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REPORT ON INSPECTION OF URANIUM OCCURRENCES AND AIRBORNE RADIOMETRIC ANOMALIES, WESTMORELAND , NORTHWEST QUEENSLAND.

by

B.P.WALPOLE

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SUMMARY.

Airborne radiometric anomalies in the Westmoreland area of Northwest Queensland located within the Upper Proterozoic Westmoreland Conglomerate, are due in some cases to lenses of radioactive sediments. One of these, Livingstones Prospect, is an eroded and leached remnant of what may once have been a lens containing about 2,000,000 tons, of low grade ore.

Other anomalies in the area are due to a variety of causes such as outcrops of slightly radioactive volcanic rocks.

Livingstones Prospect is the first known example in Australia of the Blind River-Witwatersrand type of uranium occurrence. As such, it should help to stimulate a search for further occurrences of this type in the Upper Proterozoic rocks of Northern Australia.

INTRODUCTION

This report presents the results of an inspection of airborne radiometric anomalies in the Westmoreland area of North-western Queensland.

The anomalies were located during the course of an airborne survey of the Calvert Hills and Westmoreland areas carried out during October and November 1956 by D. F. Livingstone, Bureau of Mineral Resources, Geology and Geophysics. An Auster aircraft equipped with a modified M.E.L. scintillation counter was used in the survey. The Westmoreland survey was on ground covered by an Authority to Prospect held by Mt. Isa Mines Limited.

Some of these anomalies were examined by ground parties from Mt. Isa Mines in 1956. Secondary uranium mineralization was found at one anomaly (exposure No. 1, Livingstones Prospect).

An inspection of the area on behalf of the Australian Atomic Energy Commission was carried out in May 1957 by J. H. Brooks of the Geological Survey of Queensland and B. P. Walpole, C. E. Prichard and G. F. Clarke of the Bureau of Mineral Resources. The area where uranium mineralization was located in 1956 by Mt. Isa Mines ground parties (Livingstones Prospect) and a representative selection of other anomalies in the area were examined.

The inspection of the area was greatly assisted by the efforts of a party of four prospectors led by Mr. J. A. Smith of Mt. Isa Mines Limited and by the facilities provided by and the courtesy of Mr. S. R. Carter, Chief Geologist of that company.

Location and Access

The Westmoreland area is about 100 miles west of Burketown in Northwestern Queensland. The main area of present interest is about 16 miles south-west of Westmoreland Homestead and about 6 miles east of the Northern Territory-Queensland border. It lies in the region of monsoonal climate and is inaccessible by road for long periods during the summer wet season. It is reached by a track which turns off the main Burketown-Wollogorang road about 2 miles south of Westmoreland Homestead. Landing grounds for light aircraft are located at Corinda, 50 miles south-east of Westmoreland and at Carolina, about 10 miles west of the Queensland-Northern Territory border. Doomadgee Mission (plate 1) has a weekly service by DC3 aircraft from Cloncurry.

The area is drained by Lagoon Creek. A number of billabongs on this creek hold water for part of the year. Permanent springs and waterholes are found where this creek and its tributaries cut through the Westmoreland Conglomerate.

GENERAL GEOLOGY

The area lies on the western part of the Westmoreland sheet of the Australian 4-mile series. This sheet was mapped in 1953 during a geological reconnaissance conducted jointly by the Bureau of Mineral Resources and the Queensland Geological Survey. Some further reconnaissance work was carried out by the Bureau and by Mt. Isa Mines Limited in 1956.

The rock units present are interbedded sediments and volcanic rocks of Upper Proterozoic (probably Upper Adelaidean) age. They were deposited on or near the north-eastern margin of a major Upper Proterozoic depositional basin. This basin lies for the most part in the Northern Territory (Plate 4) and extends from the Daly River area in the north probably to the Jervois Range in the south.

The sediments in the Westmoreland area were probably derived from a land mass to the east. They are markedly lenticular in character and lens out or change in facies to the west. The rock units present are listed below:

Cliffdale Volcanics

These are acid to intermediate volcanics and porphyries which include rhyolites, dacites and quartz felspar porphyry. They form the basal unit of the Upper Proterozoic sequence in this area and crop out in the valley of the Cliffdale and Scrutton creeks (Plate 5). Minor occurrences of uranium and copper mineralization are associated with shears in these rocks.

Westmoreland Conglomerate

This unit overlies the Cliffdale Volcanics. It consists of two members in the area examined. The basal member is a coarse conglomerate with rounded pebbles and cobbles of quartzite, reef quartz and acid volcanics. The cobbles range up to 1 foot in diameter. The second member consists of coarse grained kaolinitic sandstone with conglomerate pebbles and lenses of grit and conglomerate. The kaolin has probably resulted from the weathering of felspar.

The pebbles and boulders of volcanic rocks in the basal member may have been derived from the underlying Cliffdale Volcanics. These would have been in a solid state very shortly after extrusion and thus available as a source material for later sediments. Their presence as pebbles in the Westmoreland Conglomerate does not necessarily indicate an unconformity between these two units.

The known uranium mineralization in the Westmoreland area is in the upper member of the Westmoreland Conglomerate.

Peters Creek Volcanics

These are intermediate to basic lavas which overlie the Westmoreland Conglomerate. In places, the Westmoreland Conglomerate is intruded by dykes which acted as feeders to the Peters Creek Volcanics. Uranium and copper mineralization is associated with these rocks, mainly in the form of small fissure lodes in shears at or near the contact of the Peters Creek Volcanics and the underlying Westmoreland Conglomerate.

Wollogorang Formation

This consists mainly of thin bedded dolomite, dolomitic siltstone and sandstone. In some places the dolomite contains algal fossils.

Constance Sandstone

This unit is composed of arenaceous rocks ranging from micaceous, shaly and flaggy fine sandstone to coarse grained poorly cemented sandstone.

Golden Creek Volcanics

These are mainly basic lavas with volcanic breccia, tuff and tuffaceous sediments and with minor lenses of thin bedded dolomite and dolomitic siltstone. Copper mineralization occurs in these rocks at Redbank and near Wollogorang Homestead in the Northern Territory. Minor radioactivity occurs with weak copper mineralization in a small lens of slumped and brecciated, thin-bedded dolomite six and a half miles north of Wollogorang Homestead.

Nicholson Granite

This is a red coloured microline-granite which crops out in the Cliffdale Valley (Plate 1). It is not known definitely to intrude the Upper Proterozoic sediments and could possibly represent an exposed basement high. Its position in the geological column has yet to be determined.

The rocks in the Westmoreland area have been only gently folded and most of the fold structures present can be attributed to slightly modified depositional features. Dips are commonly shallow and do not exceed 10 degrees except adjacent to faults.

In the main area of interest, the Westmoreland Conglomerate strikes at approximately 80 degrees magnetic and dips at 2-3 degrees to the north. It is cut by a system of south-east trending faults but little vertical or lateral displacement of the beds has taken place. Vertical jointing is well developed. Three main sets are present; a major set trending about south-east and subsidiary sets trending north-west and 350 degrees to the north.

RADIOACTIVITY

General

The low level scintillograph survey of the area resulted in the location of several radiometric anomalies and broad plateaux of radioactivity. Ground inspection showed that the general level of radioactivity was highest in the Cliffdale Volcanics. The Westmoreland Conglomerate was not noticeably radioactive away from the lenses of radioactive sediments. Some anomalies are due to uranium mineralization; others are due to a variety of causes such as outcrops of radioactive volcanic rocks surrounded by non-radioactive alluvium and to topographic effects.

Livingstones Prospect

This prospect is situated 16 miles on a bearing of 220 degrees magnetic from Westmoreland Homestead and is shown by the airborne survey as a number of sharp anomalies within a broad plateau (Plate 5).

The prospect lies in the upper sandstone member of the Westmoreland Conglomerate. The prospect area is cut by a gorge between 50 and 100 feet deep, eroded along a major joint striking at about 50 degrees magnetic. The sediments on both sides of this gorge dip north at 2-3 degrees. They have been eroded into rough terraces and are dissected by gullies cut along north trending joints.

Mineralization.

Uranium mineralization was found in four separate localities in the prospect area during the course of the inspection and other occurrences may be present. For convenience the four localities are numbered as shown on Plate 2.

Exposures No. 1 and No. 2 are isolated patches of high grade secondary uranium mineralization on or near the floor of the gorge. What ore is present at No. 2 Exposure appears to follow the bedding but some excavation will be necessary at both exposures to determine if they have any economic significance. Renardite, soddyeite and phosphouranylite have been identified from No. 2 exposure.

Exposure No. 3 consists of a partly eroded lens of radioactive sandstone and grit which was traced along the strike for about 2,500 feet. The western limit of this lens appears to be a facies change to conglomerate. The reason for the eastern limit is not yet known. The lens is irregularly exposed in cross section over a width ranging up to 550 feet. The thickness of the lens, in its present state of erosion, ranges from 5 to 25 feet. The present limits of the lens up dip and down dip are probably mainly due to erosion.

The general level of radioactivity is high and in most places is over 10 counts per second and ranging up to 30-50 counts per second on a Phillips Monitor Geiger Counter. Secondary uranium minerals were found at a number of places in this exposure.

Torbernite was found near the eastern end (Section B, Plate 3). A few small, sausage-shaped pods of very high grade secondary uranium mineral were also observed in this area. These are up to an inch and a half in length and one half inch in diameter. The material from one such pod gave a radiometric assay of 57.2% eU_3O_8. The mineral gives an X-ray pattern similar to carnotite.

A waxy yellow mineral, not yet identified, is commonly associated with counts of greater than 10 per second in this exposure. This mineral in general is confined to the section within two inches or less of the surface. Specimens containing this mineral were taken from outcrops giving up to 50 counts per second. They were only weakly radioactive and gave radiometric assays as low as 0.02% eU_3O_8. These specimens had a low equilibrium factor indicating leaching of uranium. The same mineral gives a very strong, positive sodium fluoride bead test for uranium. Results of chemical assay of a typical specimen are not yet available. The sediments in this exposure consist of mainly porous, coarse grained sandstone. Manganese stained quartz grains are common. The rocks have obviously been subjected to severe leaching and most of the uranium content has been removed. The western limit appears to be a facies change to a lens of conglomerate.

Exposure No. 4 is again characterized by the presence of the unidentified waxy yellow mineral. In general the radioactivity in this exposure is higher than at No. 3. High grade secondary ore was found in two places (Section A, Plate 3) but the amount which could be seen on the surface was not large. Carnotite has been identified from this exposure.

Preliminary sections constructed with Abney Level and tape, and for which no great accuracy is claimed, indicate that Exposures 3 and 4 may lie on the same horizon. If this is so, two possibilities may be considered: the exposures are separate lenses in the same horizon, or they were originally part of the same lens, the middle section of which is now eroded away. Small patches of radioactive sediment in section line A, Plate 2, support the hypothesis that they belong to the same lens. On this assumption, the original deposit took the form of a lens dipping 2-3 degrees north and with a spread of at least 1,800 feet in cross section by 2,500 feet in long section. The plan view of the original lens would be most irregular and the dimensions given above may represent the maxima in both cases. For example, exposure 4 may represent a narrow prolongation up dip of the lens.

It is not possible to estimate the original extension down dip of the lens beyond Exposure 3.

The sections also indicate the possibility that Exposure 1 is on the same horizon as 3 and 4. They show that exposure 2, although on strike with 3, is on a lower horizon, probably about 100 feet below that on which Nos. 1, 3 and 4 are situated.

Economic Possibilities

Livingstones Prospect can be summed up as follows:

1. Some secondary ore is present in all four known exposures but the amount which can be seen at surface is too small to be of immediate economic significance.

2. The outcropping radioactive sediments are highly leached and most of the original uranium content has been removed. No accurate estimate of the original grade can be made. The writer's guess is that it was less than 4 lb. per ton. The ore was probably patchy with small sections of high-grade material in generally low-grade rock.

3. An optimistic reconstruction of the original deposit shows that it may have contained about 2,000,000 tons of low grade ore. This assumes that exposures 3 and 4 were connected and that exposure 4 continues up dip for at least part of the section between 4 and 1. The presence of a body of this size (before the present erosion cycle) enhances the chances of other large bodies being present, e.g. on a lower horizon such as at exposure No. 2.

   If, however, the exposures represent separate small lenses, the chances of finding a body of economic dimensions must be considerably reduced.

4. There is a possibility of ore being located in the sections between exposures 1 and 4, up dip from 1 and up dip and down dip from exposure 2.

5. One of the most important features of Livingstones Prospect is that it is the first deposit of the Blind River-Witwatersrand type to be found in Australia. As such it should promote the search for similar occurrences elsewhere in Australia, particularly in the Upper Proterozoic rocks of Northern Australia.

Other Airborne Anomalies

Other airborne anomalies inspected are shown on Plate 5. Some of these are within the Westmoreland Conglomerate. The remainder are located in the Cliffdale

Volcanics.

Each of these anomalies is the subject of a separate inspection report and the details need not be considered here. In general, no reason for the broad plateaux shown on the anomaly map could be determined from the ground inspection. This could be due to the type of instrument used - Phillips Monitor - as ground traversing with such an instrument is not precise. However, no evidence was found to suggest that such of these as were examined are important.

Point source anomalies plotted on the anomaly map were very accurately located by the airborne team. No difficulty was experienced in finding these anomalies on the ground. All were due to small patches of radioactive sediments but in only one case was any uranium mineralization noted. This was on an anomaly adjacent to a basalt dyke (Plate 5) where a few specks of torbernite were found in a lens of radioactive sediment about 50 square yards in area. The anomaly has no material of ore grade. It does, however, confirm the bedded character of the radioactive deposits in this area.

The anomalies examined on the Cliffdale Volcanics are due to outcrops of slightly radioactive rhyolite and quartz felspar prophyry surrounded by non-radioactive soil and alluvium. These have no economic significance. It is possible that other anomalies in these rocks may be due to small deposits of radioactive minerals located on shears such as those in the nearby Pandanus Creek area (Lord, 1955).

REGIONAL CONSIDERATIONS

The Westmoreland area lies within a mineral province which includes the Pandanus Creek Milestone Wollogorang-Redbank and Mullera Creek areas of North-western Queensland and the north-eastern part of the Northern Territory. Four main types of mineral occurrence have been found in this province. These are:

1. Copper and uranium occurrences localized on shears in volcanic rocks: Examples of these are Norris' prospects in the Pandanus Creek area and Blackwell's and El Husein prospect in the Milestone area. Blackwell's and El Husein are localized on shears on or near the contact of the Peters Creeks Volcanics and the Westmoreland Conglomerate.

The known occurrences of this type are not likely to be important even though small amounts of high grade pitchblende ore have been found at Blackwell's and El Husein.

2. Copper deposits in volcanic rocks: In this group are the Redbank mines, the recently discovered (by Mt. Isa Mines Limited) Vulcan prospect, and several small showings of copper in the Golden Creek Volcanics. Of these the Redbank mines and the Vulcan prospect are worthy of detailed investigation.

3. Bedded iron ore deposits in the Mullera Creek Formation. These are now being investigated by Broken Hill Proprietary Ltd.

4. Bedded uranium deposits such as Livingstones Prospect.

The first two groups are mineral deposits of undoubted hydrothermal origin and are probably genetically associated with the volcanic rocks of the region. The iron ore deposits

and the bedded uranium deposits are considered on present evidence to be probably of syngenetic origin.

This mineral province lies on the north-eastern margin of what is considered by the writer to be a major basin structure in which rocks of Upper Proterozoic age were deposited. The approximate outline of this basin is shown on Plate 4. A similar and smaller basin is present in the Kimberley area of Western Australia.

RECOMMENDATIONS

The bedded uranium deposits in the Westmoreland area are in coarse clastic rocks of Upper Proterozoic age and are associated - in a regional sense - with bedded iron ore deposits. They lie near the margin of the depositional basin. It would appear therefore that other clastic rocks near the margins of this basin or other basins, warrant investigation. These should include:

(i) Constance Sandstone, south of the Nicholson River in Queensland;

(ii) the Upper Proterozoic clastic sediments in the Roper River area, Northern Territory;

(iii) the Upper Proterozoic sediments in the Jervois Range area; and

(iv) the Upper Proterozoic sediments on the margins of the Kimberley Basin.

REFERENCES.

LORD, J.H., 1955 - Report on an Inspection of a Uranium Find at Pandanus Creek, N.T. Bur. Min. Resour. Aust. Rec. 1956/115.

_____, 1956 - Report on the Inspection of Uranium Discoveries in the Calvert Hills area, N.T. Bur. Min. Resour. Aust. Rec. 1955/63.

Canberra,
25/6/57.

PLATE 1

SKETCH MAP

Showing

Distribution of Upper Proterozoic Rocks

North-West Queensland

Scale:- 10 Miles to 1 Inch

10 5 0 10 20 30 Miles

N

QUEENSLAND — NORTHERN TERRITORY BORDER

Settlement Ck.
Lagoon Ck.
Cliffdale Ck.
Walford Ck.
Lily Ck.
Peters Ck.
Cuffsgate Ck.
Nicholson R.

Westmoreland H.S.
Livingstone's Prospect
Corinda H.S.
Doomadgee Mission
Iron Deposits
Iron Deposits

Pun
Pua
Pug
Pup
Puw
Puf
Pgn
Pul

UPPER PROTEROZOIC

Mullera Formation	Pul	Shale, sandstone, some ferruginous
Golden Ck. Volcanics	Pun	Acid & intermediate lavas
Constance Sandstone	Pua	Sandstone
Wollogorang Form.n	Pug	Dolomitic limestone & sandstone
Peters Ck. Volcanics	Pup	Acid & intermediate lavas
Westmoreland Congl.	Puw	Conglomerate & sandstone
Cliffdale Volcanics	Puf	Mainly rhyolite
Nicholson Granite	Pgn	Red microcline granite

LOWER PROTEROZOIC

N.T.
W.A.
QLD.
S.A.
N.S.W.
VIC
T

Locality Sketch

Bureau of Mineral Resources, Geology and Geophysics · June 1957.

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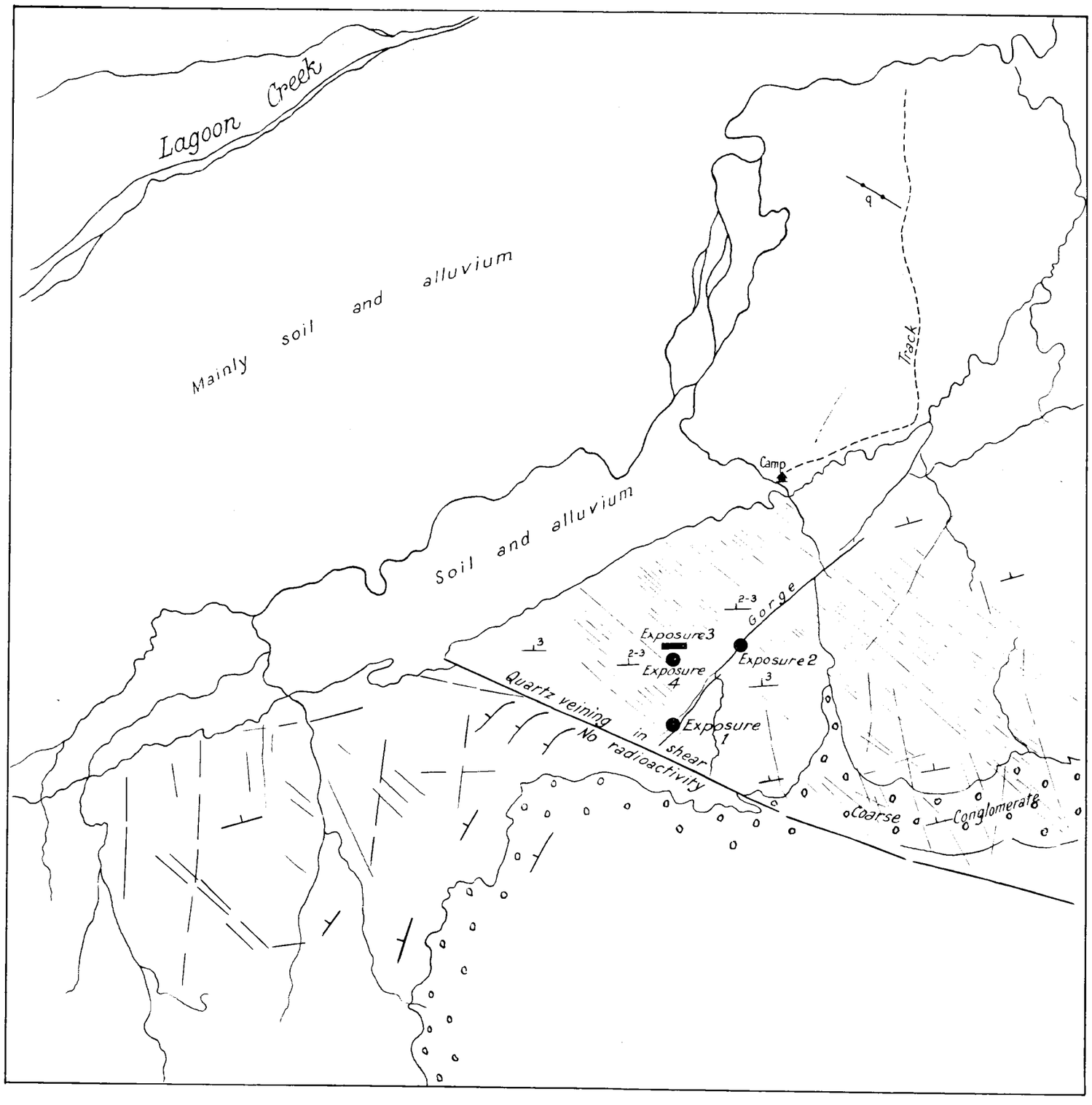
PLATE 2

SKETCH PLAN
OF
Livingstone's Prospect
WESTMORELAND AREA
(From Photo 5099 · Run 8 · Westmoreland)
Showing Distribution of Exposures of Radioactive Sediments



N

Westmoreland Conglomerate

Upper coarse sandstone member

Lower coarse conglomerate member

1 ½ 0 1 2 MILES

Scale: 1:50,000

Bureau of Mineral Resources. Geology and Geophysics · June 1957

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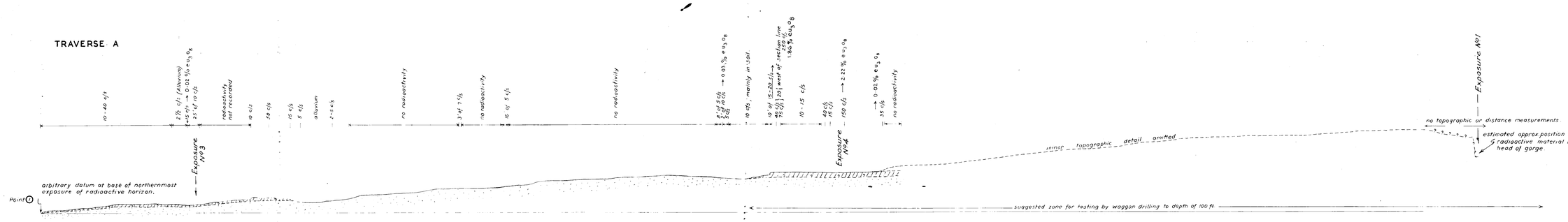
PLATE 3



Radiometric assays of specimens shown thus :
2·22 % eU_3O_8

Cross section looking east of A horizon, Livingstones Prospects, Westmoreland Area.
Traverse Bearing 190° Magnetic.
Traverse levels by Abney & Tape
Estimated accuracy to 15 %
Radiometric measurements by Phillips Monitor GeigerCounter
Regional strike of beds 80°
Regional dip 2° - 3° north

Scale 100' to 1"

100 80 60 40 20 0 100 200 FEET

Horizontal Scale equals Vertical Scale

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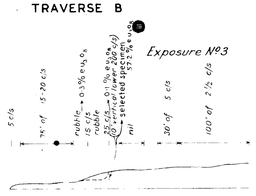

• Traverse approx 2500 ft east of traverse A on western end of outcrops of A radioactive horizon bearing 166° magnetic.

Grab sample 4·0 %
specimen 2·77 % eU_3O_8 = radioactive material at bottom of gorge,
" 8·2 % " position & thickness shown diagrammatic only

Traverse bearing 270°

Traverse looking south from gorge to datum at point 1

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MAY 1957

PLATE 4

SKETCH MAP

Showing

Approximate Outlines of MacArthur River & Kimberley Depositional Basins

Areas recommended for investigation for Westmoreland-type deposits.

Scale :- 100 Miles to 1 Inch

100 50 0 100 Miles

124° 130° 136°

14°

20°

DARWIN

Bulman (Pb. Zn)

Gulf of Carpentaria

Urapunga

Roper R.

(Fe)

Victoria R.

Kimberley Basin

(Lower & Upper Adelaidean)

Yampi (Fe)

Iron Bearing Beds

Iron Bearing Beds

Iron Bearing Beds

Mac Arthur River Basin

(Mainly Upper Adelaidean)

MacArthur River (Pb. Zn)

MacArthur R.

Borroloola

Calvert Hills

Redbank (Cu)

Blackwells (U)

Pandanus Ck (U)

Westmoreland

Livingstones Prospect (U)

Nicholson R.

Burketown

Constance Range (Fe)

Tennant Creek

Alice Springs

Jervois Range

Mt. Isa

QUEENSLAND

WESTERN AUSTRALIA

NORTHERN TERRITORY

124° 130° 136°

Bureau of Mineral Resources, Geology and Geophysics · June 1957.

Q50/4

PLATE 5

GEOLOGICAL SKETCH MAP

Livingstone's Prospect Area

Showing Position of Airborne Radiometric Anomalies in Relation to Regional Geology

Approximate Photo Scale

½ 0 1 2 miles

Reference

- Westmoreland Conglomerate
- Cliffdale Volcanics
- Anomalies Inspected
- Radioactive Anomaly
- Radiometric Contours

Bureau of Mineral Resources, Geology and Geophysics · June 1957

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