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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

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RECORDS

1960/46

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HALLS CREEK AREA

AIRBORNE RADIOMETRIC SURVEY, W.A. 1959

by

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CONTENTS.

ABSTRACT.

During the period August to November 1959 an Auster aircraft of the Bureau of Mineral Resources carried out a low-level airborne radiometric survey in the Halls Creek area of Western Australia. The survey covered the Lower Proterozoic Halls Creek Metamorphic rocks south of the Ord River.

A total area of 2,200 square miles was surveyed and 44 radiometric anomalies were located. The positions of anomalies are plotted on the map attached to this report.

There is an occurrence of uranium mineralisation on Saunders Creek; a number of anomalies in the Saunders Creek - Panton River area may also represent uranium mineralisation.

1. INTRODUCTION.

This Record describes a low-level airborne scintillograph survey for uranium in the Halls Creek area of the Kimberley Division, Western Australia. The survey was carried out during the period August to November 1959 by the Geophysical section of the Bureau of Mineral Resources using Auster Autocar aircraft VH-RES.

Deposits of uranium ore have been discovered in Lower Proterozoic rocks that crop out over a large area between Katherine and Darwin in the Northern Territory. A continuation of this belt of Lower Proterozoic rocks can be traced across to the Daly River and west of Port Keats. Thereafter, it is covered in places by Upper Proterozoic and Cretaceous sediments, but may be continuous with the Lower Proterozoic rocks which crop out east of the Burt Range and which can be traced down to Halls Creek in an almost unbroken line of outcrop. It has also been intruded in many areas by granite. The prospects of uranium discovery in these rocks is considered good.

A high-level reconnaissance scintillograph survey by the Bureau in 1954 gave the first indication of the occurrence of radioactive anomalies in the East Kimberley district. This survey stimulated both aerial and ground prospecting. In October 1954 the first deposit containing uranium was discovered by ground parties of United Uranium N.L. in the Denham River area and in subsequent years many companies and the Bureau sent field parties to both the Denham River and Halls Creek areas.

The extensive airborne and ground prospecting in the Halls Creek area discovered many radioactive anomalies. These had hitherto been attributed to radioactive volcanics or granite rocks or, in one instance, to a slight supergene enrichment of radioactive element in a ferruginous capping. However, in 1958 prospectors of United Uranium N.L. investigating some anomalies located during the Bureau's high-level reconnaissance airborne surveys discovered that one anomaly occurred on an outcrop of radioactive conglomerate. This anomaly, now considered to be a Blind River type uranium deposit, is discussed more fully later. As the anomaly lies in the Halls Creek Metamorphics, it was decided to carry out a low-level airborne radiometric survey over these rocks.

The area surveyed in 1959 is shown on Plate 1. It extends from the Ord River in the North almost to Christmas Creek in the south and covers 2200 square miles.

Those who took part in the survey were J.E.F. Gardener (Geophysicist, Party Leader), H.S. Herzog (Geophysical Assistant), A. Crowder (Draftsman), and N.A. Ashmore (Field Assistant) of the Bureau of Mineral Resources and K.M. Dodds (Pilot) and J. Parkes (Engineer) of Trans-Australia Airlines.

2. EQUIPMENT.

The scintillograph used was built in Melbourne by Austronic Engineering Laboratories Pty.Ltd. It consisted of two units (detector head and ratemeter) coupled to a Texas Instrument Company dual-channel recorder, on one channel of which the ratemeter output was recorded. A continuous record of radioactivity detected was thus provided. Operation of the scintillograph was controlled and monitored in flight by a remote control unit.

The detecting element in the scintillograph consists of a thallium-activated sodium iodide crystal, cylindrical in shape, $4\frac{1}{2}$ in. in diameter and 2 in. thick, mounted with its axis vertical. This is optically coupled to a photomultiplier tube, Dumont type 6364.

To maintain a near-constant height above ground level, a radio-altimeter, type AN-APN1, was fitted to the aircraft. Divergence from a preselected altitude above ground level was indicated to the pilot by a system of limit lights on the aircraft dashboard, and a record of altitude above ground level was made on the second channel of the recorder.

3. OPERATIONS.

The survey was flown at a height of 200 feet above ground level and at this height the lane scanned is approximately 500 feet in width. The area was flown at a flight-line spacing of one fifth of a mile, giving a 50 per cent coverage. However, in areas where anomalies occurred, the coverage was considerably greater. The aircraft speed was maintained at about 85 knots.

Flight lines and check points were plotted on aerial photographs by the observer during flight, and the accuracy of positioning should be within 300 feet. Anomalies which were deemed significant were always re-located.

The scintillograph performance was checked before and after every flight by noting the response to a standard radioactive sample placed in a fixed position relative to the detecting element. A confidence check on the radio-altimeter was carried out at regular intervals by flying the aircraft over the runway and checking the radio-altimeter against the barometric altimeter.

Operations were conducted from Halls Creek during August, from Springvale during September and from Margaret River during October and November. It was found possible to carry out two flights per day during the early part of the survey, in the early morning and late afternoon; turbulence rendered flying inadvisable in the middle of the day. Early in September, as the weather became hotter, turbulence prevented afternoon flying.

Survey flying totalled 165 hours. A total area of 2,200 square miles was covered by 9350 flight line miles.

The terrain in general presented some difficulty for the Auster, especially north of Halls Creek. This area was surveyed first, when the climatic conditions were most favourable. No attempt was made to fly the area north of the Ord River because of the ruggedness of the terrain.

Loss of survey time due to aircraft maintenance and equipment failures was negligible, but survey flying was limited by unfavourable weather, in particular by the strong easterly winds which seem to prevail in the Eastern Kimberlies during late winter and early Spring.

4. GEOLOGY.

Traves (1955) has described the geology of part of the area surveyed. Further geological information, with particular reference to uranium, is given by Ostle and Lord (1955), and by Walpole and Pritchard (1958).

The present survey was carried out over the Lower Proterozoic Halls Creek Metamorphics. These rocks comprise extensive beds of closely folded sedimentary rocks with interbedded basic lava flows. The dominant sedimentary types are micaceous sandstone, slate and shale, with occasional bands of chlorite-carbonate rock. In the vicinity of Halls Creek there are comparatively fresh lavas, while at Mary River and Mt. Dockerell to the south and Grants Creek to the north there are large areas of basic sedimentary rocks. The whole series strikes N.40°E. and is tightly folded.

5. RESULTS.

In all, 44 anomalies were located during the course of the survey. These anomalies were selected after critical inspection of the records of radioactivity and altitude above ground, in conjunction with an examination of aerial photographs and geological maps.

In the preliminary examination of radioactivity all possible anomalies were plotted on aerial photographs. These anomalies were then re-flown in order to provide more detailed information and thus enable the effects of topography, altitude and geology to be assessed. In evaluating an anomaly its profile was examined and the height and width were considered; all available geological information was also studied. Considerable care was exercised in evaluating the effects of topography on the anomaly profile, and many anomalies were plotted on the tops of hills and ridges. In these cases it was considered that the anomaly was caused not by topography but by exposures of radioactive rocks. Where there was doubt as to whether an anomaly should be selected or not, it was always included.

All the selected anomalies, which were plotted on the accompanying map, occur in the Halls Creek Metamorphic rocks. There are two main groupings; one in the Saunders Creek-Panton River area, and the other on the headwaters of Butchers Gully. The Saunders Creek-Panton River anomalies (Nos. 1-11, 14 and 15), and anomaly No. 16 are probably the most important ones located during the survey. Two anomalies (Nos. 14 and 15) occur on or very close to the Saunders Creek Prospect; the remainder appear to be on the same formation, and therefore have a reasonably good chance of containing uranium mineralisation. The terrain in the Saunders Creek-Panton River area is very rugged and it was impossible to fly the area as accurately or in as great detail as was desired, due to the severe turbulence that arose during every flight in that area.

The Saunders Creek Prospect consists of radioactive quartz pebble conglomerate bands in less radioactive quartz greywacke. The rocks are cross bedded and contain heavy minerals such as magnetite and rutile. They form part of a geosynclinal sequence of Lower Proterozoic sediments. The radioactive sediments crop out on the north-western shoulder of an overturned closed anticline. Surface radioactivity is low but the rocks have been highly leached and have been shown to contain leaching products of pitchblende. A drilling programme has been arranged by the Bureau to be carried out in 1960 to explore the prospect more thoroughly.

The second main group of anomalies (Nos. 26-39) lies on the headwaters of Butchers Gully, five miles south of Old Halls Creek. A co-operating B.M.R. geological party examined some of these but could find no direct cause for them. The country consists mainly of quartzite and has many small localised faults. Surface radioactivity is low.

The geological party also examined three other anomalies (Nos. 17-19). They reported that the anomalies were associated with outcrops of radioactive conglomerate related to but not identical with that at the Saunders Creek Prospect. No evidence of mineralisation was found on the ground but the surface rocks were highly leached. These anomalies gave lower readings both in the air and on the ground than the Saunders Creek-Panton River anomalies and it is probable that they are of less importance.

From an examination of aerial photographs and geological maps it is thought that a further nine anomalies (Nos. 20-25 and 40-42) may be due to formations similar to that in which anomalies 17-19 fall.

The causes of the remaining four anomalies (Nos. 12, 13, 42, 43) are not clear but it is possible that some of them may also be due to conglomerates.

The area covered by the present survey is part of the area covered by high level survey using a DC3 aircraft (Goodeve, 1955). The final results of the DC3 survey are shown on B.M.R. Drawings G187-1 (Sheets 1 and 2). The agreement between the two sets of results is reasonably good over most of the area; groups of anomalies recorded in the present survey coincide with one or more anomalies recorded in the high-level survey.

The results obtained from the Auster Survey are for technical reasons more precise than those obtained with the DC3, because (1) they permit more accurate fixing of the position of the radioactive sources, and (2) they permit better discrimination between weak, widely-dispersed sources, and those which are stronger and more concentrated and therefore more likely to be significant. This results from the slower speed and lower flying-height of the Auster.

Some of the anomalies shown in the earlier DC3 results were not verified by the Auster work and were evidently due to causes other than localised radioactive sources; some may be due to uncorrected or imperfectly corrected topographical effects. There is evidence that in certain parts of the Northern Territory, surface radioactivity varies with climatic conditions. The same effect may occur in the Halls Creek area; if so, the results of surveys at different seasons and in different years would not agree in detail.

6. CONCLUSIONS.

The recent airborne survey located some anomalies in the Saunders Creek-Panton River area. This is an area where the chances of discovering uranium mineralisation are promising; its principal disadvantages as a potential mining field are the ruggedness of the terrain, and the remoteness from existing treatment plants.

It is recommended that anomalies located should be examined on the ground, and that airborne surveying should be extended north of the Ord River to search for further radioactive anomalies. The chances of finding more anomalies of the Saunders Creek Prospect type seem good.

The difficulty of surveying over rugged terrain would be partly overcome by the use of the Cessna aircraft which the Bureau has purchased to replace the Auster.

7. REFERENCES.

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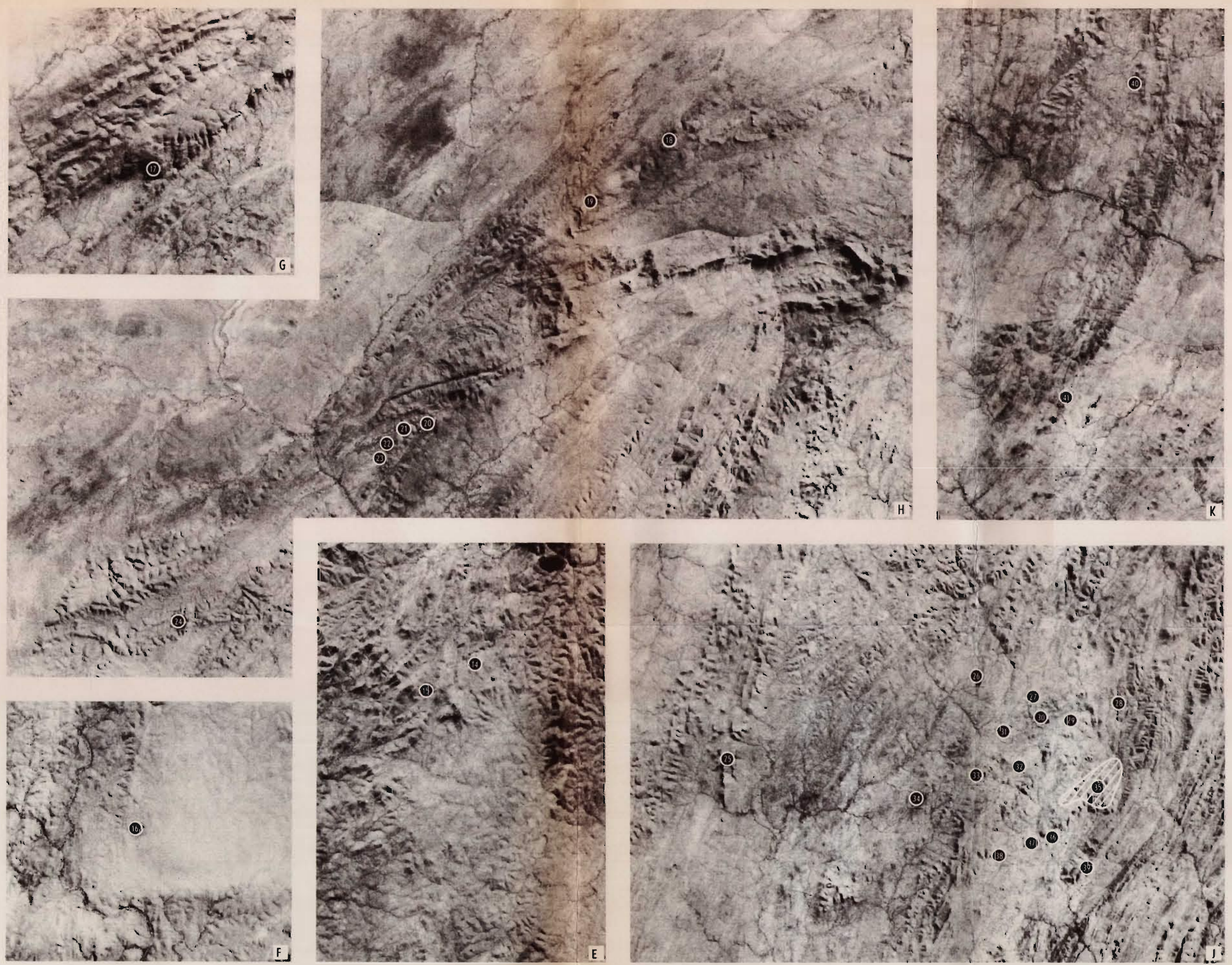
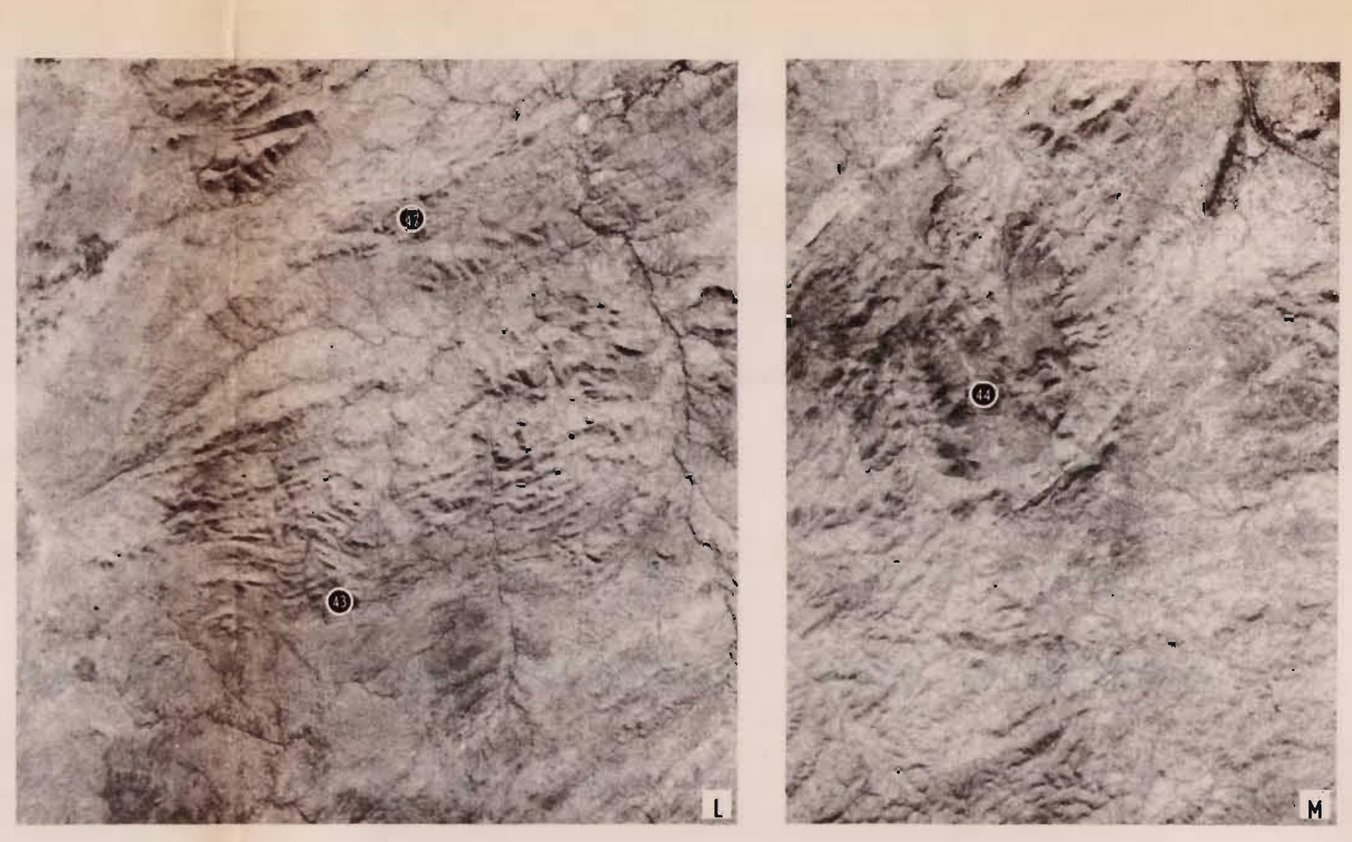
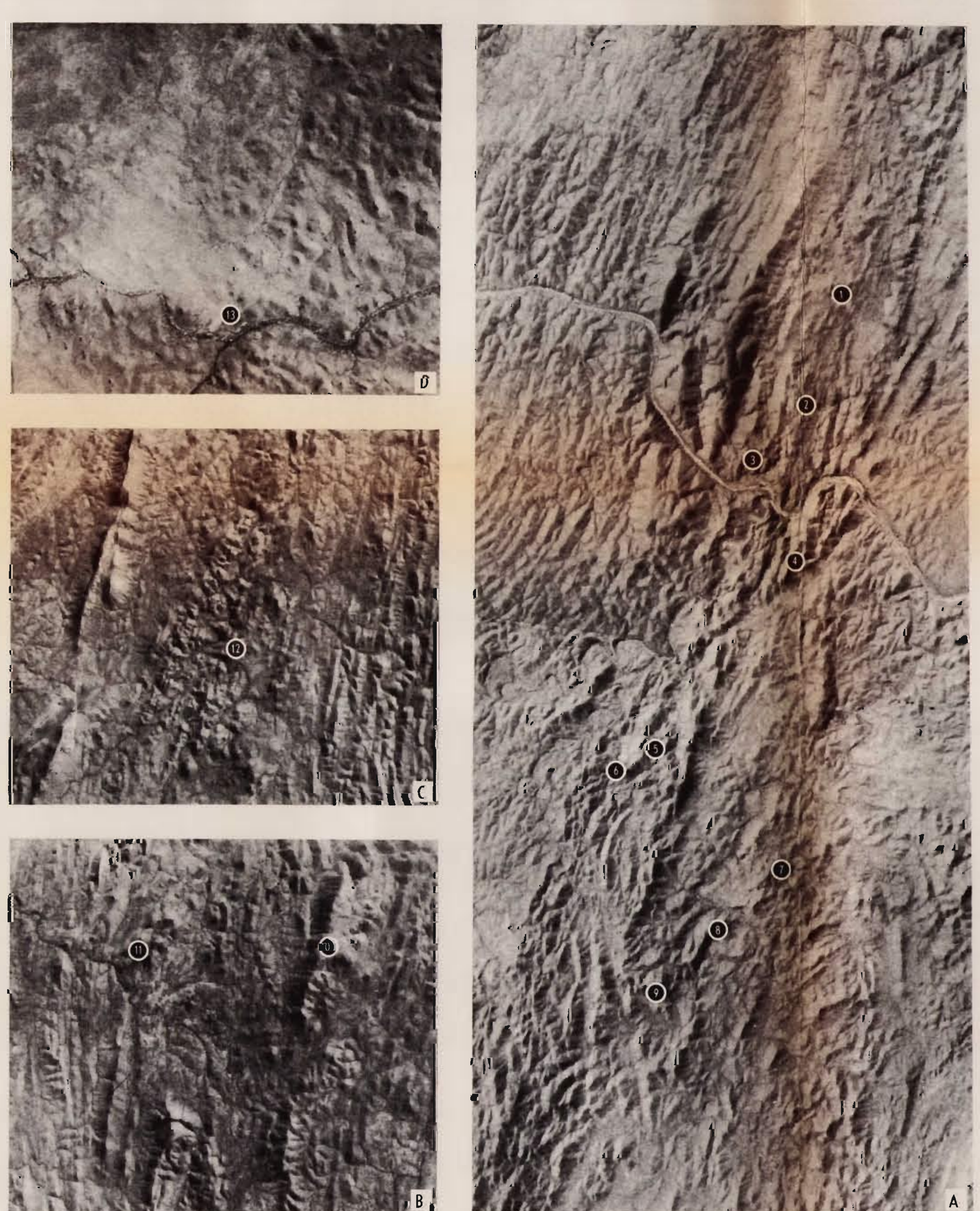
TRAVES, D.M., 1955 - The geology of the Ord-Victoria region, Northern Australia. Bur. Min. Resour. Aust. Bull. 27.

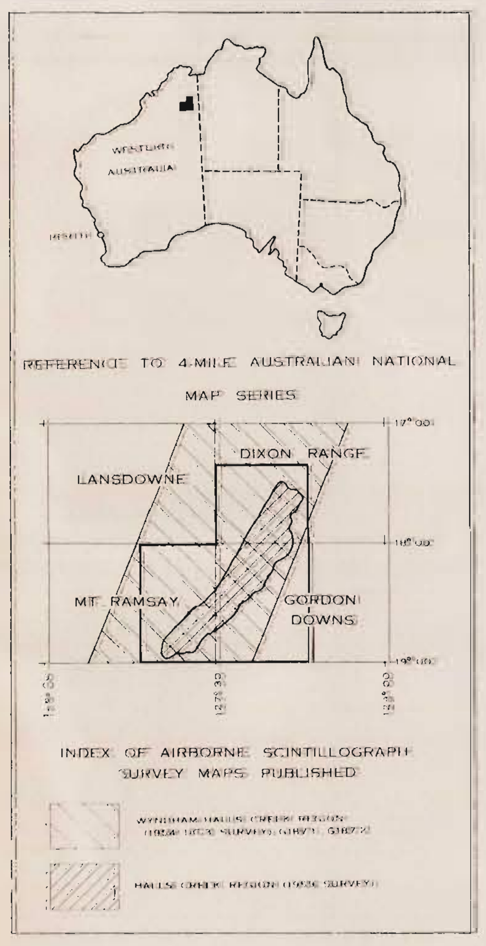
WALPOLE, B.P. and PRITCHARD, C.E., 1958 - Report on an inspection of the Halls Creek uranium prospect. Bur. Min. Resour. Aust. Rec. 1958/79.







LOCATION DIAGRAM



MAP DATA

PROJECTION: TRANSVERSE MERCATOR AUSTRALIAN SERIES

DETAIL: PLANIMETRIC DETAIL WAS COMPILED FROM WESTERN AUSTRALIAN DEPARTMENT OF LANDS AND SURVEYS 4-MILE PLANIMETRIC MAPS OF DIXON RANGE, MOUNT RAMSAY AND GORDON DOWNS

RELIABILITY: RELIABLE SKETCH

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

WESTERN AUSTRALIA

HALLS CREEK REGION

MAP SHOWING

RADIOMETRIC ANOMALIES

DETECTED BY AIRBORNE SCINTILLOGRAPH

AUGUST-NOVEMBER, 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

- 21 22 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