Copy 2

COMMONWEALTH OF AUSTRALIA.

---

**DEPARTMENT OF NATIONAL DEVELOPMENT.**

BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS.

---

**RECORDS.**

1954/10

# PRELIMINARY REPORT ON THE A.B.C. URANIUM PROSPECT, KATHERINE AREA, NORTHERN TERRITORY.

by

N. O. Jones

CANBERRA.

# PRELIMINARY REPORT ON THE A.B.C. URANIUM PROSPECT, KATHERINE AREA, NORTHERN TERRITORY.

by

N. O. Jones

Records No.1954/10.

## CONTENTS.



## PLANS AND SECTIONS.

| Plate No. | | Scale |
|---|---|---|
| 1. | Locality map and reference to Australian 1-mile and 4-mile series | |
| 2. | Preliminary Geological Map | 100 ft: 1 in |
| 3. | Preliminary Geological Map | 40 ft: 1 in |
| 4. | Sections along costeans and Radiometric Profiles and Assay Results. | 10 ft: 1 in |

# PRELIMINARY REPORT ON THE A.B.C. URANIUM PROSPECT, KATHERINE AREA, NORTHERN TERRITORY.

## SUMMARY.

(1) The A.B.C. Prospect, situated approximately 11 miles north-north-east of Katherine township, has been found in volcanic and pyroclastic rocks which form part of the Mt. Callanan Group of Upper Proterozoic age.

(2) Uraniferous minerals, autunite and phosphuranylite, are contained largely in banded "veins" which show irregular and discontinuous outcrop. The origin of the "veins" is in doubt, but they are probably composed of hydrothermally altered volcanic rocks.

(3) Distribution of uraniferous ore suggests concentration and possible transport by ground water to form a near-surface zone of enrichment.

(4) Development to date has been by costean and of 38 assay samples, representing a length along costeans of 104 ft., 24 give values greater than 0.1% $eU_3O_8$; the highest value being 1.532% $eU_3O_8$.

(5) The prospect cannot be properly evaluated until some costeans are deepened and extended, shallow holes drilled to seek the zone of primary ore and detailed geological mapping extended.

## INTRODUCTION.

In the course of geological investigation of the area included in the Katherine, Mt. Todd and Lewin Springs 1-mile sheets, carried out by J. H. Rattigan and A. B. Clark, Bureau of Mineral Resources, A. B. Clark found, in September 1953, uranium mineralization subsequently know as the A.B.C. Prospect, 11 miles north-north-east of the township of Katherine.

This report is a record of the detailed investigation which followed the discovery. The work was carried out in September and October, 1953, under the direction of D. E. Gardner.

Access to the prospect is provided by a dry-weather track which runs north-north-east from Katherine, following the trend of Cnuckey and McAdden Creeks. This track passes approximately 2 miles south of the prospect to which a connecting road will be constructed by the Department of Works as soon as weather permits.

## REGIONAL GEOLOGY.

Strata of both Lower and Upper Proterozoic age outcrop in the Katherine region and these are overlain in places by Cambrian and Mesozoic sediments. Strongly folded tuffaceous sandstones and slates of the Brocks Creek Group (Lower Proterozoic) have been intruded by granitic masses and are overlain unconformably by a sequence of more gently folded interbedded pyroclastics, lavas and sediments - the Edith Creek Volcanics and overlying Mt. Callanan Group - which are referred to the Upper Proterozoic.

The rocks in the vicinity of the A.B.C. Prospect (see Plate 1) are entirely of Upper Proterozoic age and include portion of both the Edith River Volcanics and the Mt. Callanan Group. The Edith River Volcanics in this area consist mainly of andesitic and dacitic lavas, pyroclastics and interbedded tuffaceous sediments.

The Edith River ~~Group~~ VOLCANICS is overlain unconformably by the Mt. Callanan Group, also of Upper Proterozoic age. The Mt. Callanan Group consists of alternating members of sandstones and volcanics. The basal member has in places, a basal conglomerate but is mainly conglomeratic sandstone, with a well-bedded sandstone at the top. Current-bedding is typical of both sandstones. A few thin beds of red-brown siltstone are present near the top of this member, which has a thickness of 3,000 feet in the type section at the Edith Falls but may be thinner near the prospect.

The second member of the Mt. Callanan Group consists of volcanic and pyroclastic rocks including amygdaloidal basalt, dense blue basalt, dolerite, acid lavas, tuffs and agglomerate. It is within this member that the A.B.C. Prospect occurs. The amygdular fillings in the basalts comprise zeolites, carbonates, and chalcedony and are in places copper-bearing. Near the prospect the copper-bearing band appears to lie toward the top of the member. These volcanics have a probable thickness of about 800 feet.

Above these volcanics is another sandstone member, finer-grained than the basal member, and having a distinctive bed of red micaceous siltstone at the top. At the Edith Falls the next member consists of basalt flows and pyroclastics but these do not appear to continue south to the vicinity of the A.B.C. Prospect. The highest known member of the Mt. Callanan Group is composed of sandstones.

The Mt. Callanan Group is overlain by rocks of Cambrian age to the west, and of Mesozoic age to the north, but these do not occur near the Prospect.

The Brock's Creek Group is tightly folded but the overlying rocks of Upper Proterozoic age are broadly folded into domes and basins with their longer axes trending north or north-west. The A.B.C. Prospect occurs on the western flank of the Edith Falls basin and the dips in the area, where not disturbed by faulting, are about 20 degrees to the north-east. Considerable faulting has occurred, the major faults generally having a north-easterly trend.

## LOCAL GEOLOGY

### Rock types and alteration

The A.B.C. Prospect lies in the lower part of the first volcanic member of the Mt. Callanan Group. It was not possible to obtain a stratigraphic section across the volcanics in the vicinity of the prospect because of poor exposures and disturbance by faulting.

Much of the rock in the area immediately adjacent to the prospect is an amygdaloidal volcanic rock of andesitic or basaltic composition. One thin section from a highly weathered specimen was available for examination. The ferromagnesian minerals had been entirely destroyed by weathering or alteration but the structure of the felspars remained. The filling of the amygdules was dominantly chalcedony with some quartz and serpentinous material. Also present are other rocks which appear to be fine-grained non-amygdaloidal volcanics. Tuffaceous rocks are possibly interbedded. The three types of volcanics shown in the sections in Plate 4 were based on hand specimens only, and this, together with the high degree of weathering in most specimens, made determination and mapping difficult. The two aphanitic volcanics appear to be gradational, being amygdaloidal phases of the same rock-type.

Within these volcanics "veins", apparently contain the uraniferous minerals. The veins have an irregular and discontinuous outcrop (see Plate 3) and much of the material exposed is fragmental and very little definite information was obtained outside the costeans. The veins have moderate to vertical dips and strikes ranging from 330 degrees through north to 090 degrees. They range in width from 1 inch to 4 feet, commonly about 1 feet.

The colour of the "veins" varies from green and fawn to red depending on the amount of hematite present. Some are very siliceous and hard, others contain considerable soft earthy

material, and these different types in some places appear to be gradational. The "veins" generally show sharp contacts with the surrounding volcanics but in costean F the section from 18 to 33 feet ( from the south end) was logged as a non-amygdaloidal volcanic but specimens from it seem to have similarities to the "veins", being brecciated and somewhat hematitic in appearance.

The minerals present in the veins are quartz, sericite, chlorite and iron ore (mainly hematite), and the ground mass is dominantly cryptocrystalline.

A feature of many of the "veins" is a marked banding, in some places regular, in others irregular. The strike of this banding is not consistent but the dip never exceeds 30 degrees and is commonly less than 10 degrees. There is no relationship between the dip and strike of the veins and those of the banding.

Several of the thin sections are open to more than one interpretation and with the limited field evidence available the nature of the "veins" remains uncertain. They are definitely not fracture fillings and in some cases appear to be altered volcanic rock, similar to the country rock, the banding being interpreted as a flow structure. The extent of hydrothermal alteration and introduction of material cannot be accurately gauged because of the extensive weathering in the available specimens and the recrystallization of the fine matrix. The proportion of introduced material would appear to be low except, perhaps, in some of the more hematitic specimens when irregular masses of earthy iron ore may indicate pyritization in the primary zone. Some of the "vein" rocks are strongly brecciated and finely veined with quartz and this appears to have followed an earlier alteration of the volcanic rock and possible introduction of silica and iron.

A long sequence of events has probably been involved in the formation of the "veins" and variations in them may be due to the omission of parts of the sequence e.g. late brecciation, in some of the "veins". Thus many of the "veins" may be zones of altered rock which have never been mineralized to a significant degree.

Mineralization

The uranium-bearing minerals so far observed at the prospect are the phosphates autunite and phosphuranylite. These secondary minerals are distributed along planes in the "veins" and adjoining volcanics and also as fillings in small cavities which occur in the more highly hematitic portions of the "veins". The amount of uraniferous minerals present is more or less proportional to the development of hematite in the veins. It is probable that some of this iron was introduced with the uranium but evidence of any other mineralization is lacking.

The distribution of the oxidized uraniferous ore appears, from the development carried out, to be subject to sharp changes in a vertical direction, which are controlled by topography rather than rock type and possible hydrothermal alteration. The present position of the ore is apparently due to concentration and possible transport by ground waters to form a near-surface enriched zone. This is illustrated by the distribution in costeans A and C.

At 40 to 50 feet from the southern end of costean A surface counts were 2,000-10,000 per minute with, in part, abundant autunite. At a depth of 1 to 2 feet the maximum development of autunite was present with counts of 5,000 to greater than 10,000 per minute. Part of the costean was deepened to 3 feet 6 inches and at this depth much less autunite was visible and counts had decreased to 1,000 to 5,000 per minute. These variations are noted in both the volcanics and a high angle "vein".

At 80 to 105 feet from the southern end of costean C, surface counts ranged from 150 to 700 counts per minute (in part over sandy alluvium). At a depth of 12 to 18 inches (in bedrock) counts ranged 1,000 to 6,000 per minute. At a depth of 2 feet 6 inches to 3 feet 6 inches counts exceeded 10,000 per minute over half the section and

nowhere were less than 5,000 per minute. Two veins dipping at moderate angles cut the volcanics in this section.

These examples show:- marked reduction in count due to shallow soil cover; a probable near-surface enrichment and suggest the possibility of lateral spread during this near-surface enrichment.

At several points in McAdden's Pocket permanent water is supplied by springs issuing from fault planes or by ground water trapped above "bars" of sandstone. It is considered that the water table, and the primary zone, will be met at a fairly shallow depth. The presence of "veins" of altered rock, together with the rich showings of secondary ore, must be regarded as favourable for the existence of a significant body of primary uranium ore.

Structure.

A complex joint pattern is developed in the volcanics at the prospect but little other structure can be seen. The only places where flow structure has definitely been observed are in some of the "veins". Sporadic indications of possible shearing have been observed which show great variation in both dip and strike. Narrow veinlets of quartz and specular hematite cut irregularly across the volcanics but appear to be concentrated near the "veins". The veins are probably fracture-controlled but no relationship has been observed to the joints in the volcanics.

The underlying sandstones are well exposed to the south, west and north of the prospect. The bedding is disturbed but the overall direction of dip is to the north, ranging 330 to 080 degrees, with the angle of dip 25 to 85 degrees, commonly about 70 degrees. These sandstones are highly fractured and individual blocks often show slickensides on several faces. Many of the fractures are coated with quartz or hematite. There has probably been only minor displacement along many of these slickensided faces but faults trending approximately 080 degrees appear to be important because they mark changes in direction and attitude of bedding. There is also some evidence of faults trending slightly east of north.

A major fault occurs approximately 500 feet south of the prospect, but its position is indefinite in this area due to concealment by alluvium. It trends approximately 050 degrees, and dips at a high angle, probably to the south-east. The southern side has been downthrown and displaced to the west and, near the prospect, the apparent horizontal displacement is nearly a mile. Many minor faults can be shown to be associated with this fault and probably the easterly trending faults west of the prospect are related to it.

A minor doming is superimposed on the major basin structure south of the fault, and if repeated on the northern side would occur in the vicinity of the prospect.

## GEOPHYSICAL INVESTIGATIONS

Following the initial investigation of the prospect an area of 500 by 400 feet shown in plate 3 was investigated by radiometric grid by R. de Groot, Geophysicist. The background scintillometer count for the area, obtained over sandstone detritus, was 15 counts per second. An anomalous area with greater than 40 counts per second extended 340 feet in a north-easterly direction and had a width of 200 feet, and showed a general correspondence with the area of outcropping volcanics. A smaller area extending 200 feet in a north-easterly direction and 70 feet wide had greater than 75 counts per minute. An area 80 feet long and 20 feet wide had greater than 500 counts per second.

No further geophysical work was carried out while the mapping and costeaning were in progress but during November and December 1953 the radiometric grid was extended to cover a large area adjoining the prospect, and magnetic and self-potential surveys of the area most likely to contain ore were commenced. The results

of this later work are not available for inclusion in this report.

During the logging of the costeans, radiometric profiles were obtained by use of an Austronic Ratemeter, type PRM 200. The background count in the costeans was 80 counts per minute, but as low as 40 counts per minute was obtained on sandstone detritus. These profiles are shown with the sections of the costeans in Plate 4.

## SAMPLING AND ASSAYS

Following the discovery of the prospect two grab samples of the better grade of ore exposed were taken and values of 0.59% and 0.457% eU308 were obtained by radiometric assay.

Further assay samples were taken from channels cut along the bottoms of the costeans (representing lengths of 3 feet except in costean A where lengths were 2 feet and 2 feet 6 inches) The values obtained for these samples by radiometric assay are tabulated below and shown graphically in Plate 4.

| Sample No. | Costean | Length of section (Measured from SE end of costean) | Assay Value % eU308 |
|---|---|---|---|
| A8905 | A | 48'-50' } Depth 2 ft. | 0.066 |
| A8906 | " | 46'-48' } | 0.131 |
| A8907 | " | 44'-46' | 0.192 |
| A8908 | " | 42'-44' | 0.351 |
| A8909 | " | 40'-42' | 0.218 |
| A8910 | " | 37'6"-40' | 0.663 |
| A8911 | " | 35'6"-37'6" | 0.183 |
| A8912 | " | 33'6"-35'6" | 0.064 |
| A8922 | " | 46'-48' } | 0.046 |
| A8923 | " | 49'-50'6" } 3 ft. 6 ins. | 0.023 |
| A8913 | B | 8'11" | 0.072 |
| A8914 | " | 11'-14' | 0.072 |
| A8915 | " | 42'-45' | 0.08 |
| A8916 | " | 50'-53' | 0.066 |
| A8917 | C | 56'-59' | 0.022 |
| A8918 | " | 59'-62' | 0.049 |
| A8919 | " | 62'-65' | 0.072 |
| A8920 | " | 65'-68' | 0.178 |
| A8924 | " | 68'-71' | 0.431 |
| A8925 | " | 71'-74' | 0.921 |
| A8926 | " | 74'-77' | 0.990 |
| A8927 | " | 77'-80' | 1.523 |
| A8928 | " | 80'-83' | 0.759 |
| A8929 | " | 83'-86' | 0.768 |
| A8930 | " | 86'-89' | 0.217n |
| A8931 | " | 89'-92' | 0.290 |
| A8932 | " | 92'-95' | 0.449 |
| A8933 | " | 95'-98' | 0.800 |
| A8934 | " | 98'-101' | 0.739 |
| A8917 | " | 100'-102' | 0.560 |
| A8952 | F | 15'-18' | 0.027 |
| A8953 | " | 18'-21' | 0.144 |
| A8954 | " | 21'-24' | 0.800 |
| A8955 | " | 24'-27' | 0.747 |
| A8956 | " | 27'-30' | 0.559 |
| A8957 | " | 30'-33' | 0.306 |
| A8958 | " | 33'-36' | 0.083 |
| A8959 | " | 36'-39' | 0.058 |

Of a total of 38 assay samples, representing a length along costeans of 104 feet, 24 gave values greater than 0.1% eU308, the highest value obtained being 1.523% eU308. Sections with higher values are summarised in the table below:-

| Costean | Section containing at least 0.1% eU3O8 (measured from SE end of costean). | eU3O8 Content of Section | | |
|---|---|---|---|---|
| | | Minimum % | Maximum % | Average % |
| A | From 35'6" to 48' (12'6") | 0.131 | 0.663 | 0.305 |
| C | From 65' to 102' (37') | 0.178 | 1.523 | 0.75 |
| F | From 18' to 33' (15') | 0.144 | 0.800 | 0.511 |

The northern end of the section noted in costean C corresponds to the edge of alluvium in the costean and deepening of the costean might considerably extend the length of this section.

No chemical assays have been made of ore from the A.B.C. Prospect but from the mineralogical determinations made it may be assumed that the radioactivity at the prospect is deminantly due to uranium.

All portions of costeans with greater than 2,000 counts per minute (Austronic Ratemeter) were sampled and also some portions with 1,000-2,000 counts per minute. Good correspondence was found between geiger count and radiometric assay value. It is considered that all portions of costeans containing greater than 0.1% eU3O8 have been sampled.

In considering the significance of the assay results consideration must be given to the previously discussed possibility of near-surface enrichment and the likelihood that in this enriched zone considerable lateral spread of ore has occurred. The assay values both in value and extent, are probably greater than those likely to be obtained in the lower part of the oxidised zone. Because of these possibilities, and the absence of information about the primary ore, no estimate of reserves can be made at present beyond the small quantity of approximately 200 tons disclosed by the costeans.

## DEVELOPMENT

The prospect, as outlined by the radiometric grid, was mapped at a scale of 40 feet to 1 inch, and a larger area at a scale of 100 feet to 1 inch (see Plates 1 and 2).

Development of the prospect, to date, consists of eleven shallow costeans. Sections along the costeans are shown in Plate 4. Six narrow costeans (A-F) were dug by hand labour across the prospect, in a direction approximately perpendicular to the axis of the radiometric anomaly. These costeans are parallel, approximately 40 feet apart, and have a total length of 550 feet. Outside the area giving high geiger counts, the costeans are generally 12 to 18 inches deep and because of soil cover and highly weathered rock little information can be gained. Where the counts are higher, depths range from 2 feet to nearly 4 feet and it is from these portions that most information about the prospect has been obtained.

The five bulldozed costeans, (H-L), have a total length of 1400 feet, but are in areas covered by alluvium and deeper soil. None have been carried to an adequate depth and very little information has been gained from them.

## CONCLUSIONS AND RECOMMENDATIONS

The A.B.C. Prospect cannot be properly evaluated at this early stage of development. The association of rich secondary uraniferous ore and "veins" of probably hydrothermally altered rock

is promising but no evidence has yet been observed of major primary mineralization.

The hand-dug costeans B, C, D and F require deepening as below:-

| Costean | Length | Reason for further work |
|---|---|---|
| B | | To determine source for high counts as no uranium minerals visible. |
| C | | To determine continuation in depth of rich ore, and expose possible vein intersection. |
| D | | To test for richer ore beneath present observed radioactivity. |
| | | To test for possible ore and obtain information on nature of veins. |
| F | 18-33 ft. | To obtain information on nature of veins. |

All the bulldozed costeans need some extension and considerable deepening in order to expose possible concealed uraniferous material and to determine the position of the sandstone-volcanic boundary which appears to provide the best "marker" for structure, and may also have been a locus for mineralization.

Mapping of a larger area is required to obtain information on structure and to outline further areas in the vicinity which appear suitable for mineralization. It is intended to carry out further geophysical work as soon as possible in 1954. Further petrological work will obviously be needed when more suitable material becomes available.

A programme of drilling has been laid down subject to the further testing of the prospect being carried out by the Bureau of Mineral Resources. Shallow vertical drilling should help to indicate the extent of the "veins", the nature of the primary zone and the position of the underlying sandstone. Drilling for a deeper intersection is not advisable because of the irregular nature of the veins and the possibility that the underlying sandstone may be found at a fairly shallow depth.

## ACKNOWLEDGMENTS

The writer gratefully acknowledges the assistance of W. B. Dallwitz and D. A. White with petrological and mineralogical determinations and particularly the help of D. E. Gardner who was in charge of the field work at the prospect.

## REFERENCES.

MATHESON, R. S., 1953 - Progress report on the A.B.C. Prospect at 31st Oct., 1953. Bur.Min.Resour.Aust., Records 1953/123.

RATTIGAN, J. H., and CLARK, E. B. 1954 - The Geology of the Katherine, Mt. Todd and Lewin Springs sheets, Norther Territory. Bur.Min.Resour.Aust., Records 1954/?

PLATE 1

# LOCALITY MAP

# A.B.C. URANIUM PROSPECT

## KATHERINE AREA
## NORTHERN TERRITORY

Approximate True North

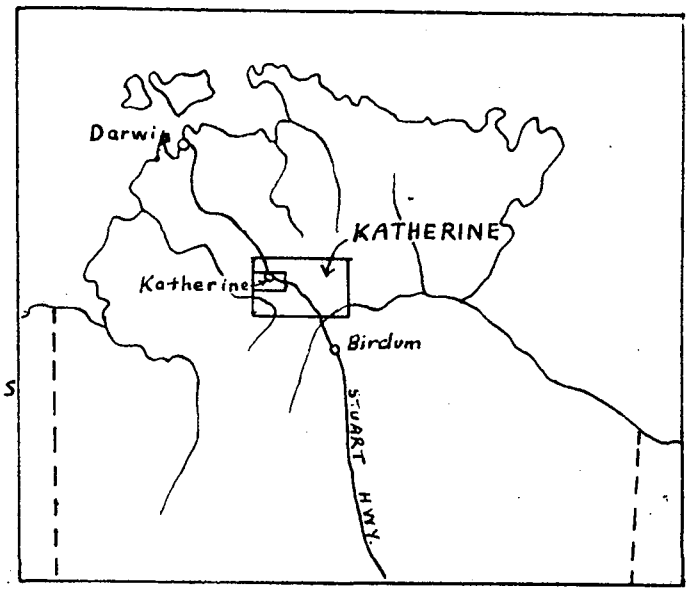
Map at scale of aerial photographs, approximately 2 inches to 1 mile.

REFERENCE

| | | |
|---|---|---|
| $P_{\mu c_E}$ | Sandstone | Mt. Callanan Group |
| $P_{\mu c_C}$ | Well bedded sandstone and thin red siltstone | |
| $P_{\mu c_B}$ | Basalts and pyroclastic rocks | |
| $P_{\mu c_A}$ | Massive, jointed conglomeratic sandstone | |
| $P_{\mu e}$ | Andesites, dacites, pyroclastics and tuffaceous sediments | Edith River Volcanics |

Fault, definite

Fault, probable




POSITION OF AREA DEALT WITH IN REPORT AND REFERENCE TO AUSTRALIAN FOUR-MILE AND ONE-MILE SERIES

AREA SHOWN IN PLATE 2

To Katherine

Traced from aerial photographs by N. Jones

Geology largely after Rattigan & Clarke

PLATE 2

# GEOLOGICAL PLAN
# A.B.C. URANIUM PROSPECT
## KATHERINE AREA
## NORTHERN TERRITORY

SCALE

100 50 0 100 200 300 400 Ft

T.N. M.N.

REFERENCE

- $Q_{TS}$ Soil and wash
- $P_{\mu c_B}$ Volcanics
- $P_{\mu c_A}$ Sandstone
- Si, He Silicification and haematisation along joints
- Probable faults
- Baseline and peg
- 100 Contour (As. datum 100ft at A)

Fragments of sandstone possibly in situ

Plane table and telescopic alidade survey and geology by D.E. Gardner + N. Jones, Sept-Oct. 1953.

NT 66-2

PLATE 3

# GEOLOGICAL PLAN

# A.B.C. URANIUM PROSPECT

## KATHERINE AREA
## NORTHERN TERRITORY

SCALE

40 20 0 40 80 120 160 Ft.

T.N. M.N.

REFERENCE

$Q_{TA}$ Soil and wash

$P_{uc_B}$ V

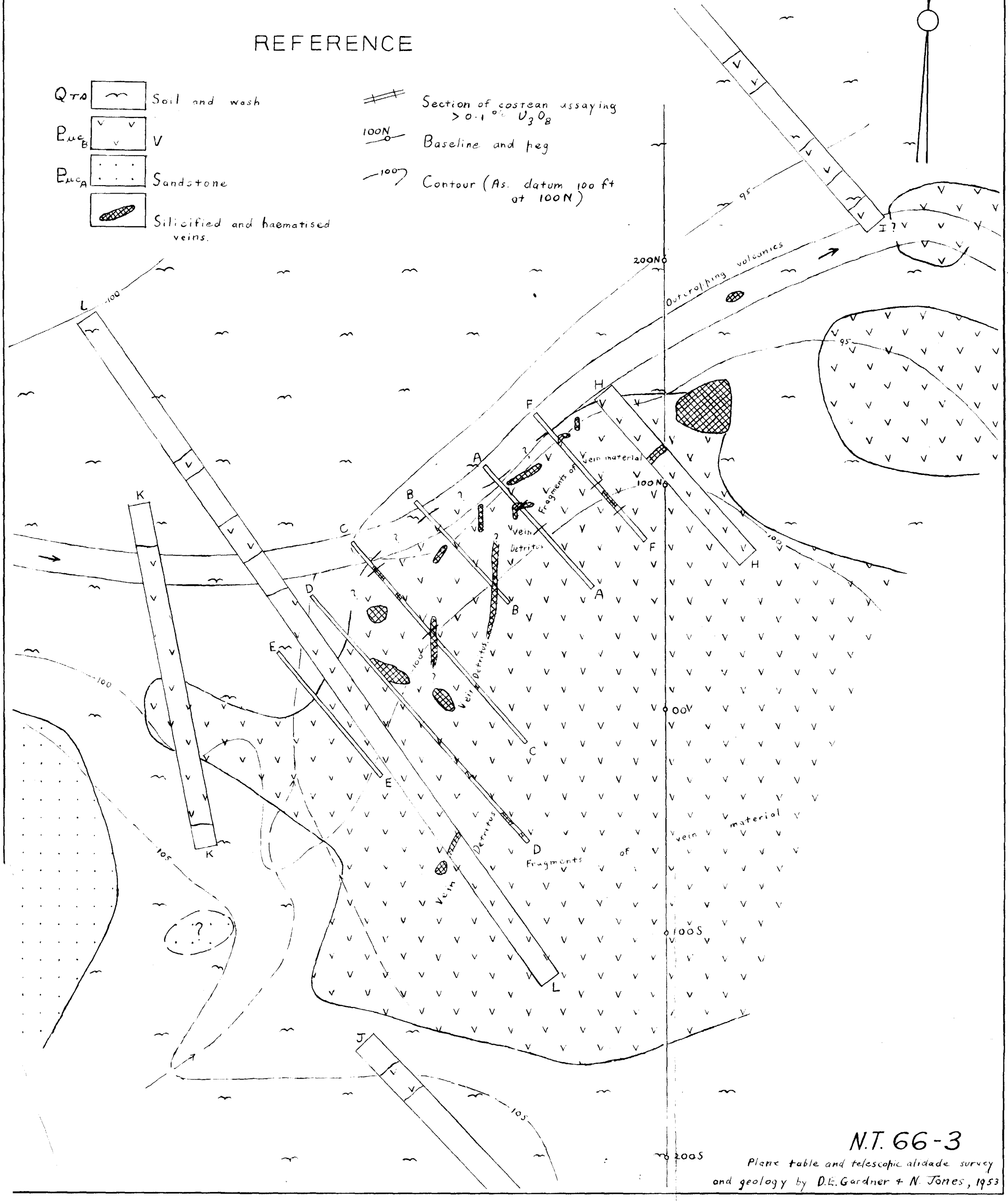
$P_{uc_A}$ Sandstone

Silicified and haematised veins.

Section of costean assaying > 0·1 % $U_3O_8$

100N Baseline and peg

100 Contour (As. datum 100 ft at 100N)




N.T. 66-3

Plane table and telescopic alidade survey and geology by D.E. Gardner & N. Jones, 1953

PLATE 4

# A.B.C. URANIUM PROSPECT

KATHERINE AREA
NORTHERN TERRITORY

## SECTIONS ALONG COSTEANS

showing

## RADIOMETRIC PROFILES

and

## ASSAY RESULTS

### SCALE

Vertical and horizontal

10 0 10 20 30 40 50 FEET

### REFERENCE

$Q_{TS}$ Sandy alluvium

$P_{MC_B}$ Aphanitic (microcrystalline) volcanic, amygdaloidal

" Aphanitic (microcrystalline) volcanic, non-amygdaloidal

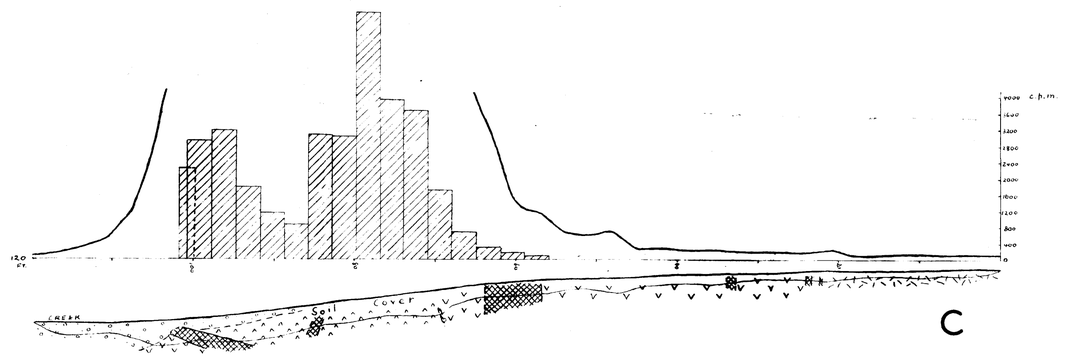
" Fine-grained volcanic, non-amygdaloidal

Silicified and Haematised veins

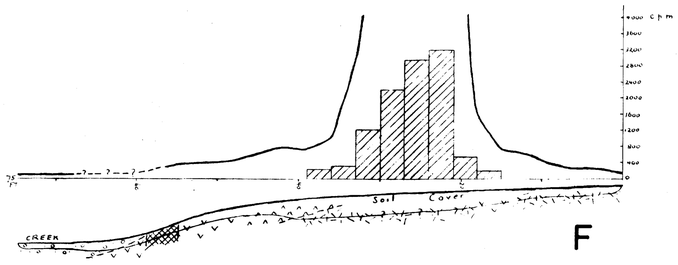
Radiometric profiles along bottom of costean
Counts greater than 4000 c.p.m. not shown
Background count on volcanics is 80 c.p.m. (using Austronic PRM 200)

Profiles showing original surface and bottom of costeans
Distances measured from SE end

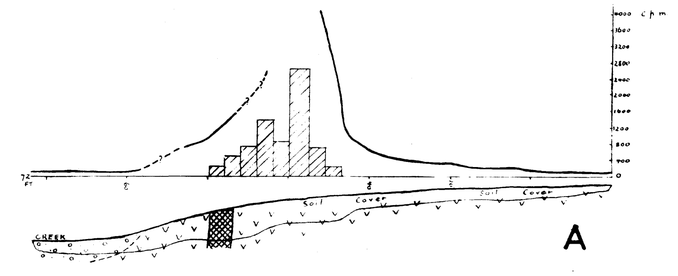
Assay results
Height proft. to value of assay (1 inch = 0·500% $eU_3O_8$)
Base proft. to length of sample channel on bottom of costean



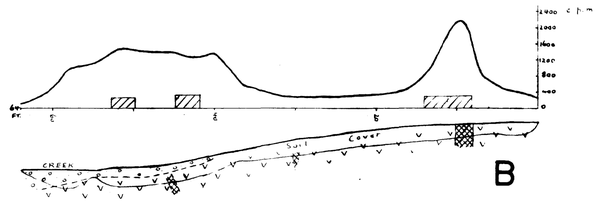

C



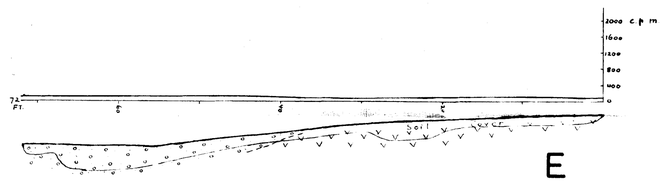

F



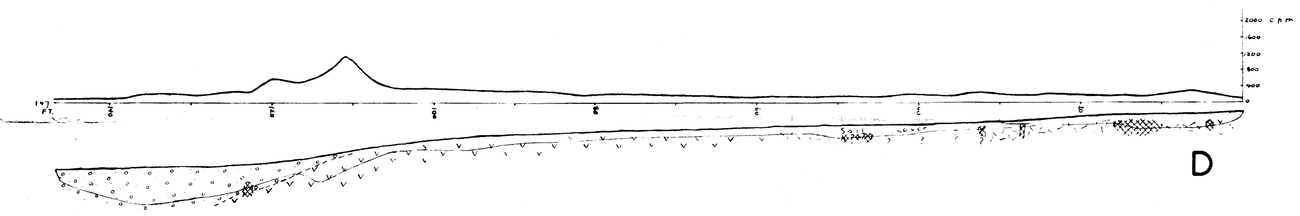

A



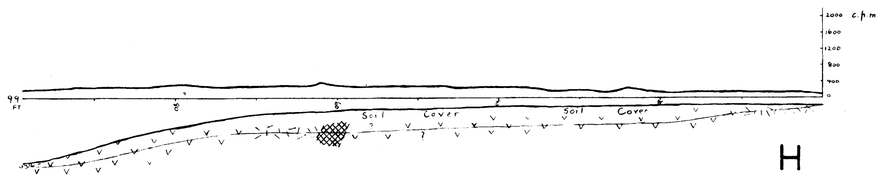

B



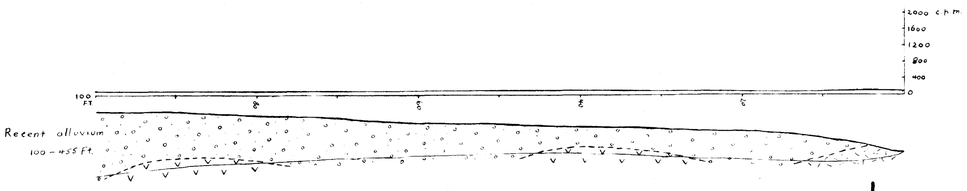

E



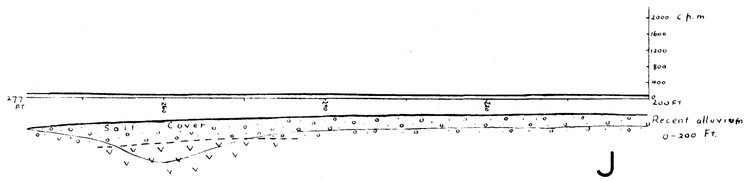

D



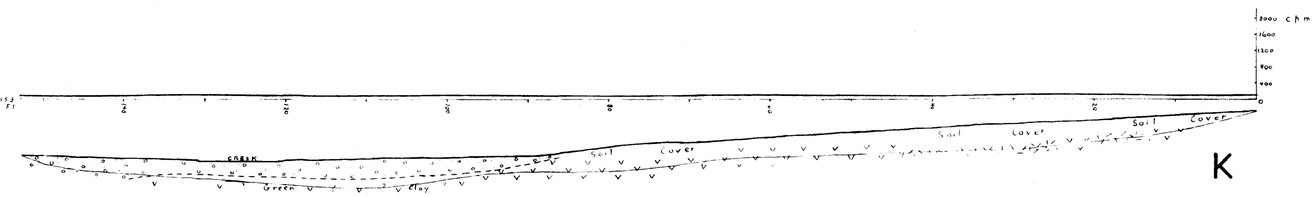

H



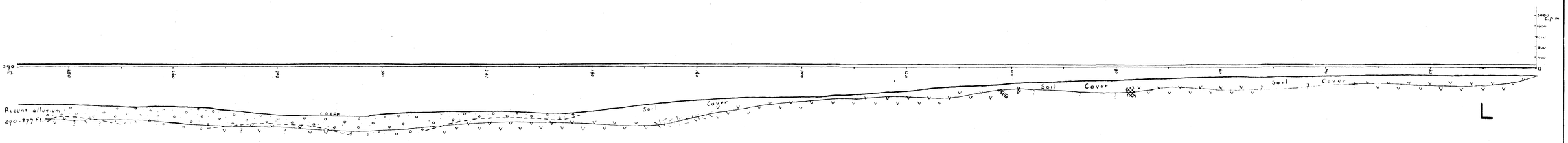

I




J




K




L

Logging of costeans and sampling
by D.E. Gardner & N. Jones Sept-Oct, 1953