AUSTRALIAN DEVELOPMENT LIMITED

ANNUAL EXPLORATION REPORT
EXPLORATION LICENCE 677 - DALY RIVER

NORTHERN TERRITORY

for the year ending
15th September, 1973

CR73/239

AUSTRALIAN DEVELOPMENT LIMITED

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CONTENTS

SECTION 1. ANNUAL EXPLORATION REPORT.

1. INTRODUCTION

Exploration Licence 677 covers an area of 62 square miles, and is situated immediately south of the Daly River copper field on the southern side of the Daly River. This area is approximately 90 miles south southwest of Darwin.

Exploration work on the E.L. area has consisted of a complete coverage with colour photography, followed by airborne geophysics. A follow-up reconnaissance field programme of geological mapping, geochemical sampling and ground location of airborne geophysical anomalies was then completed.

2. EXPLORATION

2.1 General

Due mainly to climatic and access conditions, the Daly River area has proved to be difficult to prospect.

The area has a monsoonal climate, with a short summer wet season of three to five months and a winter dry season of seven to nine months. The mean annual rainfall in the area is in the region of 50 inches. The intensity of rainfall is high, with almost all the rain falling within the short wet season period.

Access to the area is limited to a short period during the dry season when the Daly River crossing is sufficiently low for vehicular use.

During this period, most of the country in the area is accessible by vehicle. Dry season roads and tracks provide reasonable access within the E.L. Cross country driving is possible during the dry season.

Movement within the E.L. is impossible during the wet season. In this period, the Daly River crossing is not usable.

Considerable difficulty has been experienced by field parties in gaining access to the area, and several attempts have been unsuccessful due to the impassable state of the Daly River crossing.

The area was flown with colour photography during May, 1972, after a previously unsuccessful attempt during October, 1971.

A low level airborne geophysical survey was then flown over the complete E.L. area during June, 1972, and the final results received during September, 1972.

A geological and geochemical reconnaissance survey was completed over the area in October, 1972. The major aims of the survey were to geologically map and prospect the E.L. area at a scale of 1:24,000, to follow up any airborne geophysical anomalies on the ground, and to conduct a geochemical stream sediment sampling programme.

2.2 Aerial Photographic Survey

The entire area of the E.L. was flown for the Company by a contractor with colour photography during May, 1972.

The flight height was 12,000 feet AMGL and the scale is 1" = 2,000'. The photography contractor also produced an uncontrolled mozaic suitable for use as a base plan and also for navigation for the airborne geophysical survey.

The first attempt to complete this contract was made during October, 1971, but due to excessive smoke haze from bush fires and the cloud cover due to the onset of the wet season, the attempt was postponed until after the 1971/72 wet season. The extended wet season meant that the contractor was unable to complete the photography till mid May, 1972.

2.3 Airborne Geophysical Survey

A contract was signed by the Company with McPhar Geophysics Pty. Ltd. to complete an airborne geophysical survey over the entire area. Results from the survey were to include magnetics, four channel scintillometer and KEM. Line spacing for the survey was $\frac{1}{8}$ mile, the M.T.C. at 375 feet, and the survey was to be flown east-west. The energy source for the KEM was to be the VLF transmitter in Japan.

During the survey, the contractor found that the signal from the transmitter in Japan could only be received at a strength equivalent to the background noise level. This unusual phenomenon may have been due to freak sunspot activity or another

similar cause. The survey therefore had to be completed without the recording of the KEM data.

Flying was completed at the end of June, 1972, and the results received during September, 1972.

Qualitative examination of the airborne results showed an aeromagnetic pattern which indicated an extension along strike of the Daly River copper field rocks into the eastern half of the E.L. area. Within this area, several aeromagnetic anomalies were indicated, and four selected for follow-up ground examination.

2.4 Ground Reconnaissance Survey

During October, 1972, a field party was able to gain access to the E.L. area and complete a geological and geochemical reconnaissance survey.

This survey achieved the following:-

(a) Geological Mapping - The Burrell Creek Formation, considered to be the most prospective rock type in the E.L. area for location of high grade copper orebodies, was geologically mapped using the colour photography at a scale of 1" = 2,000'. This formation was mapped in reconnaissance detail.

The Noltenius Formation and other units in the area were considered less prospective and mapped by restricted cross traverses, coupled with aerial photo interpretation.

During this mapping, a pyritic gossan zone was discovered, which recorded slightly anomalous geochemical values for copper.

(b) Ground follow-up of airborne geophysics - the four magnetic anomalies selected from the airborne survey results were investigated on the ground.

Of the three anomalies located within the Finniss River Group rocks, none were explained by outcropping rocks. No magnetic rocks occurred in outcrop in these areas, and the exact reason for the magnetic response is unknown.

The large magnetic anomaly that is situated in the southwest of the area was found to be due to rocks of the Hermit Creek Metamorphics which often contain large amounts of dissemin-

ated magnetite. It is felt that these rocks contain sufficient magnetite to cause a strong magnetic response.

(c) Geochemical survey - the geochemical stream sediment sampling programme was restricted to the drainage pattern of the eastern half of the E.L. area.

The rocks occurring in the western half of the area were considered unprospective and their drainage systems were not sampled.

A total of 167 samples were collected for analysis over an area of 27½ square miles. The average sample density was 6 samples per square mile. All the samples were analysed for Cu, Bi, Pb, Zn, Ag, Mo, Ni and Co.

Several geochemical anomalies were located by the stream sediment sampling programme.

The detailed results of this programme are outlined in the appended report (also see Plan No. 854).

2.5 Relinquishment of E.L.

After assessing the results of the exploration programme to date on E.L. 677, it is felt that the area does not possess sufficient potential to warrant further exploration.

It was therefore recommended that the E.L. be relinquished.

3. SUMMARY AND EXPENDITURE

A summary of exploration work on E.L. 677 Daly River; during the period is given below.

Aerial Photography	62 square miles
Airborne Geophysics	62 square miles
Stream Sediment Samples	167 samples collected
Geological Mapping - semi-detail	10 square miles
Geological Mapping - reconnaissance	52 square miles.

The total expenditure on E.L. 677 for the period was $5,602.

AUSTRALIAN DEVELOPMENT LIMITED.

MEMO TO: Senior Geologist.

FROM: G. GRANGER.

SUBJECT: GEOLOGICAL REPORT - DALY RIVER A.P. 2325,
& RESULTS OF RECONNAISSANCE SURVEY,
OCTOBER, 1972.

DATE: 25th November, 1972.

INTRODUCTION:

The Daly River A.P. 2325 is an area of 63 square miles situated approximately 90 miles SSW of Darwin.

A geological and geochemical reconnaissance Survey was completed over the area in October, 1972.

There are no records of previous systematic prospecting of the A.P. area, although a great deal of exploration has, and still is, taking place in the Daly River Copper field to the north.

The Bureau of Mineral Resources conducted a detailed reconnaissance of the Daly River area in 1955. This work resulted in the Daly River 1 mile geological sheet.

STRATIGRAPHY AND PETROGRAPHY REGIONAL.

The rocks of the Daly River region form part of the Australian Pre-Cambrian Shield. The area contains rocks ranging in age from Archaean to Recent.

The main geological units in the region are the lower Proterozoic Pine Creek Geosyncline and the Mid-Cambrian Daly River Basin.

The Pine Creek Geosyncline was a shallow intracratonic basin in an Archaean Shield area. The main axis of the Geosyncline trends south-east. (Traves, 1955).

The succeeding younger flanking basins of which the Daly River basin is representative, were also shallow in character, and seem to have a detrital source other than the Pine Creek Geosynclinal rocks.

Although the geosynclinal sequence has been folded, in places severely, there is no severe regional metamorphism in the sedimentary sequences of the area ranging over 2,000 million years of geological time.

Most of the igneous intrusions in the Pine Creek Geosyncline are Carpentarian in age, and appear to be related to vertical movements in the basement rather than to the tectonic movements initiating the folding of the Pine Creek Geosynclinal sediments.

Since the Carpentarian, the region has probably remained very stable, and younger sediments were deposited in very shallow basins or as thin sheets.

ARCHAEAN.

The Hermit Creek metamorphics are most probably of Archaean age, and comprise migmatite, schist and gneiss. These metamorphics have been intruded by Carpentarian granite and exist as inliers in the granite.

The presence of these Archaean rocks helps to define the western limits and explain the structure of the Pine Creek geosyncline.

Structural trends in the metamorphic inliers strike north-west in the A.P. area.

The Archaean unconformity is not represented in the A.P. area, but a structural and metamorphic unconformity has been observed with Proterozoic sediments in the Rum Jungle area.

The Hermit Creek Metamorphics outcropping the A.P. area consist of high grade biotite Kyanite schists, and contain appreciable quantities of magnetite, causing a magnetically disturbed area in the granite.

LOWER PROTEROZOIC.

Finniss River Group:- This is basically a greywacke, siltstone assemblage; and is divided into two formations; the Burrell Creeek Formation and the Noltenius Formation. These formations are time stratigraphic equivalents.

Sedimentary material was derived from a westerly source, the Noltenius Formation containing the coarse, near shore clastic material, while the Burrell Creek Formation represents the finer clastic material carried further basinwards to the east. There has been considerable turbidity current redistribution of coarse Noltenius Formation material basinwards, forming extensive thin tongues of coarse sediment within the Burrell Creek Formation. The presence of Noltenius Formation rocks to the east of the Burrell Creek in this area, illustrates the degree of interfingering between the two formations. Noltenius formation rocks to the west have probably been intruded and absorbed by the Litchfield Complex.

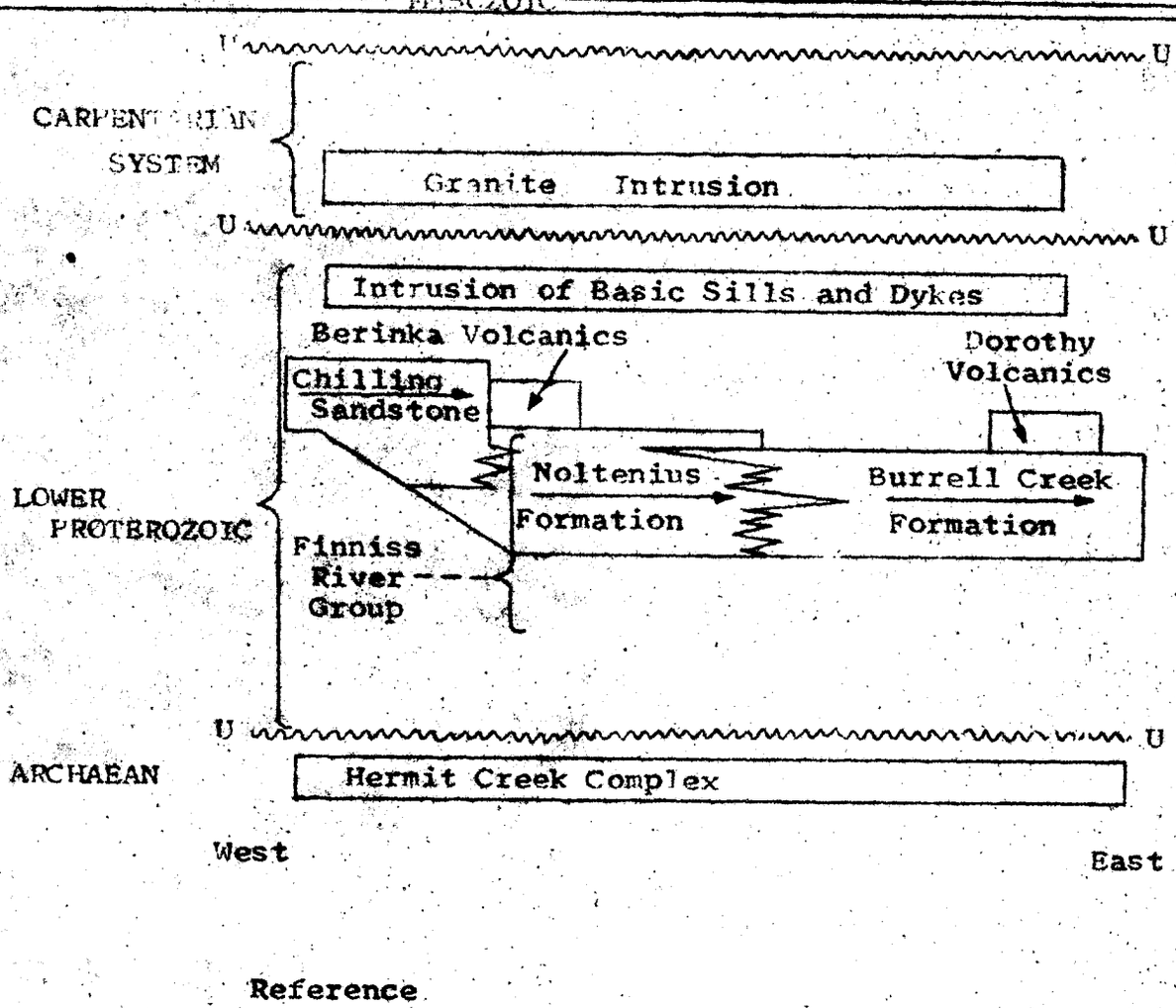
The Berinka and Dorothy volcanics are included in the Finniss River Group, although they have not previously been recognised in the Daly River area.

Noltenius Formation:- The Noltenius formation is confined to the western section of the Pine Creek Geosyncline. In the area of A.P. 2325, it forms the major outcropping unit and has the highest relief expression.

In the Daly River area, the rocks consist of greywacke, siltstone, shale, quartz pebble conglomerate, greywacke conglomerate, quartz sandstone, and minor tuffaceous greywacke and tuff. Cobble conglomerate has also been observed in the formation.

Although siltstone probably constitutes about one half of the succession, only a small proportion of actual outcrop is siltstone.

A finely banded hematitic siltstone approaching banded iron, has been observed in the formation.



Reference

U U Unconformity

Direction of main sedimentation

Fig. 1. Relationship of rock units, Daly River A.P.2325 (after Fig. 7 - B.M.R. Bulletin 82, Volume 1.)

In the A.P. area, the formation is at least 4,000 feet thick.

The formation is a transgressive sequence, being more arenaceous in the south-east, grading to more argillaceous rocks in the north-west and west of its outcrop. This places the near-shore environment in the south-east. The non-outcropping Noltenius to Burrell Creek interfingering transition probably occurs on the western side of the Noltenius outcrop.

The presence of isolated tuff and tuffaceous greywacke beds has previously not been recorded in the formation in this area. The volcanic rocks may represent the Berinka volcanics. The type locality for the Berinka volcanics occurs 15 miles south of the A.P. area. In this locality, the volcanic rocks are reported to be interbedded with the Noltenius Formation siltstones. It appears likely that the interbedded volcanics occurring in the Noltenius Formation in the A.P. area are equivalent to the Berinka volcanics. The Berinka volcanic unit is described as consisting of granophyre, tuff, ashstone, agglomerate, metarhyolite, spherulitic acid volcanics and amygdaloidal intermediate flows.

Burrell Creek Formation:- The Burrell Creek Formation crops out in the north-east section of the A.P. area. The rocks outcrop on the flanks of two major quartz filled fault ridges which have a high relief.

The formation has been divided by the author into three units, based on field observations of the lithologies of the outcropping rocks.

The unit which crops out on the eastern flank of the major north-east trending fault consists principally of siltstone, laminated shale, turbidite greywacke, siltstone greywacke, and pebble conglomerate. Siltstone and greywacke are the most abundant rock types in this unit. The rocks are generally similar to those in the Noltenius Formation, but are finer in grain size. The siltstone generally has an argillaceous matrix and contains irregular quartz grains and commonly iron oxide flecks. The siltstone grades into greywacke siltstone with an increase in lithic fragments.

Turbidite greywacke is common in this unit, with large angular fragments of fine siltstone and shale included in a graded greywacke. There is some evidence of rhythmic deposition with the repeated sequence being pebble conglomerate, greywacke, greywacke siltstone, siltstone, shale and then back to conglomerate again. This repetition is from east to west in outcrop.

There is a marked change in lithology in the Burrell Creek Formation across the fault line.

The second and third units are in contact, forming a south plunging anticline between two prominent and diverging fault lines.

The second unit consists of sandstone, tuffaceous greywacke, siltstone and grit, with minor interbedded intermediate to basic flows and tuffs.

This unit exhibits very little structure in outcrop. The general grain size is slightly coarser than in the first unit.

The volcanic rocks in the Burrell Creek Formation may represent the Dorothy Volcanics Unit. This Unit is recorded as being folded with the Burrell Creek formation east of Katherine, (B.M.R. Bull. 82), where it comprises folded basic lavas, pyroclastic rocks and tuffaceous sediments.

The third unit of Burrell Creek rocks outcropping in the A.P. area consists of amygdaloidal intermediate to acid lavas, spherulitic acid flows, with minor interbedded tuffaceous sandstone, greywacke, and siltstone. This unit has a low relief outcrop over approximately 3 square miles in the extreme north-east of the area, and appears to form an anticlinal core, underlying unit two described above. The lithology of this unit appears to be very similar to the lithology of the Berinka volcanics. (B.M.R. Bull. 82)

Rather than conjecturally differentiate these above units into Burrell Creek Formation and Berinka Volcanics, it is felt preferable to include them all in the Burrell Creek Formation, and mention the possibility of an equivalence to the Finniss River Group Volcanic Units.

In general terms, the Burrell Creek Formation can be described as being the basinwards, argillaceous equivalent.

Chilling Sandstone:- Although the Chilling Sandstone has been previously mapped in the Daly River A.P. area, (Malone, 1962), it has here been included in the Noltenius Formation.

A thick series of white, silicified quartz sandstones outcrop as a prominent ridge in the south-east of the A.P. area. From field reconnaissance observation, the sandstone series appears to grade uniformly along strike into the Noltenius Formation greywackes, sandstones and siltstones. The sandstone is faulted against opposite-dipping Noltenius greywackes on its eastern side. This sandstone may well be related to the Chilling sandstone, but there is no advantage in differentiating it at this stage.

The Chilling Sandstone is a platform deposit, (B.M.R. Bull. 82) developed as a late-stage phase of the geosyncline, and conformably overlies the Finniss River Group. The type locality for the Chilling Sandstone exhibits common ripple marked and cross-bedded blocky white silicified quartz sandstone (B.M.R. Bull. 82).

Basic Sills:- Dolerite sills were intruded into the Pine Creek Geosynclinal sediments during the Lower Proterozoic and were folded with the sediments. The sills generally conform to the structure but are locally transgressive (Malone, 1962).

A small outcrop of a possible basic sill occurs in the Noltenius Formation in the central east of the A.P. area. The rock is highly weathered but contains a large percentage of magnetite. The body appears to be conformable with the sediments.

LITCHFIELD COMPLEX.

Intrusive rocks of the Litchfield Complex occupy large areas on the western margin of the Pine Creek Geosyncline.

The western half of the A.P. area is underlain by biotite granite of the Litchfield Complex. Other rocks

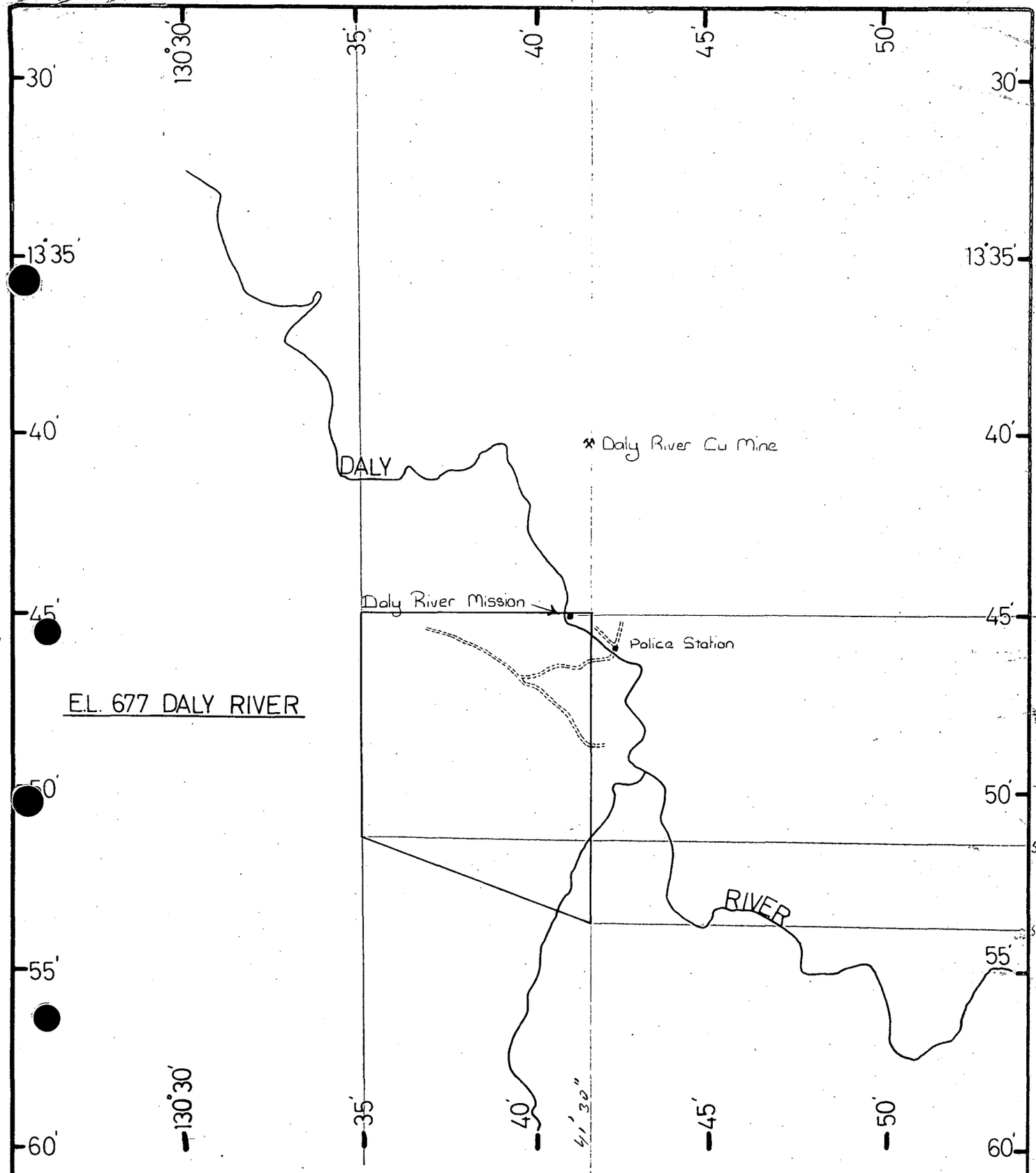


FIG.1 LOCALITY MAP:- E.L. 677 DALY RIVER

SCALE 1:250,000

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recorded in the complex near this area include grey, garnetiferous granitorite, tonalite, adamellite, and some basic rocks (B.M.R. Bull. 82). The outcrop expression is very poor, with small isolated tors surrounded by deep granitic soil.

An increase in the proportion of garnet towards the contact with the Hermit Creek Metamorphics suggests hybridization with the granite. The contact between the Litchfield Complex and Finnis River Group sediments has not been observed. Although it has been suggested that the Litchfield granite was formed by granitisation of the Lower Proterozoic sediments, it is more likely that the complex is anatectic in origin, derived from Archaean rocks such as the Hermit Creek Metamorphics.

Age determinations have shown that the last movements of the complex took place in early Carpentarian, but the close association of the complex with Archaean Metamorphics suggest that it may be partly Archaean in age (see B.M.R. Bull, 82, page 134).

CAINOZOIC.

Quaternary alluvium covers a large part of the A.P. area, and obscures contacts between the major rock units. The alluvium includes gravel, sand, sandy silt and clay.

The alluvium has been drilled in some localities, and is up to 50 feet thick. The clay deposits in swamps and stream valleys may be up to 25 feet thick.

The Cainozoic deposition in this area is regarded as completely alluvial in origin, and no attempt has been made to trace their depositional history.

STRUCTURE.

Archaean:- The limited outcrop of the Archaean rocks has restricted knowledge of their structure. Where observed, the Hermit Creek Metamorphics have a north-west trending foliation. The original bedding was not recognised.

Lower Proterozoic:-

Folding:- The Lower Proterozoic sediments have been moderately folded in the A.P. area. The trends in the fold axes range between 360° and 20°, and are approximately parallel to the Giants Reef Fault.

The folds are open, dips of greater than 70° being uncommon.

The major folds mapped in the A.P. area include a large, south plunging anticlinal fold in the Burrell Creek Formation in the north-east of the area.

Low angle plunge folds are recognised in the Noltenius Formation to the centre and south-east of the area. Although not mapped in detail, a relatively large anticline occurs on the western side of the north north-east fault system in this formation. The eastern limb of this anticline is truncated by several large faults. Between this fault zone and the Giant's Reef Fault, the sediments dip to the west, probably indicating that the fault zone represents the axial plane of a syncline. Much more complex folding occurs in other regions of the Pine Creek Geosyncline.

Faulting:- There are three principal sets of faults, trending north-westerly (300° to 340°), northerly (350° to 20°) and north-easterly (30° to 45°). The fault zones are marked by shearing and abundant quartz veining.

(a) North-westerly Faults.

In the A.P. area, faults of this group occur in the Noltenius Formation and in the granite of the Litchfield Complex. The faults of this system in the Noltenius Formation trend approximately 330°, and have a horizontal displacement of about 400 feet, east block south. These faults appear to be associated with the larger north-east trending faults. Two faults, trending 310° and 335°, have been interpreted from the aerial photography on the granite contact in the central north section of the A.P. These faults have no outcropping expression and their displacements are unknown.

(b) Northerly Faults.

There is only one major fault of this type, trending 350° to 0°. It occurs in the north of the A.P. and forms the western boundary of the Burrell Creek Formation outcrop. It is a large fault with an open quartz filled breccia. It extends for over 18,000 feet, but no horizontal displacement can be measured, although the west block appears to be downthrown. The quartz breccia forms a prominent ridge line in the area.

An associated fault trending 340° occurs immediately to the west. This fault also has an open quartz breccia filling.

The eastern boundary of the Litchfield Granite Complex may be controlled by such a north trending lineament.

(c) North-easterly Faults.

This system of faults is the most prominent in the A.P. area.

The largest fault of this type in the area is the Giant's Reef Fault, the displacement of which has been measured at about 3 miles, west block north (Malone, 1962). In the A.P. area, this fault trends between 10° and 20°.

The major folds in the area are sub-parallel to this set of faults. The Giant's Reef Fault is a tear-fault, with a quartz filled breccia in many of its outcrops. There are numerous associated sub-parallel tear faults and shears in the Noltenius Formation. Most of these are quartz filled and have numerous associated quartz veins.

A fault that trends approximately 25° passes through the Burrell Creek Formation in the north-east of the A.P. area. This fault has no measured displacement, but forms a definite lithological boundary for 10,000 feet in the formation. The fault forms a prominent ridge of quartz filled breccia, and can be traced in the area for about 20,000 feet. This fault has numerous associated quartz veins and hydrothermal quartz shear fillings. Some of the associated quartz veins have resulted in pyritic alteration of the surrounding sedimentary wall rock. A gossan in the north-east of the formation outcrop appears to be associated with shearing along this fault.

A fault trending 40° displaces the granite contact in the mid-south of the A.P. area. This fault may be a southerly extension of the large fault that passes through the Burrell Creek Formation in the north-east of the sheet.

Faults of this system appear to have been active at a late stage in the geosyncline.

ECONOMIC GEOLOGY.

DALY RIVER COPPER FIELD.

The Daly River Copper Field is situated about five miles to the north of the A.P., and is located in rocks of the Burrell Creek Formation, similar to and along strike from the Burrell Creek sediments outcropping in the A.P. area.

The Daly River Copper Field includes a group of copper and silver-lead deposits. Most of these deposits occur on two sub-parallel shear zones; the shear zones trend a few degrees east of north, and can be traced for about five miles.

The major producer in the field has been the Daly River Copper Mine. The Mine was worked intermittently between 1884 and 1918. The lode material is reported to have been largely malachite, azurite, and chalcopyrite, with quartz and limonite gangue. The lode appears to have occurred in a shear zone in sediments and/or volcanics of the Burrell Creek Formation. A prominent gossan is associated with the deposit.

Recorded production was about 6,000 tons of ore, averaging 20% copper. All the ore was obtained from the oxidised zone.

Several smaller mines operated in the area and all appear to have similar shear controls for the mineralization. The ore extracted from these mines was high grade oxidised copper ore, with some gold. The silver lead deposits were recorded as containing cerussite, anglesite, mimetite and pyromorphite. The area is at present being extensively explored by several companies.

DALY RIVER A.P. 2325 MINERALIZATION.

In view of the type of mineralization existing in the Daly River copper field to the north, it is felt that the most favourable area for mineralization in the A.P. area exists in the Burrell Creek Formation in the north east of the area.

A reasonably large pyritic gossan has been located in the Burrell Creek Formation, immediately adjacent to a north-east trending fault. Pyritic sediments have also been observed in the vicinity of the gossan. The gossan contains goethite, hematite and limonite, and in some parts is siliceous. Numerous large limonite pseudomorphs after cubic pyrite crystals are included in the gossan material. The gossan is located along a shear in altered quartz greywackes and sandstone. The sediments are often sericitic in the region of the gossan. The lode appears to be of hydrothermal origin, as there are numerous hydrothermal pyritic quartz veins in the area.

EXPLORATION PROGRAMME - OCTOBER, 1972.

The major aims of the exploration programmes first phase were:-

1. to produce a semi-detailed geological map of the area, using 1" to 2,000' scale photography. The purpose of this mapping was to define the major geological units and delineate the main structural controls of any mineralization. This mapping was mainly concentrated in the Burrell Creek Formation.

2. to visit the Daly River Copper Field and observe the major mineralization controls. These were then to be applied to the A.P. area in an attempt to delineate areas of potential mineralization.

3. to follow up the airborne magnetics and scintillometer results. The purpose of this was to define the geological factors causing geophysical response in the area.

4. to conduct a reconnaissance stream sediment sampling programme in the A.P. area, as a geochemical guide to areas of anomalous mineralization.

RESULTS.

1. A geological map of the A.P. area was compiled from the reconnaissance mapping. (see Drawing No. 852)

The Burrell Creek Formation was mapped in reconnaissance detail, whereas the Noltenius Formation and other units were mapped only from restricted traverses and aerial photo interpretation.

From the mapping, it was found that the eastern half of the A.P. area contained favourable Lower Proterozoic Formation, whereas the western half of the area contained Carpentarian Granites and Archaean Metamorphics.

Several lithological divisions were made within the Finniss River Group rocks as a result of the mapping.

2. The prospecting of the Burrell Creek Formation resulted in the locating of a sulphide gossan. The gossan was sampled and the four composite samples of the gossan returned the following results:-

Sample No:	Au Dwt/ton		Cu ppm	Bi ppm	Pb ppm	Zn ppm	Ag ppm	Mo ppm
13948	0	0	55	110	55	360	4	1
49	0	0.2	35	100	50	180	2	1
50	T	0	55	140	60	350	2	1
51	T	T	85	120	60	325	2	1

The samples were analysed by two methods for gold. A normal fire assay was conducted, and then the assay was repeated by using the "Iron nail" method to overcome the effects of any sulphur in the sample.

3. Four of the largest magnetic anomalies indicated by the airborne magnetic survey were investigated on the ground. The large anomaly occurring in the north east of the Burrell Creek Formation was not explained by the ground

investigation because the area was covered with quartz scree from the large neighbouring fault. This magnetic anomaly lies within 2,000 feet of the outcropping gossan. The large anomaly in the central east of the area occurred in the Noltenius Formation. The area of the anomaly did not contain any outcropping rocks.

The anomaly centred in the south-east of the area occurred over a hill consisting of interbedded siltstones, shales, greywacke, tuffaceous greywacke and conglomerate of the Noltenius Formation. No magnetic rocks were located in the area.

Attempts to explain the magnetic anomalies in the areas of high relief by altitude factors in the original survey were not completely successful. It appears unlikely from examination of the flight tapes that the magnetic anomalies are due solely to altitude changes. (Personal conversation with P. Dreverman). A large area of magnetic highs in the south west of the A.P. area was found to contain outcrops of metamorphic rocks containing magnetite. The magnetic metamorphics are members of the Hermit Creek Metamorphics. It is felt that the rocks contain sufficient magnetite to cause a strong magnetic response.

4. A geochemical stream sediment sampling programme was conducted in the A.P. area. The sampling was restricted to the streams in the eastern half of the A.P. The rock types occuring in the western half of the A.P. were considered unprospective and their drainage systems were not sampled.

A total of 167 samples were collected for analysis over an area of 27± square miles. The average sample density was 6 samples per square mile.

During the sampling procedure, a record was compiled of sample type, colour, percentage grain size, as well as organic content, stream width and approximate stream grade. (See Appendix I). This data was collected to aid the geochemical interpretation.

The samples were sieved to obtain the minus 80 mesh fraction.

The minus 80 mesh fraction was first analysed using cold extraction leaching. The elements analysed were Cu, Bi, Pb, Zn, Ag, Mn, Ni, Co and Cd.

In most cases, the cold extraction results did not show sufficient variation to enable a meaningful determination of background limits. The results were very low in all elements except Mn.

The samples were then hot leached and analysed for Cu, Bi, Pb, Zn, Ag, Mo, Ni and Co.

The results for Bi, Ag and Mo were very low, and did not show any usable variation.

The results for Cu, Pb, Zn, Ni and Co were plotted on distribution histograms. (See Appendix II). The upper limit of normal background fluctuation in each case was fixed at the distribution mean plus twice the standard deviation. The values occurring above background were divided into categories of first, second and third order. In general, each order constituted two standard deviations.

Scatter diagrams were compiled for Ni against Co, Pb against Zn, and Cu against Pb. In each case, the diagram showed only one population present. (See Appendix II)

The anomalous results for Cu, Pb, Zn, Ni and Co, were plotted on stream sediment geochemical plans. (See accompanying plans.)

Three main anomalous areas were outlined by the geochemical results.

(1) In the Burrell Creek Formation in the north-east of the A.P. area, strong coincidence between Cu, Pb and Ni results occurred. The main coincident anomalous results occurred on either side of the NNE trending fault on the eastern side of the Formation outcrop.

A consistently anomalous result also occurred in a small stream draining the volcanic rocks in the centre of the Formation outcrop.

(2) An area with strong Pb and Cu coincident results occurs east of the northernmost extension of the Chilling sandstone outcrop in the south-east of the A.P. area. This area has very high Pb values, greater than 5 times background.

(3) An area with coincident anomalous Cu, Zn and Co values occurs in the south-western part of the Noltenius Formation outcrop. This area occurs on the western slope of the ridge of Chilling Sandstone, adjacent to area 2.

RECOMMENDATIONS.

As a second phase in the exploration of the area, a follow-up programme of geochemical sampling is recommended in the areas outlined by the regional stream sediment survey.

The follow-up programme in these areas should include detailed stream sediment sampling and rock-chip sampling.

In the area of the geochemical anomalies, geological mapping at a scale of 1" to 500' should be completed.

A geophysical method should be employed to indicate the presence of any sulphide body in the area of the outcropping gossan. It is felt that an I.P. Survey would be the best method available for this area. The gossan area should also be geologically mapped at a small scale, no greater than 1" to 500'.

ACCOMPANYING PLANS.

The following plans accompany this report.

Plan No. 852 - Surface Geological Plan - 1" = 2,000'.
Plan No. 854 - Geochemical Results for Stream Sediment Survey, Cu, Pb, Zn, Ni, and Co. (Five Plans.)
Appendices I and II also accompany this report.

G. GRANGER,
Geologist.

30th January, 1973.

GG:JES

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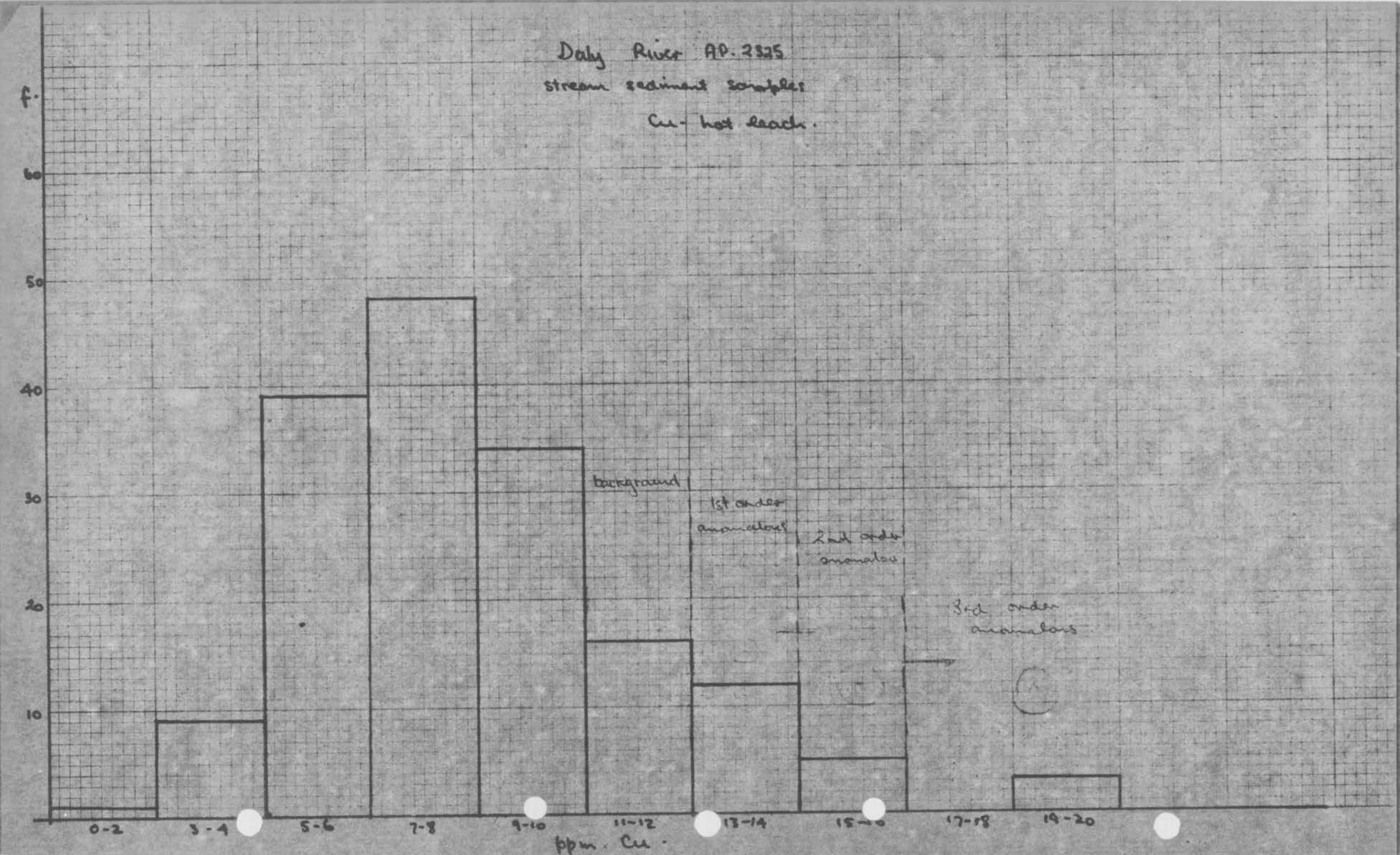
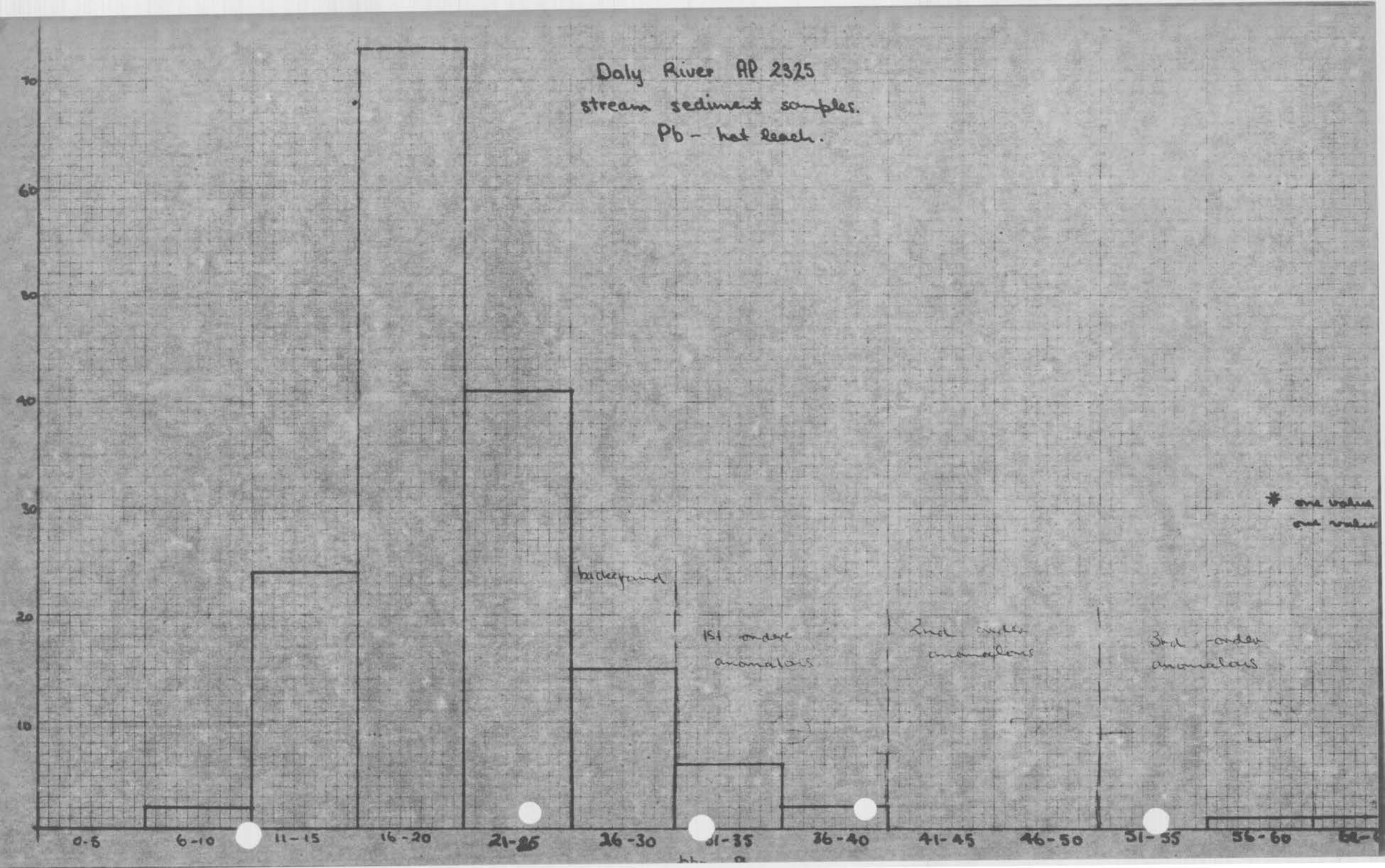
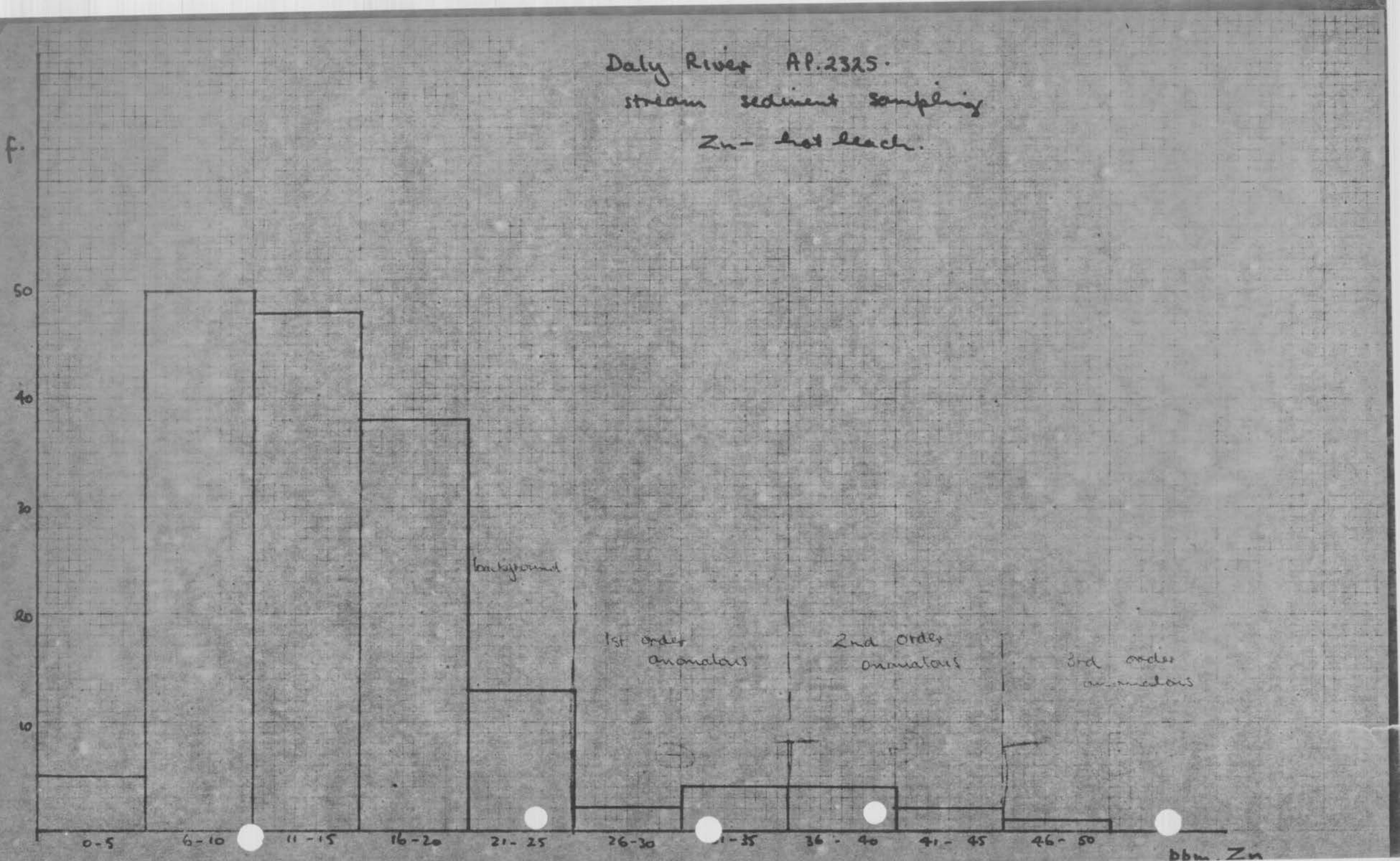

Daly River AP. 2325
stream sediment samples
Cu - hot leach.
f.
60
50
40
30
20
10
background
1st order anomalous
2nd order anomalous
3rd order anomalous
0-2
3-4
5-6
7-8
9-10
11-12
13-14
15-16
17-18
19-20
ppm. Cu.

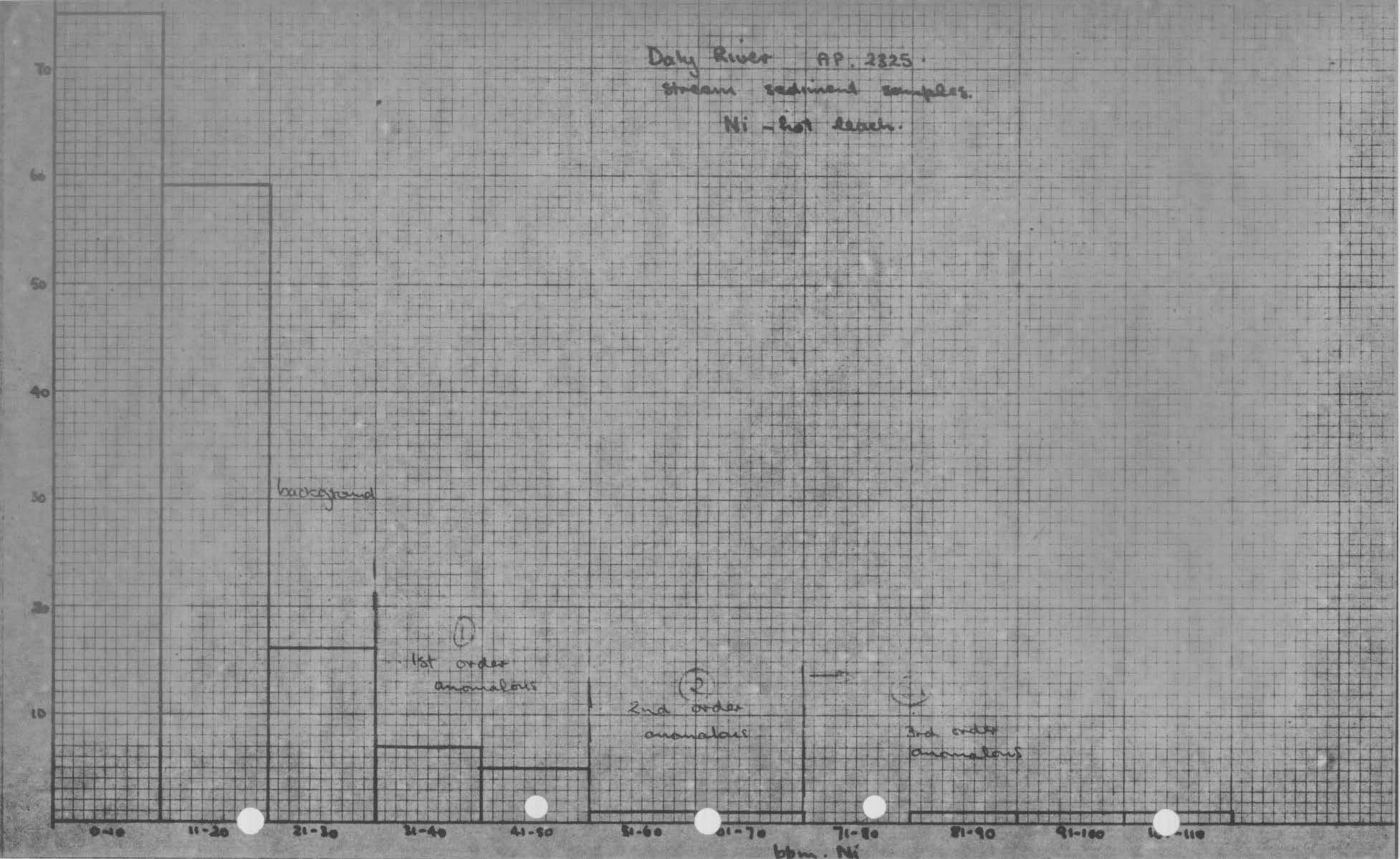

Daly River AP 2325
stream sediment samples.
Pb - hot leach.
70
60
50
40
30
20
10
background
1st order anomalous
2nd order anomalous
3rd order anomalous
0-5
6-10
11-15
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
56-60

Daly River AP.2325.

stream sediment sampling

Zn - hot leach.

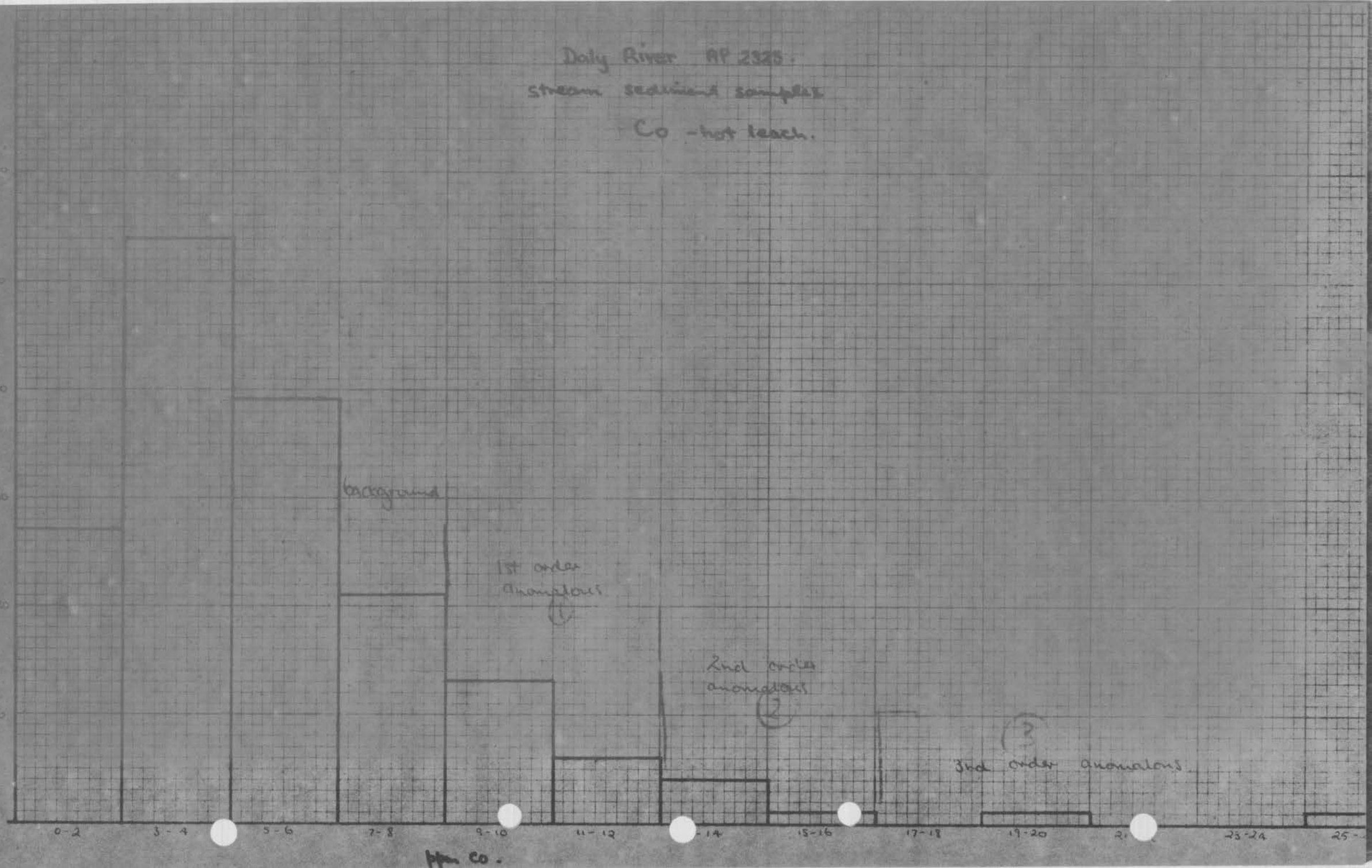



Daly River AP. 2325.
stream sediment samples.
Ni - hot leach.
background
1st order anomalous
2nd order anomalous
3rd order anomalous
0-10
11-20
21-30
31-40
41-50
51-60
61-70
71-80
81-90
91-100
ppm. Ni

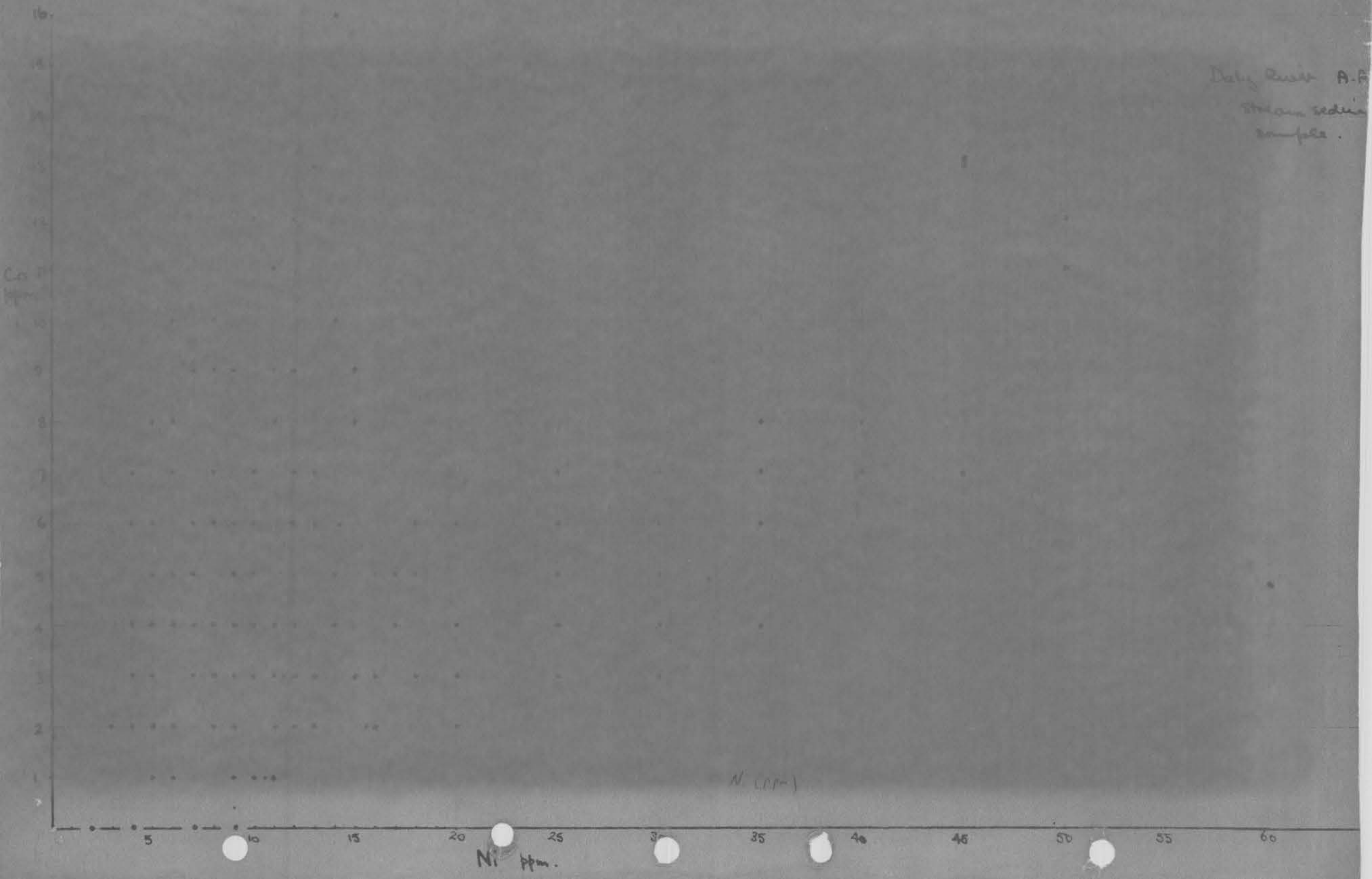
Daily River AP 2325.

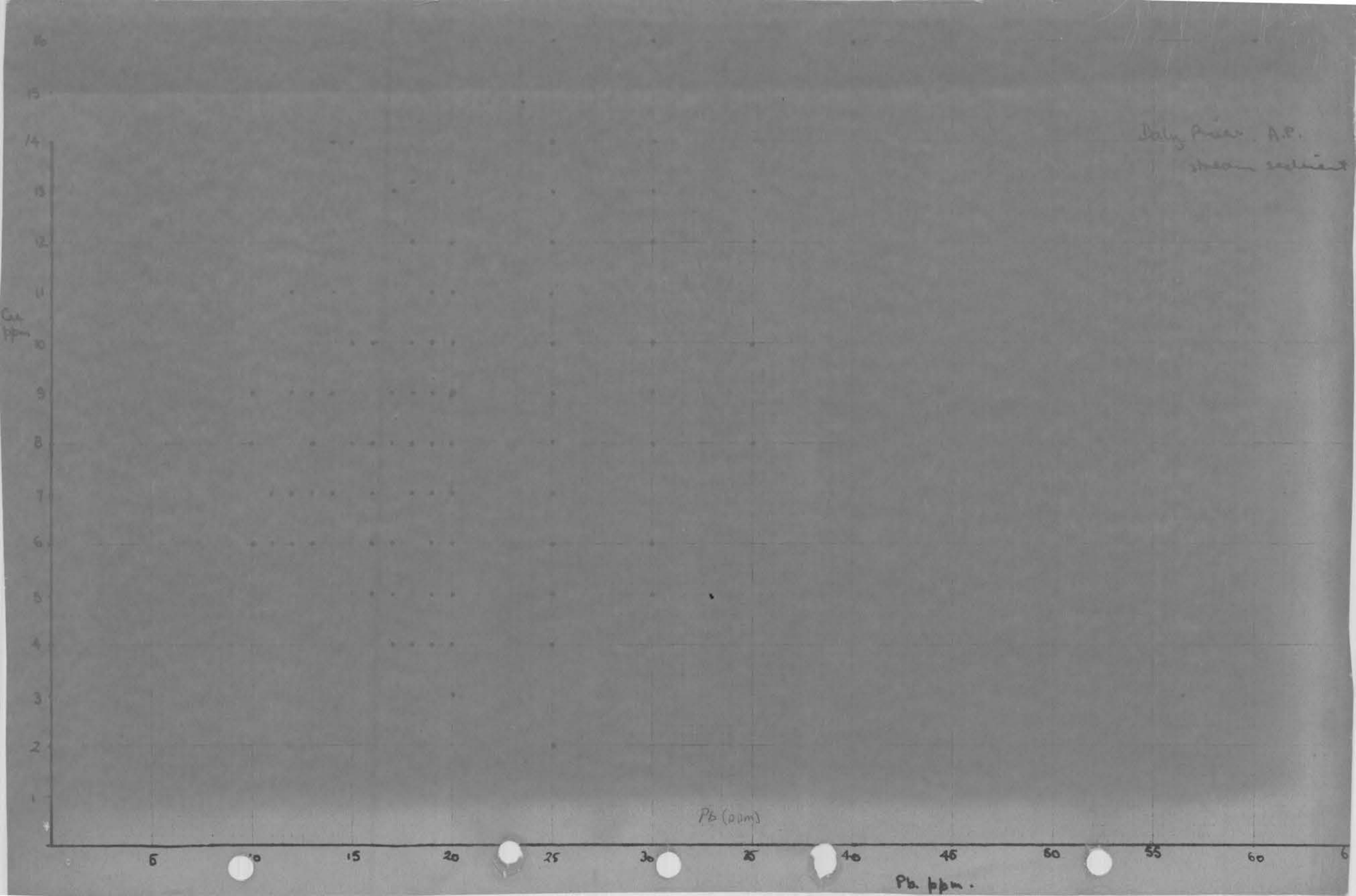
stream sediment samples

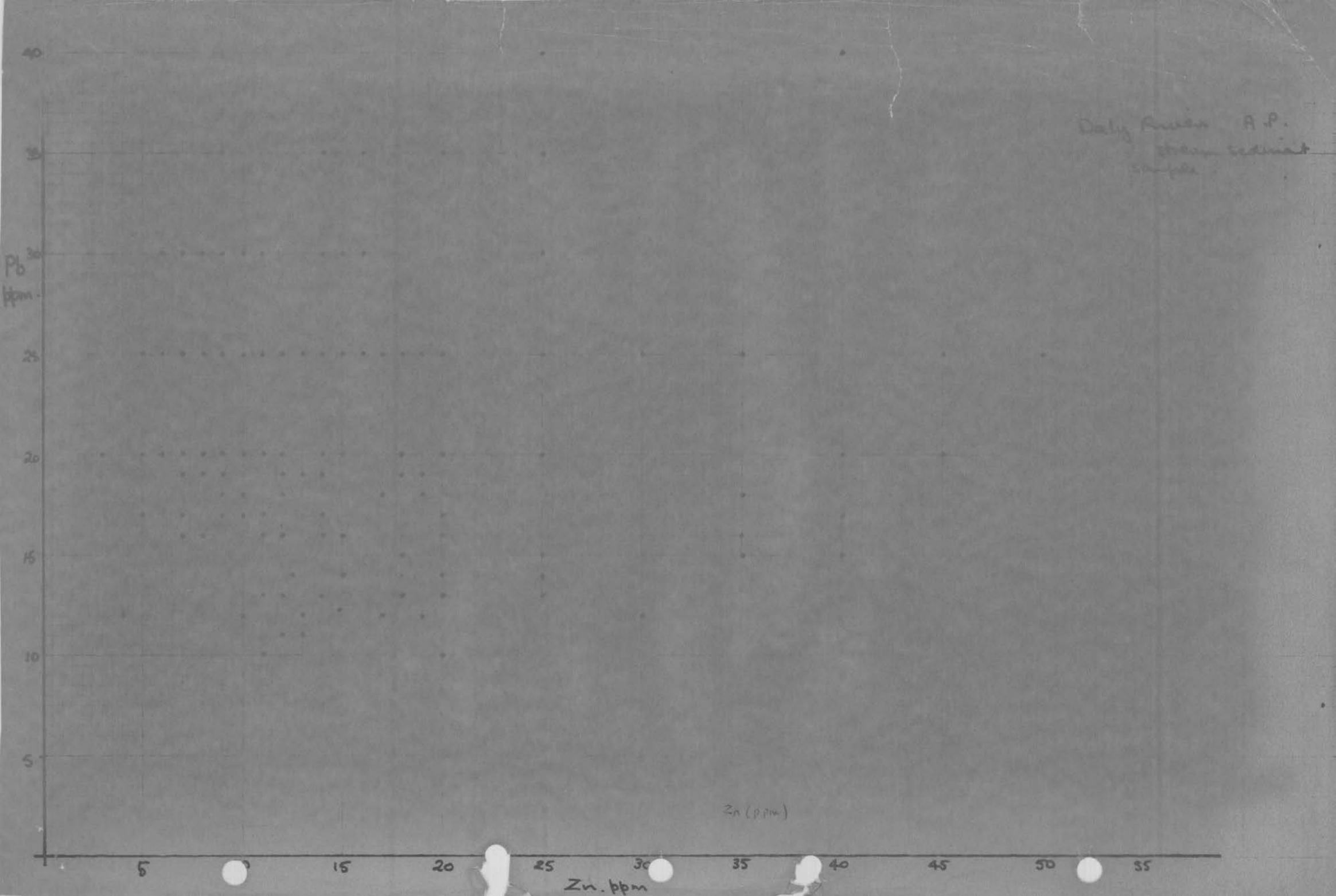
Co - hot leach.



ppm Co.


5
10
15
20
25
35
40
45
50
55
60
Ni ppm.


Daly River A.P.
stream sediment
Cu ppm
Pb (ppm)
Pb. ppm.


Daly River A.P.
stream sediment
samples
Pb ppm.
40
35
30
25
20
15
10
5
Zn (ppm)
5
15
20
25
30
35
40
45
50
55
Zn. ppm

SECTION 2. TECHNICAL DATA.

1. Airborne Geophysical Survey (see Pocket)

1.1 Drawing No. 857

Aeromagnetic Total Intensity Contours.

1.2 Drawing No. 858

Total Count Scintillometer Contour Plan.

2. Ground Reconnaissance Survey (see Pocket)

2.1 Drawing No. 852

Surface Geological Plan.

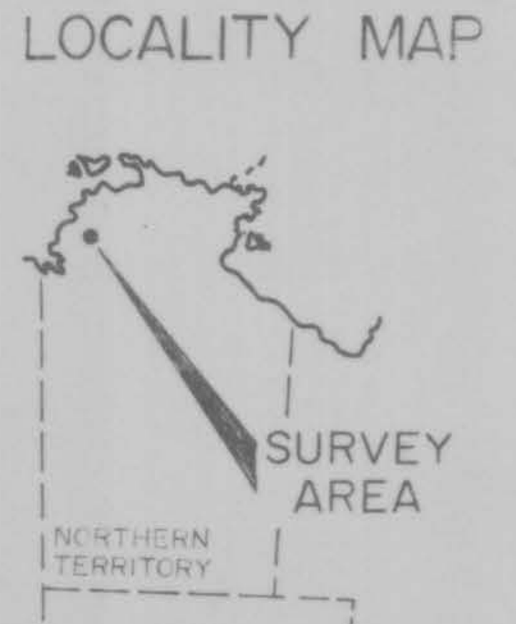
2.2 Drawing No. 854

Geochemical Results. Stream Sediment Survey (5 plans, one each for Cu, Pb, Zn, Ni and Co).

2.3 Report - Geological Report and Results of Reconnaissance Survey 25.11.72, (see attached).

McPHAR GEOPHYSICS PTY. LTD.

LOCALITY MAP



AUSTRALIAN DEVELOPMENT LIMITED

DALY RIVER A to P 2325

NORTHERN TERRITORY

AEROMAGNETIC TOTAL INTENSITY CONTOURS

SCALE IN FEET

0 2000 4000 6000 8000

LEGEND

500 GAMMA CONTOUR
100 GAMMA CONTOUR
20 GAMMA CONTOUR
MAGNETIC LOW
16 FLIGHT PATH

McPHAR

NOTE: This survey was flown with a mean terrain clearance of 375 feet using the following instruments:

(1) Varian proton precession magnetometer
(2) McPhar AV-4 Radiation Spectrometer with two 6x4 inch crystals

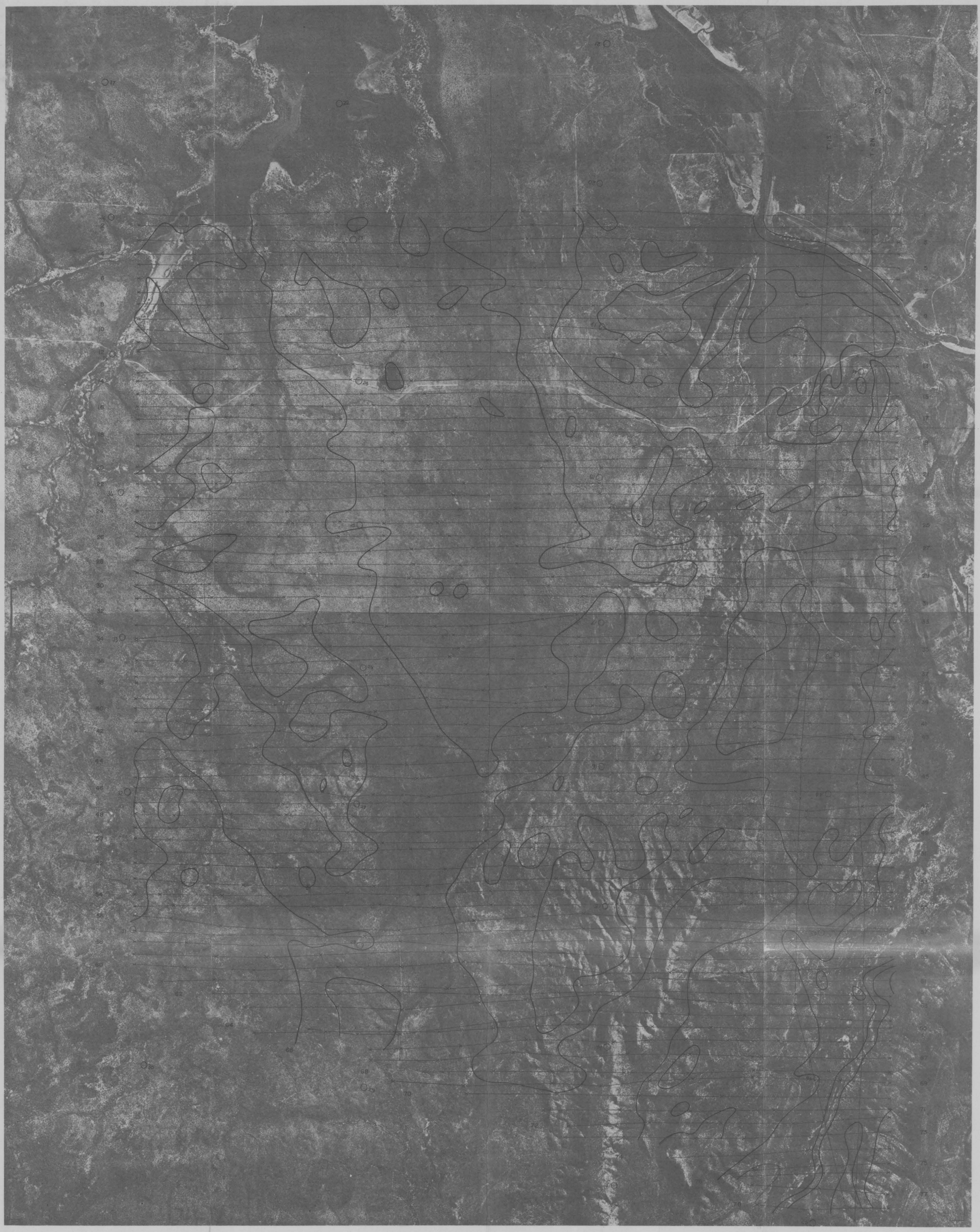
Survey flown: July 1972

DRAWN:	D.C.S.
DATE:	31·8·72
APPROVED:	J.C.S.
DATE:	1·9·72

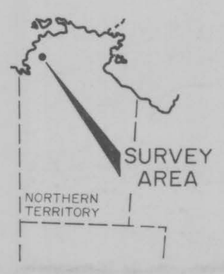
DRAWING NUMBER

857

McPHAR GEOPHYSICS PTY. LTD.



LOCALITY MAP



AUSTRALIAN DEVELOPMENT LIMITED

DALY RIVER A to P 2325

NORTHERN TERRITORY

TOTAL COUNT SCINTILLOMETER CONTOUR PLAN

SCALE IN FEET

0 2000 4000 6000 8000

McPHAR

NOTE This survey was flown with a mean terrain clearance of 375 feet using the following instruments:

(1) Varian proton precession magnetometer
(2) McPhar AV-4 Radiation Spectrometer with two 6x4 inch crystals

Survey flown: July 1972

DRAWING NUMBER

858

APPROXIMATE A.P. BOUNDARY ONLY.

N

LEGEND

QUATERNARY

Alluvium and sand cover.

LOWER PROTEROZOIC – Agicondian System

Litchfield Granite Complex – garnetiferous granite and granodiorite.

Finniss River Group

Burrell Creek Formation

Laminated shale, turbidite greywacke, greywacke, pebble conglomerate, siltstone.

Sandstone, tuffaceous greywacke, siltstone, grit, minor interbedded andesitic tuffs and flows.

Intermediate to basic lavas with minor interbedded tuffaceous sandstones, greywackes and siltstones.

Noltenius Formation

Shale, sandstone, quartz pebble conglomerate and greywacke conglomerate, greywacke, siltstone and minor tuffaceous greywacke and tuff.

ARCHAEAN

m — Hermit Creek metamorphics – schists and banded quartzite, banded granulite and migmatite.

NOTE: Compiled from reconnaisance traverses and aerial photograph interpretation.
Numbers G1, G2 etc. refer to field notes.

AUSTRALIAN DEVELOPMENT LTD

SURFACE GEOLOGICAL PLAN
DALY RIVER A.P.

SCALE	1" = 2000'	DRAWING NUMBER
DATE	25·10·72	852
GEOLOGY		
DRAWN		

LOCATION OF A.P. BOUNDARY APPROXIMATE ONLY

N

+20 +40 +23 +41 +19 +36 +24 +18 +34 +42 +25 +17 +43 +33 +26 +16 +44 +32 +27 +15 +45 +31 +28 +14 +46 +30 +29 +13 +47

FIRST ORDER ANOMALOUS 31-50 ppm

SECOND ORDER ANOMALOUS 51-70 ppm

THIRD ORDER ANOMALOUS >70 ppm

AUSTRALIAN DEVELOPMENT LTD
GEOCHEMICAL RESULTS
STREAM SEDIMENT SURVEY

Ni ppm (-80 mesh)

DALY RIVER A-P 2325

SCALE	1" = 2000'	DRAWING NUMBER
DATE	23 · 11 · 72	854
CHECKED	[signature]	
DRAWN	[signature]	

LOCATION OF A.P. BOUNDARY APPROXIMATE ONLY

N

+ 20
+ 36
+ 23
+ 40
+ 19
+ 38
+ 24
+ 41
+ 18
+ 34
+ 25
+ 42
+ 17
+ 33
+ 26
43
+ 16
+ 32
+ 27
+ 44
+ 15
+ 31
+ 28
+ 45
+ 14
+ 30
+ 29
46
+ 13
+ 47

FIRST ORDER ANOMALOUS 26-35 ppm
SECOND ORDER ANOMALOUS 36-45 ppm
THIRD ORDER ANOMALOUS >45 ppm

AUSTRALIAN DEVELOPMENT LTD
GEOCHEMICAL RESULTS
STREAM SEDIMENT SURVEY
Zn ppm (-80 mesh)
DALY RIVER A-P 2325

SCALE	1" = 2000'	DRAWING NUMBER
DATE	23 · 11 · 72	854
CHECKED	[illegible]	
DRAWN	[illegible]	

LOCATION OF A.P. BOUNDARY APPROXIMATE ONLY

N

+ 20
+ 40
+ 23
+ 30
+ 19
+ 36
+ 24
+ 41
+ 18
+ 34
+ 42
+ 25
+ 17
+ 43
+ 33
+ 26
+ 16
+ 32
+ 27
+ 44
+ 15
+ 31
+ 45
+ 28
+ 14
+ 30
+ 46
+ 29
+ 13
+ 47

FIRST ORDER ANOMALOUS 13-14 ppm
SECOND ORDER ANOMALOUS 15-16 ppm
THIRD ORDER ANOMALOUS >16 ppm

AUSTRALIAN DEVELOPMENT LTD
GEOCHEMICAL RESULTS
STREAM SEDIMENT SURVEY
Cu ppm (-80 mesh)
DALY RIVER A-P 2325

SCALE	1" = 2000'	DRAWING NUMBER
DATE	23 · 11 · 72	854
CHECKED	[illegible]	
DRAWN	[illegible]	

LOCATION OF A.P. BOUNDARY APPROXIMATE ONLY

N

+ 20
+ 36
+ 23
+ 40
+ 19
+ 35
+ 24
+ 41
+ 18
+ 34
+ 25
+ 42
+ 17
+ 33
+ 26
43+
+ 16
+ 32
+ 27
+ 44
+ 15
+ 31
+ 28
+ 45
+ 14
+ 30
+ 29
46+
+ 13
+ 47

FIRST ORDER ANOMALOUS 31-40 ppm
SECOND ORDER ANOMALOUS 41-50 ppm
THIRD ORDER ANOMALOUS 51-60 ppm
FOURTH ORDER ANOMALOUS >60 ppm

AUSTRALIAN DEVELOPMENT LTD
GEOCHEMICAL RESULTS
STREAM SEDIMENT SURVEY
Pb ppm (-80 mesh)
DALY RIVER A-P 2325

SCALE	1" = 2000'	DRAWING NUMBER
DATE	23 · 11 · 72	854
CHECKED	[illegible]	
DRAWN	[illegible]	

LOCATION OF A.P. BOUNDARY APPROXIMATE ONLY

N

+ 36 + 23 + 35 + 24 + 34 + 25 + 33 + 26 + 32 + 27 + 31 + 28 + 30 + 29

+ 20 + 40 + 19 + 41 + 18 + 42 + 17 + 43 + 16 + 44 + 15 + 45 + 14 + 46 + 13 + 47

FIRST ORDER ANOMALOUS 9-12 ppm

SECOND ORDER ANOMALOUS 13-16 ppm

THIRD ORDER ANOMALOUS >16 ppm

AUSTRALIAN DEVELOPMENT LTD
GEOCHEMICAL RESULTS
STREAM SEDIMENT SURVEY
Co ppm (-80 mesh)
DALY RIVER A-P 2325

SCALE	1" = 2000'	DRAWING NUMBER
DATE	23 · 11 · 72	854
CHECKED	[illegible]	
DRAWN	[illegible]	