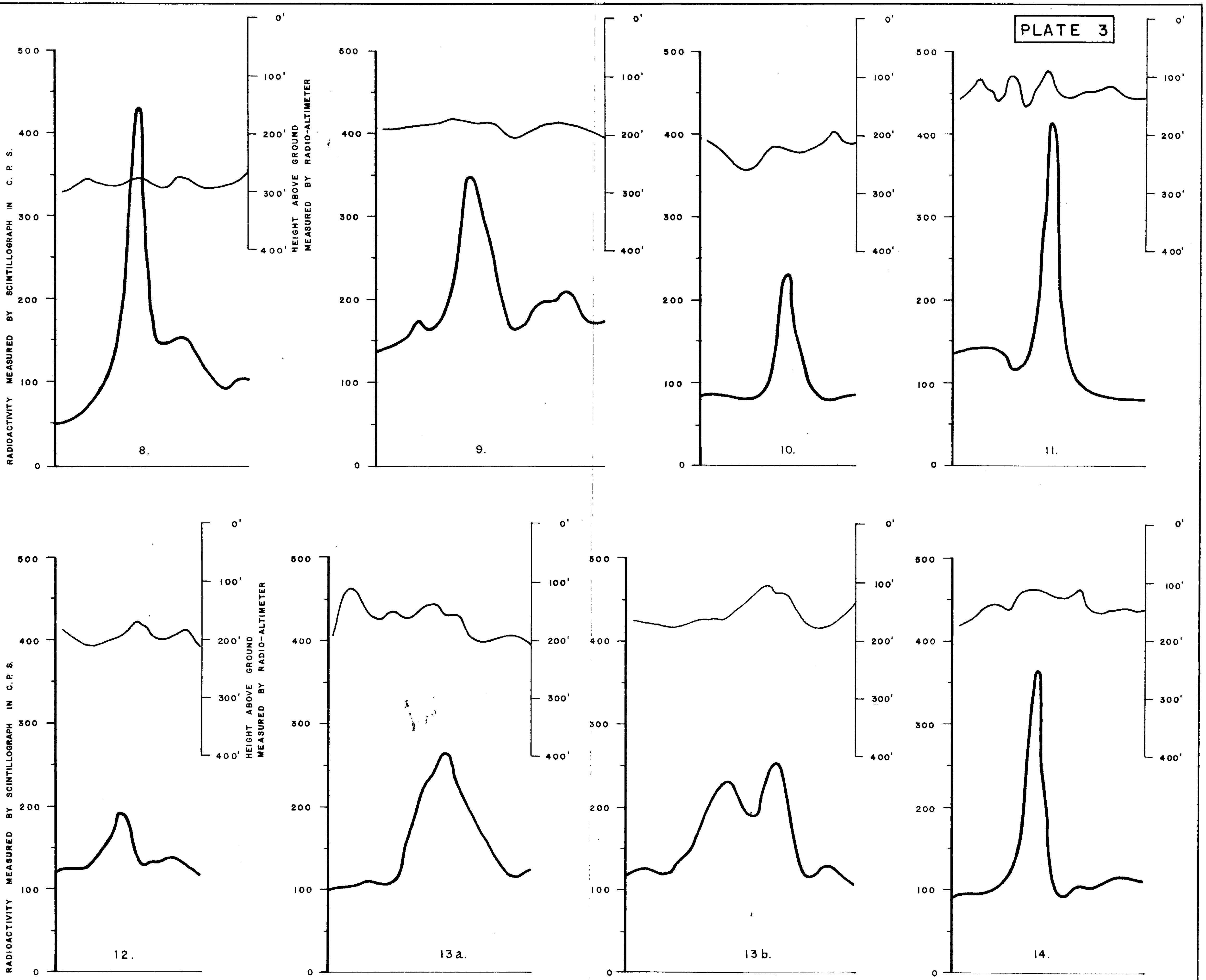
RADIOACTIVE INTENSITY PROFILES RECORDED OVER ANOMALIES

MILES 1 0 HORIZONTAL SCALE 1 2 MILES

Geophysical Branch, Bureau of Mineral Resoures, Geology and Geophysics. G 181-12

To accompany Record 1961 N°74

PLATE 3



MT. ISA REGION, AIRBORNE SURVEY 1959.

RADIOACTIVE INTENSITY PROFILES RECORDED OVER ANOMALIES.

HORIZONTAL SCALE

MILES 1 0 1 2 MILES

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. G 181-13

To accompany Record 1961 No 74