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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

RECORDS

1953/70

PRELIMINARY REPORT ON THE TENNYSON'S NO.2 URANIUM PROSPECT EDITH RIVER, N.T.

By

D.E. GARDNER

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PLANS.

PLATE NO.

SUMMARY.

At Tennyson's No.2 Prospect, 4 miles south-west of the Edith River Railway Siding, Geiger-counts ranging from 4 to 12 times the background count of the area were obtained at 6 localities in and adjacent to two shear-zones. The country-rock is fine-grained granite. The uranium-mineral, probably anturite, occurs within small lenses of hematitic lode material, formed by alteration of fine-grained granite and of narrow acidic(?) dykes. Geiger-counts exceeding 4 times background were obtained over lengths of about 8 feet and 17 feet in two lenses occurring along the strike of the shear-zones, and over a length of 6 feet in one lens occurring in a (?) tension-fracture near the main shear-zone. Elsewhere, the uranium-mineral appears to be restricted to smaller portions of the lenses, possibly adjacent to cross-joints or cross-fractures.

Small grab-samples taken from the surface down to a depth of about 3 inches contained uranium oxide, ranging from 0.02 to 0.26 per cent by weight. On the basis of the sampling that was done, one prospect, apparently the best, probably contains, from the surface down to a depth of 3 inches, an average of 0.135 per cent uranium oxide, over a length of 13 feet and average width of 15 inches. Inspection of the prospect under ultra-violet light shows a marked increase in the proportion of fluorescent mineral at a depth of a few inches below the surface, and hence the surface-samples that were taken may be expected to contain a lower proportion of uranium oxide than the lode-material at slightly greater depths.

INTRODUCTION.

Geiger-counts exceeding 4 times the background-count in the area were obtained early in 1953 by Mr. S. Tennyson at 6 localities along shear-zones 3¼ miles south-west of the bridge across the Edith River on the Stuart Highway. The area was inspected by R. S. Matheson and D. E. Gardner during May, 1953, and mapped later in the month in a plane-table survey by D. E. Gardner and N. O. Jones. Samples were taken from each of the localities where high geiger-counts were obtained, and then uranium-oxide content was determined radiometrically at Darwin. A base-line was pegged to facilitate geophysical investigation of the area.

SITUATION AND ACCESS.

Tennyson's No.2 Uranium-Prospect is 3½ miles west of the Stuart Highway, and 3¾ miles south-west of the highway bridge across the Edith River, which is 177 miles by road southwards from Darwin and 33 miles northwards from Katherine. The Edith River Siding on the Darwin-Birdum Railway is ¼ mile east of the highway-bridge. The prospect is reached by travelling 3½ miles westward along the Florina track, which leaves the Stuart Highway ¼ mile south of the bridge and thence 2¼ miles southwards. The No. 2 Prospect is 1½ miles in a direct line south-south-east of Tennyson's No.1 Prospect discovered by him late in 1952, and 4½ miles west of "The Edith River Uranium-Bearing Area", (Fisher, 1952)

GENERAL GEOLOGY.

Tennyson's No.2 Prospect lies within the southerly extension of the Cullen granite. (Fisher, 1952). About ¼ mile west of the Prospect, a narrow belt of felspathized sandstones of the Brocks Creek group crop out from beneath a lateritic cover. The granite in the area is fine-grained, and in places

it contains scattered phenocrysts of felspar. The proportions of the essential minerals - quartz, felspar, and biotite - change rather abruptly from place to place, and as a result, a small area may contain typical quartz-orthoclase-biotite granite, along with types that are more quartzose or more felspathic. The boundaries of these compositional types were not mapped.

SHEAR- and FRACTURE-ZONES.

The main structural features in the area mapped comprise three systems of shear- and fracture-zones, one striking 333 to 337 degrees and dipping at high angles to the west, another at 070 to 080 degrees, vertical, or dipping at high angles to both north and south, and a third striking at about 050 degrees, and apparently vertical. The earliest fracturing appears to have been shearing under compression, accompanied by minor silicification or gneisenization, along the shear-zones trending 333 and 337 degrees. This was succeeded by tension-fractures trending 070 to 080 degrees, into which vein-quartz was introduced. Later, slight displacement along the tension-fractures resulted in relative westward movement of the northern walls and slight brecciation of the vein-quartz. Shearing or faulting with a considerable horizontal component then took place along the shear-zone trending 333 degrees, giving an apparent northward displacement of the eastern side over a length of 430 feet. Intrusion of narrow acidic (?) dykes into the shear-zones, and successive hematite and hematite -uranium mineralizations may be related to the end-stage of these movements.

The latest fracturing that was accompanied by significant displacement was in a broad, poorly-defined zone trending approximately 050 degrees. This movement offset the 333- and 337- degree shear-zones approximately 300 feet. Minor quartz-veins are associated with it. A strong jointing at 039 to 044 degrees, which, in places, appears to be related to the hematite-uranium mineralization, may have developed during the final movements along the 333-degree shear-zone.

The main shear-zone, trending 333 degrees, contains a vein of quartz-flourite-(?) carbonate. This has filled a tension-fracture, which may have been opened by the stress that later gave rise to the latest faulting observed in the area, viz., that which trends 050 degrees.

Shear-zone NS/1. This shear-zone has been mapped over a length of approximately 800 feet, from its northern end southwards. It is about 60 feet wide, trends 333 degrees, and dips measured on siliceous bands in it range from 78 to 85 degrees west. It is made up mainly of fractured and sheared fine-grained granite - the country-rock - in part silicified. Narrow, lenticular quartz-veins and stringers, introduced probably during the main period of horizontal displacement, have been fractured by later movement, but nor markedly brecciated. Late introductions into the shear-zone include, in succession, a narrow acidic (?) dyke, hematite, hematite and uranium-bearing minerals, and a vein of quartz-fluorite-(?)carbonate.

The western side of shear-zone NS/1 is marked by strong platy shearing or jointing which terminates at fracture-zone EW/1. Hence, the earliest movements in shear-zone NS/1 preceded those in fracture-zone EW/1. Later movements along NS/1 resulted in a 430-foot northward displacement of the eastern part of EW/1, to the position of EW/2. The earliest movements appear to have been accompanied by silicification,

and perhaps some greisenization, along the platy joint-planes. During the later movements, narrow lenticular veins of quartz were deposited within the shear. A subsequent slight movement along the strike, probably accompanied by slight tension rather than compression, provided openings for the successive introduction of a narrow acidic dyke (? toscanite), of hematite, and of hematite together with one or more uranium-bearing minerals.

The (?) dyke rock occurs in narrow, lenticular or vein like masses along the strike of the shear-zone, and is a "stockwork" in slightly-brecciated portions of it. It may also have entered tension-fractures adjacent to NS/1, trending about 040 degrees. The hematite appears to be in part associated with the acidic dyke. It has replaced portions of the dyke-rock and also of the adjacent sheared granite both along the strike of the shear-zone and apparently adjacent to fractures or joint-planes across it, forming a hematitic rock containing grains of quartz, uniformly distributed. Uranium minerals occur in places in the hematitic rock.

A vein of "sugary quartz" containing fluorite and probably calcite, and in places barite, occurs within the shear-zone. It is not noticeably jointed or brecciated. Branches from the main body cut across the shear-zone, e.g., towards the southern end of the area mapped, in a direction approximately 320 degrees. The quartz-fluorite - (?) carbonate vein has apparently been deposited in tension-fractures, opened up, possibly, by the stress that later caused fracturing at the northern end of N.S./1, and displacement along a zone trending 050 degrees. This faulting has displaced the northern ends of shear-zones N.S./1 and N.S./2 to the positions of N.S./4 and N.S./3, respectively. A mass of sheared rock 100 feet north-northeast of the northern end of shear-zone N.S./1, adjacent to the 050 degree fracturing is apparently a displaced portion of N.S./1.

Shear-Zone N.S./2. Shear-zone N.S./2 has been mapped over a length of 500 feet, southwards from its northern end. The strike is 337 degrees and it dips 87 degrees west. Near the northern end, its width is 40 to 50 feet, although this may comprise two parallel shears enclosing a band of relatively massive granite. The shear-zone has been displaced by minor faulting in a north-easterly direction at points 110 feet and 260 feet northwards from fracture-zone E.W./1. At these two localities the northern part has been offset 5 feet and 30 feet, respectively, to the east. Silicified bands, and lenticular quartz-veins up to 1 foot thick crop out along the strike of the shear-zone, forming a resistent band about 5 feet wide. A brecciated and hematized mass 13 to 18 feet south of fracture-zone E.W./1 gives geiger counts up to 12 times the background count.

The shearing in zone N.S./2 must have preceded that in E.W./1, which has slightly dislocated it, and may have been contemporaneous with the early fracturing in zone N.S./1. The stress that brought about the large horizontal displacement in zone N.S./1 does not seem to have affected zone N.S./2. However, the highest geiger-counts at the N.S./2 uranium-prospect appear to be associated with a jointing trending 038°, and this can probably be linked with tension fractures resulting from the stress that provided the openings for hematite and hematite-uranium mineralization in shear-zone N.S./1.

Shear-Zone N.S./3. This shear-zone has been mapped from its southern end northwards for 300 feet. Its strike is 337 degrees, dip 87 degrees west, and width near its southern end at least

/ 40 feet.

40 feet. It is offset a distance of 15 feet by shear-zone E.W./3, the northern side moving westwards. The country-rock is fine-grained granite, and the shear-zone contains a hard band 6 feet wide, silicified and in places hematized, immediately north of shear E.W./3. An acidic (?) dyke ranging in width from 2 to 12 inches occurs adjacent to the western edge (hanging wall) of the hard band near the southern end of the shear-zone. High geiger-counts are obtained here in a rock composed of granular quartz embedded in a hematitic matrix. This appears to be in part a replacement of dyke-rock and in part a replacement of sheared, fine-grained granite.

Shear-zone N.S./3 is apparently the faulted northern end of shear-zone N.S./2.

Fracture-Zone E.W./1. Fracture-zone E.W./1 was mapped over a length of 600 feet, from its eastern end to approximately 200 feet west of shear-zone N.S./2. It comprises a quartz-reef up to 1-foot thick, and, on the northern side of the reef, a zone about 4 to 15 feet wide, containing numerous narrow quartz-stringers filling tension-fractures splitting off from the main fracture. These have a trend of 034 degrees, and on their eastern side, form an acute-angle with the main fracture, thus indicating a slight westward movement of its northern side. The quartz-reef is intersected by a later jointing or minor fracturing trending in approximately the same direction as the quartz-stringers. It has been broken up into short segments that have been slightly rotated in an anticlockwise direction, thus indicating a relative northward movement of the eastern walls of the joints or minor fractures. A slight horizontal slickensiding is seen on them.

At about 30 feet westward from shear-zone N.S./1, fracture-zone E.W./1 is intersected by a lenticular body of uraniferous hematitic rock, which trends 026 degrees. This apparently occupies a tension-fracture.

Fracture-zone E.W./1 appears to have originated as a tension-fracture, in which there was a slight westward movement of the northern side. This is verified by a slight dragging of siliceous bands in shear-zone N.S./2. The westward movement along E.W./1 may be related to the westward displacement of the northern portion of shear-zone N.S./3 by shear-zone E.W./3. The fracturing of the quartz-reef in E.W./1 and rotation of the segments may have been contemporaneous with the main horizontal movement along shear-zone N.S./1. The lens of uraniferous hematitic rock may occupy a tension-fracture formed at the time that similar mineralization occurred in shear-zone N.S./1 - supposedly at the end-stage of horizontal displacement in that shear-zone.

Fracture-Zone E.W./2. This fracture-zone has not been examined closely. It is marked by a white quartz-reef about 1 foot wide, and resembles fracture-zone E.W./1. The cross-fracturing at about 034 degrees, which divided E.W./1 into lenticular segments, was not noticed on E.W./2.

Shear-Zone E.W./3. Shear-zone E.W./3 is about 20 feet wide, strikes 072 degrees, and appears to be vertical. It is in part silicified, and in its central position contains veins of white quartz, which have an aggregate width of about 2 feet. The quartz is in part brecciated, presumably by the westward displacement of the northern wall that offset shear-zone N.S./3. Shear-zone E.W./3 is approximately parallel to, and was presumably contemporaneous with fracture-zone E.W./1. The larger horizontal displacement in it is reflected in the development of a narrow shear-zone instead of a simple tension-fracture. Like fracture-zone E.W./1, it has been faulted by

/ the

the horizontal displacement seen along N.S./1, viz., it terminates in an easterly direction at shear-zone N.S./4, which is the displaced northern extension of N.S./1.

Fracture-zones E.W./4 and E.W./5. These appear to be faulted portions of a single fracture-zone. It may have been a tension-fracture, subsidiary to zone E.W./2 - E.W./1, but this is not certain, because, in E.W./4, brecciated quartz-veins occur in a narrow shear-zone, which has an exposed width of 6 feet. This may be due to vertical displacement, but it is possible that minor shearing and brecciation took place along E.W./4 - E.W./5 prior to any fracturing along E.W./1 - E.W./2.

N.E. Fracture-zone. This appears to be a broad zone of platy jointing containing narrow sheared bands, and intervening bands or "horses" of relatively massive granite. A little vein-quartz has been introduced and occurs in short lenses striking 050 to 054 degrees. The northern side of the fracture-zone has been displaced approximately 350 feet in a direction approximately 050 degrees.

OCCURRENCE OF URANIUM.

General. Uraniferous minerals occur (a) within four small tabular or lenticular bodies of hematitic rock along the strike of shear-zones N.S./1, N.S./2 and N.S./3,; (b) in a small outcrop of hematitic rock, surrounded by detrital material, within shear-zone N.S./1, and (c) in a lens of hematitic lode-material in a (?)tension- fracture within fracture-zone E.W./1. The tension-fracture is thought to be a result of stress that caused late movement along shear-zone N.S./1. In two of the tabular or lenticular bodies, viz., at localities A in shear-zone N.S./3 and B 1 in shear-zone N.S./1, a comparatively high geiger-count is obtained for an appreciable distance along the strike. At localities B 3 and D, high counts are restricted to small portions of the hematitic lenses, and this may be a result of replacement adjacent to cross-fractures or joints. At locality C, the lenticular body of hematitic rock is small but given counts ranging from 4 to 12 times background over its length. The outcrop at B 2 is small and its structural environment is not known, but Geiger-counts around it indicate that the body of lode-material is very small.

At each locality, the uranium-bearing mineral fluoresces bright-green under ultra violet light. It cannot be seen in hard-specimen in ordinary light, and presumably it is autemite, either reddish-coloured, or marked by the red colour of the hematite. Assay samples were taken from each prospect. Later inspection by ultra-violet light showed that at the surface, the lode material contains a much smaller proportion of the fluorescing mineral than it does at a depth of a few inches, particularly in localities where the surface-layer of the hematitic rock is weathered and somewhat friable. The samples that were taken, were broken or chipped at or near the surface, using a geological hammer, and hence are probably lower in grade than the lode-material at a slightly greater depth.

The prospects will be described here under the headings (a), (b) and (c) given above.

(a) Tabular or Lenticular Bodies along Shear-Zones.

Locality A. A lenticular acidic (?) dyke ranging in width from 3 inches to 12 inches and approximately 30 feet long occurs along the strike of shear-zone N.S./3. It appears to

/ have

have been emplaced subsequent to any appreciable horizontal displacement along the shear-zone, the only fractures observed being steep or vertical joints that strike at 029, 054, 079, and 284 degrees. It contains grains of quartz, a little smaller than 1 mm. diameter, uniformly dispersed in a fine-grained or ophanitic matrix, reddish in colour, probably because of introduced hematite. In places, small masses of crystalline hematite are observed, and these probably represent joint or fracture fillings, and replacements of adjacent dyke-rock. Sheared five-grained granite adjacent to the dyke is also in part replaced by hematite. A uranium-bearing mineral, probably reddish autunite, occurs within two lenticular areas enclosing portions of the altered dyke-rock and the altered granite, in part disseminated and in part occurring as thin films on joint planes. The prospect was sampled (See Plate 2) at the "Northern Sample Channel", where its width is 15 inches and the Geiger count 450/m., and at the "Southern Sample Channel", 3 feet further southward, where the width is 18 inches and the geiger-count 1250/m. The background count in the area was 100/m. The count-rate between the northern sample channel and a print 5 feet further northward along the lode ranged from 450 to 600/m. Between the southern sample channel and a point 5 feet southward it ranged from 1250 to 400 per min. From 11 feet to 14 feet southwards from the southern sample channel it was 400/m. In addition to the samples taken for assay, the following specimens were collected:-

No.A 5934	Dyke-rock, 10 feet northwards from northern sample channel.
A 5936	Altered dyke-rock, containing crystalline hematite, 13 feet southward from southern sample channel.
A 5935	Altered fine-grained granite, sheared, and partly replaced by hematitic material, from the shear zone, adjacent to the eastern edge of the dyke.

Assay Results. Radiometric determination of uranium oxide in the samples gave the following results:-

Sample No. and Geiger-count at sample channel	Description of sample.	Uranium Oxide per cent.
A 5907 450/m.	Channel sample, 15" long and 3" wide, from surface to depth of 3", across the lode.	0.048
A 5908 1250/m.	Channel sample, 18" long and 3" wide, from surface to depth of 3", across the lode.	0.182

Using the graph shown in Plate 3, the uranium oxide content of the surface of the lode was estimated for each locality where a geiger-count was recorded, but no sample taken for assay. On the basis of these estimates, used in conjunction with the assay results given above, the average uranium-oxide content of the surface material at locality A, down to a depth of about 3 inches is probably as follows:-

/ Northern

Northern Part of Lode.

Length, 13 feet.
Average width, 15 inches.
Average uranium oxide content, 0.135 per cent (surface to depth of 3").

Southern Part of Lode.

Length, 3 feet
Average width, 0.75 feet
Average uranium oxide content, 0.056 per cent (surface to depth of 3").

The uranium oxide content may be expected to be higher at a depth of a few inches from the surface.

Locality B1. A lens of altered acidic (?)dyke-rock, 6 feet long and up to 9 inches wide occurs along shear-zone N.S./1. Its strike is 334 degrees, and dip 80 degrees east. The country-rock is strongly sheared, fine-grained granite. The lens appears to have been emplaced after movement along the shear-zone had ceased - it does not appear to be fractured or sheared. It consists of a dense, aphanitic, reddish matrix in which quartz-grains are sparsely scattered. A geiger-count equal to 4 times the background-count in the area was obtained over a length of 15 inches. A cross-jointing trending 044 degrees was recorded here. Inspection with ultra-violet light showed a bright-green fluorescence, presumably from autunite, both disseminated and coating fracture surfaces, and a little (?)antunite occurs throughout the lens.

A specimen (No.A.5932), and a grab sample for assay (No. A 5905) were taken from the locality.

Assay Result. The uranium-oxide content of sample A 5805, determined radiometrically, is 0.096 per cent.

Locality B 3. A band approximately 40 feet long and 9 inches wide of hematitic-rock containing numerous small quartz-grains and rebit of (?) felspars occurs in shear-zone N.S./1. Geiger-counts approximately 4½ times background were obtained near either end. A speciment (No. A 5933) was taken near the northern end. It consists of altered fine-grained granite or (?) dyke-rock; red; numerous quartz-grains and (?)felspar rebits. No sample was taken for assay, but the probable uranium-oxide content of the surface material at the localities where the geiger-counts are 4½ times background, estimated from the graph in Plate 3, is 0.06 per cent.

Locality D. (See Plate 2) A mass of hematitic rock with outcrop dimensions approximately 5' x 5' x 5' is intersected by two sets of joint or fracture planes, one trending 039 degrees and dipping 60 degrees north; the other trending 294 degrees and dipping steeply both to north and to south. The dip at the western wall is 85 degrees east. The outcrop is composed of sheared, fine-grained granite containing narrow siliceous bands, apparently slightly brecciated and intruded by a "stockwork" of acidic (?)dyke-rock. The granite and the dyke-rock have been altered by the introduction of hematitic material. Small cavities were seen containing encrusting crystalline quartz. Geiger-counts over the outcropping mass range from a little less than 3 times background, up to 10 times background within a small area near the north-west corner.

Sampling, and Assay Results. Two samples were broken from the surface at points (Plate 2) where the geiger-counts were 4 times and 10 times background, respectively. Details are:-

/SAMPLE NO.

Sample No.	Geiger-count where sample taken	Uranium oxide per cent.
A 5901	10 x background	0.108
A 5909	4 x background	0.031

Specimen taken was:-

Spec. No.	Locality	Description
A 5930	See Plate 2.	Altered fine-grained granite; red; numerous quartz grains; grains of altered felspar.

(B) Small Outcrop of hematitic lode material, in detritus.

Locality B2. Weathered hematitic material about 1 sq. ft. in area barely cropping out from surrounding detrital material within shear-zone N.S./1, gave a Geiger-count equal to 4 times background. A grab-sample from the surface, No.5904, contained 0.134 per cent uranium oxide.

(C) Hematitic Lode in Tension Fracture.

Locality C (See Plate 2) A lens of altered (?) dyke-rock across fracture-zone E.W./1, ranges in width from 1 foot at the southern and to 2 inches at the northern end, and has a strike of 026 degrees. Geiger counts along it ranged from 6 times to 12 times background. Ultra-violet light shows (?) autunite, both disseminated and as thin films on fracture-surfaces. A sample for assay, No. A 5903, was broken from the western wall of the lode, near its southern end, where the count-rate was 12½ times background. A specimen, No. A 5931, was taken from a point 3 feet northward along the lode. It appears to be altered acidic dyke-rock, containing scattered quartz grains in a dense, apparently aphanitic matrix, reddish in colour because of introduced hematite.

Assay Result. The uranium-oxide content of sample A 5903 was determined, radiometrically, to be 0.255 per cent. On the basis of this assay, and the probable uranium-oxide content at the northern end (read off from Plate 3), the average uranium-oxide content of the superficial portion of the deposit, over a length of 6 feet and average width of 8 inches, is estimated to be 0.21 per cent. However, the sampling was inadequate, and this figure may be too high.

REFERENCE.

Fisher, N.H. 1952: The Edith River Uranium-Bearing Area, Cwlth. Min. Res., Records 1952/69.

PLATE 1.

TENNYSON'S No2 URANIUM PROSPECT

EDITH RIVER AREA

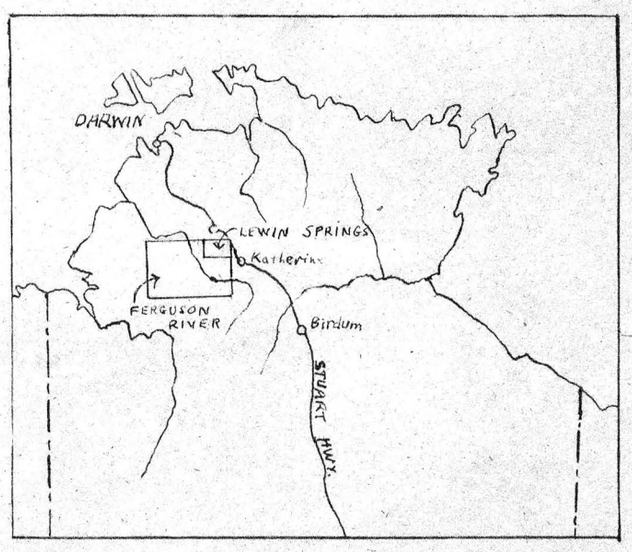
NORTHERN TERRITORY

PRELIMINARY GEOLOGICAL MAP

SCALE

100 0 100 200 300 400 500 FEET

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



LOCALITY MAP

(Traced from photo mosaic)

Scale

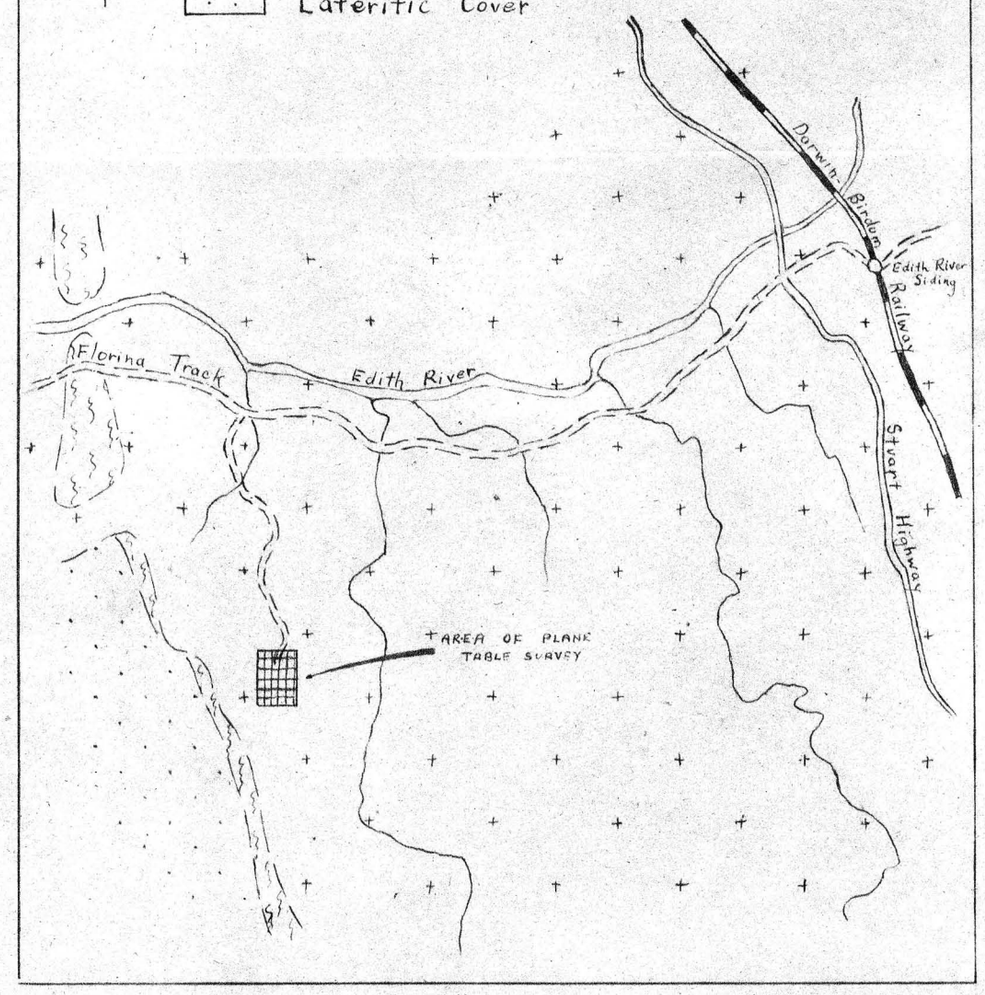
½ 0 1 2 Miles

Reference

Pl + + Granite

T Lateritic Cover

Brock's Creek Group



Reference

+ + + Fine-grained granite (Lower Proterozoic?)

Quartz-fluorite-(?)Carbonate vein

Quartz vein

Lode formation

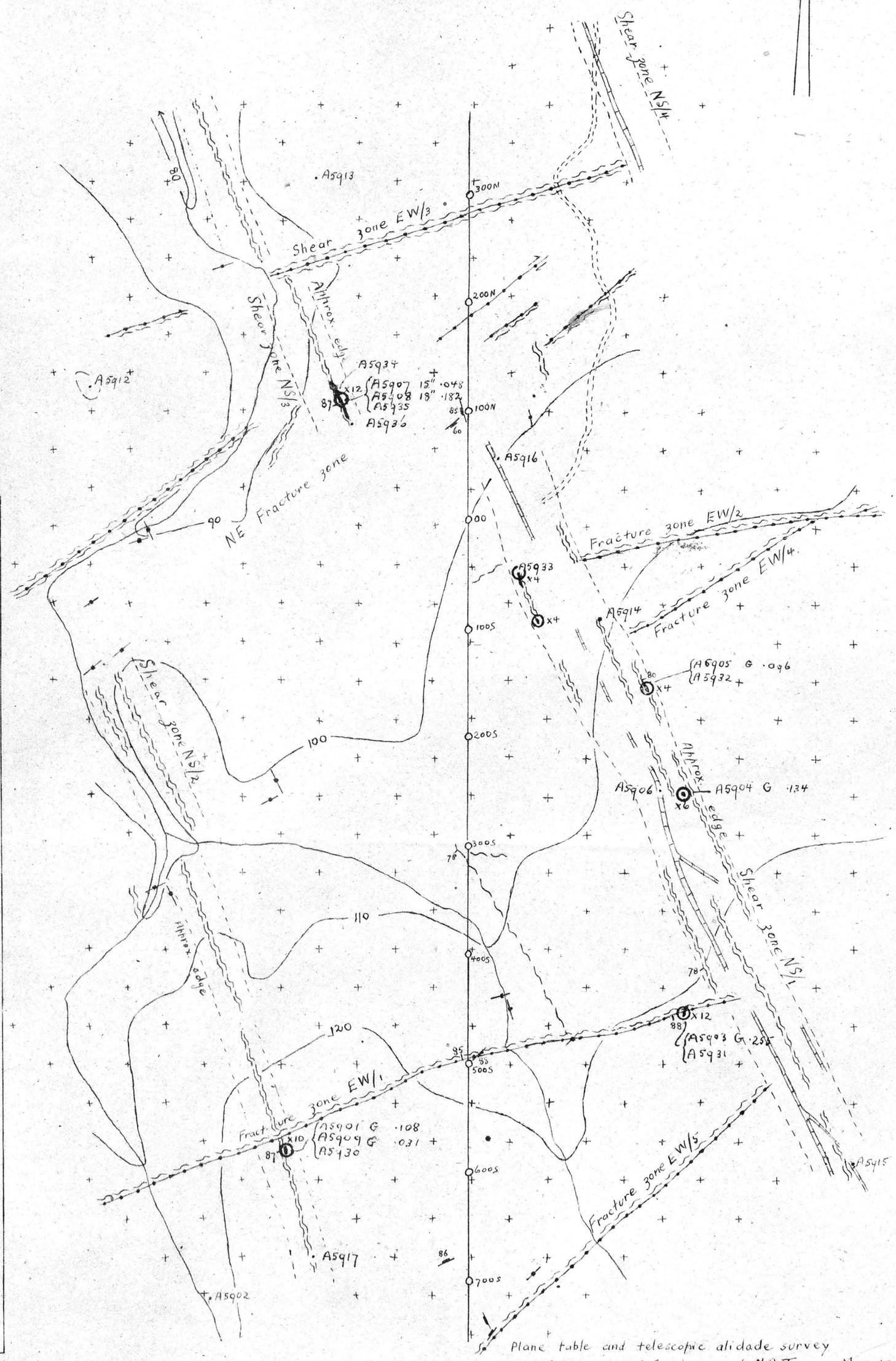
Shear zone

200N Baseline and pegs for radiometric survey

A5907 15"
A5909 G
A5915 Sample nos (width sampled or "grab" if for assay)

X4 Geiger readings greater than 3 times backgd.

90—2 Contours (assumed datum 100 ft. at peg 00)



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

PLATE 2.

TENNYSON'S No 2 URANIUM - PROSPECT

EDITH RIVER, NORTHERN TERRITORY

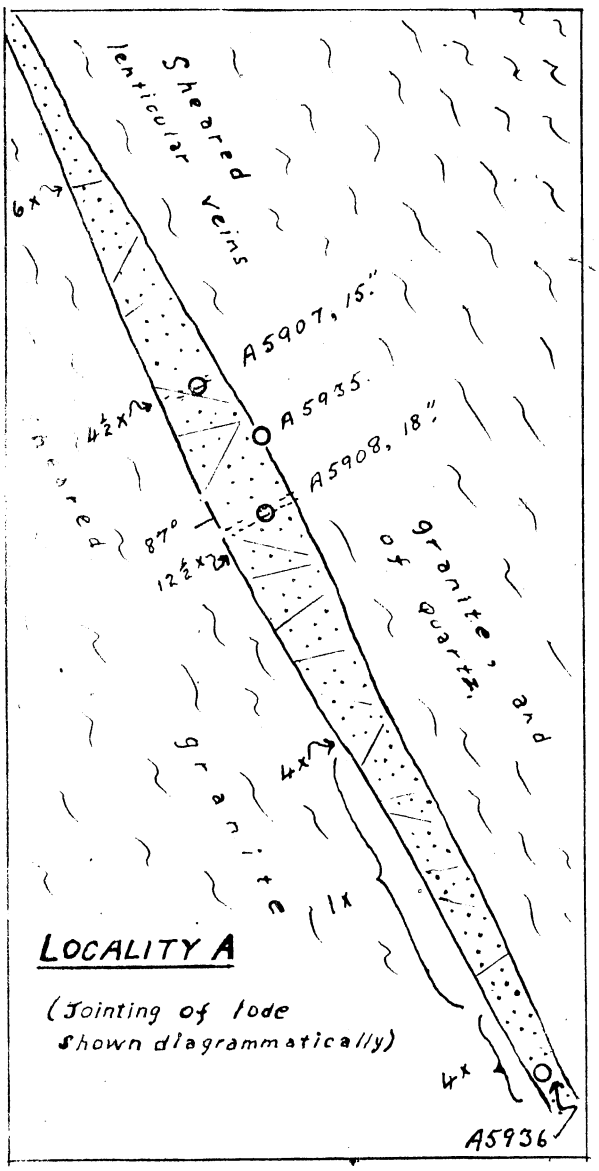
SKETCH PLANS OF LOCALITIES A, D, AND C.

Scale of feet

0 2 4 6 8 10

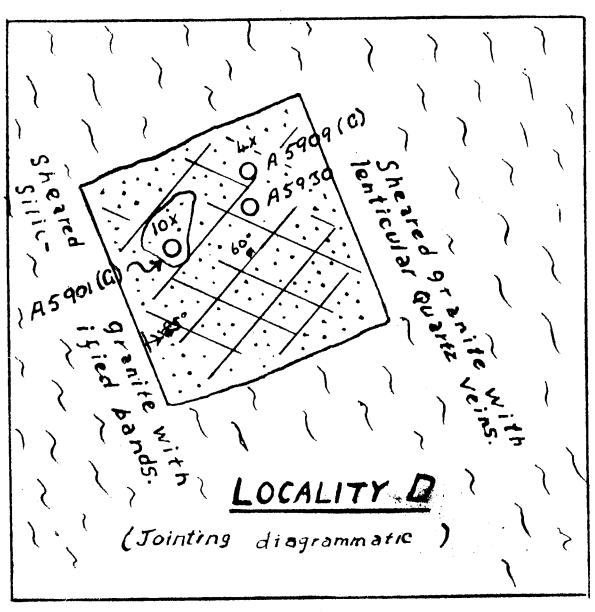
Reference

- Hematitic lode.
- A5907, 15" Sample for assay and sample width
- A5909(G) Grab sample for assay
- A5935 Specimen No
- 6x Geiger count 6 times background count.



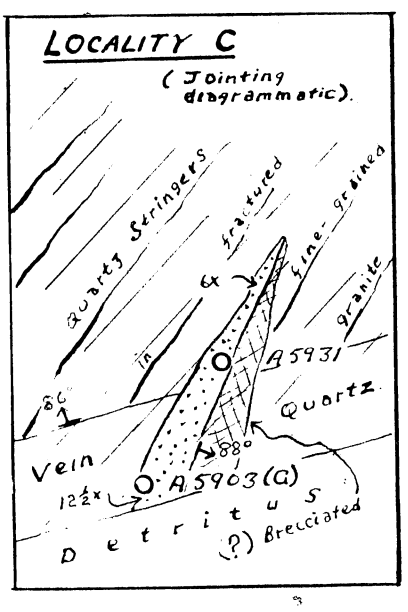
LOCALITY A

(Jointing of lode shown diagrammatically)



LOCALITY D

(Jointing diagrammatic)



D.F. Gardner & N.O. Jones

Plate 3

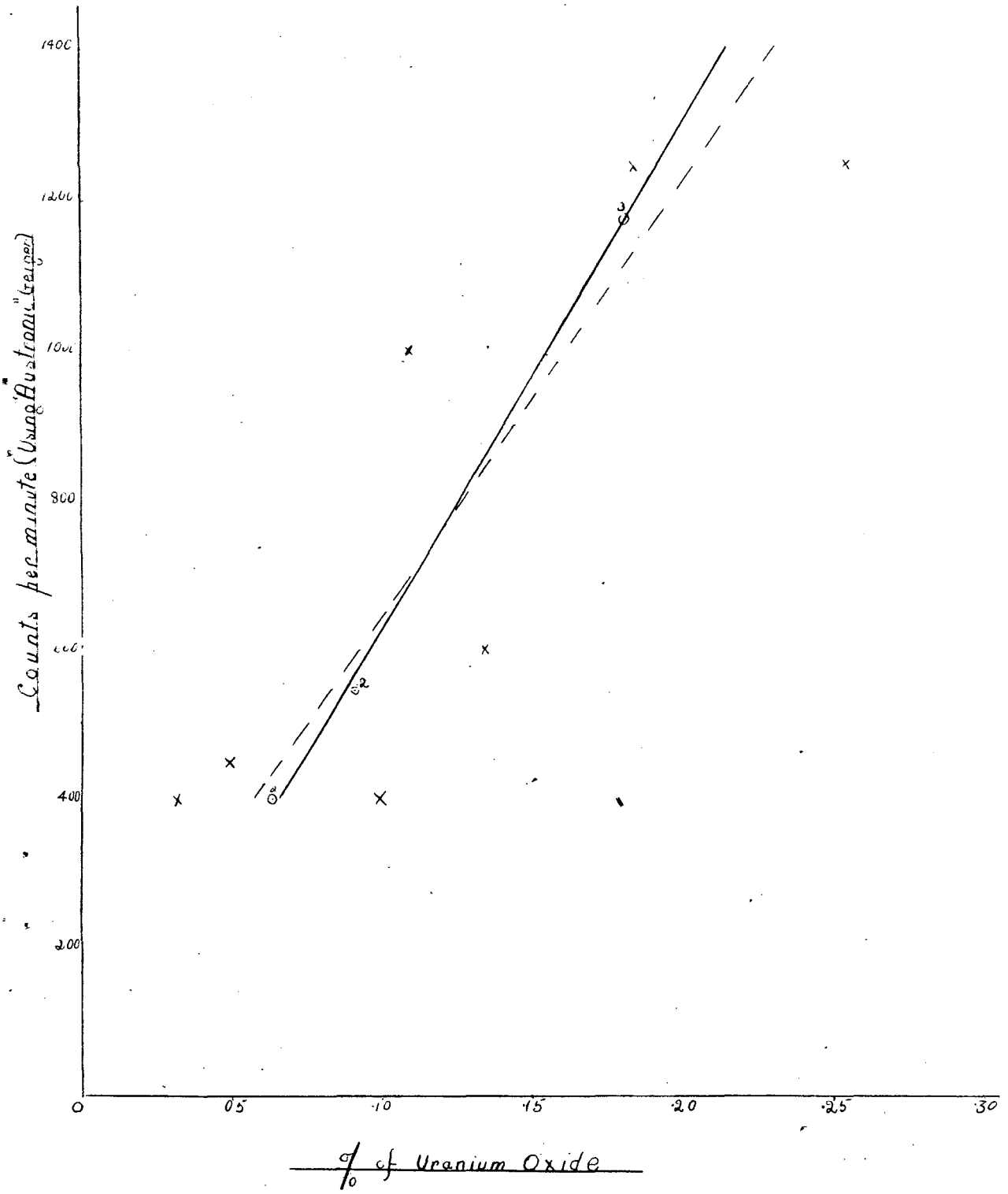
TENNYSON'S NO. 2 URANIUM PROJECT

PRELIMINARY REPORT

Graph Relating Geiger Counts to Assay Results of Surface Samples

Grouped Counts { 0 - 600, 600 - 1000, 1000 - 1400 ——— ○

Single Counts — — — — — — — x



D.F. Gardner & A.O. Jones.