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REPORT ON EXPLORATION LICENCES
4/69 and 5/69 KING ISLAND, TASMANIA

for

GEOPEKO LIMITED

STAGE 2. STREAM SEDIMENT SAMPLING
and
MINERALOGICAL and PETROLOGICAL EXAMINATIONS

by

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Accompanying Plans:
- Listed in Appendix Report.

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SUMMARY

During Stage 2 of the exploration on the two Exploration Licences 4/69 and 5/69 on King Island, Tasmania, stream sediment geochemical surveys and mineralogical and petrological examinations of granitic rocks have been completed.

The geochemical surveys covered the Porky Creek and Reekara Road areas, and results were compared with a similar survey over the known orebody at Bold Head.

No similar anomalies were found, however a high anomaly for Lead and Zinc was found in the Porky Creek area.

The mineralogical and petrological examinations of the granites within the Exploration Licences have shown that except for the Porky Creek area, all the granitic rocks appear to be older than the granite at Grassy. The granite at Porky Creek has been tentatively correlated with the Grassy granite.

An interesting exploration target is thus appearing in the Porky Creek area and recommendations for further work are set out at the end of this report.

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CONTENTS

	page
Summary	
Introduction	1
Stream Sediment Sampling	1,2,3
Mineralogical and Petrological Examinations - AMDEL'S report -	3
Discussion	4,5
Recommendations	6
Appendix	

INTRODUCTION

Exploration of the two Exploration Licences, numbers 4/69 and 5/69, on King Island, has continued during the 6 month period.

A stream sediment survey and a mineralogical and petrological examination of different granitic and pegmatitic rocks has been accomplished. Some geophysical work is also in progress.

STREAM SEDIMENT SAMPLING

A total of 205 stream sediment samples was taken from three regions - two of the regions were within the Exploration Licences and the third was around the Bold Head orebody area.

The samples taken were fine sediment generally just above creek junctions. Many of the "streams" that were sampled were man made irrigation channels, some of which were quite recently excavated.

Occassionally minor contamination occured due to vegetation, but most of the vegetation was taken out after drying.

The samples were analysed by Minex Analytical Laboratories Pty. Ltd. of Melbourne for Molybdenum, Tungsten, Lead, Zinc, and Tin. The systems used were:

Atomic Absorption with ± 15% relative accuracy for Molybdenum, Lead and Zinc,

Colorimetric Dithiol for Tungsten,

An undisclosed method for Tin.

Frequency/Distribution graphs for each individual metal have been plotted and are attached in the Appendix to this report. Of the 205 samples taken, 18 came from the Bold Head area where a known orebody exists, 95 from the Reekara road area, and 92 from the Porky Creek area.

The interpretation of the results is based on a comparison between the Bold Head mineralised area and the two areas in the Exploration Licences. A summary of the distribution curves is shown in chart form:

METAL	BOLD HEAD	PORKY CREEK	REEKARA ROAD	COMBINED
Molybdenum	Peak at 4 p.p.m. Only 2 twice background results.	Peak at 3 p.p.m. One high result.	Peak at 3 p.p.m. No high results.	Averaged curve superimposes all areas fairly well.
Tungsten	High distribution between 6 and 20 p.p.m.	Peak at 6-10 p.p.m. No high results.	Peak at 0-5 p.p.m. 4 very high results	Averaged curve reflects P.C. and R.R. distribution. B.H. has broader high distribution.
Lead	Broad high distribution 21-40 p.p.m. No high results.	Peak at 0-10 p.p.m. with minor peak at 51-60 p.p.m. 10 results greater than 60 p.p.m.	Twin peaks at 11-20 p.p.m. and 31-40 p.p.m. 4 medium/high results.	Averaged curve reflects individual peaks giving poor correlation between areas.
Zinc	High distribution up to 30 p.p.m. Only two results higher than 30 p.p.m.	Broad high distribution from 0-20 p.p.m. with minor peak at 51-60 p.p.m. 7 results greater than 60 p.p.m.	Peak at 0-10 p.p.m. Only 5 results greater than 30 p.p.m.	Averaged curve reflects all areas fairly well although B.H. high distribution is slightly broader.
Tin	Low results obtained with peak at less than 10 p.p.m.	Generally low results obtained with peak at 0-20 p.p.m. 2 results greater than 30 p.p.m.	Peak at less than 10 p.p.m. 9 results greater than 30 p.p.m., two of them over 100 p.p.m.	Averaged curve superimposes all areas fairly well.

All the results for the three areas have been plotted and are part of the Appendix. The colouring system is based on the combined average curve rather than individual area frequency curves in order that a comparison between the three areas can be made. Assay results coloured red are greater than 2 times background. A summary of these results is as follows:

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METAL	BOLD HEAD	PORKY CREEK	REEKARA ROAD
Molybdenum	Two high results are directly related to the known orebody.	Two high results lie adjacent to the main road.	No anomalous areas recorded.
Tungsten	Regionally high results recorded, the highest being directly related to the known orebody.	7 medium/high results unrelated except for two co-incident with the Molybdenum highs above, and two lying within the Lead/Zinc anomalous area.	4 spot very high results, one related to a spot high result for Lead.
Lead	Relatively high background readings but no highly anomalous areas.	Highly anomalous area covering over 1 square mile drainage pattern north and east of the airfield. Three spot medium/high results elsewhere. Background very low.	5 spot medium/high results with background readings generally similar to Bold Head.
Zinc	Two spot high results unrelated to the orebody. Generally low background results.	Highly, anomalous area similar to that for Lead above. Three spot medium high results co-incident with two of the lead spot high results.	5 medium/high results near the North Road in the west but not directly related to each other. One high is co-incident with a high Lead result.
Tin	No anomalous results recorded.	No anomalous results recorded.	5 high results in the same area as the Zinc highs however only one result is co-incident. 4 other spot medium/ high results unrelated to other spot highs.

A correlation of these results follows in the Discussion section of this report.

MINERALOGICAL AND PETROLOGICAL EXAMINATIONS

Eleven granitic and pegmatitic rock specimens were taken from different parts of the island and submitted to the Australian Mineral Development Laboratories in Adelaide for Petrological and Mineralogical examinations.

The location of these specimens is shown on the plan in the accompanying appendix. Three of the rocks were taken from the granite at Grassy (assumed to be the mineralizer of the main scheelite orebody) and the other eight were taken from different outcrops scattered throughout the Exploration Licences.

AMDEL'S report is enclosed in full.

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DISCUSSION

1. Stream Sediment Sampling

Sampling of the Bold Head area has shown anomalous values for both Molybdenum and Tungsten, with relatively high background values for Lead. Zinc and Tin gave no anomalous response. The high Molybdenum and Tungsten values can be directly attributable to the known mineralization, and the high background for Lead can be attributed to the presence of the limey Mine Series rocks.

This combination of anomalous results does not occur in the Porky Creek or Reekara Road areas.

In the Porky Creek area two adjacent co-incident anomalous results for Tungsten and Molybdenum were found next to the main road, but may possibly be due to the farm situated at that position.

A broad area of over 1 square mile drainage pattern is highly anomalous in Lead and Zinc. This area lies north and north east of the airfield. The values obtained are much higher than at Bold Head and it is thought that they are due to mineralization as opposed to rock type background values. It is also assumed that the anomalous area is not due to agricultural fertilizers since the area covers various different properties, and the fertilizers commonly used were super-phosphate and copper-cobalt spread at approximately 7 lbs/acre every three to four years.

In the Reekara Road area no well defined anomalous zones exist. Four apparently unrelated high values for Tungsten were obtained in an area of relatively high background Lead values. However no anomalous Molybdenum occurs at all. The anomalous Tin and Zinc results lie some miles to the west of the Tungsten spot high region and are unrelated.

2. Mineralogical and Petrological Examinations

It appears from AMDEL's report that all the granitic rocks in the Exploration Licences except at Porky Creek and possibly Currie are of an older age than the Grassy granodiorite. Recrystallization of the granites in the Reekara Road and Cape Wickham areas are thought to be associated with the later regional faulting.

The rock specimen taken from the Porky Creek area has been tentatively correlated with the Grassy granodiorite due to the presence of orthite, the similarity in size of the pleochroic haloes about the metamict zircons in the biotite, and the inference that the rock is the product of a single magmatic event.

The aerial magnetic plan indicates a change in structure and rock type in the Porky Creek area thus supporting the suggestion that the granite is of a different age from the other granites on the western side of King Island.

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DISCUSSION cont'd

3. General

A definite zone of interest exists in the Porky Creek area. High Lead and Zinc geochemical results appear to be related to a granite intrusive of similar age to the Grassy granodiorite, as opposed to the older granites within the Exploration Licences.

Photo-interpretation of the area is hampered by the flatness of the area and the obscuring of the older topography by sand dunes. One possible structure may exist trending N.E. - S.W. through the airfield, interpreted as being a fault contact between the later granite and the older country rock. However the host rock for any mineralization in the area is still obscure.

The exploration of the Reekara Road area has failed to bring any strong anomalous zones to notice, and it appears that the granite rock in this area is originally the same as elsewhere on the western coast.

RECOMMENDATIONS

1. Hand auger drilling of the anomalous zone in the Porky Creek area to obtain sub-surface samples on a grid basis. These samples to be analysed for Lead, Zinc, Tungsten and Molybdenum.

2. A ground magnetic survey of the same area to obtain any structural information possible, to be interpreted by Geopeko's consultant geophysicist.

3. An induced polerization survey of the same area only if high analyses are obtained for Lead and Zinc in the geochemical survey outlined above.

4. A scout sub-surface sampling programme of the areas with anomalous Tin/Zinc and Tungsten stream sediment sample results in the Reekara Road region.

5. Scout Gemco auger drilling of the sand dunes in the Cape Wickham and Boggy Creek areas when the auger drill becomes available.

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ELEVEN PEGMATITIC AND GRANITIC ROCKS FROM KING ISLAND

Eleven granitic and pegmatitic rocks were submitted to Amdel for petrographic and mineralogic examination by Anthony McKenna and Partners Pty Ltd, acting on behalf of Geopeko Limited on King Island Tasmania.

Thin sections of all samples were prepared and examined in transmitted light with the aid of a polarizing microscope.

The results of the investigation are presented below.

1. MINERALOGICAL NOTES

Grain sizes:

coarse-grained	1 mm
medium-grained	1 mm - 0.5 mm
fine-grained	0.5 mm

All reported mineral percentages are determined by a visual estimate.

The reported compositions of the plagioclase minerals have been determined in thin section by interference figure identification, and extinction angle measurements using the A-normal method.

The minerals used as qualifiers to rock names are listed in increasing order of abundance.

Terminology is according to: Hatch Wells and Wells, (1961) The Petrology of Igneous Rocks. Thomas, Murby and Sons.

2. BACKGROUND

In order to obtain some appreciation of the types of granitic rocks exposed on King Island two references were consulted. These were:

Edwards P.B., Baker G. and Callow K.J. (1956) Metamorphism and Metasomatism at King Island Scheelite Mine. Jour. Geol. Soc. Aust. 3, 55-98.

McDougall, Ian, and Leggo P.J. (1965). Isotopic Age Determinations on Granitic Rocks from Tasmania. Jour. Geol. Soc. Aust. 12, (2), 296-332.

Edwards et al (1956) state that the granodioritic rock responsible for the contact metamorphism of the ore-body at King Island is composed of quartz, orthoclase perthite, microcline and oligoclase with biotite as the chief ferro-magnesian mineral and lesser amounts of green hornblende. The biotite is partially chloritized and the accessory minerals include sphene, apatite, zircon, orthite and opaque iron-oxides.

McDougall and Leggo (1965) indicate that along the West Coast of King Island granitic rocks intrude a Precambrian sedimentary sequence. This granite is a composite body composed of massive to weakly foliated adamellite ranging to granodiorite. In thin section the rocks almost invariably have a cataclastic texture; this is shown particularly well by the extreme undulose extinction of quartz which is partially recrystallized in many places. The micas and feldspars often are deformed. Muscovite- and biotite-bearing, feldspar, quartz, tourmaline pegmatites occur sporadically in dyke-like and irregular bodies up to three feet in thickness.

McDougall and Leggo also indicate that undeformed adamellites are found near Grassy and south east of Mount Counsel. These two bodies are reportedly similar although no details of their petrography are given.

3. SUMMARY PRESENT SUITE

K.I. 1 A massive, porphyritic, orthite-epidote-hornblende-sphene-biotite granodiorite composed of minerals which have crystallized during a single magmatic event. Minor ?deuteric alteration has affected the rock.

K.I. 2 A massive orthite-epidote-sphene-hornblende-biotite adamellite composed of minerals crystallized during a single magmatic event. Mineralogically and petrogenetically this rock is related to K.I. 1.

K.I. 3 A massive epidote-orthite-sphene-hornblende-biotite granodiorite that mineralogically and petrogenetically resembles samples K.I. 1 and K.I. 2.

K.I. 4 A massive, incipiently recrystallized muscovite-biotite adamellite. The relationships of this rock are obscure but the muscovite-biotite association and the evidence for incipient recrystallization suggest this sample may be related to the cataclastically deformed muscovite-bearing rocks of this suite, viz, K.I. 5, 6, 7.

K.I. 5 A massive garnet-tourmaline-muscovite adamellite. This rock appears to be composed of minerals which crystallized during a single generation from a residual magmatic liquid. Unlike in other muscovite and tourmaline bearing rocks of this suite there is no evidence for cataclastic deformation. However, the mineral assemblage is sufficiently distinctive to enable the rock to be tentatively correlated with K.I. 7.

K.I. 6 Massive, coarse-grained, tourmaline-muscovite pegmatite of granitic composition. The rock is composed of a mineral assemblage which has crystallized as two generations. The primary mineral assemblage is the product of magmatic crystallization while the secondary mineral assemblage is the product of a dynamic metamorphic event.

K.I. 7 Massive, coarse-grained, garnet-tourmaline-muscovite pegmatitic gneiss of adamellitic composition. This rock is petrogenetically very similar to K.I. 6 although is distinguished by the presence of garnet (? spessartite). The presence of garnet gives affinities to K.I. 5.

K.I. 8 Massive, coarse-grained topaz-tourmaline-biotite-muscovite pegmatite of adamellitic composition. This rock is the product of magmatic crystallization and has subsequently been deformed and partially recrystallized under the influence of a dynamic metamorphic event. The rock is very similar to K.I. 11.

K.I. 9 Medium grained orthite-biotite adamellite. The mineral assemblage is the product of a single magmatic event. Although the mineral assemblage is not particularly distinctive this rock is tentatively correlated with K.I. 1, K.I. 2 and K.I. 3.

K.I. 10 A deformed and altered adamellite. This is a granitic rock which has been extensively deformed and partially recrystallized during a dynamic metamorphic event. The primary ferromagnesian minerals are completely replaced.

K.I. 11 A topaz-tourmaline-muscovite-biotite granodiorite. The rock is the product of magmatic crystallization but has been subjected to mild deformation and incipient recrystallization. The rock is similar to K.I. 8.

4. SOME TENTATIVE CORRELATIONS

In the absence of field data it is perhaps unwise to propose correlations between rocks of this suite. However, in at least some instances the writer considers that the mineral assemblages and interpreted petrogeneses are sufficiently distinctive to permit some tentative correlations to be made.

On the basis of mineralogy and to a lesser extent petrogenesis the rocks can be subdivided into four groups. These groups are detailed below:

1. Granodioritic rocks containing the mineral assemblage of orthite, epidote, hornblende, sphene and biotite which are the product of magmatic crystallization and which have not been subjected to a dynamic metamorphic event or to recrystallization, viz. K.I. 1, K.I. 2, K.I. 3.

2. Adamellitic rocks containing a mineral assemblage which includes abundant muscovite and tourmaline with or without garnet. These rocks are the product of magmatic crystallization and have been subsequently deformed and partially recrystallized under the influence of a dynamic metamorphic event, viz. K.I. 5, K.I. 6, K.I. 7.

3. Pegmatitic and granitic rocks of adamellitic composition which are characterised by the assemblage muscovite-biotite-tourmaline and topaz, viz. K.I. 8 and K.I. 11. These rocks are the product of magmatic crystallization but have been deformed and partially recrystallized under the influence of a mild dynamic metamorphic event. It seems possible that these rocks are a somewhat earlier differentiate of the magma which produced the rocks of group 2 above.

4. Granitic rocks of doubtful affinities, viz. K.I. 4, K.I. 9, K.I. 10. Sample K.I. 4 can tentatively be correlated with the group 3 rocks (above) on the basis of the muscovite-biotite association and on the basis of the evidence for incipient recrystallization. Sample K.I. 9 is tentatively correlated with the group 1 rocks (above) on the basis of the distinctive accessory mineral orthite, and because it appears to be the product of a single magmatic event. Sample K.I. 10 is unable to be included in any of the above groups because of the degree of alteration and recrystallization. However, the evidence for a dynamic metamorphic event perhaps suggests the sample is related to the group 2 and 3 rocks above.

The rocks tentatively correlated in group 1 above conform to the granitic rocks described by Edwards et al (1956) and which reportedly are responsible for the contact metamorphism of the ore-body at King Island.

The rocks tentatively correlated in groups 2 and 3 above conform to the granitic rocks described by McDougall and Leggo (1965) as occurring along the West Coast of King Island. It is of interest that McDougall and Leggo do not, however, report the occurrence of garnet (?spessartite) and topaz in their rocks.

Tabulated below are the correlations tentatively suggested as a result of the present investigation.

1. Rocks correlated with the Ettrick River and Cape Wickman Granites - probably Pre-Cambrian:

   K.I. 5, K.I. 6, K.I. 7, K.I. 8, K.I. 11, ?K.I. 4.

2. Rocks correlated with the Grassy Granite, probably early Carboniferous:

   K.I. 1, K.I. 2, K.I. 3, ?K.I. 9.

3. Rocks possibly correlated with the Cambrian acid intrusives (Murcheson, Dove, etc.):

   K.I. 10.

   Alternatively this rock could be related to the group 2 (Carboniferous) rocks above. The petrographic features do however suggest a correlation with the Cambrian Intrusive Granites of mainland Tasmania.

In an attempt to verify the authenticity of the above correlations the pleochroic haloes about the metamict zircons in the biotite of the biotite bearing samples were measured. It has been established in the literature[1] that the size of the haloes about metamict zircons in biotite is directly related to the age of the enclosing rocks; the older the rock the larger the halo.

The results of measurements made on 7 of the submitted samples are tabulated below. The samples were examined in transmitted light and the maximum dimension of 12 haloes in each sample was measured.

Sample	Range mm	Average mm
K.I. 1	0.01 - 0.05	0.032
K.I. 2	0.01 - 0.03	0.029
K.I. 3	0.01 - 0.03	0.02
K.I. 4	0.08 - 0.10	0.086
K.I. 8	0.04 - 0.08	0.054
K.I. 9	0.01 - 0.03	0.018
K.I. 11	0.04 - 0.09	0.06

From this study it can be seen that the rocks correlated with the Grassy Granite (which is probably Carboniferous in age) have pleochroic haloes about the zircons in their biotites

[1] Ichikazu Hayase (1954) Relative Geological Age Measurements on Granites by Pleochroic Haloes and the Radioactivity of the Minerals in their Nuclei. Am. Min. V.39 pp 761-772

which range in average size from 0.032 - 0.018 mm in diameter. On the other hand the pleochroic haloes about the zircons in the biotites of the rocks tentatively correlated of the Ettrick River and Cape Wickman Granites of probable Pre-Cambrian age have average dimensions in the range 0.054 - 0.086 mm. The difference in these dimensions is thought to be significant and not attributed to chance. In addition, it is important to note that the pleochroic haloes are very much more abundant in the older rocks (K.I. 4, K.I. 8 and K.I. 11) than they are in the younger (K.I. 1, K.I 2, K.I. 3 and K.I. 9).

A more rigorous approach to this technique would probably more clearly define distinct differences between the two sets of pleochroic haloes. This approach could be a simple and valid one for the distinction of the relative ages of the granitic rocks of King Island.

5. CONCLUSIONS

It is concluded that a knowledge of available radiometric data combined with reliable field observations and petrographic data can probably enable a determination of the relative ages of the granitic rocks of this suite. The validity of this conclusion is dependant on the results of field observations.

6. PETROGRAPHY

Sample: K.I. 1: TS 23996

Rock Name:

Porphyritic orthite-epidote-hornblende-sphene-biotite granodiorite

Hand Specimen:

A massive, porphyritic granitic rock composed of an interlocking mosaic of quartz and feldspar crystals (up to 5 mm) through which are randomly distributed flakes of dark ferromagnesian minerals. Large phenocrysts of pink potash feldspar (up to 4 cms) dot the rock.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	40
Plagioclase	20
Microcline perthite Orthoclase perthite	12
Biotite	12
Chlorite	6
Epidote	2
Sphene	3
Hornblende	2
Clay minerals	3
Zoisite	Accessory
Apatite	Accessory
Zircon	Accessory
Tremolite	Accessory
Orthite	Accessory
Opaques	Trace
Hydrated iron oxides	Accessory

Mineralogically this sample closely resembles sample K.I. 3. The mineral assemblage of biotite, hornblende, epidote, sphene and orthite is distinctive and characteristic.

The rock has a xenomorphic texture and is composed of coarse-grained, idiomorphic crystals of quartz and feldspar through which are distributed large (up to 4 mm) crystals of plagioclase and crystals of ferromagnesian minerals.

The coarse-grained crystals of plagioclase have an irregular habit and are composed of a compact aggregate of smaller idiomorphic crystals. The feldspar has the composition of albite-oligoclase (about An_{10}) and is included with numerous fine-grained crystals of ferromagnesian minerals and alteration products. The principal alteration product is crystals and flakes of muscovite/sericite which appear to have a random distribution within the plagioclase host. A second alteration product is cryptocrystalline, dark in colour and possibly a mixture of epidote group minerals and chlorite. Other minerals included within these plagioclase crystals include epidote, green "anomalous" chlorite, zoisite, biotite, quartz and carbonate.

The plagioclase of the remainder of the rock forms sub-idiomorphic crystals which are oligoclase (about An_{15}) in composition. These crystals have been subjected to similar type of alteration as have the larger crystal aggregates. The alteration products include sericite/muscovite, epidote, and a dark greenish-grey crypto-crystalline material.

The microcline and orthoclase are very similar and are recognized only on the basis of the presence or absence of cross-hatched twinning. Both are perthitic with small blebs and beads of perthite randomly distributed throughout the potash-rich host. The crystals have a patchy discolouration imparted by dusty and disseminated opaque mineral phases.

Quartz forms irregular plates and crystals which occupy the interstitial positions between the feldspar crystals. The mineral has a straight to weakly undulose extinction and contains numerous fine inclusions of opaque mineral phases.

The principal ferromagnesian constituent is laths and plates of a strongly pleochroic biotite. The biotite is pleochroic from deep reddish-brown to pale straw-yellow. Many of the crystals are fresh although included with metamict inclusions of zircon and lesser inclusions of apatite. By contrast a few crystals are extensively replaced along cleavage traces by a pale green chlorite. Yet other crystals are partially replaced by a pale-green pleochroic amphibole (hornblende) and sphene. The ratio of altered crystals to comparatively fresh crystals is about 1:2.

A few discrete crystals of fresh, pale-green, pleochroic hornblende are also found.

The remainder of the rock is composed of minerals which are found in small proportions. The most important of these is orthite which forms small euhedral crystals which are zoned, and have a random distribution. Topaz, sphene, epidote and opaques are the other accessory minerals.

Discussion:

This is a granitic rock of granodioritic composition which is the result of igneous crystallization. The rock has been subjected to minor alteration. The mineral assemblage developed is similar to that of sample K.I. 3.

Sample: K.I. 2: TS 23997

Rock Name:

An orthite-epidote-sphene-hornblende-biotite adamellite

Hand Specimen:

A massive, crystalline, equigranular rock of granitic composition. The rock is composed of an interlocking mosaic of quartz (colourless), plagioclase (white) and potash feldspar crystals (pink) through which are distributed small prismatic crystals of dark ferro-magnesian minerals.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	40
Plagioclase	15
Orthoclase perthite	3
Microcline perthite	7
Biotite	12
Hornblende	5
Chlorite	12
Apatite	Accessory
Zircon	Accessory
Sphene	1
Clay minerals	5
Orthite	Accessory
Zoisite	Accessory
Iron oxides	Accessory
Opaques	Accessory
Epidote	Accessory

This sample closely resembles samples K.I. 1 and K.I. 3 and is composed of a coarse-grained, equigranular mosaic of zoned plagioclase crystals, potash feldspar and quartz crystals through which are distributed crystals of ferromagnesian minerals.

The plagioclase crystals display an oscillatory zonation that is even more pronounced than that displayed by sample K.I. 1 and range in composition from oligoclase (about An_{22}) to albite (about An_5). The crystals are coarse-grained and range in habit from idiomorphic to sub-idiomorphic. Many of the crystals are fresh but others are extensively replaced by fine-grained sericite/muscovite and a cryptocrystalline alteration product as in K.I. 1. Small idiomorphic inclusions of hornblende and biotite occur in some crystals.

The potash feldspar appears to be both orthoclase and microcline although the distinction is based only on the presence or absence of the distinctive cross-hatched twin lamellae of microcline. The potash feldspars form as large plates and lakes enclosing the idiomorphic plagioclase crystals. Both microcline and orthoclase are perthitic. The perthite blebs are of the string and bead type and vary in abundance from one crystal to another. Both minerals are fresh although in the vicinity of the exsolution lamellae they tend to be discoloured by finely disseminated, dusty opaque mineral phases.

The principal ferromagnesian minerals, biotite and hornblende, are similar to those found in K.I. 1. The biotite assumes two distinct habits. The first is as discrete crystals and plates and the second is as aggregates of small fibrous crystals. Both are strongly pleochroic from deep reddish-brown to pale-straw yellow. The larger crystals have usually been subjected to partial chloritization and the biotite is interleaved with a pale-green, faintly pleochroic, "anomolous" chlorite. Sphene accompanies the chlorite in the more extensively altered laths. The crystals contain numerous inclusions of apatite and more rarely metamict zircons. The finer-grained and more fibrous biotite in places appears to be partially replaced by hornblende.

The hornblende is pale-green and moderately pleochroic. For the most part is occurs as discrete, euhedral to subhedral crystals but as mentioned above it also is found intergrown with the fibrous biotite. These relationships are similar to those observed in K.I. 1. The crystals are usually fresh although a few have hydrated iron oxides precipitated along cleavage traces.

The accessory minerals include sphene, zircon, apatite, orthite, epidote and ?zoisite. Sphene is common and forms rhombohedral to idiomorphic crystals which have a random distribution. The apatite and zircon are usually associated with the biotite crystals. The orthite is not common but forms discrete, zoned crystals similar to those found in K.I. 1 and K.I. 3. The epidote and zoisite are alteration products of both the ferromagnesian minerals and possibly of the plagioclase.

Discussion:

This rock mineralogically and petrogenetically closely resembles samples K.I. 1 and K.I. 3. It is a granitic rock of granodioritic to adamellitic composition which is a result of magmatic crystallization. The rock has been subjected to minor alteration as a result of ?deuteric events. The mineral assemblage of biotite, hornblende, orthite, epidote and sphene is characteristic and distinctive.

Sample: K.I. 3: TS 23998

Rock Name:

Epidote-orthite-sphene-hornblende-biotite granodiorite

Hand Specimen:

A massive, very coarse-grained, crystalline, granitic rock composed of crystals of clear quartz, white plagioclase and pink potash feldspars through which are distributed fine-grained dark ferromagnesian minerals.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	40
Plagioclase	18
Orthoclase perthite ?Microcline perthite	12
Biotite	10
Hornblende	7
Sphene	2
Chlorite	5
Apatite	Accessory
Clay minerals	5
Zircon	Accessory
Orthite	1
Epidote	Accessory
Zoisite	Accessory
Opaques	Accessory

This rock displays an xenomorphic texture and is composed of subhedral to anhedral, equant crystals of quartz, plagioclase and potash feldspars through which are distributed crystals of coloured ferromagnesian minerals.

The plagioclase forms subidiomorphic single and compound crystals which display well developed polysynthetic twinning and an oscillatory compositional zonation. The mineral has a compositional range from oligoclase (about An_{20}) at the core to albite (about An_5) at the rim. The mineral is traversed by a network of fine, discontinuous fractures along which cryptocrystalline coloured silicates and disseminated opaques have crystallized. Small euhedral to subhedral crystals of apatite may also be found as inclusions.

The most common potash feldspar is orthoclase perthite. This mineral forms subidiomorphic crystals which are usually discoloured by patchy, disseminated opaque mineral phases. Small inclusions of quartz are found within the crystals. The perthite is of the ribbon and string type and develops along crystallographic directions within the host crystal.

Crystals of potash feldspar which apparently have sufficient triclinicity to be classified as microcline are also found. These resemble in all respects the orthoclase crystals and may be twinned according to the Carlsbad law superimposed on which is a shadowy cross-hatched twin characteristic of microcline.

Quartz forms as irregular crystals infilling the interstices between the feldspar crystals. The mineral has a mildly undulose extinction and contains a few inclusions of very finely disseminated opaque and silicate mineral phases.

The coloured silicates have a random distribution. Chief among these is biotite. This mineral forms raggedly terminated laths and is strongly pleochroic from deep-brown to pale straw yellow. Inclusions of apatite and more rarely zircon are common. The biotite has been subjected to incipient alteration to chlorite. The chlorite is pale-green and is interleaved with the biotite in places.

Epidote and sphene are commonly associated with the biotite. The epidote has an intense greenish-yellow colouration indicating it to be an iron rich variety. The sphene ranges from euhedral (rhombic cross section) to idiomorphic and may be intimately associated with the biotite or related to opaque mineral phases (?ilmenite).

Partially chloritized, green hornblende is the second most abundant ferromagnesian constituent. It forms idiomorphic crystals some of which are simply twinned and which are faintly pleochroic. The hornblende has been subjected to patchy alteration to a pale-green chlorite and may contain small inclusions of zircon and sphene.

The accessory minerals apatite, zircon and opaques have already been mentioned. In addition to these zoisite and orthite are found. The zoisite is an alteration product of the feldspars in some places and is found in association with chlorite. Orthite forms discrete, euhedral and zoned crystals which have a random distribution although are not common.

Discussion:

This is a granitic rock of adamellitic composition which is the result of igneous crystallization. The rock has been subjected to minor alteration (particularly the plagioclase, biotite and hornblende). The mineral association of biotite, hornblende, iron-rich epidote and orthite is distinctive and characteristic.

Sample: K.I. 4: TS 23999

Rock Name:

Incipiently recrystallized muscovite-biotite adamellite

Hand Specimen:

A massive, finely porphyritic, crystalline granitic rock composed of very coarse-grained (up to 3 cms) crystals of potash feldspar set in an equigranular mosaic of plagioclase and quartz crystals and ferromagnesian minerals.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	45
Plagioclase	13
Microcline perthite	4
Orthoclase perthite	8
Biotite	15
Muscovite	10
Chlorite	5
Zircon	Accessory
Opaques	Accessory
Apatite	Accessory

Mineralogically this rock has one of the least distinctive assemblages of the rocks described in this suite, however, the mineralogy and petrogenesis do together suggest certain correlations.

The rock has a coarse-grained, xenomorphic texture and is composed of large idiomorphic crystals of plagioclase and potash feldspar set in lakes of quartz. The ferromagnesian minerals, muscovite, and biotite, have a random distribution.

The plagioclase crystals are generally somewhat smaller than the potash feldspar crystals. They are idiomorphic in habit, polysynthetically twinned and display a poor to moderately well defined compositional zonation. The crystals range in composition from oligoclase (about An_{15}) to albite (about An_5). The plagioclase has been subjected to incipient alteration to sericite and in places to muscovite and saussurite.

The orthoclase forms large idiomorphic crystals in which are included small, zoned plagioclase crystals similar to those described above (monzonitic fabric). In addition to inclusions of plagioclase, inclusions of muscovite, biotite and chlorite are also found. The orthoclase host is strongly perthitic with numerous string perthites oriented along crystallographic directions. The orthoclase perthite crystals are fresh but many of the included elements are altered. The plagioclase inclusions are altered in a manner similar to that of the discrete plagioclase crystals described above. Much of the chlorite, which also forms inclusions, is probably derived from the biotite. Some of the orthoclase could possibly have sufficient triclinicity to be classified as microcline.

The quartz forms large lakes of compound crystals. The mineral displays a moderate to strong undulose extinction and may be traversed by a series of sub-parallel dislocations. When in juxtaposition two quartz crystals may display a serrated contact or the grain boundary may be defined by an aggregate of fine-grained, polygonal crystals.

The principal ferromagnesian minerals are biotite and muscovite. The biotite is possibly somewhat earlier than the muscovite and forms idiomorphic to subidiomorphic platy laths and crystals which usually have ragged terminations. The mineral is strongly pleochroic from deep reddish-brown to pale brown and is included with numerous, small metamict zircons. For the most part the mineral is fresh but in places there is evidence for incipient chloritization.

Some of the muscovite has a similar habit to the biotite although some occurs as small aggregates of flaky crystals and some is interleaved with the biotite. Where muscovite is interleaved with biotite disseminated opaques and sphene also crystallize. This intergrowth is probably symplectic. In other areas the muscovite occurs alone and is fresh. There is some evidence to suggest that the muscovite has a weak foliation and that some at least has crystallized along rehealed planes of deformation. However, this evidence is meager.

Zircon, opaques and minor apatite are the accessory components.

Discussion:

This rock is a granitic rock with adamellitic affinities. It is largely a product of magmatic crystallization, however, there is evidence for incipient recrystallization and for very minor deformation. The association of muscovite and biotite suggests the rock may be related to K.I. 5, K.I. 6 and K.I. 7.

Sample: K.I. 5: TS 24000:

Rock Name:

Medium grained garnet-tourmaline-muscovite adamellite

Hand Specimen:

A medium-grained, equigranular, granitic rock composed of a saccharoidal textured mosaic of colourless to grey quartz crystals set in pale-pink feldspar. Black crystals of tourmaline display an incipient foliation with laths of colourless muscovite.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	25
Plagioclase	25
Microcline perthite	12
Orthoclase perthite	14
Tourmaline	10
Garnet	2
Muscovite	10
Sericite	2
Zircon	Accessory

The rock is composed of an equigranular mosaic of quartz and felsic minerals through which are distributed weakly foliated laths of colourless muscovite and crystals of greenish-yellow tourmaline and colourless garnet.

Plagioclase and potash feldspars are about equally abundant and form irregular shaped, equigranular crystals. The plagioclase is oligoclase (about An_{20}) and some crystals are weakly zoned. The core regions of the zoned crystals are partially replaced by colourless muscovite and disseminated silicate and opaque mineral phases. The zone adjacent to the core is usually quite fresh and less well twinned than the core zone. The outermost zone, where it occurs, is altered in a similar manner to the core. The plagioclase crystals which are apparently not zoned are uniformly altered to muscovite, sericite and disseminated opaques, many crystals of which are oriented along crystallographic directions.

The potash feldspar is both microcline and orthoclase perthites. The microcline displays a poorly developed cross-hatched twinning while the orthoclase is untwinned. In both the perthites are of the ribbon and string type predominantly with occasional patch perthites. The potash feldspars are somewhat fresher than the plagioclase but are included with disseminated opaques.

Quartz is the other felsic constituent. The mineral occupies interstitial positions between the feldspar crystals and may be poikilitically included within the potash feldspars. The quartz displays a moderately undulose extinction and is traversed by lines of disseminated opaques which may form along rehealed fractures.

Tourmaline forms large euhedral to subhedral crystals which are strongly pleochroic from pale greenish-yellow to a deep greenish-yellow (schorlite-iron rich tourmaline). Rarely the mineral may be included within feldspar crystals but more commonly it appears to have crystallized along grain boundaries between feldspar and quartz crystals.

Muscovite is the principal mafic constituent. It forms euhedral, tabular and platy laths which usually display ragged terminations. The mineral is fresh and contains a very few inclusions of zircon about which pale lemon-coloured haloes are found. Some laths are included with tourmaline.

Garnet crystals are associated with both the muscovite and the tourmaline. They display a subhedral to sub-rounded habit and usually form as discrete crystals. The mineral is quite fresh.

The rock shows very minor evidence for incipient deformation. The quartz has a moderate strain extinction and some of the plagioclase shows evidence for slight contortion and bending of the twin lamellae.

Discussion:

There is no evidence for recrystallization in this sample and all minerals appear to be the product of single generation of crystallization. The rock has abundant evidence to indicate that it crystallized as an igneous rock. There is no evidence to indicate that the garnets are xenocrystic and it is concluded that they crystallized during the main stage of magmatic crystallization. The rock could represent a late pegmatitic phase of a larger granitic intrusion.

Sample: K.I. 6: TS 24001

Rock Name:

Tourmaline-muscovite pegmatite of granitic composition

Hand Specimen:

A coarse-grained, pale-coloured, pegmatitic rock composed of white feldspars, grey quartz and laths of weakly foliated, colourless muscovite. The rock is traversed by numerous planes along which there has been a reduction in the grain-size.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	30
Plagioclase	15
Orthoclase perthite	10
Microcline perthite	20
Muscovite	15
Tourmaline	5
Opaques	Accessory
Zoisite	Accessory
Chlorite	Accessory
Sericite	Accessory

This rock, in all but the absence of garnet (?spessartite), resembles K.I. 7. The rock has a cataclastic texture and is composed of minerals which have crystallized as two generations.

The texture displayed by the primary mineral assemblage was probably xenomorphic although this has since been substantially modified by later events. The relict minerals of the first generation assemblage include plagioclase, microcline, orthoclase, quartz, muscovite and tourmaline.

The plagioclase is oligoclase in composition and poly-synthetically twinned according to the albite law. The mineral is comparatively fresh although included with numerous fine-grained silicate phases (including muscovite) and disseminated opaques.

The potash feldspars form coarse-grained idiomorphic crystals which are perthitic. The microcline displays a well developed cross-hatched twinning and displays ribbon-like perthites, the development of which is probably related to strain in the crystal. The orthoclase is untwinned and displays the development of patch-perthites some, at least of which are related to strain in the crystals. Both minerals are fresh.

The remaining quartz of the primary assemblage displays a pronounced undulose extinction but is water clear. Much has been reconstituted during subsequent events.

The first generation muscovite and tourmaline have also been affected by the subsequent history of the rock. Primary crystals of muscovite are flaky and platy or in places form books. The crystals have ragged terminations and are generally fresh and lack inclusions. A little muscovite forms as inclusions within the plagioclase but most occupies interstitial positions. Tourmaline forms as small idio-morphic to subhedral crystals which display a striking pleochroism from greenish-yellow to pale yellow. The mineral is fresh and has a random distribution.

The second generation assemblage has crystallized in response to a dynamic metamorphic event which has resulted in sub-stantial and striking modifications to the primary mineral assemblage. The rock has been subjected to cataclastic deformation under the influence of a uni-directional stress system. The felsic minerals and the muscovite and tourmaline have been deformed and in most instances partially recrystallized.

Along planes of deformation the quartz has been granulated and partially recrystallized to ribbon-like aggregates of dimensionally oriented crystals which display a pronounced undulose extinction. In some places the dimensionally oriented quartz swirls about porphyroclastic remnants of the primary assemblage.

The feldspars have been subjected to less severe modifications. In most places partial granulation has occurred and most of the primary crystals are deformed, bent and dislocated.

Where deformation has been extreme the muscovite crystals have been distended and bent in the plane of the stress and in many places the primary crystals have partly to completely broken down to a cryptocrystalline aggregate of sericite/muscovite flakes which are drawn out to elongate lenses in the plane of the deformation. Tourmaline crystals have also been disrupted and partially broken up along the planes of deformation.

Discussion:

This rock was originally the product of igneous crystallization and probably represented a pegmatitic phase of a larger granitic intrusion. Post the igneous crystallization the rock has been subjected to a dynamic metamorphic event in response to which extensive cataclasis and partial recrystallization has ensued.

Mineralogically the rock is related to K.I. 5 and K.I. 7 with the exception of the absence of garnet in K.I. 6 and petrogenetically it is related to K.I. 7. The deformation has, however, been somewhat more intense in K.I. 6 as compared to K.I. 7.

<u>Sample: K.I. 7: TS 24002</u>

Rock Name:

<u>Garnet-tourmaline-muscovite pegmatitic gneiss of adamellitic composition</u>

Hand Specimen:

A coarse-grained, pegmatitic rock composed of crystals of white feldspar, grey quartz and foliated laths of muscovite.

The rock has been cataclastically deformed and granulated to fine-grained material along particular planes.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	35
Orthoclase perthite	10
Plagioclase	18
Microcline	10
Muscovite	15
?Phlogopite	5
Tourmaline	5
Sericite	Accessory
Garnet	2
Apatite	Accessory
Zircon	Accessory

The rock has a cataclastic texture and is composed of minerals which have crystallized during two separate events.

Minerals of the first generation assemblage display an xenomorphic texture and are composed of plagioclase, microcline and orthoclase perthites, muscovite, tourmaline and garnet. The plagioclase is oligoclase (about An_{20}) and forms equigranular and irregular crystals whose primary habit has been modified by the effects of subsequent deformation. The mineral is included with numerous, very fine crystals of colourless micas, some of which have crystallized along cleavage traces and with disseminated opaques. A few crystals of tourmaline may also be included within the plagioclase.

The potash feldspar is both microcline and orthoclase. The microcline is characterised by a poorly developed cross-hatched twin lamellae. A few blebs of string perthite are evident in the microcline and are oriented along crystallographic directions. In addition a second set of perthites have developed, usually at an angle to the first. This second set has developed as a result of strain deformation and parallels the planes of cataclastic deformation in the rock. The development of perthites in the orthoclase is similar to that in the microcline. Both of the potash feldspars are included with numerous flakes of colourless micas in a manner resembling that of the inclusions within the plagioclase.

Much of the first generation quartz has been reconstituted to form a part of the second generation assemblage. However, relict crystals are preserved. These are comparatively coarse-grained, water-clear and display a very pronounced undulose extinction. Some are traversed by a series of dislocations which parallel the planes of cataclastic deformation in the rock.

Muscovite forms coarse-grained platy laths. The mineral is fresh and contains few inclusions.

The other essential minerals of the primary assemblage are tourmaline and garnet. The tourmaline is strongly pleochroic from deep greenish yellow to pale yellow and forms subhedral to idiomorphic crystals which have a random distribution. In some places the crystals are included within plagioclase crystals but more generally they appear to occupy interstitial areas between the crystals of the felsic constituents. A few of the tourmaline crystals are skeletal and intergrown with quartz and muscovite.

The garnet forms as small subhedral to rounded crystals which also have a random distribution. The garnet is the product of the first generation (igneous) assemblage and the overall composition of the rock suggests it to be spessartite although this is not confirmed.

The second generation assemblage has crystallized in response to a dynamic metamorphic event and is related to subparallel planes of shear which traverse the sample. Along the planes of deformation the felsic minerals have been granulated and partially recrystallized to a fine-grained polygonal mosaic of crystals. The muscovite flakes are bent, distorted and frequently distended in the plane of the deformation. In addition some of the muscovite has partially recrystallized. Probably as a result of the deformation much of the muscovite is now foliated and oriented in the plane of the deformation. The recrystallized muscovite is bent around porphyroclastic relicts of quartz and feldspar and associated with the recrystallized felsic minerals.

Where a deformation plane traverses tourmaline and garnet crystals these have splintered and broken. At a distance from the deformation planes minor recrystallization along the grain boundaries of the felsic minerals is apparent. In addition, there is abundant evidence for fracturing, dislocations and undulose extinctions developing in crystals of the first generation assemblage.

Apatite and very minor zircon and opaques form the accessory minerals.

Discussion:

This rock, in terms of primary composition, closely resembles K.I. 5. However, it has had a different petrogenesis. The rock probably represents a late pegmatitic phase of a larger granitic intrusion. After consolidation the rock has been subjected to a dynamic metamorphic event in response to which cataclasis and partial recrystallization has ensued.

Sample: K.I. 8: TS 24003

Rock Name:

Topaz-tourmaline-muscovite-biotite pegmatite of adamellitic composition

Hand Specimen:

A weakly foliated crystalline, granitic rock composed of an equigranular mosaic of bluish-grey quartz and pale-pink to white feldspars through which are distributed weakly foliated laths of muscovite and crystals of black tourmaline.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	30
Plagioclase	20
Microcline perthite Orthoclase perthite	30
Biotite	5
Tourmaline	3
Opaques	Accessory
Muscovite	10
Apatite	Accessory
Zircon	Accessory
Zoisite	Accessory
Chlorite	2
Sphene	Accessory
Topaz	Accessory

This rock displays a modified xenomorphic texture. The primary texture has been modified by a mild dynamic metamorphic event which has promoted cataclastic deformation and incipient recrystallization. As a result the present mineral assemblage is the product of two generations of crystallization.

Much of the rock is the product of the first period of crystallization. The minerals form an equi-granular mosaic of idiomorphic, interlocking crystals of felsic minerals through which are randomly distributed ferromagnesian minerals.

Both microcline and orthoclase compose the potash feldspars. The microcline has a poorly developed, cross-hatched twinning and is strongly perthitic. The perthites are of the patch type and are randomly distributed, throughout the crystals. At least some of the perthites have developed as the result of strain. The microcline is faintly reddened by very finely disseminated opaque mineral phases but otherwise is fresh. The mineral identified as orthoclase optically does not appear to have sufficient triclinicity to be classified as microcline. In other respects, though, it resembles the microcline.

The plagioclase forms coarse-grained, idiomorphic crystals many of which display a weak compositional zonation. The outer margins of many of the crystals are albite in composition in contrast to the core which is oligoclase (about An_{15}). The crystals display a well developed polysynthetic twinning. The core regions are extensively replaced by microcrystalline sericite, muscovite and, in addition contain very minor inclusions of quartz and disseminated opaques. There is no evidence for the development of antiperthites. Like the potash feldspars the plagioclase is lightly dusted with very finely disseminated opaque mineral phases.

The quartz forms coarse-grained, idiomorphic crystals and plates between the feldspar crystals. The quartz displays a strongly undulose extinction and the margins of the crystals are serrated suggesting incipient recrystallization. The mineral contains a few very minor inclusions of opaque and silicate phases and is traversed by "trains" or lines of disseminated opaques which have probably collected along rehealed fractures.

The biotite forms ragged lath-like crystals which have a random distribution. The mineral is strongly pleochroic from a yellowish brown to a deep greenish-brown and contains metamict mineral grains (?zircons) as inclusions. The biotite has been subjected to partial alteration. In places it has been replaced by an iron-stained chlorite and in other areas it has been partially replaced by and is interleaved with muscovite. In these latter areas zoisite frequently accompanies the alteration.

Muscovite forms as large platy crystals and crystal aggregates which are often associated with the biotite and which also have a random distribution. This mineral is fresh although in places contain small, ragged and partly altered inclusions of biotite.

Tourmaline is perhaps not as conspicuous as it is in some other rocks of this suite, but nevertheless is present. The mineral is the same as that found in K.I. 5, K.I. 6, K.I. 7 and K.I. 11 and again displays the distinctive pleochroic scheme from pale golden yellow to a greenish-yellow. It forms idiomorphic to sub-idiomorphic crystals and is quite fresh. Associated with some of the crystals is a second tourmaline. This mineral forms very small crystals and is pale sky-blue in colour. Along small fractures in some tourmaline crystals a colourless, epidote-group mineral (?zoisite) with a moderate birefringence has crystallized.

A third conspicuous accessory mineral of the first generation assemblage is topaz. This mineral occurs in only small amounts and forms subidiomorphic crystals which contain small inclusions of quartz and micas.

The second generation mineral assemblage has crystallized in response to a dynamic metamorphic event. Sub-parallel planes along which a uni-directional stress system has caused rupture traverse the rock. The mineral which has undergone the most significant adjustment to the new conditions is quartz. In places the mineral forms ribbon-like aggregates of dimensionally oriented crystals which display an intensely undulose extinction. In other areas relict primary quartz crystals are mantled in a fine-grained polygonal mosaic of quartz crystals which are a product of recrystallization.

Muscovite is another mineral phase which is common in the second generation assemblage. It forms foliated aggregates of microcrystalline and fine-grained laths oriented in the plane of the deformation.

In addition to the obvious effects of deformation small fractures have developed in crystals of the primary mineral assemblage. Along these fractures quartz and muscovite of the second generation assemblage have crystallized. Strain features such as dislocations and undulose extinctions are also evident in many crystals of the primary assemblage.

Discussion:

This sample closely resembles K.I. 11 in all respects (viz, chemically, mineralogically and petrogenetically). The mineral assemblage biotite, muscovite, topaz and tourmaline is characteristic and distinctive. The rock is a product of magmatic crystallization and has subsequently been deformed and partially recrystallized under the influence of a dynamic metamorphic event.

Sample: K.I. 9: TS 24004

Rock Name:
Medium-grained orthite-biotite adamellite

Hand Specimen:
Medium-grained, weakly foliated, crystalline, granitic rock composed of a crystalline mosaic of quartz, white to buff feldspars and weakly foliated biotite.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	30
Plagioclase	22
Orthoclase Microcline	28
Biotite	15
Chlorite	3
Zoisite	2
Orthite	Accessory
Zircon	Accessory
Opaques	Accessory
Sericite	Accessory

This rock has an xenomorphic texture and is composed of an equigranular mosaic of quartz and feldspar through which are randomly distributed flakes and laths of a pleochroic brown biotite. The rock is a little finer grained and more equigranular than other samples examined in this suite.

The plagioclase feldspar forms as euhedral to subhedral prismatic crystals which display a prominent polysynthetic twinning and in some crystals a weakly developed compositional zonation. The crystals range in composition from oligoclase to albite (about An_{15} to An_5). Many of the crystals, and particularly the smaller ones, are fresh. However, some crystals show evidence for alteration which may be confined to particular zones in the crystal or may be related to incipient deformation. More usually though, the alteration, if present, is widespread through the crystal. The products of alteration include fine-grained and disseminated clay minerals and sericite, some zoisite, chlorite and disseminated opaques.

The potash feldspars include both microcline and orthoclase. The microcline is distinctively twinned according to a cross-hatched twinned law while the orthoclase is untwinned. Both have been subjected to patchy exsolution resulting in the formation of perthites. The crystals are more generally idiomorphic and may be included with smaller crystals of plagioclase and biotite. Both the orthoclase and the microcline are fresh.

Quartz occupies the interstitial positions between the feldspar crystals and the shape of the interstices tends to control its habit. The mineral has a strongly undulose extinction and in places is traversed by a series of small cracks and dislocations. The mineral is clear although along some of the cracks cryptocrystalline, faintly coloured, silicate minerals have crystallized.

Biotite is ubiquitous and is the principal ferromagnesian constituent. It forms subhedral to idiomorphic laths which display a pronounced pleochroism from deep reddish-brown to pale straw yellow. The laths are included with small subhedral crystals of apatite and less common metamict zircons. In some crystals, and particularly in those which show some evidence for incipient deformation aggregates of cryptocrystalline opaques (?sphene, ?leucoxene) have a sporadic distribution. Some crystals show evidence for partial chloritization. In these the chlorite is very pale-green, slightly pleochroic, and interleaved with the biotite along cleavage planes.

An accessory mineral whose presence is possibly significant from the point of view of correlation purposes is a completely altered, poorly zoned ?metamict mineral. It forms subhedral to anhedral crystals which are now composed of a mixture of chlorite, clay minerals and hydrated iron-oxides. This mineral could well have been metamict orthite. Other accessory minerals include apatite, zircon and opaques.

Discussion:

This rock is a granitic rock with granodioritic to adamellitic affinities. It is the product of magmatic crystallization and the mineral assemblage is the product of a single event. The alteration is possibly deuteric in character. The mineral assemblage is not particularly distinctive. However, the presence of possible orthite suggests a correlation with the biotite and orthite bearing samples K.I. 1, K.I. 2 and K.I. 3.

Sample: K.I. 10: TS 24005

Rock Name:

Deformed and altered adamellite

Hand Specimen:

A medium to coarse-grained granitic rock composed of comparatively large crystals of potash feldspar set in a mosaic of fine-grained ferromagnesian minerals and quartz, plagioclase and minor K-feldspar. The rock has been subjected to deformation.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	35
Orthoclase perthite / Microcline perthite	20
Plagioclase	30
Chlorite	10
Zoisite / Epidote	5
Sphene	Accessory
Sericite	Accessory
Muscovite	Accessory

This rock differs substantially from the remainder of the rocks in this suite in that there is a complete absence of fresh mafic silicates. On the other hand it resembles cataclastically deformed muscovite and tourmaline bearing rocks in that there has been substantial deformation and partial recrystallization resulting in a mineral assemblage that is of at least two generations.

The primary rock probably displayed an xenomorphic texture and was composed of an equigranular aggregate of quartz and feldspar crystals through which were distributed magnesium- and iron-rich mafic silicates.

The predominant potash feldspar is orthoclase perthite and forms large idiomorphic crystals. The perthite is of the bead and string type and the blebs are oriented along crystalographic directions. Microcline is less common but resembles the orthoclase in most respects.

Many of the potash feldspar crystals have been ruptured and are traversed by a network of fine fractures along which the potash feldspar has recrystallized. Whereas the potash feldspar of the host crystal is clear the recrystallized feldspar is discoloured with finely disseminated opaque mineral phases. In addition the potash feldspar of the veins and fractures has crystallized with an optical orientation which differs from that of the host crystal. Both generations of feldspar are fresh.

The plagioclase forms idiomorphic to sub-idiomorphic crystals which are somewhat smaller than the potash feldspar crystals. Some are included within the larger potash feldspar crystals. The plagioclase was probably albite/oligoclase in composition although the crystals are now altered to an extent where precise identification is impossible. The products of alteration are predominantly microcrystalline and include abundant flakes and small laths of sericite/muscovite which are randomly distributed through the plagioclase host. Irregular and patchy aggregates of microcrystalline epidote and zoisite with lesser amounts of chlorite are the other alteration products. In general the plagioclase appears to be somewhat less susceptible to rupture than the potash feldspars but where deformation has occurred chlorite (dominant) sphene and epidote/zoisite have crystallized.

Quartz occupies most of the available interstitial positions between the feldspar crystals. The mineral has an irregular habit which appears to have been largely controlled by the shape of the interstitial area. It is essentially clear although very finely disseminated opaques are found in some crystals. The quartz displays a pronounced strain extinction which tends to parallel the planes of deformation and rupture in the rock. Along the planes of stress release and between grain boundaries the quartz has recrystallized to a micro-crystalline, polygonal mosaic of crystals.

The primary ferromagnesian minerals are almost completely replaced by a secondary mineral assemblage. The only primary mineral remaining is relict crystals of biotite which are now composed predominantly of a pale-green, anomolous chlorite and sphene. In addition to these minerals chlorite, sphene, epidote, zoisite and disseminated opaques have a wide distribution. These are products of the secondary alteration of primary mafic silicates.

Discussion:

This is a granodioritic rock which has crystallized from a magma but which has been subjected to a dynamic metamorphic event which has promoted the recrystallization of some of the quartz and potash feldspar and almost completely destroyed the primary mafic silicates.

It thus resembles some of the Cambrian acid intrusives (Murchison, Dove, etc. Granites). Cambrian basic volcanics are known to occur along the east coast of King Island but no Cambrian intrusive bodies of acid to intermediate composition have been reported on King Island.

Sample: K.I. 11: TS 24006

Rock Name:

Topaz-tourmaline-muscovite-biotite granodiorite

Hand Specimen:

A massive, crystalline, granitic rock composed of large crystals of potash feldspar (up to 1.5 cms) set in an equigranular mosaic of quartz and plagioclase with lesser amounts of potash feldspar and ferromagnesian minerals.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	30
Microcline } Orthoclase }	15
Plagioclase	30
Muscovite	8
Tourmaline	2
Biotite	12
Chlorite	2
Zoisite	1
Sericite	Accessory
Zircon	Accessory
Opaques	Accessory
?Topaz	Accessory

The rock has a xenomorphic texture and is composed of an interlocking mosaic of equigranular crystals of felsic minerals through which are distributed flakes, plates and crystals of ferromagnesian minerals. The mineral assemblage has crystallized essentially during one event although there is some evidence for incipient recrystallization along grain boundaries.

The felsic minerals include potash-feldspars, plagioclase and quartz. The potash-feldspars are microcline and orthoclase. The microcline forms idiomorphic crystals which display a pronounced cross-hatched twinning and are perthitic. The perthite is of the bead type although string perthites have developed in places, probably in response to strain. In addition, the crystals may be included with small, irregular crystals of quartz, micas and plagioclase. The mineral is fresh.

The orthoclase has a similar habit to that of the microcline. It too displays the development of numerous string perthites indicating that at the time of crystallization it was relatively enriched in the soda component. Poikilitic inclusions of quartz, plagioclase (oligoclase) muscovite and biotite are a feature of these crystals which are quite fresh.

The plagioclase usually forms as aggregates of sub-idiomorphic or subhedral crystals and has the composition of oligoclase (about An_{20}). Some crystals are quite fresh but most are partly altered. The crystals display a simple compositional zonation with more calcic cores and sodic rims. The core regions have been subjected to appreciable alteration to disseminated, colourless micas, muscovite, disseminated opaques and zoisite. By way of contrast the rims of the zoned crystals are comparatively fresh.

Quartz forms irregular, yet equant, idiomorphic crystals which occupy interstitial positions between the feldspar crystals. The mineral is usually clear but may contain a few minute silicate inclusions. It displays a pronounced undulose extinction. About the margins of many of the quartz crystals a polygonal mosaic of small crystals has formed. Similar features are found along small fractures which traverse some crystals.

Tourmaline forms quite large idiomorphic crystals which have a random distribution. The crystals are strongly pleochroic from almost colourless to a deep greenish-yellow with blotchy orange-coloured areas. A very few crystals may contain numerous poikolitic inclusions of quartz.

Biotite and muscovite are the principal ferromagnesian constituents. The biotite forms ragged laths which have a random distribution. The biotite has a strong pleochroic scheme from pale straw-yellow to deep brown and contains numerous inclusions of metamict zircons, and opaque minerals. All laths have been subjected to at least partial alteration and in some areas the biotite has been completely chloritized. The chlorite is pale-green and faintly pleochroic. Where it occurs small amounts of leucoxene have crystallized. Zoisite is a mineral which is also found as a product of alteration of the chloritized biotite.

Muscovite is comparatively fresh and forms flakes and books which have a random distribution. In many places the muscovite is associated with the biotite and may be interleaved with it. Apart from the coarse-grained muscovite, microcrystalline sericite/muscovite is also found as an alteration product of the plaigoclase as mentioned previously.

The accessory minerals include ubiquitous zircon, very few opaques and apatite and a mineral tentatively identified as ?topaz. The mineral forms sub-idiomorphic crystals, has a very weak birefringence, a cubic cleavage, a high relief (refractive index about 1.6) and a biaxial positive interference figure. The mineral is rare (only 2 crystals were observed in the examined section) and appears to be a product of the main-stage of crystallization. The determined optics are applicable to barite which could form as an alteration product of the potash feldspars in a rock of this composition. Topaz is favoured as the mineral does not appear to be an alteration product.

Discussion:

In as much that this rock contains abundant muscovite, a characteristic tourmaline (?schorlite) and is adamellitic in composition it resembles samples K.I. 5, K.I. 6 and K.I. 7. However, the presence of biotite and the absence of garnet (?spessartite) in this rock suggests it to be a somewhat earlier differentiate of the magma from which K.I. 5, K.I. 6 and K.I. 7 crystallized. There is some evidence to suggest that the muscovite crystallized a little later than the biotite.

The bulk of this rock is the product of igneous crystallization. However, there is evidence to indicate that the rock has been subjected to minor deformation under the influence of a deforming stress and that incipient recrystallization has ensued (viz, recrystallization of quartz and feldspars along grain boundaries, fracturing of quartz and feldspars, undulose extinction in quartz).

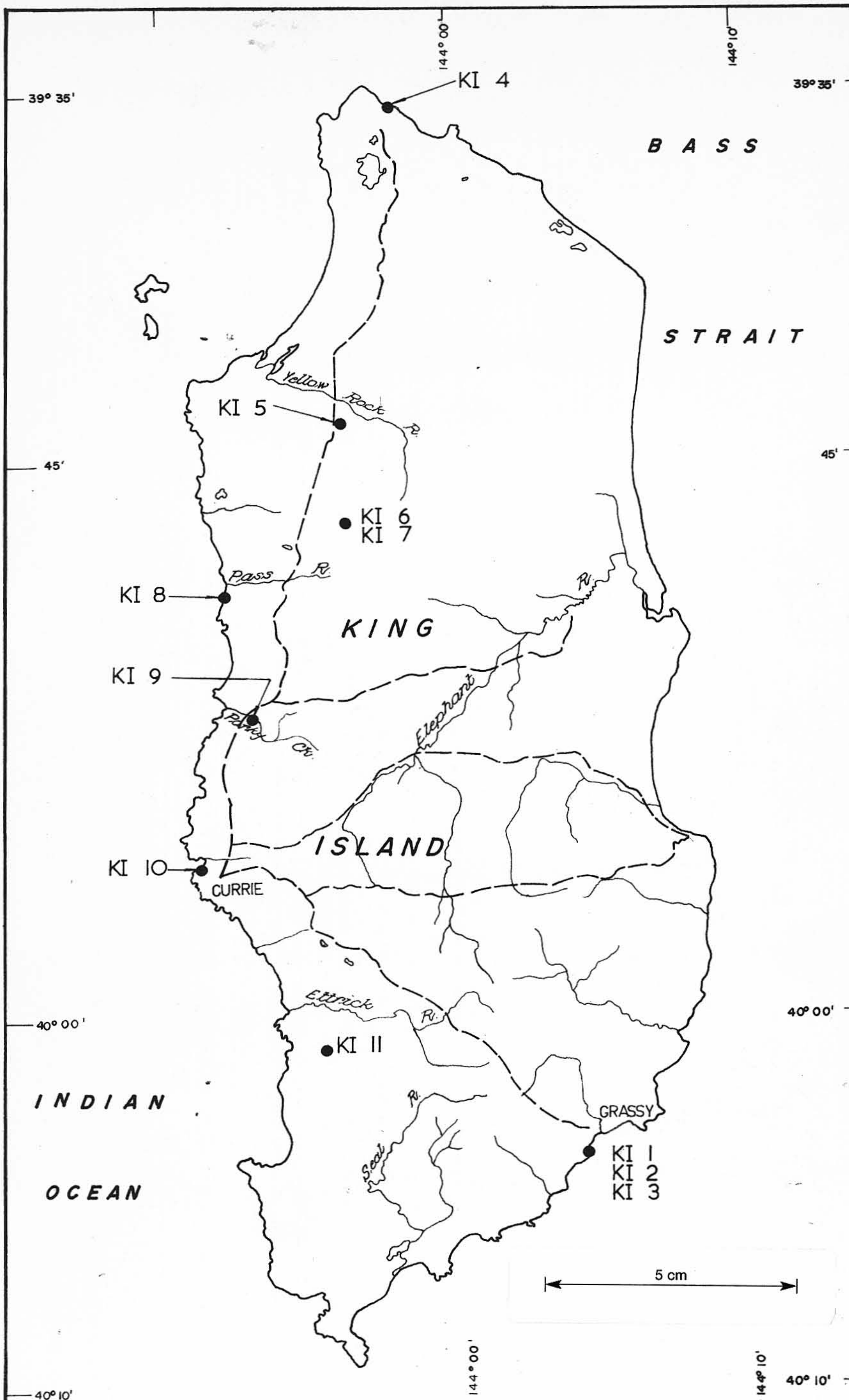
This deformation could be related to the dynamic metamorphic event which has promoted the deformation and recrystallization in K.I. 6 and K.I. 7.

024045

APPENDIX

ACCOMPANYING PLANS	SCALE
Location of Petrological Samples	1 inch to 4 miles
Distribution Graph for Molybdenum	
Distribution Graph for Tungsten	
Distribution Graph for Lead	
Distribution Graph for Zinc	
Distribution Graph for Tin	
Bold Head Stream Sediment Sample Plan for Molybdenum	1 inch to 1000 feet
Bold Head Stream Sediment Sample Plan for Tungsten	1 inch to 1000 feet
Bold Head Stream Sediment Sample Plan for Lead	1 inch to 1000 feet
Bold Head Stream Sediment Sample Plan for Zinc	1 inch to 1000 feet
Bold Head Stream Sediment Sample Plan for Tin	1 inch to 1000 feet
Porky Creek Stream Sediment Sample Plan for Molybdenum	1 inch to ½ mile
Porky Creek Stream Sediment Sample Plan for Tungsten	1 inch to ½ mile
Porky Creek Stream Sediment Sample Plan for Lead	1 inch to ½ mile
Porky Creek Stream Sediment Sample Plan for Zinc	1 inch to ½ mile
Porky Creek Stream Sediment Sample Plan for Tin	1 inch to ½ mile
Reekara Road Stream Sediment Sample Plan for Molybdenum	1 inch to ½ mile
Reekara Road Stream Sediment Sample Plan for Tungsten	1 inch to ½ mile
Reekara Road Stream Sediment Sample Plan for Lead	1 inch to ½ mile
Reekara Road Stream Sediment Sample Plan for Zinc	1 inch to ½ mile
Reekara Road Stream Sediment Sample Plan for Tin	1 inch to ½ mile

024046



ANTHONY, McKENNA & PTNRS. P.L.

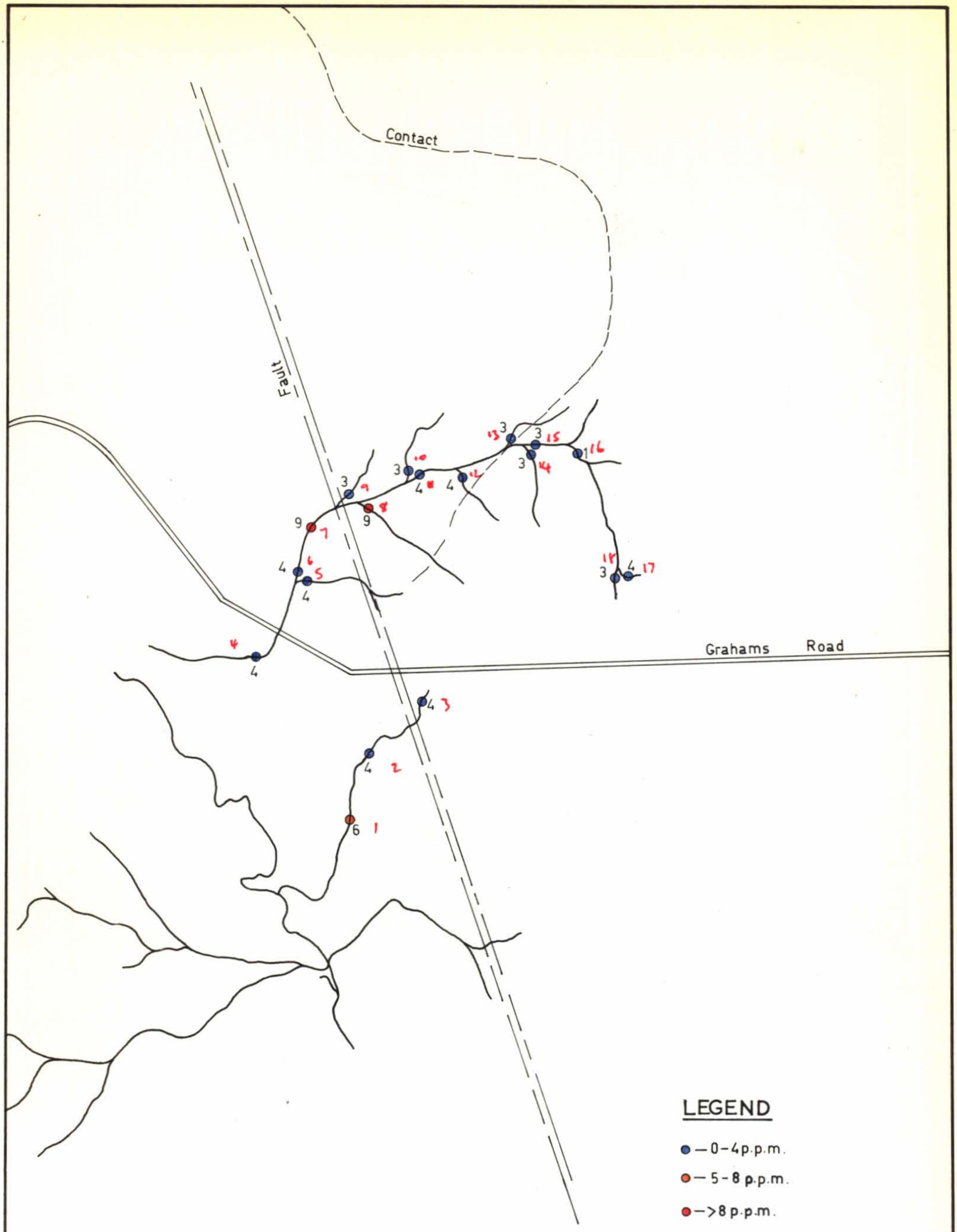
KING ISLAND

TASMANIA

LOCATION OF PETROLOGICAL SAMPLES

DATE: March, 1970 SCALE: 1" = 4 miles 70-616

024047



LEGEND

- ● — 0-4 p.p.m.
- ● — 5-8 p.p.m.
- ● — >8 p.p.m.

Assay method: Atomic Absorption ± 15% relative accuracy

5 cm

ANTHONY, McKENNA & PARTNERS PTY. LTD.

BOLD HEAD, KING ISLAND

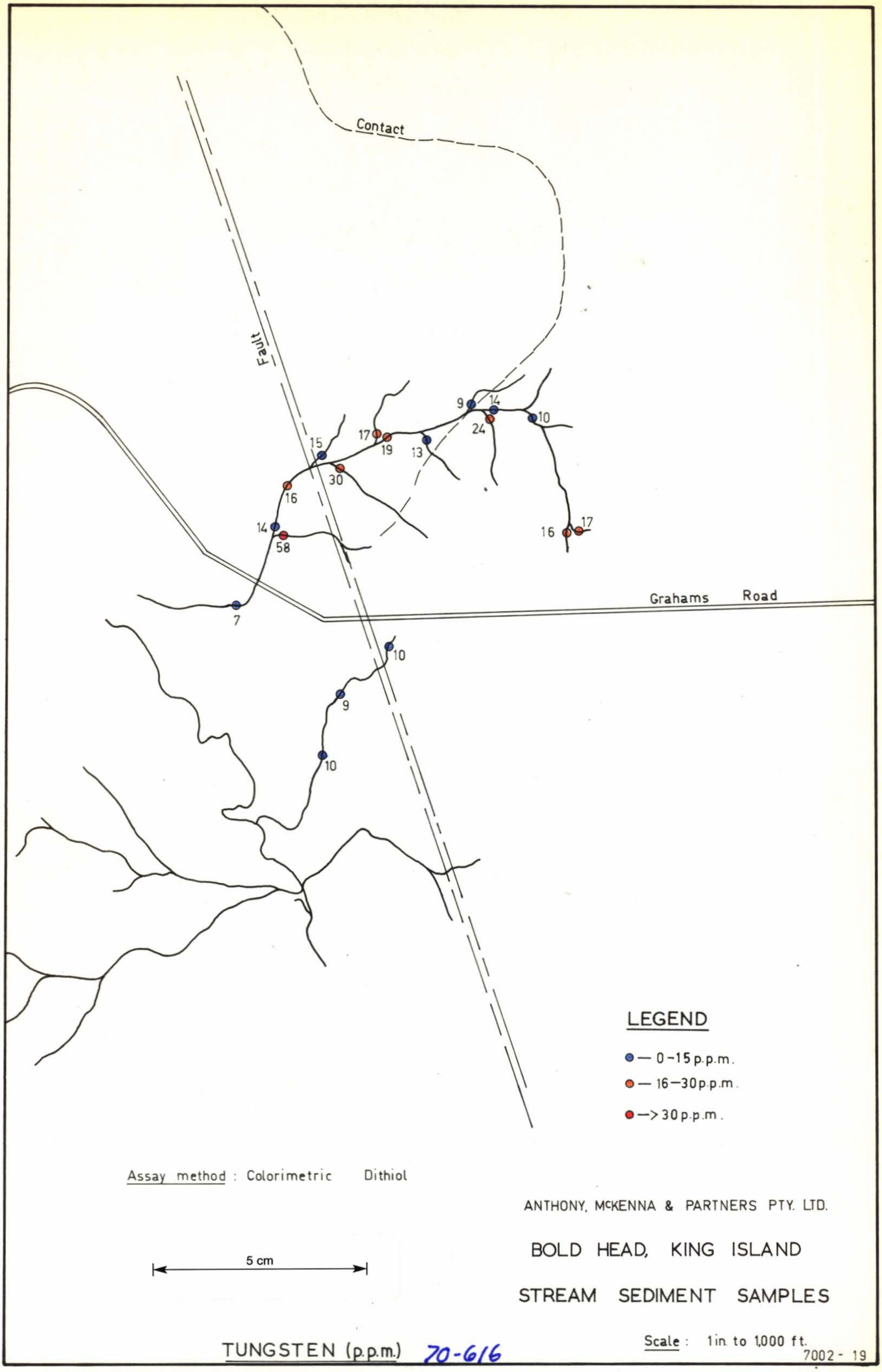
STREAM SEDIMENT SAMPLES

MOLYBDENUM (p.p.m.) 70-616

Scale: 1 in. to 1,000 ft.

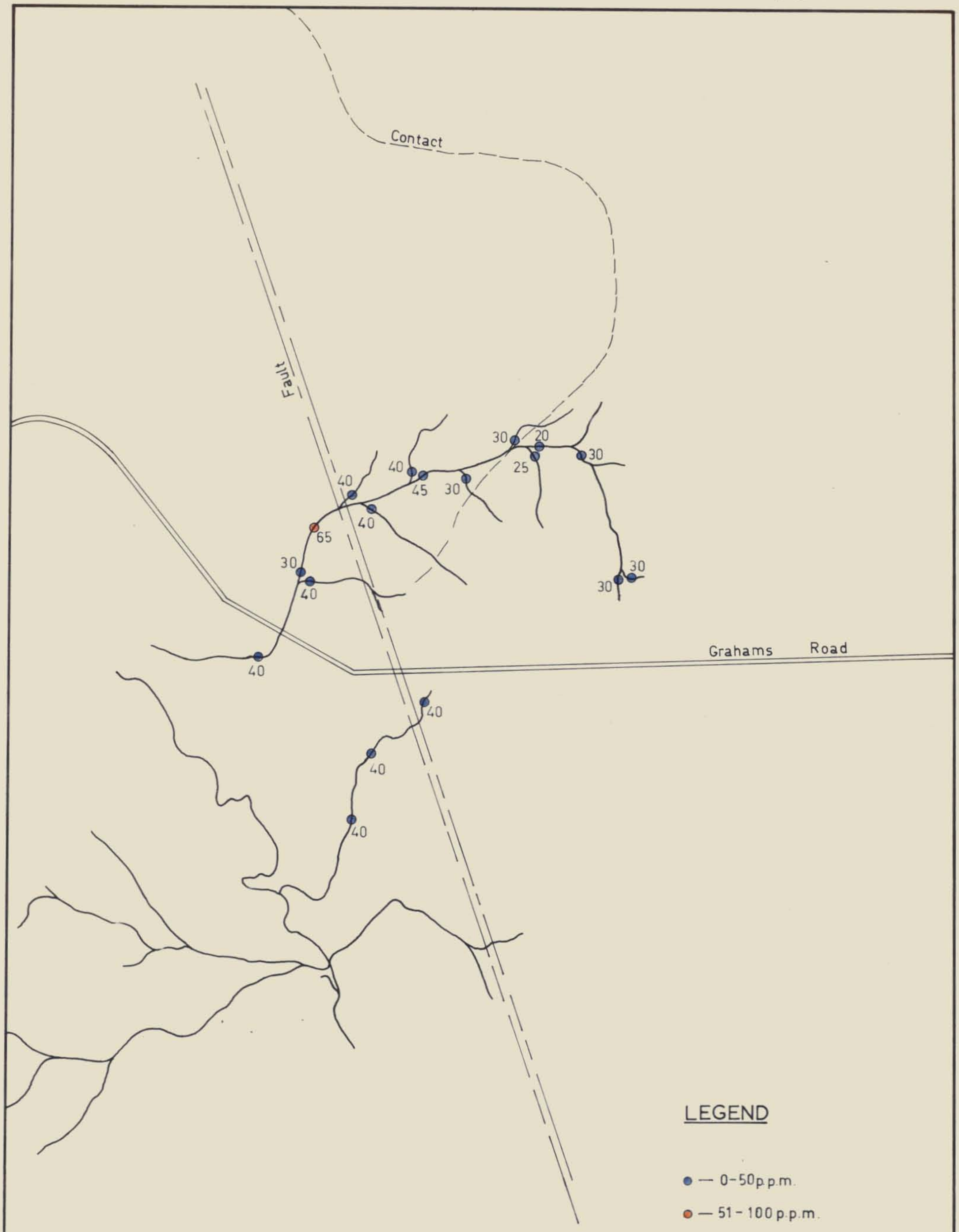
7002 - 17

024048


Contact
Fault
9
14
10
24
17
19
13
15
30
16
14
58
16
17
7
Grahams Road
10
9
10
LEGEND
— 0–15 p.p.m.
— 16–30 p.p.m.
—> 30 p.p.m.
Assay method : Colorimetric Dithiol
5 cm
ANTHONY, McKENNA & PARTNERS PTY. LTD.
BOLD HEAD, KING ISLAND
STREAM SEDIMENT SAMPLES
TUNGSTEN (p.p.m.)
70-616
Scale : 1in. to 1,000 ft.
7002 - 19

043

024049



LEGEND

- ● — 0–50 p.p.m.
- ● — 51 – 100 p.p.m.
- ● — >100 p.p.m.

Assay method : Atomic Absorption ± 15% relative accuracy

5 cm

LEAD (p.p.m.)

ANTHONY, McKENNA & PARTNERS PTY. LTD.

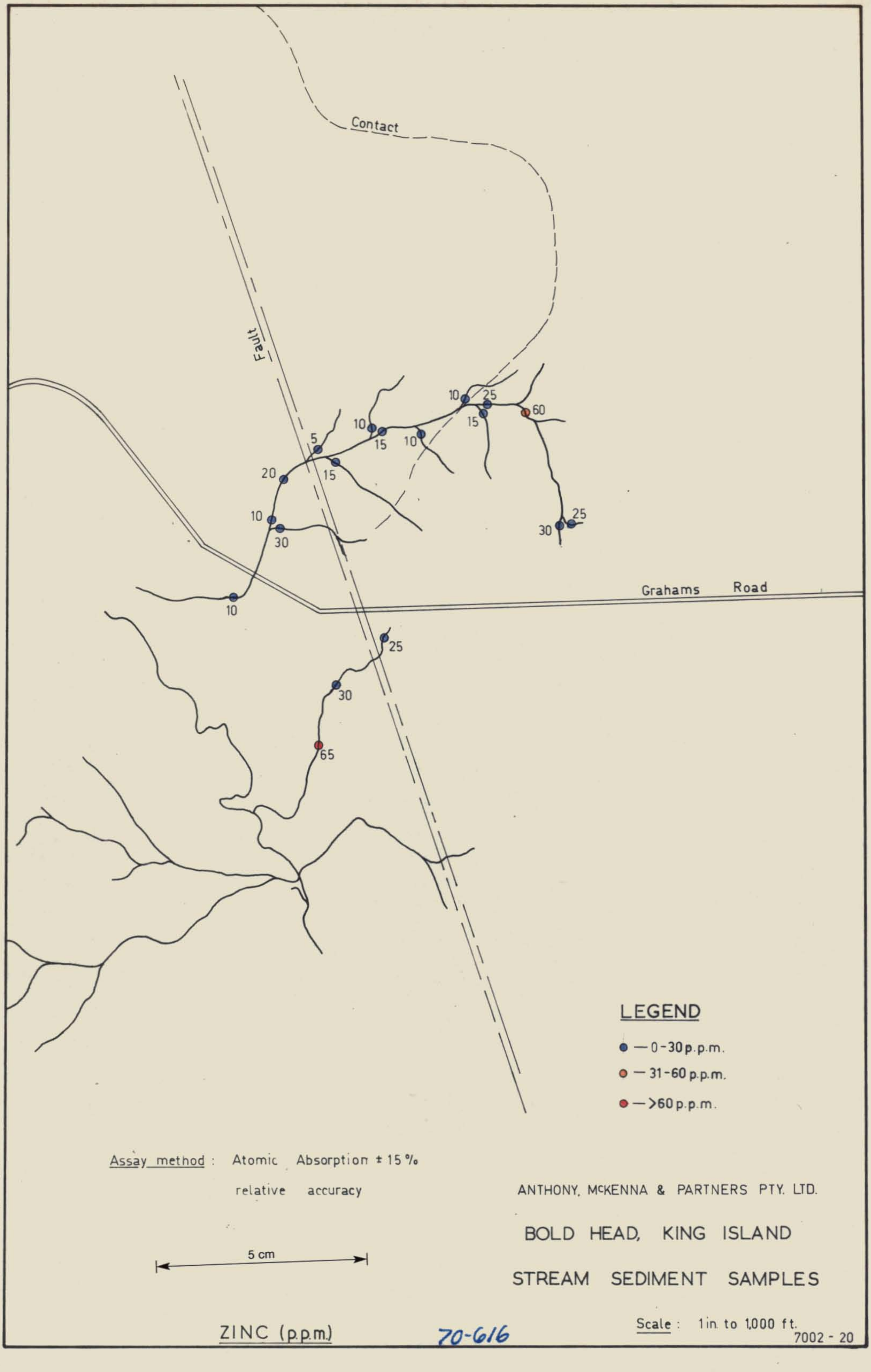
BOLD HEAD, KING ISLAND

STREAM SEDIMENT SAMPLES

Scale : 1 in. to 1,000 ft.

70-616

7002 - 16



ANTHONY, McKENNA & PARTNERS PTY. LTD.

BOLD HEAD, KING ISLAND

STREAM SEDIMENT SAMPLES

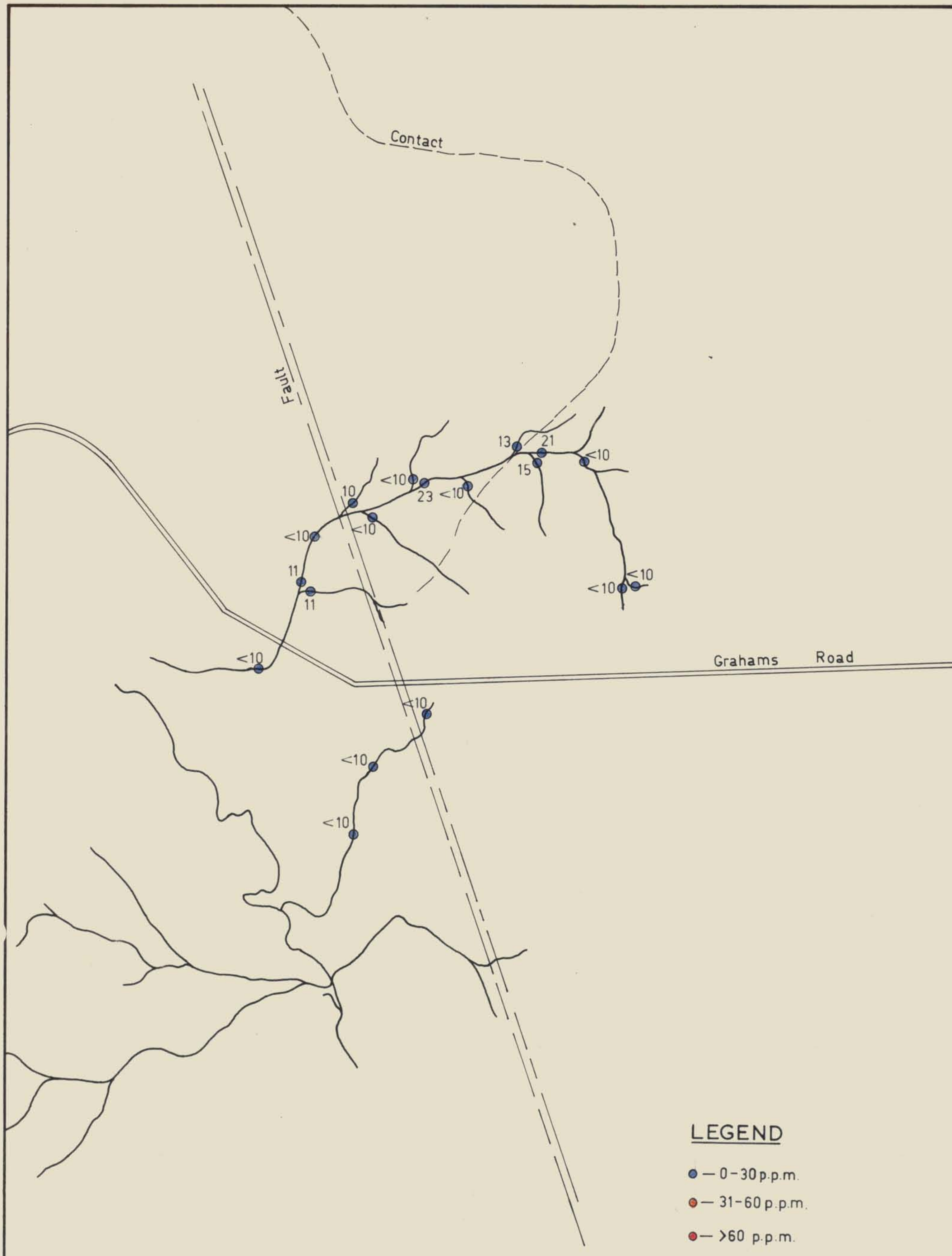
Scale : 1 in. to 1,000 ft.

70-616

7002 - 20

050

024051



Assay method : As discussed

ANTHONY, McKENNA & PARTNERS PTY. LTD.

BOLD HEAD, KING ISLAND

STREAM SEDIMENT SAMPLES

TIN (p.p.m.)

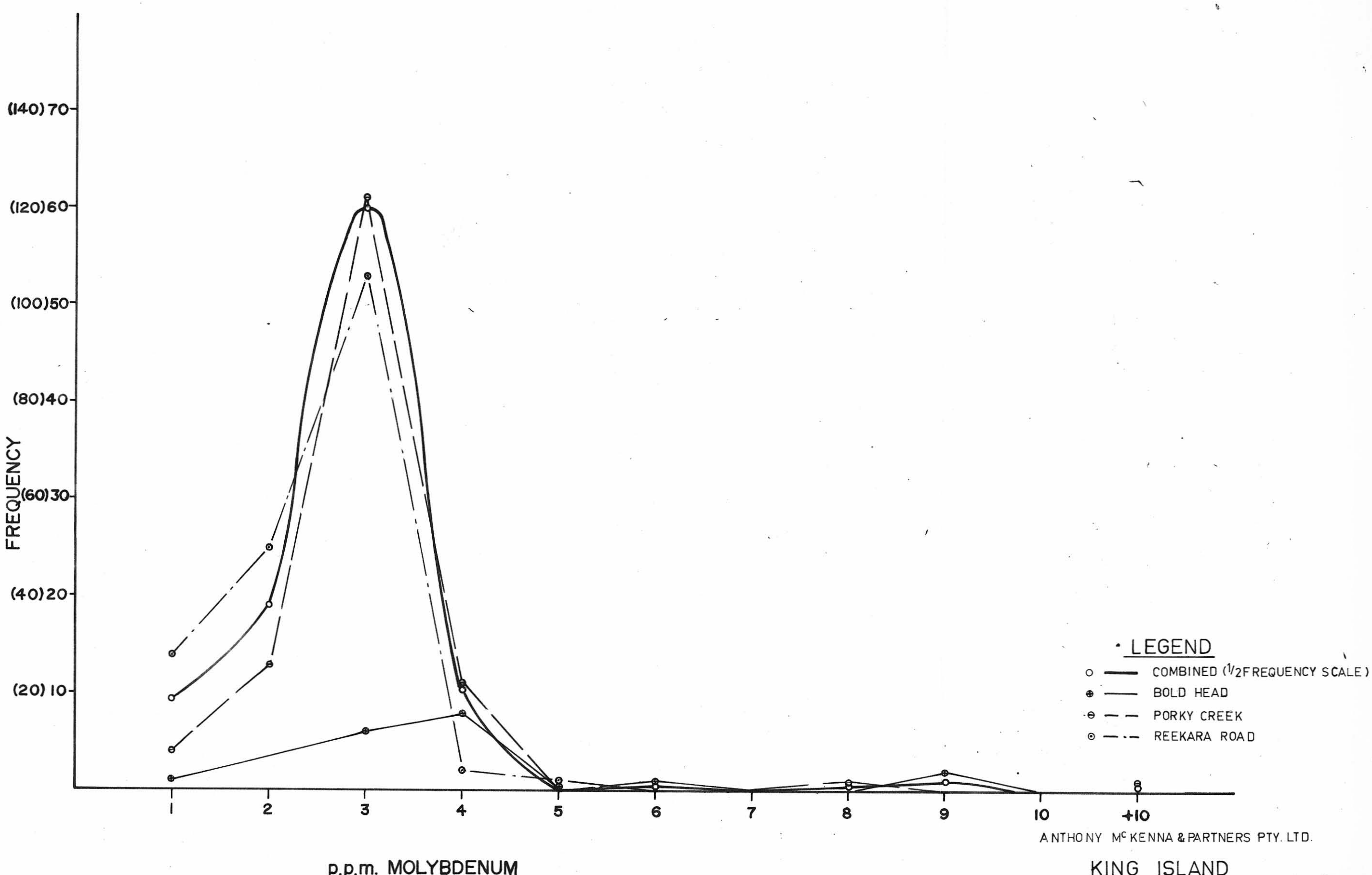
70-616

Scale : 1 in. to 1,000 ft.

7002 - 18

024052

MOLYBDENUM



ANTHONY M^C KENNA & PARTNERS PTY. LTD.

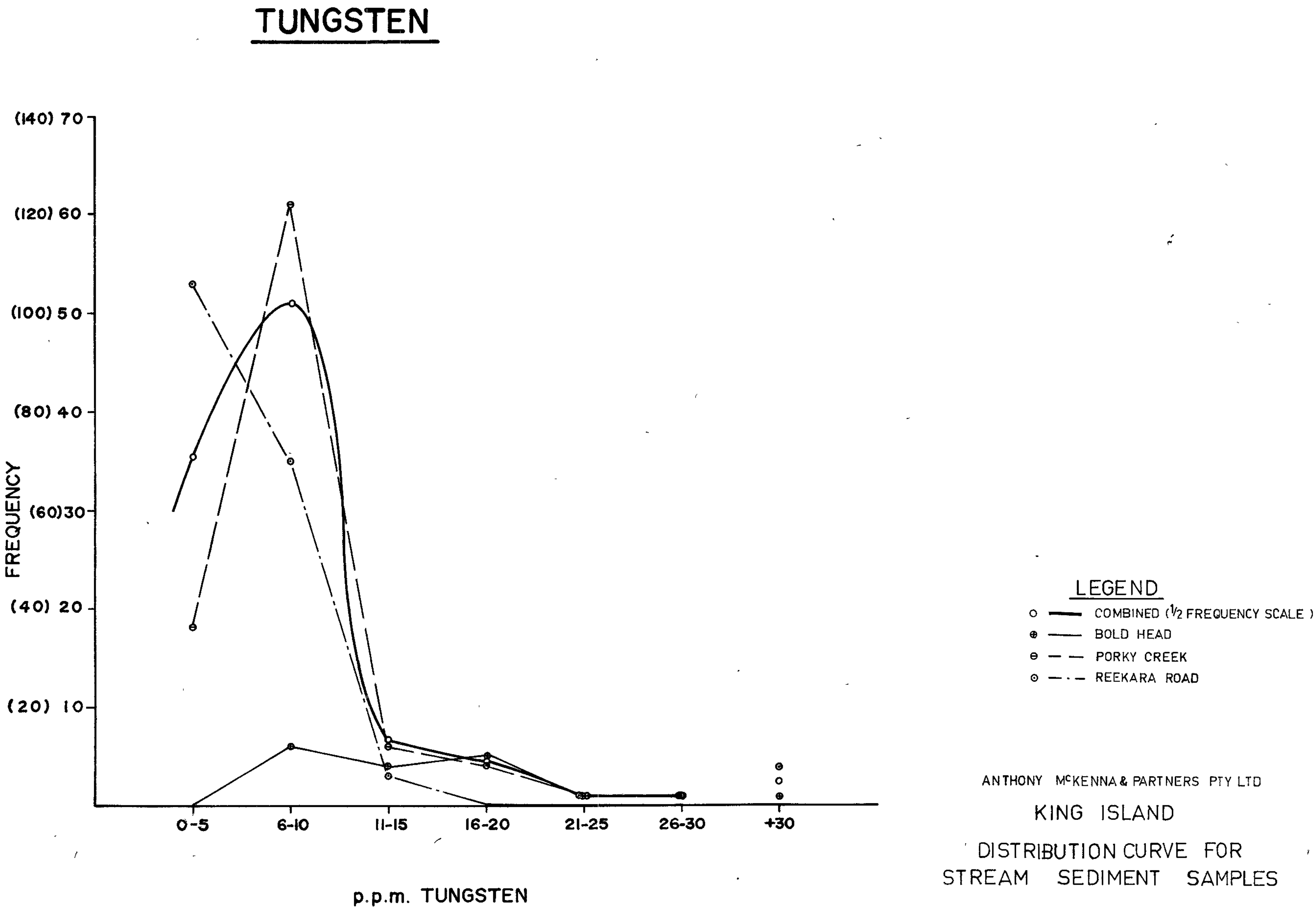
KING ISLAND

1804

DISTRIBUTION CURVE FOR
STREAM SEDIMENT SAMPLES

70-216.

Drg. No 7002 – 23



ANTHONY McKENNA & PARTNERS PTY LTD

KING ISLAND

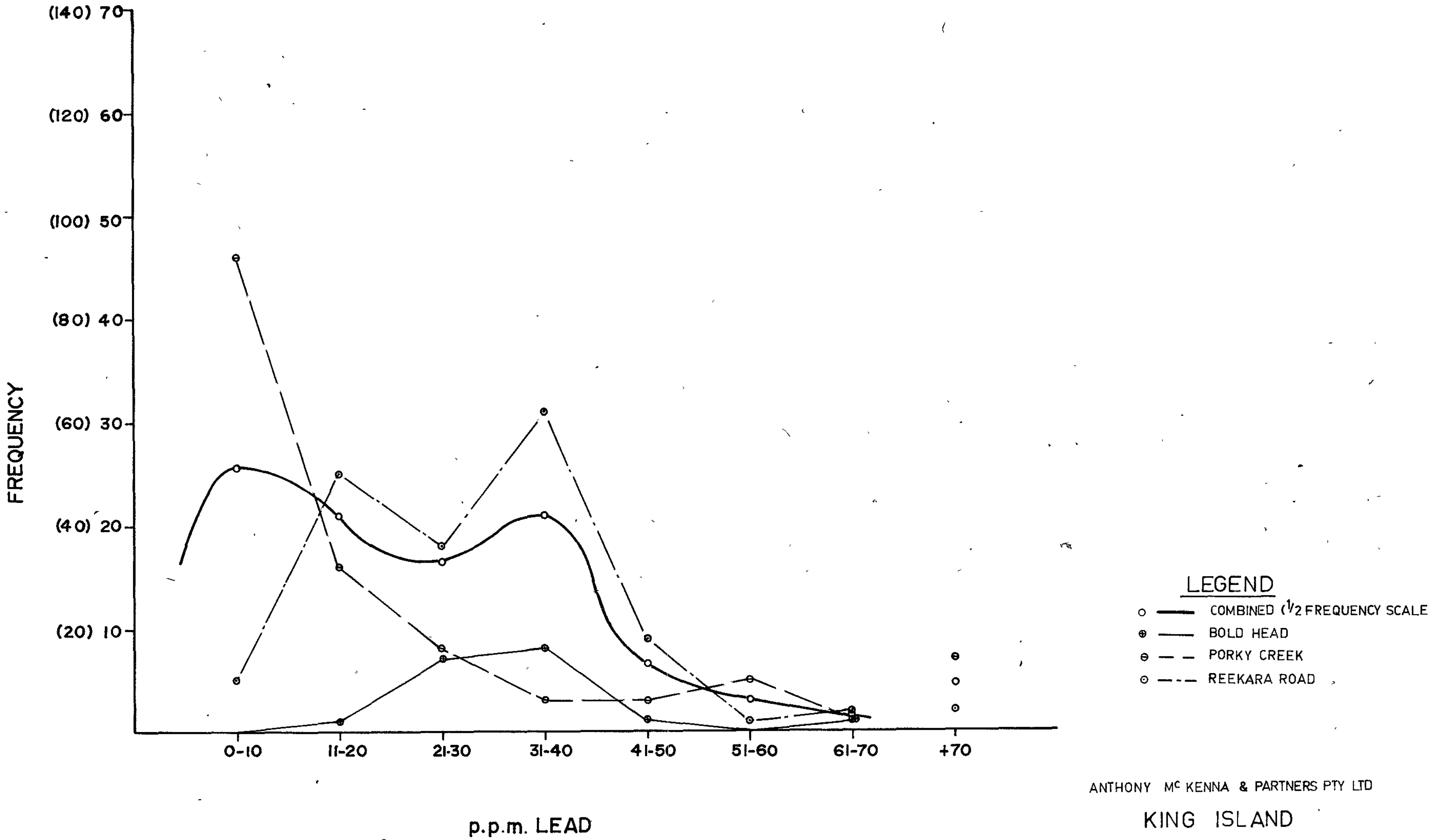
DISTRIBUTION CURVE FOR STREAM SEDIMENT SAMPLES

Drg No 7002-22 1805

70-616

024054

LEAD



ANTHONY Mc KENNA & PARTNERS PTY LTD

KING ISLAND

DISTRIBUTION CURVE FOR STREAM SEDIMENT SAMPLES

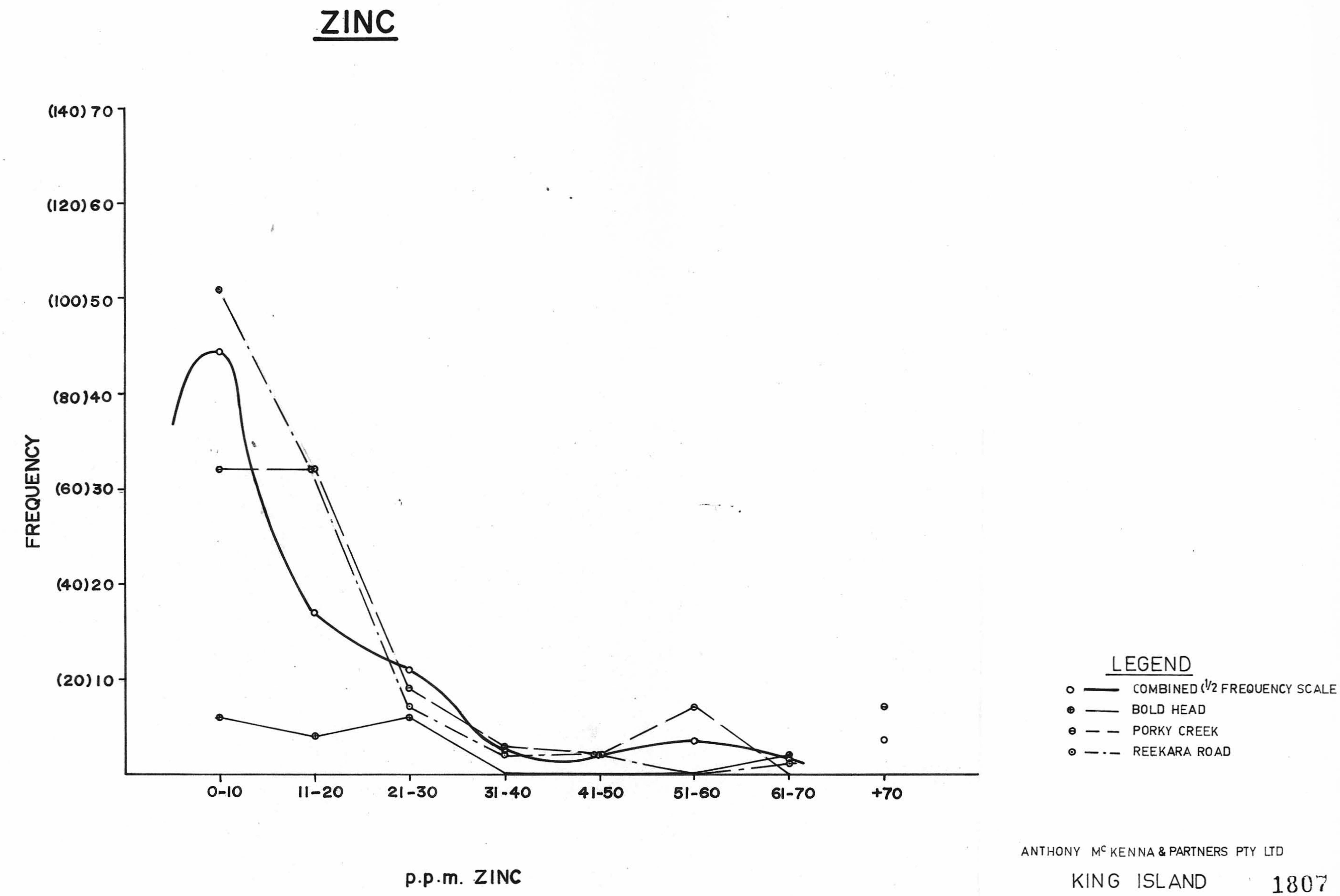
Drg. No 7002 — 25

70-616

1806

Do Not Cut

024055



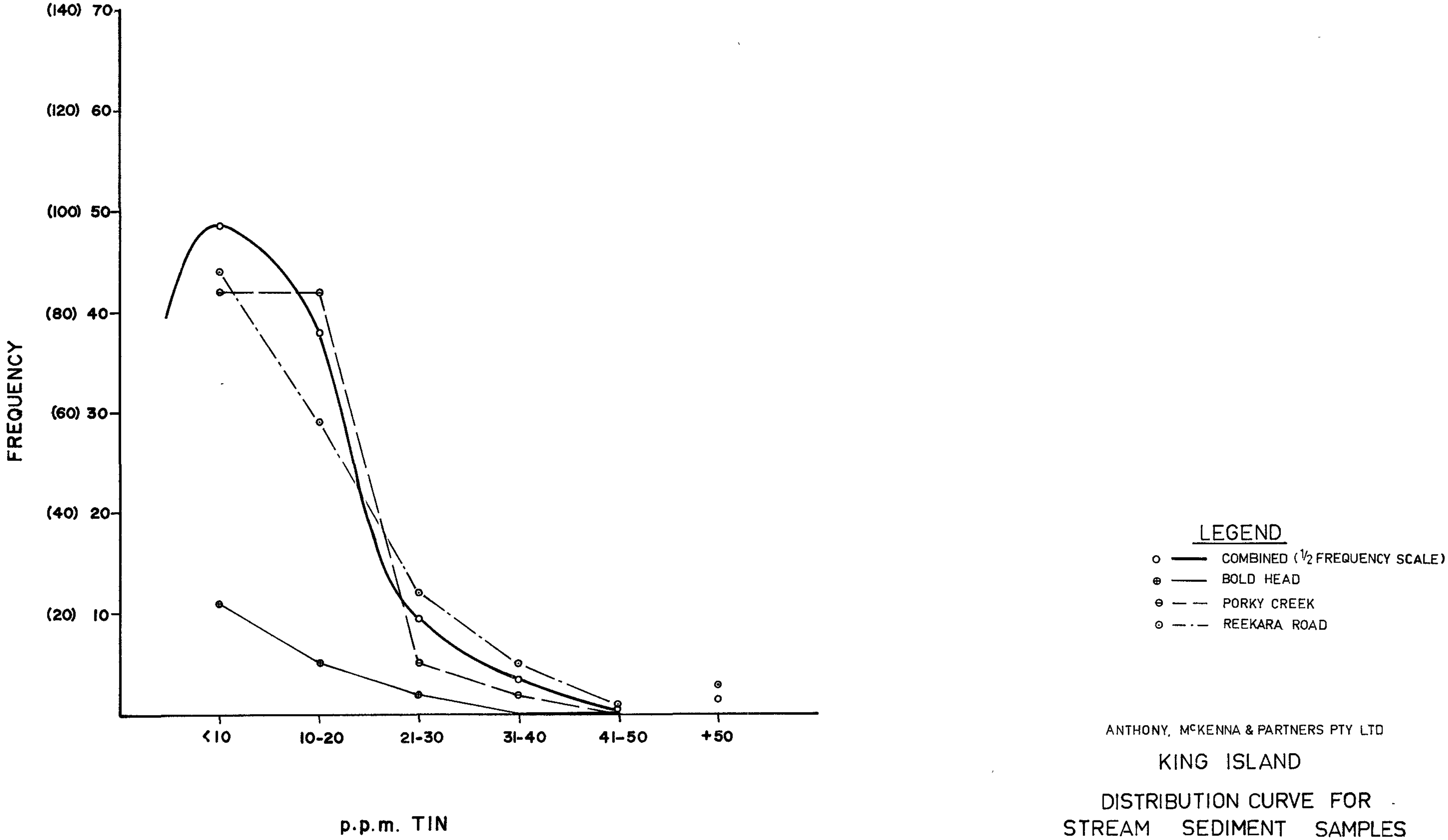
ANTHONY McKENNA & PARTNERS PTY LTD

KING ISLAND 1807

DISTRIBUTION CURVE FOR STREAM SEDIMENT SAMPLES

70-616 Drg No 7002 — 24

TIN



ANTHONY, McKENNA & PARTNERS PTY LTD

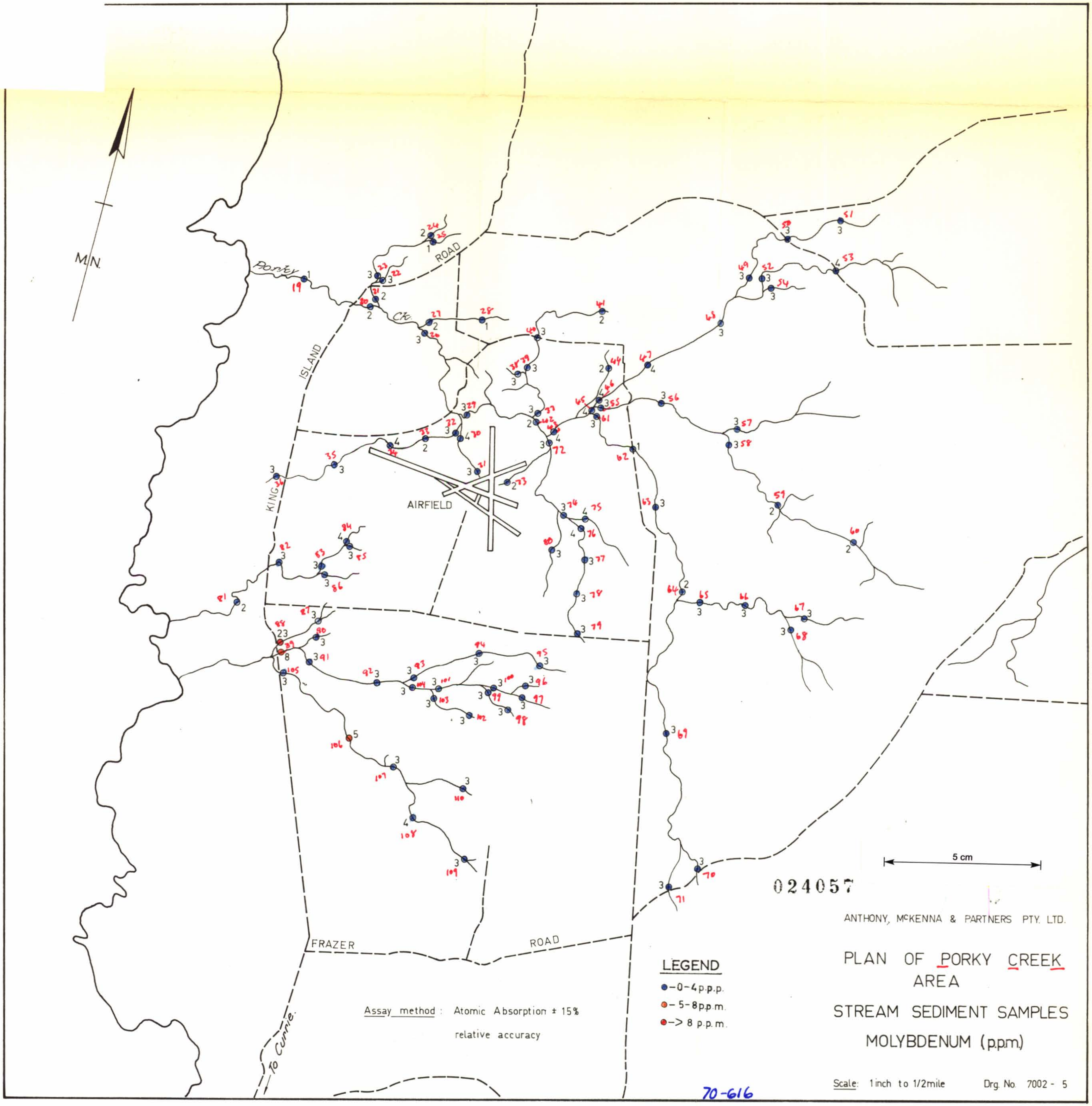
KING ISLAND

DISTRIBUTION CURVE FOR STREAM SEDIMENT SAMPLES

1808

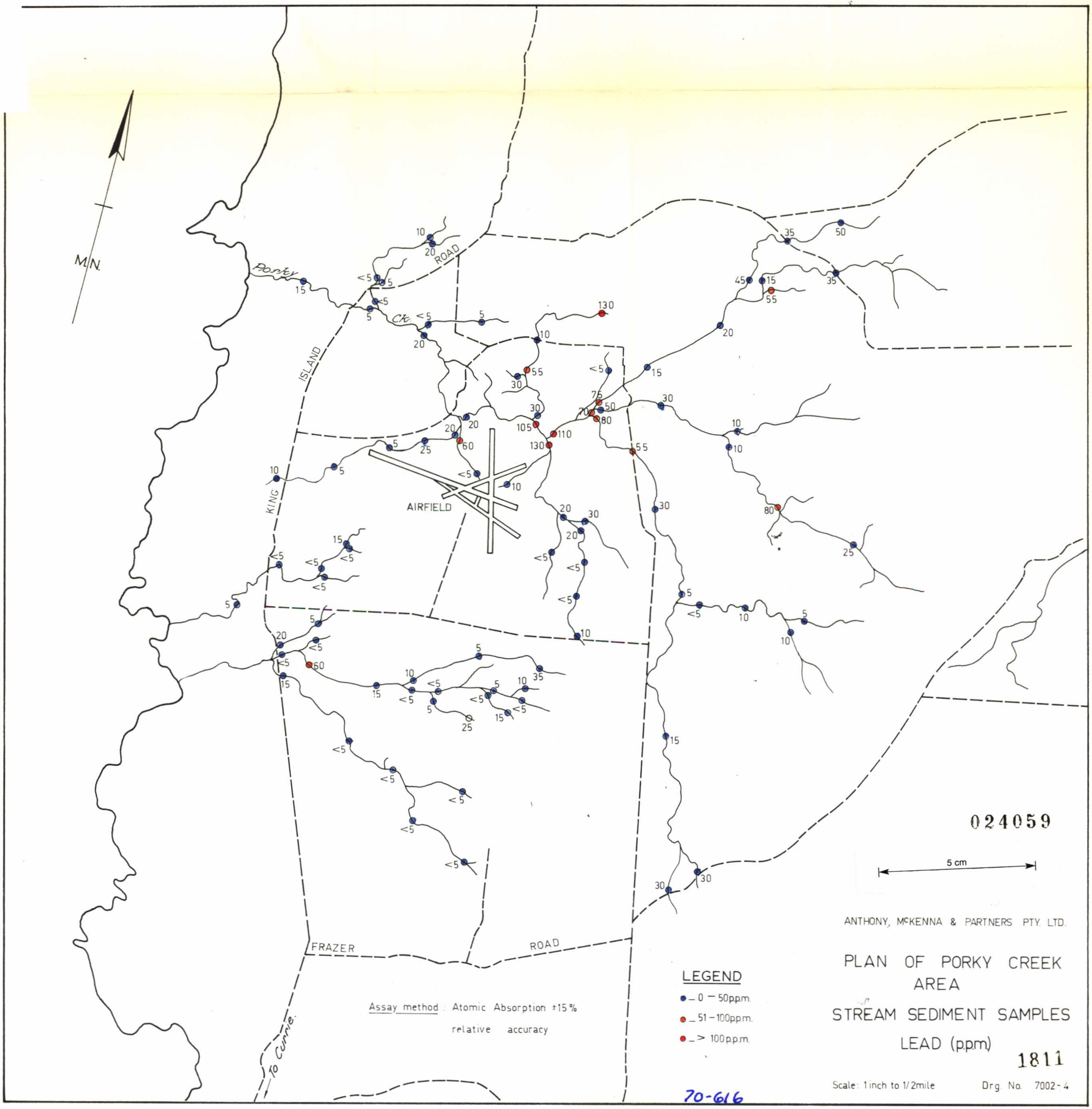
Drg No 7002–21

70-616


M.N.
Porky Ck.
ROAD
ISLAND
KING
AIRFIELD
FRAZER
ROAD
to Currie.
5 cm
LEGEND
-0-4 p.p.p.
-5-8 p.p.m.
-> 8 p.p.m.
Assay method : Atomic Absorption ± 15% relative accuracy
024057
ANTHONY, McKENNA & PARTNERS PTY. LTD.
PLAN OF PORKY CREEK AREA
STREAM SEDIMENT SAMPLES
MOLYBDENUM (p.p.m.)
Scale: 1 inch to 1/2 mile
Drg. No. 7002 - 5
70-616

1800

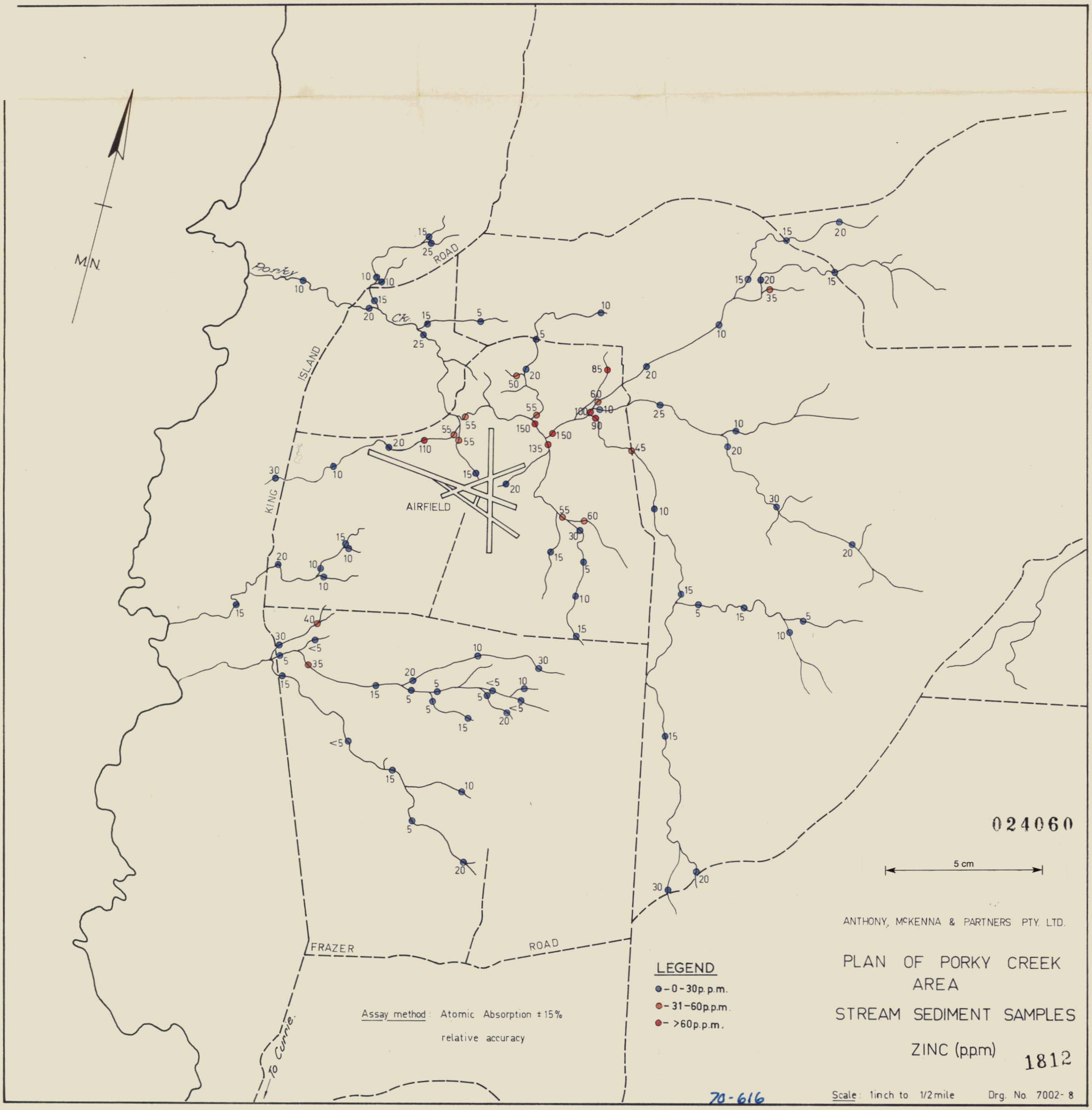

M.N.
Porky Ck
ROAD
ISLAND
KING
AIRFIELD
FRAZER
ROAD
To Currie
024058
5 cm
ANTHONY, McKENNA & PARTNERS PTY. LTD.
PLAN OF PORKY CREEK AREA
STREAM SEDIMENT SAMPLES
TUNGSTEN (ppm)
1810
LEGEND
- 0-15 p.p.m.
- 16-30 p.p.m.
- > 30 p.p.m.
Assay method : Colorimetric Dithiol
70-616
Scale 1 inch to 1/2 mile
Drg. No. 7002-7

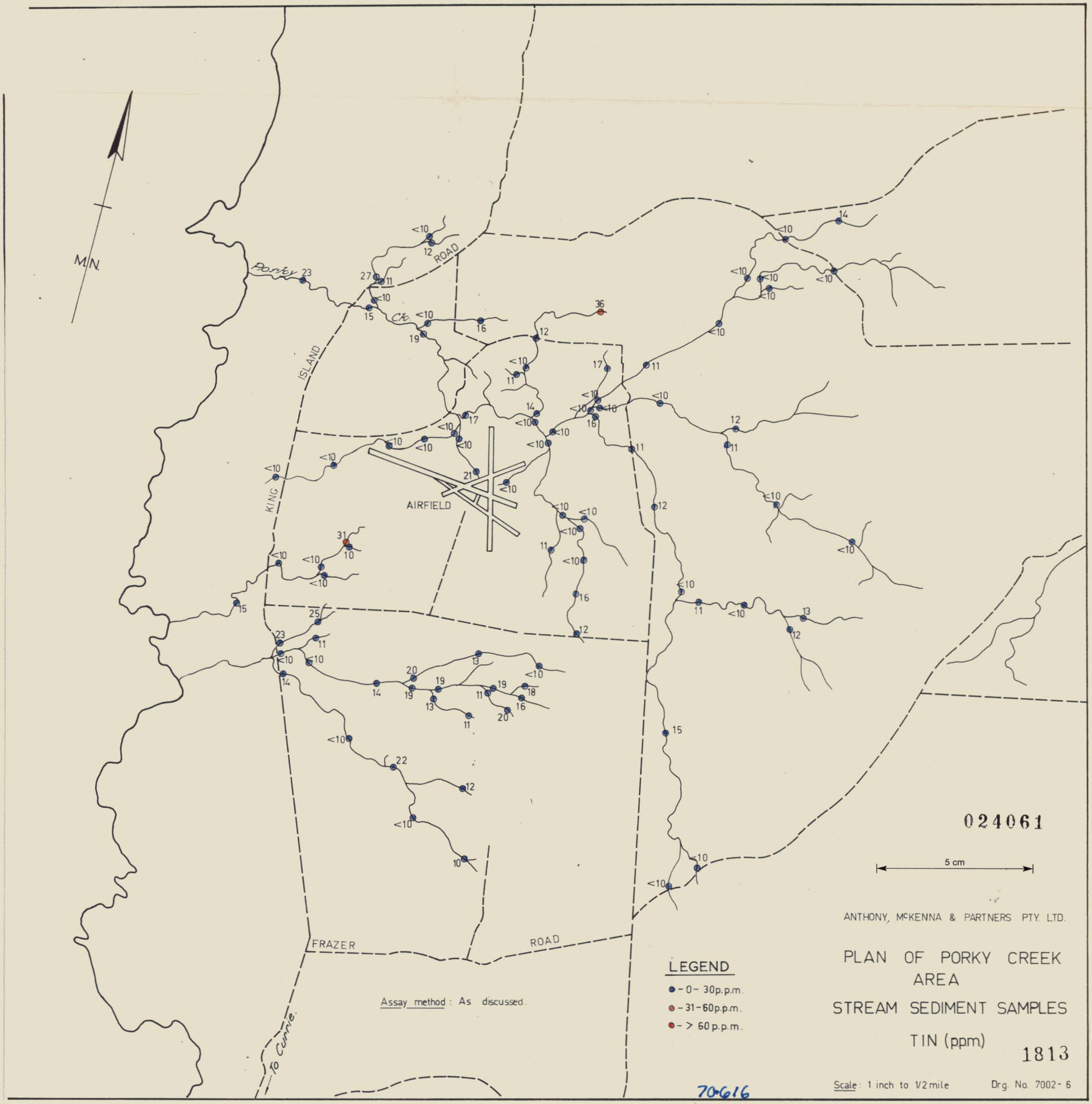


024059

1811

70-616


M.N.
Porky Ck.
ROAD
ISLAND
KING
AIRFIELD
FRAZER
ROAD
To Cunnie.
024060
5 cm
LEGEND
• – 0 – 30 p.p.m.
• – 31 – 60 p.p.m.
• – >60 p.p.m.
Assay method: Atomic Absorption ± 15% relative accuracy
ANTHONY, McKENNA & PARTNERS PTY. LTD.
PLAN OF PORKY CREEK AREA
STREAM SEDIMENT SAMPLES
ZINC (p.p.m)
1812
70-616
Scale: 1 inch to 1/2 mile
Drg. No. 7002- 8



ANTHONY, McKENNA & PARTNERS PTY. LTD.

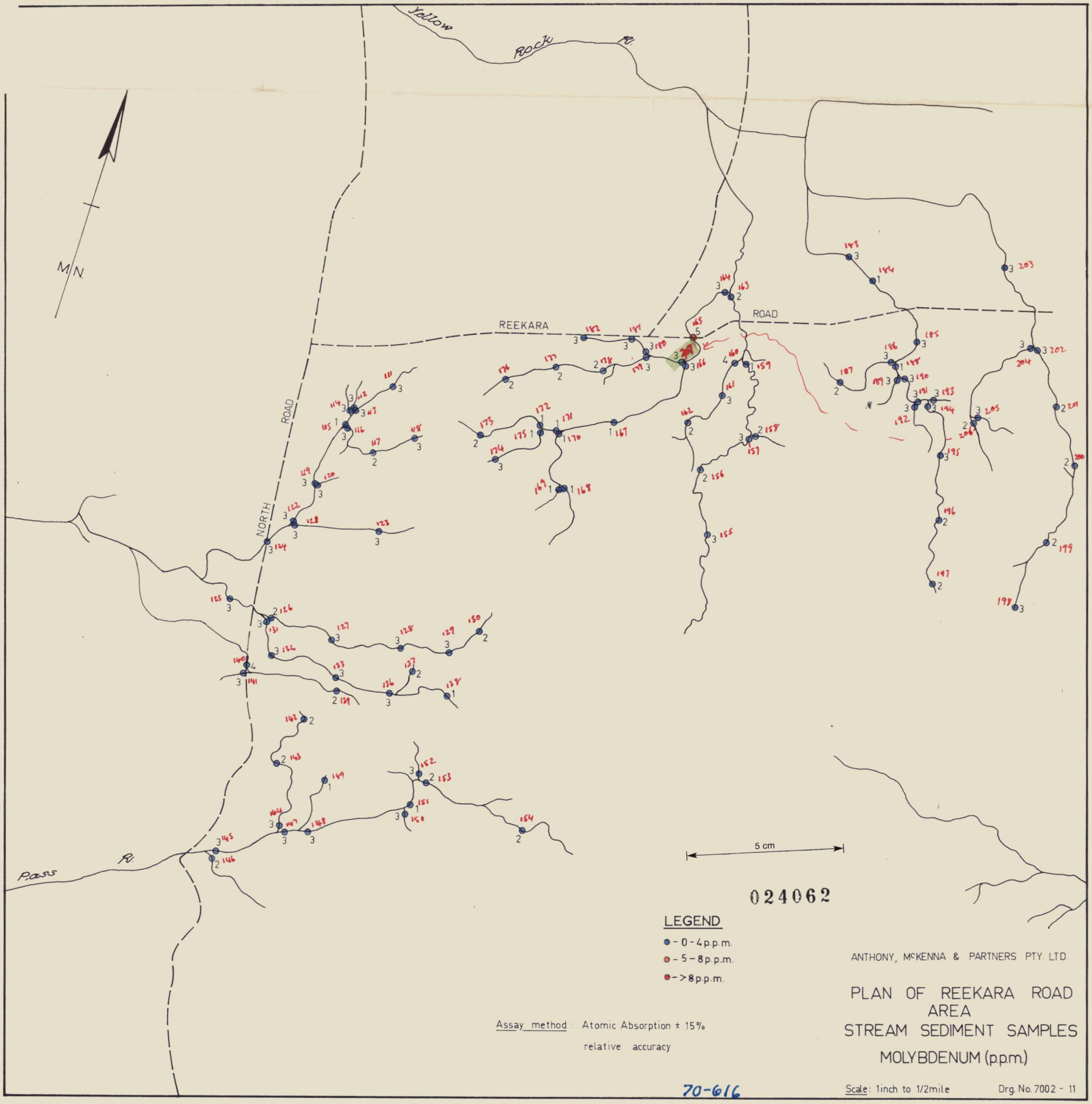
PLAN OF PORKY CREEK AREA

STREAM SEDIMENT SAMPLES

TIN (ppm)

Scale : 1 inch to 1/2 mile

Drg. No. 7002 - 6



024062

LEGEND

- ● – 0 – 4 p.p.m.
- ● – 5 – 8 p.p.m.
- ● – > 8 p.p.m.

Assay method : Atomic Absorption ± 15% relative accuracy

ANTHONY, McKENNA & PARTNERS PTY. LTD.

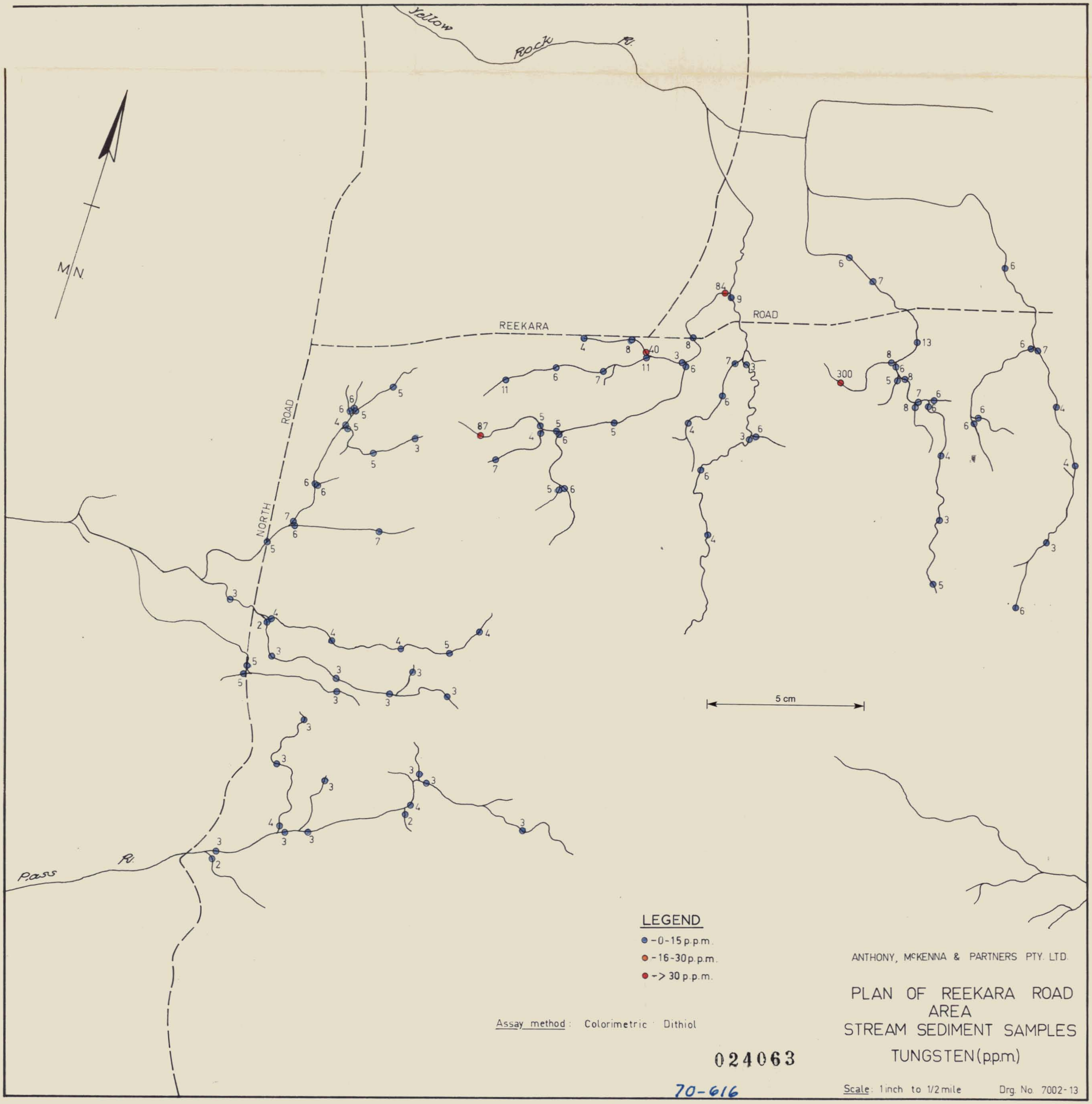
PLAN OF REEKARA ROAD AREA STREAM SEDIMENT SAMPLES

MOLYBDENUM (p.p.m.)

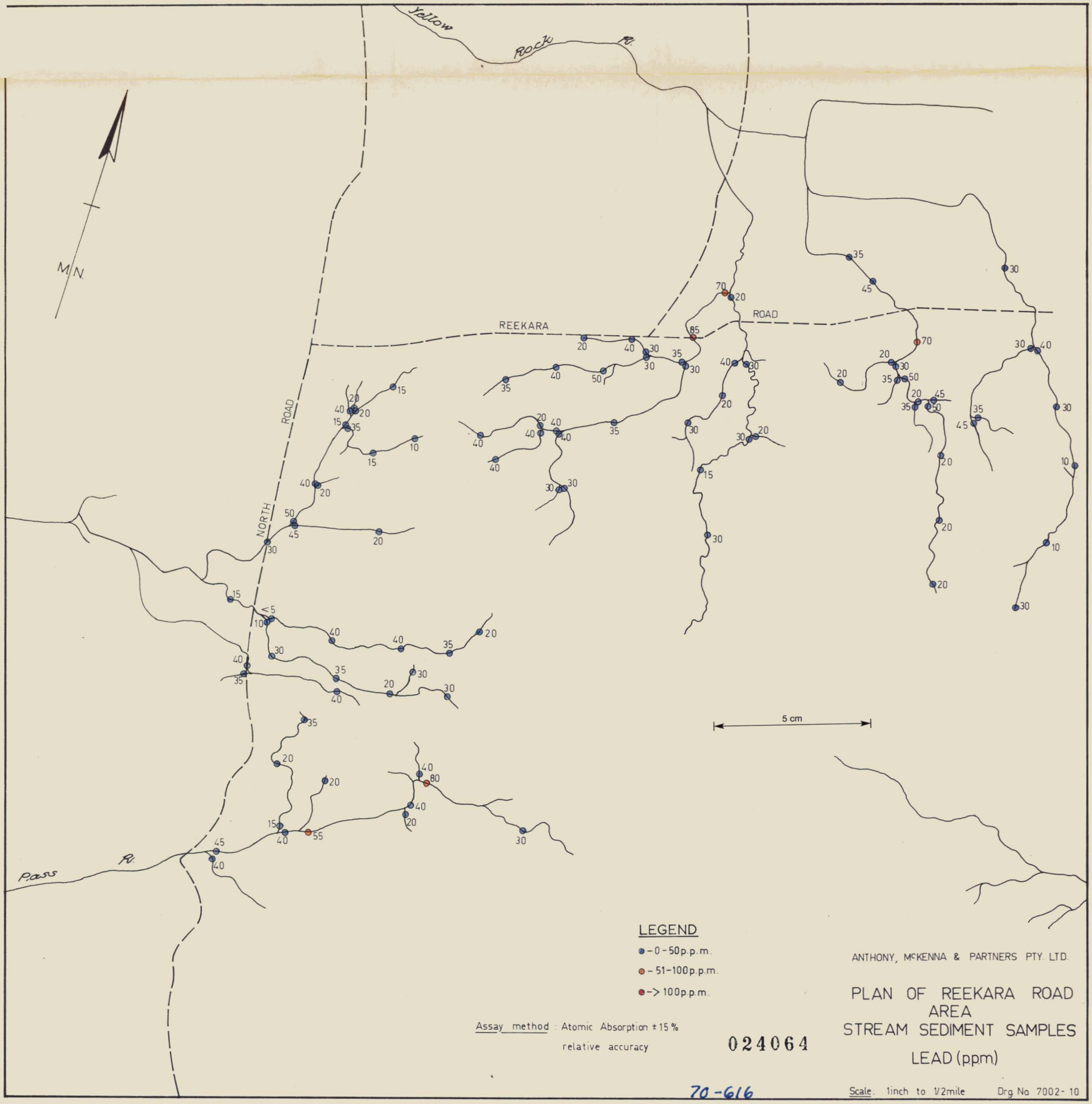
70-616

Scale: 1inch to 1/2mile   Drg. No. 7002 - 11

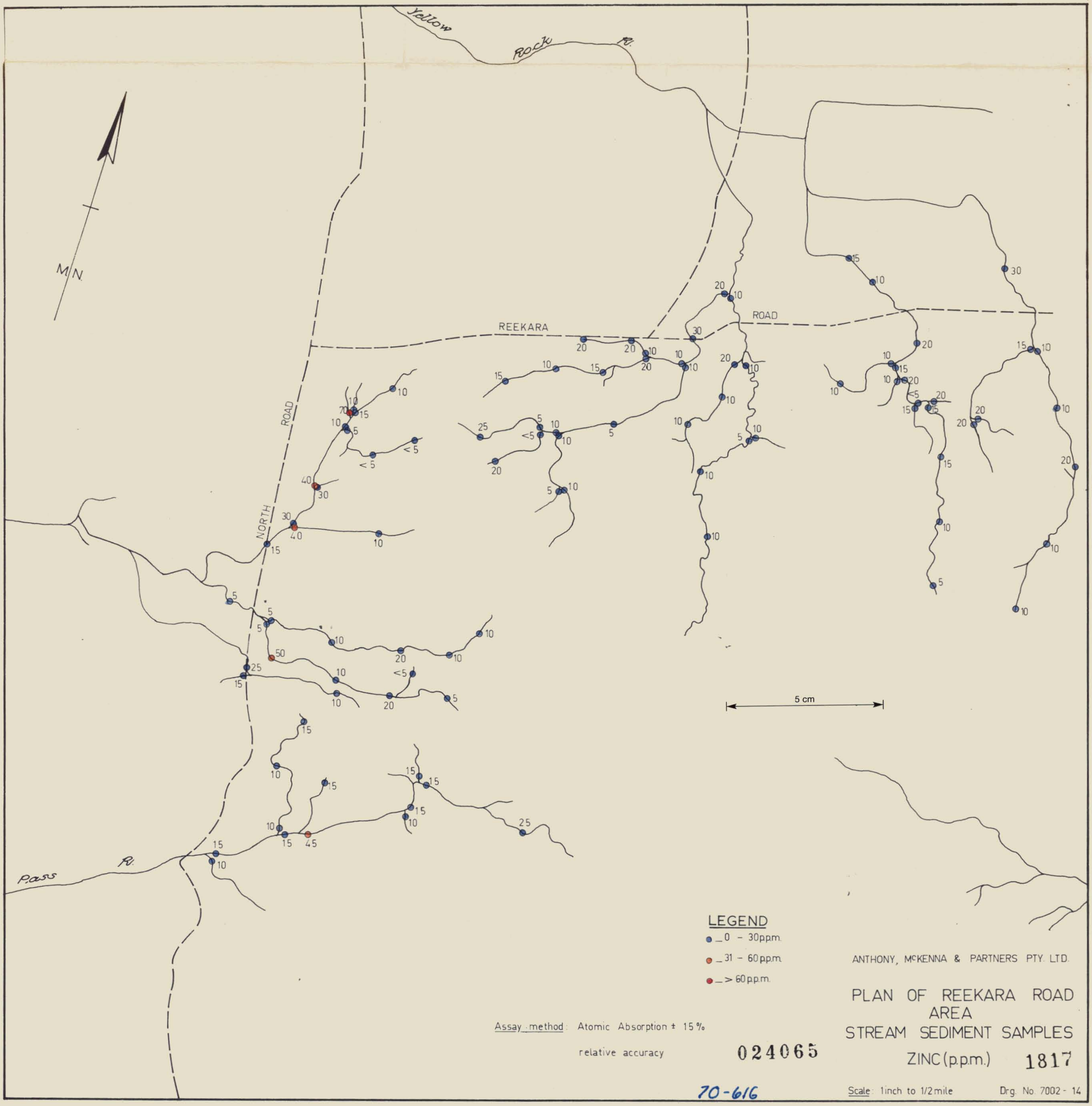
1814


Yellow Rock Rd.
Pass Rd.
M.N.
REEKARA ROAD
NORTH ROAD
5 cm
LEGEND
• - 0-15 p.p.m.
• - 16-30 p.p.m.
• - > 30 p.p.m.
Assay method : Colorimetric Dithiol
ANTHONY, McKENNA & PARTNERS PTY. LTD.
PLAN OF REEKARA ROAD
AREA
STREAM SEDIMENT SAMPLES
TUNGSTEN (p.p.m.)
Scale: 1 inch to 1/2 mile
Drg. No. 7002-13
024063
70-616

1815


Yellow Rock R.
REEKARA ROAD
NORTH ROAD
Pass R.
M/N.
5 cm
LEGEND
• - 0 - 50 p.p.m.
• - 51 - 100 p.p.m.
• -> 100 p.p.m.
Assay method : Atomic Absorption ± 15 % relative accuracy
024064
ANTHONY, McKENNA & PARTNERS PTY. LTD.
PLAN OF REEKARA ROAD AREA
STREAM SEDIMENT SAMPLES
LEAD (ppm)
Scale: 1inch to 1/2mile
Drg No. 7002-10
70-616

1216



Assay method: Atomic Absorption ± 15 % relative accuracy

024065

70-616

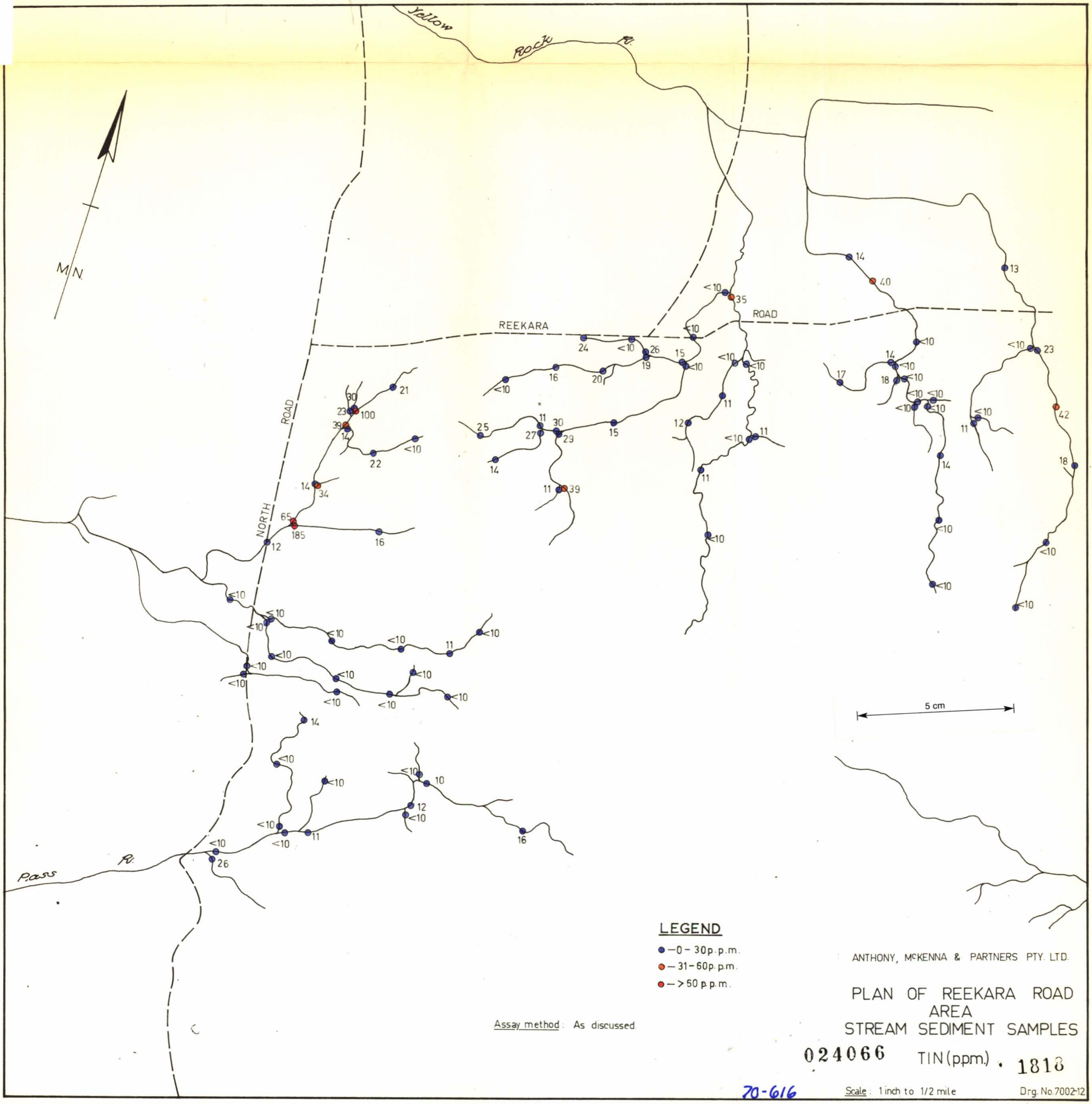
ANTHONY, McKENNA & PARTNERS PTY. LTD.

PLAN OF REEKARA ROAD AREA
STREAM SEDIMENT SAMPLES
ZINC (p.p.m.)

1817

Scale: 1 inch to 1/2 mile

Drg. No. 7002 - 14


Yellow Rock R.
M.N.
REEKARA ROAD
NORTH ROAD
Pass R.
5 cm
LEGEND
● — 0 – 30 p.p.m.
● — 31 – 60 p.p.m.
● — > 60 p.p.m.
Assay method: As discussed.
ANTHONY, McKENNA & PARTNERS PTY. LTD.
PLAN OF REEKARA ROAD
AREA
STREAM SEDIMENT SAMPLES
TIN (ppm)
024066
1818
Scale: 1 inch to 1/2 mile
Drg. No. 7002-12

70-616