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PRELIMINARY GEOPHYSICAL PROGRESS REPORT ON WATERHOUSE
URANIUM PROSPECT NO. 3, NORTHERN TERRITORY.

by

A. F. ALLE.

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PRELIMINARY GEOPHYSICAL PROGRESS REPORT ON WATERHOUSE
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C O N T E N T S.

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PLANS AND SECTIONS.

<u>Plate No.</u>	<u>Plan.</u>	<u>Scale.</u>
1	Radiometric Contour Plan.	40 feet - 1 inch.
2	Magnetic Contour Plan.	40 feet - 1 inch.

Note: It should be emphasised that the following is only a preliminary progress report. No attempt to interpret results is made, and much editing is required.

J.B. Misz.

SUMMARY.

The Waterhouse Uranium Prospect No. 3 is one of the series of anomalies detected during the Airborne Scintillometer Survey of 1952.

A specific group of these anomalies occurs between the main Darwin-Birdum railway line and the Stuart Highway. A strong similarity exists between most of them, a large number being located in the same series of shale and sandstone beds. The beds are usually silicified and well-folded though these factors vary considerably from plane to plane. In some parts the folding has been intense, numerous small shear zones being prominent. Later there has been replacement of some of the sheared and folded beds by quartz often associated with introduction of hematite.

Generally it was found that anomalies consisted of large areas of $1\frac{1}{2}$ to $2\frac{1}{2}$ times background and in every case the above factors were evident. Closer investigation did not reveal any "hot spots" but usually several small isolated areas could be located which would read about $3\frac{1}{2}$ times background.

As far as could be seen these anomalies were the ones discovered by the Airborne Survey.

No further work was recommended for any of them mainly because no worthwhile surface indications of radioactive minerals could be detected. However the author considers that to wipe off these anomalies without further investigation is not yet warranted.

While in the main the survey is at present being conducted in the search for primary or secondary deposition of detectable uranium minerals in favourable zones it should be borne in mind that if certain extensive beds of slightly higher radioactivity were found to have a suitable percentage of uranium content, these could be potential ore bodies. In this case the extent of the deposits would simply be determined by assay values.

The question as to the method of concentration of the radioactive minerals, whether they are inherent in the beds or whether the activity is due to mineralization occurring in a later epoch, is of some importance. The location and nature of the primary source in this case is important. The regional pattern of radioactive mineral distribution may help to indicate the solutions of some of these problems. It would help to indicate whether certain types of structures are favourable or not.

In view of these facts and that there are many areas of a similar nature it was decided that further work should be undertaken in one of these areas. Waterhouse Uranium Prospect No. 3 was selected as a suitable area.

It occurs in severely folded and weathered shales and sandstones with some quartz and quartz-hematite injection. No radioactive minerals were detected at the surface. However fluorescent minerals occurring as very small white veins and spots were detected. These occur only in the radioactive high zones.

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In specimens selected from area one, small white spots and veins were sparsely scattered but only a few spots could be detected in the second and third areas. Similar rocks tested outside the high areas did not fluoresce. The colour was difficult to determine but was light in all cases ,

The radiometric survey shows three major areas. Areas 1 and 2 have been defined clearly and in each the highest count is over 4 times background. In the first area the high occurs over shale rubble in a severely folded zone. In the second area the high is due to several isolated well hematized rocks.

The third area has not yet been clearly defined but seems to continue south for some distance. At present the highest readings approach 3 times background. This area encloses some zones of severe folding and much quartz, quartz-hematite injection.

A small hand pit was dug in the first area but showed only rubble. There was only a slight increase in radioactivity.

The magnetic survey indicated several highs and lows along a line south of the base line. The intensities range from 100 gamma to 2,300 gamma. They seem to be roughly along the same line as a phase of quartz-hematite injection. At present there does not appear to be any correlation with the radioactive highs. There may be some significance in the variable magnetic readings at the north of the third area.

No worthwhile detail geological work has been carried out in the area but it is hoped that this may be done towards the end of the season. The regional geological picture is also obscure at present.

Further geological work including costeaning is suggested along these lines to help interpret the results. The geophysical grids should also be extended to complete the survey.

The results of the radiometric and magnetic surveys have been plotted and are shown on the two plates at the back of this report.

INTRODUCTION.

The prospect was a second order anomaly located by the Airborne Scintillometer Survey of 1952

It is situated 4.6 miles on a true bearing of 174 degrees from the southern end of Gould Airfield. It is about one mile due east of the Darwin-Birdum railway.

The military co-ordinates on Batchelor sheet are 053240.

The Air Photos are run 20, Photos 5170 - 5171, Pine Creek Survey 1375.

After preliminary ground investigation (Preliminary Report on Airborne Scintillometer Anomalies - No. W2, by P.B. Rosenhain and A.E. Allen, 22nd July, 1953) a survey grid was set out by the geophysical section. The base line runs east-west for 800 feet. The traverse lines are spaced 100 feet apart and pegged at intervals of 100 feet.

The detailed radioactive coverage constituted the main survey. Plate 1 shows the results of this survey. Area No. 2 was the first located and the grid was laid out with the outlining of this area in view. As work progressed area 1 was discovered and later area 3. Time did not allow the grid to be extended to indicate clearly the third area.

A detailed magnetic survey supplemented the geiger work. The results are shown on Plate 2.

Access is by track running parallel to the railway line except for the last mile where there is no track. This track is left where it crosses the railway line from west to east about 5½ miles south of Batchelor Airfield. The country is steeply eroded and only accessible in the dry season.

The work commenced in July and was completed in September, 1953.

TOPOGRAPHY.

The anomaly is situated in rugged country though the relief is not great. It falls away sharply southwards to gently undulating terrain.

There are a large number of small narrow streams with steep-sided gullies. All of these are actively eroding their beds and the deposit of alluvium is either very small or bare rocks outcrop. They only flow during the wet season.

The outcrop of the Waterhouse granite occurs about 2½ miles west and volcanics occur about 600 yards south.

GEOLOGY.

There is no detail geological map of the area at present and the regional geology has not been interpreted yet in this region.

The main beds are greyish sandstones interbedded with shales, and have been severely folded. At present it appears that area 2 is on the southern limb of an east plunging anticline. Small outcrops of the beds occur sporadically throughout the generally rough rubble surface. Severe drag folding and minor shearing is evident in all three areas and are associated with the radioactive highs.

The sandstones and shales continue for some distance to the east, west and north. About 600 yards south, volcanics outcrop in the side of a steep gully. It is at present termed a quartz felspar porphyry. About 800 yards south east is a contact between sandstone and conglomerate. At present it is thought that these conglomerates belong to the Crater Lake series of beds further north.

Quartz and quartz-hematite injection occurs in the second and third areas. Several minor quartz reefs outcrop in these areas and the hematite is also closely associated with these. Some sedimentary bands have been selectively replaced by the iron solutions and such rocks are often "hot". However other outcrops have been completely hematized and they are low in radioactivity.

Large limonitic casts after pyrites occur in the sandstone. These are up to ½ inch square and occur mainly in the second and northern section of the third areas.

A certain amount of brecciation is also evident in some specimens. Angular pieces of shale are included in more sheared and partially hematized rocks.

The occurrence of small amounts of fluorescent minerals is of particular interest. Though small the fluorescent spots were prominent under the portable Mineralight. A battery operated, short wave ultra violet lamp, manufactured by John Harvey Instruments Company of Sydney, Australia. Due to the small amount of fluorescent mineral present the colour could not be accurately

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determined but appeared to be white to blue in colour but mainly light.

The mineral occurs mainly as small dull white specks on freshly broken faces in well-weathered iron stained sandstones and shales. It is sometimes powdery in form or can also occur as filling in minute veins.

Summarising there is a distinct zone of severe local folding in each area. Much quartz inflection with a little hematite is present in the third area and much quartz and hematite occurs in the second area. There is only a small amount of either in area 1.

RADIOACTIVE MINERALS.

It is interesting to note that the fluorescent mineral occurred only in the radioactive high zones and always in well hematized, well-weathered rocks. Generally these rocks had also previously been severely folded, sheared or brecciated. In freshly broken surfaces it always occurred particularly in conjunction with limonite which usually formed within reddish hematite.

It has previously been noted that much limonite is a typical occurrence with radioactively hot rocks in the Waterhouse area. Thus the particular weathering factors present appear to have concentrated any radioactive minerals present, at the surface in conjunction with the formation of limonite. This is typical of the other anomalies so far prospected in this area.

This particular aspect of the method of concentration of the radioactive minerals and the cycle of weathering involved needs complete investigation.

As yet no results of analysis of the fluorescent minerals is at hand. This work is in the hands of the Geological Section of the Waterhouse party

GEOPHYSICS.

RADIOMETRIC SURVEY.

The main traverse lines were originally read at 25 foot intervals to enable an overall picture of the area to be obtained. Further readings were then taken over selected areas to detail clearly the surface extent of the radioactive highs.

The total area of twice times background so far found is approximately 122,000 square feet. This contains 1,600 square feet of 3 times background and roughly 100 square feet of 4 times background.

A ratemeter type 1011C was used for the survey.

The anomaly has divided itself into three distinct areas and these will be discussed individually.

AREA 1. This comprises a clearly defined area of approximately 50,000 square feet of twice times background occurring in sandstone and shale. The highest concentration of radioactivity is located centrally in the southern half of the area. It occurs over rubble surface on the steep western flank of a narrow valley. It encloses an area of 1000 square feet of 3 times background and 100 square feet of over 4 times background. This zone is characterised by folding, shearing, small amounts of hematitic replacement and the existence of fluorescent minerals.

Area 1 100-1000

The area of twice times background embraces sharp ridges and gullies with small patches of alluvium. The radio-activity over the alluvium does not fall away as would be expected.

A small hand pit was dug just south of the highest area but only indicated extensive rubble covering the surface. It gave only a slight increase in counting rate. The nearest bedded rocks outcrop in the valley about 200 feet away.

AREA 2. This has been detailed and comprises an area of approximately 45,000 square feet over sandstone and shale. The area mainly encloses a ridge running east - west which has had much quartz-hematite injection on the southern side.

It is on this side that the highest counts occur giving an area of 600 square feet of three times background and several square feet of four times background. Here the highest radio-activity only occurs in isolated rocks spread several feet apart for about 20 feet, and not over the ground surface generally as in the first area.

These rocks are much hematized and brecciated and occur in sandstone containing noticeably large pseudomorphs after pyrites. The "hot" rocks show much weathering to limonite and though more completely hematized rocks occur more prominently a little further north-west the radioactive count in these drops considerably. A few particles of fluorescent mineral similar to that in area 1 were detected in these hot rocks but none could be seen in the immediately surrounding sandstone.

AREA 3. More work is necessary in this area. The present extent of twice times background area is approximately 27,000 square feet. No hot spots have been detected but a zone of severe folding in the southern portion gives generally higher readings.

The area covers a flat ridge in the north then runs diagonally down a steep valley, across a narrow creek bed and on present indications continues southwards on the other side. In the northern section quartz outcrops are prominent hematite also being associated. Numerous small quartz stringers run through the area generally. One spot of white fluorescent mineral was detected in the southern portion.

The volcanics outcrop south-west further down the same valley side.

A radiometric contour plan (Plate 1) showing the isorads in all three areas has been prepared at a scale of 40 feet equals one inch. It accompanies this report.

MAGNETIC SURVEY.

The variations in vertical magnetic intensity over the anomaly are shown on the accompanying plan (Plate 2).

This survey has indicated a series of highs and lows running east - west parallel to the base line and roughly 100 feet south of it. The magnetic intensity varies from a minimum of 100 gamma to a maximum of 2,300 gamma. These appear to occur in an ill defined brecciated and sheared zone containing much quartz and hematite. This is most evident on the surface at the western extremity just north of the third radio-active area.

David M. Smith

The large high at the eastern end occurs over a flat ridge of rubble. However there are many quartz stringers and hematitic replacement evident in the rocks, though not so prominently as at the western end.

Elsewhere the magnetic values stay very constant over sharp ridges, rock outcrops, steep valleys and alluvium. No regional rise is apparent over the area.

Peg C1 was used as a suitable base station for the anomaly. The main base station for Waterhouse is located between Batchelor airstrip and the railway line.

A Hilger and Watts Magnetometer was used having a sensitivity of 31.5 gamma per scale division. This was calibrated in the field using the small auxiliary magnet.

CONCLUSION.

The decision to carry out a radiometric survey of this anomaly has been justified and much interesting information has been brought to light.

As work has progressed the area has been expanded and the extent and nature of the radioactive anomaly more fully appreciated.

The Geiger survey should be extended to the west and south of area 3. Any slight but sustained rise in the counting rate should be fully investigated as this is the only sure method of locating a "hot" ~~ear~~ ^{area}. It is impossible at present to determine what areas may carry radioactive elements from the surface inspection of outcrops and structural pattern. Thus the careful delineation of any radioactivity is of importance.

The magnetometer survey should have more detail added to verify the high and low magnetic variations along the line already indicated. It should also be extended to the north to adequately cover area 1, and to the west and south to cover the third area.

It is considered however that until the time when some definite relationship can be established between the magnetic and radioactive anomalies this survey could only be of secondary significance.

It is thought that self-potential work would not be successful in the area due to the rugged, dry and rocky nature of the terrain. However some types of electro-magnetic prospecting may be suitably employed. This would help to locate any definite mineralization which may occur in veins or shear zones and help also to delineate the relevant structure of these.

On the present results of the survey it seems unwise that other anomalies of a similar nature should be discarded completely until some further investigation can be carried out.

A detailed Geological plan of the area is to be prepared by the Geological section towards the finish of the present season's work. When this necessary data is available further investigation work should be outlined.

Although the area is rugged it should be possible to bulldoze costeans through the rubble diagonally down the valley sides. This probably would be easier in the first area which is also of greatest interest. Concise radioactive readings should be taken over these costeans and if any radioactive trends are indicated more costeans should follow.

If these are successful, and it is anticipated that the results will not be negative even though they may not be high, a drill site should then be located. This is only contemplated after as much costeaning and surface detail work as possible has been completed. Thus after a clear picture of surface conditions has been obtained the nature and extent of the radioactivity at depth could be determined.

The "hot" areas should be constantly tested for the presence of fluorescent minerals and analysis of these together with routine sampling carried out.

In the light of this work a more complete picture of the various anomalies, their potential-extent, causes and regional significance in the Waterhouse area should become available.

REFERENCES.

- | | |
|------------------------------|--|
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Bur. Min. Res. Geophys. Records 1952/79. |
| Rosehain P.B. &
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22nd. July, 1953. |

APPENDIX.

No analysis of the fluorescent minerals are yet at hand. This and other sampling work is conducted by the Geological division.

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RADIOMETRIC CONTOUR PLAN PLATE 1
WATERHOUSE URANIUM PROSPECT
NO 3

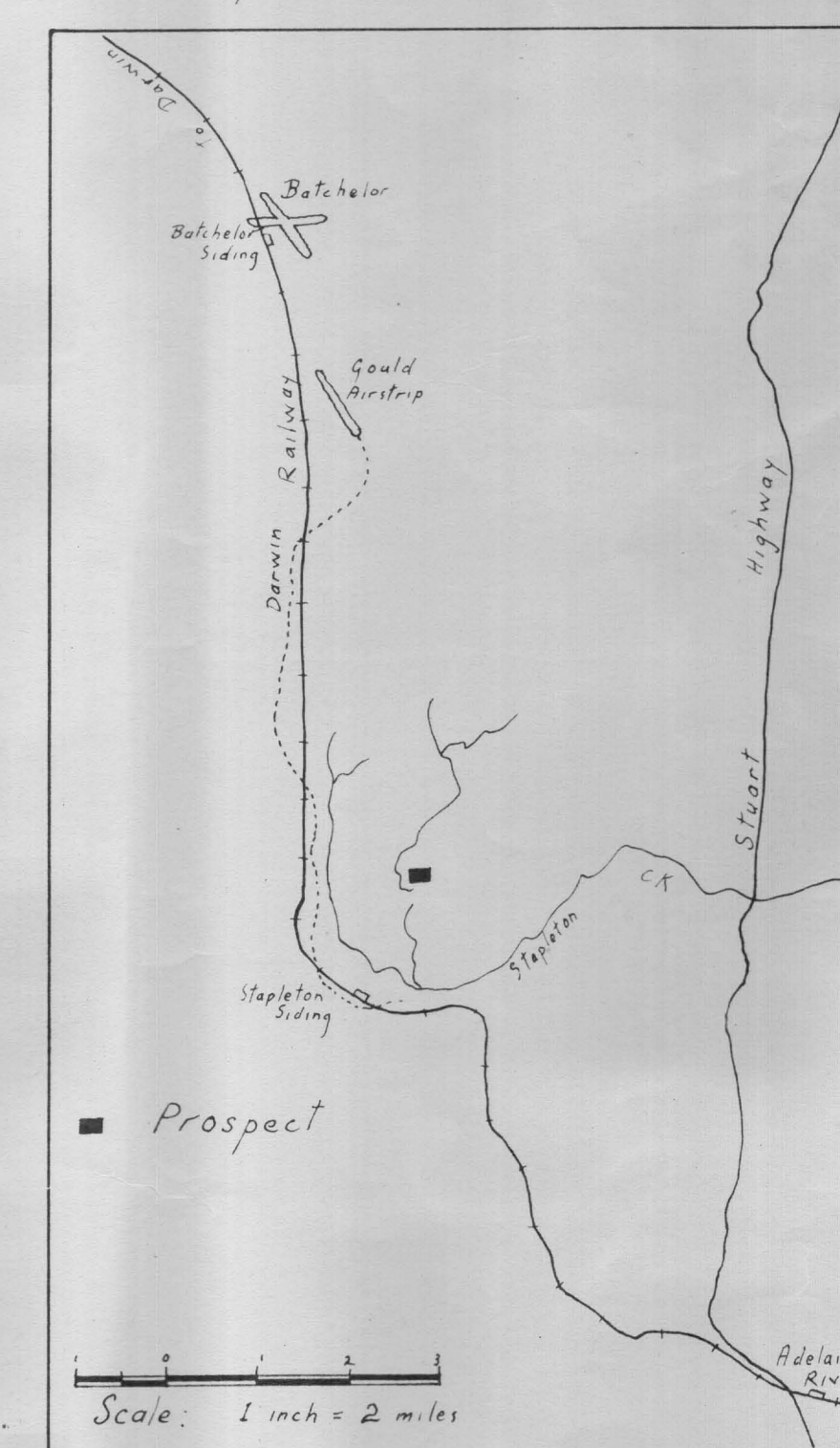
RUM JUNGLE AREA
NORTHERN TERRITORY, AUSTRALIA

Scale: 1 inch = 40 feet

Contour Interval
1 x Background

Background = 5.5 (Scale C)
Ratemeter - Type 1011C

Locality Sketch



Scale: 1 inch = 2 miles

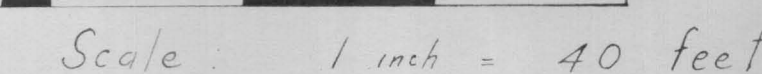
Radiometric Survey
by
A. F. Allen

July - September 1953

NO 3

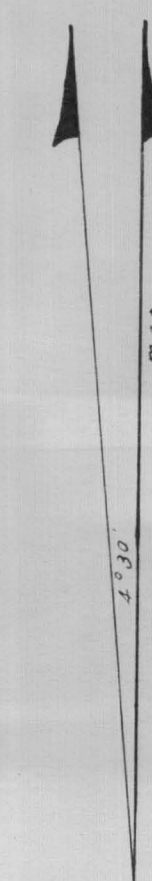
RUM JUNGLE AREA

NORTHERN TERRITORY, AUSTRALIA



Contour Interval
100 gamma

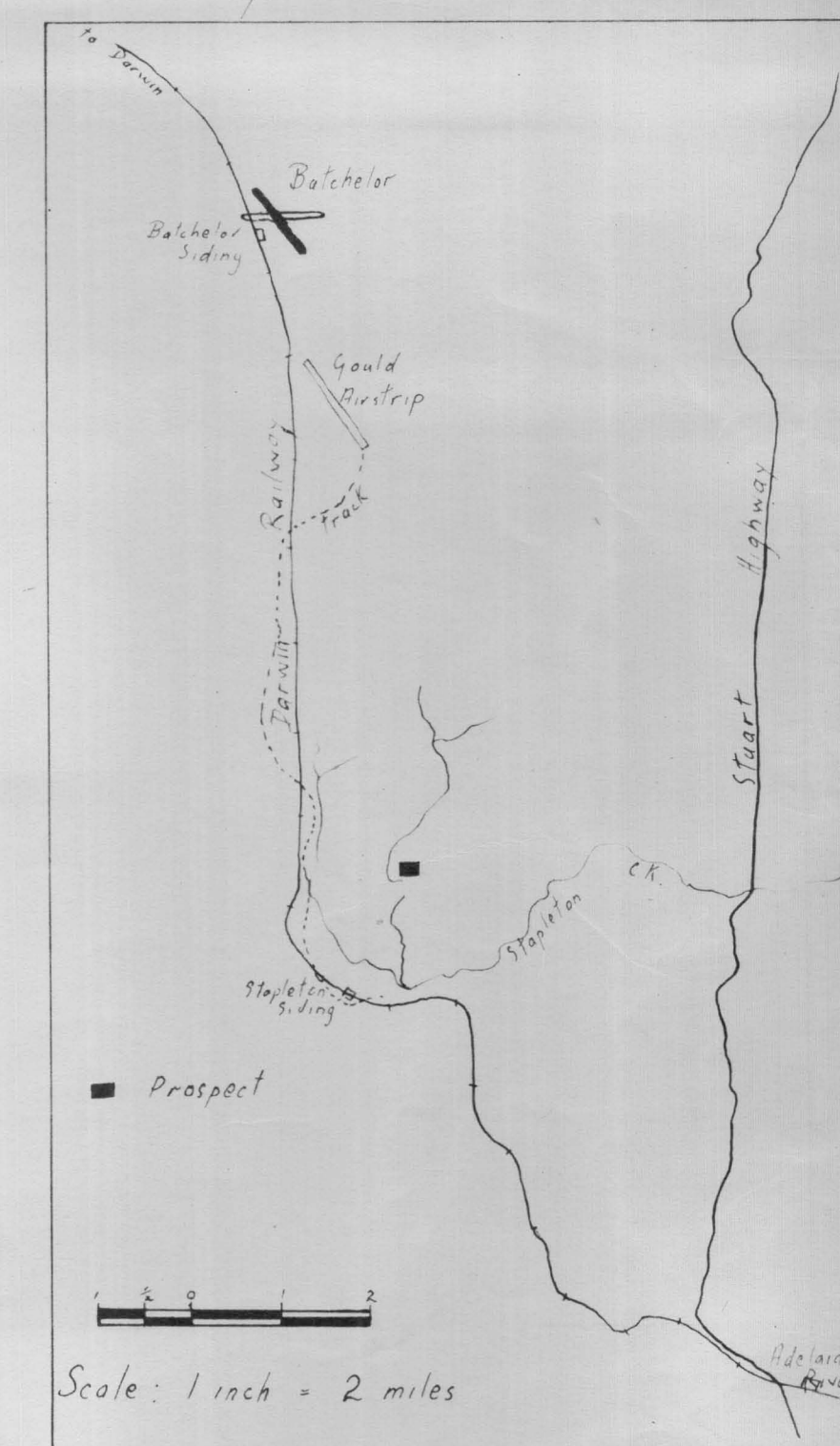
Magnetometer No 69106



Magnetometer Survey
by A. F. Aile

July - September 1953

Locality Sketch



Scale: 1 inch = 2 mile