COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORDS 1960 No. 131

INVERELL AIRBORNE MAGNETIC AND RADIOMETRIC SURVEY, N.S.W. 1958

by

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ILLUSTRATIONS

1. INTRODUCTION

The survey described in this Record covered an area (Plate 1) of approximately 400 square miles in the vicinity of the town of Inverell, N.S.W. and was done at the request of the New South Wales Department of Mines.

Within the survey area are the villages of Tingha, Stannifer, and Elsmore; alluvial tin ore has been mined in this district since 1871.

The purpose of the aeromagnetic survey was to try to outline the courses of the various deep leads with which the alluvial tin is associated. A radiometric survey, designed to indicate areas in which uranium minerals might occur, was carried out concurrently with the magnetic survey.

The magnetic method of geophysical surveying had previously been successfully applied in ground surveys by Rayner (1932), to the tracing of basalt-filled deep leads in the area of the present survey, and later in the neighbouring areas of Emmaville (Rayner, 1937a) and Stannum (Rayner, 1937b). At those places appreciable magnetic anomalies were found to be associated with unweathered basalt, and the magnitude of the anomaly could be correlated with the thickness of basalt. It was therefore considered that the aeromagnetic method also would be applicable to the problem of tracing basalt-filled deep leads.

The survey was conducted during May 1958 by a survey team using a DC.3 aircraft (VH-MIN) based at Inverell airport.

The following Bureau personnel were engaged upon the survey: - W.A.L. Forsyth, Miss C.O. Leary (Geophysicists), F.S. Clements (Senior Technician, Radio), N. Hamilton (Geophysical Assistant) and H.S. Herzog (Field Assistant).

Trans-Australia Airlines crew concerned were Captain N.K. Pascoe, First Office D.E. Wright, and J. Maskell, Engineer.

2. GEOLOGY OF THE AREA

The rocks are sedimentary, not older than Lower Permo-Carboniferous or Carboniferous, and have been intruded by two granites (Carne, 1911).

The first intrusion was by the "Tingha" granite, a light-coloured porphyritic granite of medium to coarse grain. The later intrusion was by a finer-grained eurite granite, described by Carne as the "acid" granite. Tin lodes occurred in the granites and, under the influence of weathering, the lodes gave rise to the alluvial tin deposits which have been extensively worked. Much of the area was later covered by basalt flows, which filled many of the river valleys and thus covered much of the stanniferous alluvium. This action gave rise to the "deep leads", the location of which was the main purpose of the aeromagnetic survey. Plate 3 is a geological map of the area after Carne (1911).

3. SURVEY METHOD

The survey area was covered by flying parallel north-south traverses at $\frac{1}{4}$-mile spacing, the orientation being designed to produce magnetic profiles intersecting the geological strike approximately at right angles.

The aircraft was flown at a nominal height of 500 ft above ground; the actual height above ground usually differed from this figure by up to 50 ft, owing to instrumental and pilot errors and sudden up-draughts. During the approach to and passage over particularly rugged terrain the height error was considerably greater than 50 ft.

Tie-lines were flown to establish the differences between the magnetic datums of individual profiles; such differences are due to diurnal variation and instrumental drift. Two tie-lines were flown in an east-west direction to intersect all flight lines approximately 3 miles inside the northern and southern boundaries of the survey area. In each case, the tie-line was reflown on the opposite heading immediately on completion of the first leg. This technique allows the effects of diurnal variation and instrumental drift to be eliminated from the magnetic profile along the tie-line.

The aircraft was navigated with the aid of aerial photographs; the photographs had been marked with parallel lines representing the proposed flight lines. At intervals along each flight line the pilots marked the photographs to show the approximate position of the aircraft relative to recognisable ground details. Simultaneously, corresponding annotations were made on the recorder charts.

A continuous vertical photographic record of the aircraft track was made during flight, thus enabling the track to be plotted on the photographic mosaics.

Extreme difficulty in navigation was experienced owing to unusually large variations in scale between adjacent aerial photographs, which caused mis-matching of topographical detail at the junction of photographs in the mosaics. The actual flight lines therefore departed widely from the desired system of uniformly spaced parallel lines.

4. EQUIPMENT USED

The magnetic equipment in VH-MIN consisted of a saturable-core fluxgate magnetometer, type AN/ASQ-1, the detector head of which was located at the end of a cylindrical boom projecting from the tail of the aircraft. This location reduces to a minimum the magnetic disturbance, at the detector head, due to the magnetism of the aircraft. The residual disturbance was further reduced by means of compensating coils mounted in the boom. The output of the magnetometer, representing a continuous measurement of variations in the total intensity of the earth's magnetic field, was recorded graphically on a "Speedomax" potentiometric recorder.

The radiometric equipment used consisted of two MEL scintillation detectors, the outputs of which were integrated by an MEL radiation monitor and recorded by an Esterline-Angus graphic recorder.

For continuous monitoring of the aircraft's height above the ground, use was made of an S.T.C. Type STR30A frequency-modulated radio altimeter operating in the 7-cm wavelength band. The altitude profile was recorded on an Esterline-Angus Recorder.

The track of the aircraft was continuously recorded by means of an "Aeropath" continuous-strip 35-mm camera, and the track corresponding to each flight line can thus be plotted on the aerial photographic mosaics.

All recorder charts and photographic records were correlated by means of fiducial marks on the recorder charts and fiducial marks and counter numbers on strip film.

5. RESULTS

(1) Magnetic

Plate 1 illustrates the distribution of total magnetic field intensity as recorded by the airborne magnetometer. Comparison of this map with the geological sketch map of portion of the survey area (Plate 2) indicates that, in some places, changes in magnetic field intensity may be correlated with the geology.

In general, the more intense magnetic anomalies are associated with the occurrence of basalt flows. This relation is most evident along the northern boundary of the survey area in the vicinity of the Macintyre River and east-north-east of Tingha. The basalt filling the outlet of the Gilgai deep lead, north of Gilgai, also gives rise to intense anomalies.

Magnetic anomalies, of appreciably lower intensity than those associated with the basalt, occur over the area mapped by Carne as "acid" granite; the magnetic field over the "Tingha" granite is almost free of anomaly, apart from the regional gradient.

2) Radiometric

No radiometric results are included in this report. Owing to unserviceability of the scintillograph, radiometric profiles were obtained over less than half of the survey area, and accurate evaluation of these records has proved impossible because of uncertainty as to the height of the aircraft above ground level.

As granite intrusions in many areas have been found to be considerably more radioactive than the surrounding rocks, the wide-spread occurrence of granite in the rugged terrain of the survey area makes the radiometric profiles particularly susceptible to the effects of variations in aircraft height.

6. CONCLUSIONS

Comparison of the magnetic contour plan (Plate 2) with the geological sketch map indicates that the more intense magnetic anomalies may be correlated with thick basalt flows. This conclusion is in agreement with the findings of Rayner (1937b), and suggests that the magnetic contour map might serve as the basis for selection of areas suitable for future detailed ground geophysical and geological surveys.

7. REFERENCES

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RAYNER, J.M., 1932 — Preliminary Report on Tingha-Gilgai deep leads. N.S.W. Mines Dept. Geophysical Survey Papers 33/106M.

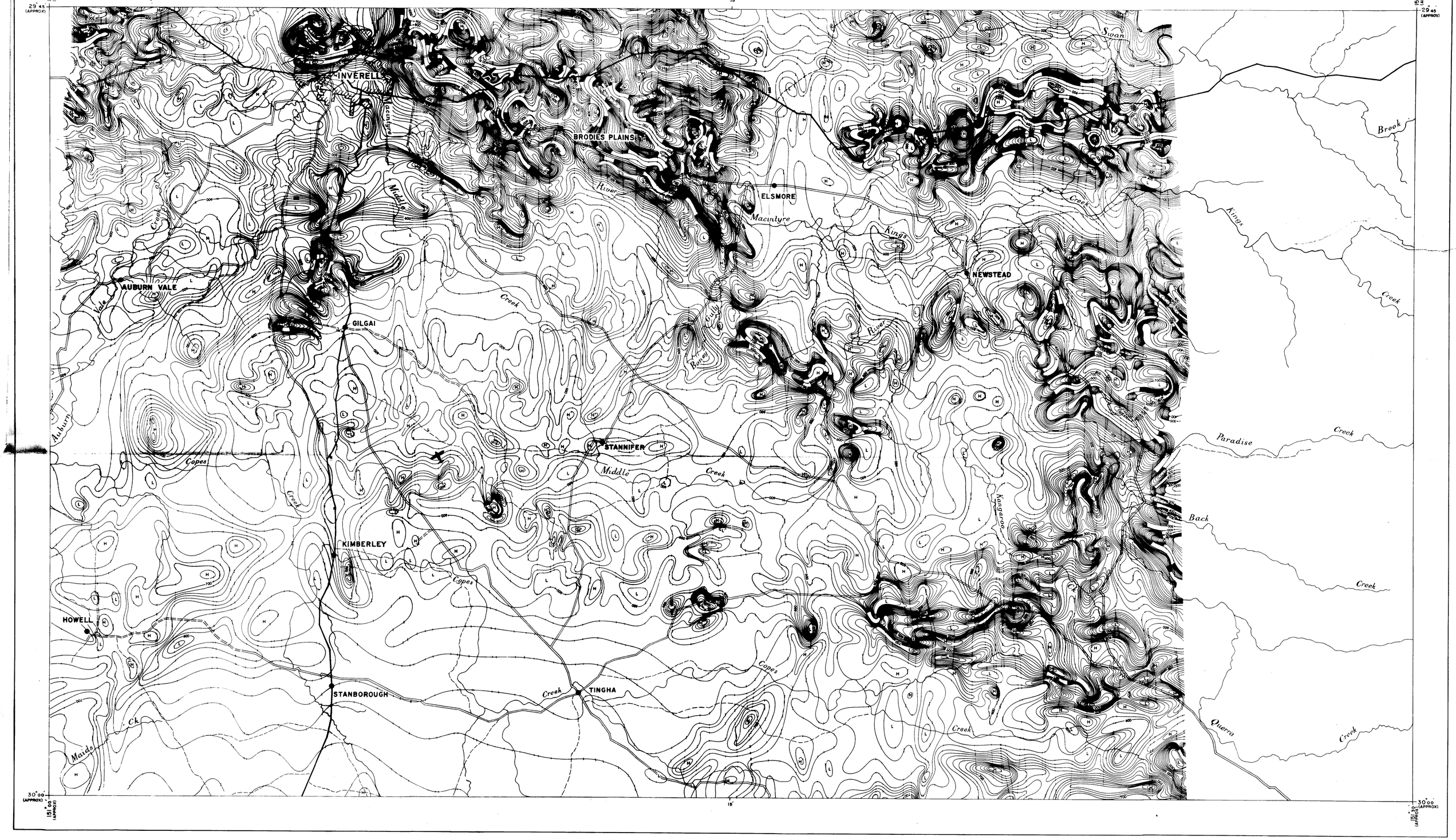
RAYNER, J.M., 1937a — Geophysical survey of Vegetable Creek deep lead, Emmaville, N.S.W. Mines Dept. Geological Survey Papers 37/5262M.

RAYNER, J.M., 1937b — Geophysical survey of Stannum deep lead. N.S.W. Mines Dept. Geological Survey Papers 37/5404M.

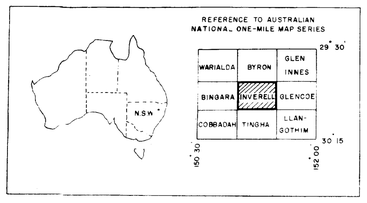
AUSTRALIA 1:63,360

INVERELL
NEW SOUTH WALES

ZONE 8 H/56/5 SHEET 282



LOCATION DIAGRAM



GEOPHYSICAL SURVEY CARRIED OUT AND MAP COMPILED AND DRAWN BY GEOPHYSICAL SECTION, MELBOURNE
REDUCTION AND CONTOURING OF AEROMAGNETIC DATA BY ADASTRA HUNTING GEOPHYSICS PTY LTD

MAP DATA

PROJECTION:- TRANSVERSE MERCATOR AUSTRALIAN SERIES

DETAIL:- PLANIMETRIC DETAIL WAS COMPILED FROM INVERELL ONE-MILE AIR PHOTO MOSAIC, PREPARED BY THE DIVISION OF NATIONAL MAPPING

RELIABILITY:- PLANIMETRIC DETAIL: SKETCH ONLY
GEOPHYSICAL DATA: POSITION OF FLIGHT LINE/CONTOUR INTERSECTIONS ACCURATE TO WITHIN 200 YARDS, RELATIVE TO PLANIMETRIC DETAIL

MAP SHOWING

TOTAL MAGNETIC INTENSITY

MEASURED BY AIRBORNE MAGNETOMETER

SCALE

MILES 1 0 1 2 3 4 5 MILES

MAGNETIC CONTOUR INTERVAL 10 GAMMAS

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
DEPARTMENT OF NATIONAL DEVELOPMENT

LEGEND

TOPOGRAPHICAL DATA
- RIVER OR CREEK
- MAIN ROAD
- ROAD
- TRACK
- TOWNSHIP
- AERODROME

MAGNETIC DATA
- 600 MAGNETIC CONTOURS
- H MAGNETIC HIGH
- L MAGNETIC LOW
- FLIGHT LINE/CONTOUR INTERSECTION

EXPLANATORY NOTES

THIS MAP WAS COMPILED FROM THE RESULTS OF AN AIRBORNE GEOPHYSICAL SURVEY MADE BY THE BUREAU OF MINERAL RESOURCES DURING MAY, 1958.

THE SURVEY WAS MADE AT AN ALTITUDE OF 500 FEET ABOVE GROUND LEVEL ALONG LINES SPACED A NOMINAL 0.25 MILE APART. THE HEIGHT OF THE AIRCRAFT WAS CONTROLLED THROUGH A RADIO ALTIMETER. PHOTO-MOSAIC ASSEMBLIES WERE USED AS A VISUAL AID TO NAVIGATION AND THE ACTUAL COURSE OF THE AIRCRAFT WAS PLOTTED FROM VERTICAL PHOTOGRAPHY, TAKEN WITH A 35 M.M. CAMERA DURING FLIGHT.

THE TOTAL MAGNETIC INTENSITY WAS CONTINUOUSLY RECORDED BY AN AIRBORNE MAGNETOMETER INSTALLED IN A DC-3 AIRCRAFT. THE DATA REMAIN UNCORRECTED FOR A REGIONAL GRADIENT IN TOTAL MAGNETIC FIELD OF 9.5 GAMMAS PER MILE IN A DIRECTION S. 17° WEST.

G 345-1
OCTOBER, 1959

AUSTRALIA 1:63360

INVERELL
NEW SOUTH WALES

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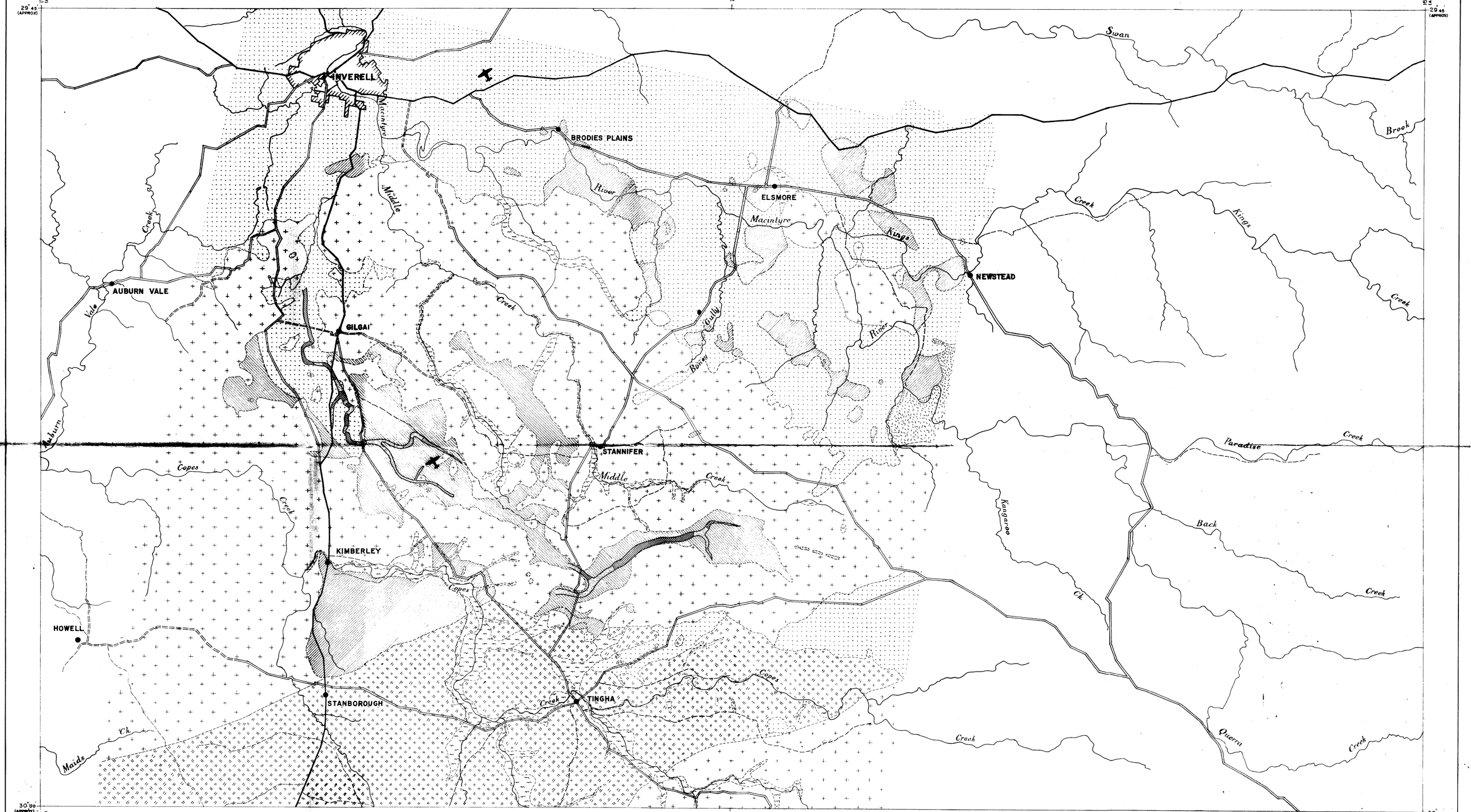
PLATE 2



GEOLOGY

Recent Pleistocene		Alluvium (Drifts along stream channels (Worked)
Tertiary		Red soil, concretionary iron oxide (Bauxitic) in places overlying basalt and covering early drainage channels. ("Leads") Frequently cloaked with granite soil, obscuring boundaries
		Basalt overlying in many parts ancient tin bearing stream channels
Upper Paleozoic Permo-Carboniferous		Sandstones, quartzite, jointed slates and cherts much altered by granitic and porphyritic intrusions
		"Tingha" granite (Basic)
		Acid granite probably intrusive in "Tingha" granite
		Quartz porphyry, intrusive in upper Paleozoic, "Tingha" and acid granite

In the middle and lower portions of the map the basalt boundaries are only approximate

Well tested or worked leads	(Rayner, 1932)
Unworked leads	
Unworked leads (probable course only)	

MAP DATA

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RELIABILITY:- PLANIMETRIC DETAIL: SKETCH ONLY
GEOLOGY: SKETCH ONLY (AFTER CARNE, 1911)

GEOLOGICAL SKETCH MAP

SCALE

MILES 1 0 1 2 3 4 5 MILES

LEGEND

TOPOGRAPHICAL DATA

- RIVER OR CREEK
- MAIN ROAD
- ROAD
- TRACK
- TOWNSHIP
- AERODROME

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DEPARTMENT OF NATIONAL DEVELOPMENT

To accompany Records 1960, No 131

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