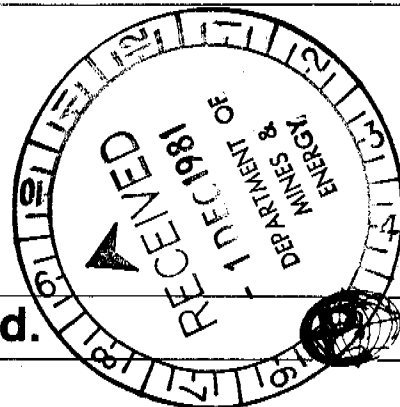


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Pacific Exploration Consultants Pty. Ltd.

OPEN FILE

EXPLORATION LICENCE 1356

PINE CREEK

1:250,000 MAP SHEET

NORTHERN TERRITORY

By:

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for and on behalf of:
GEM EXPLORATION & MINERALS LTD.

SEPTEMBER, 1981

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Regional Gravel Sample Results

APPENDIX 2

Regional Geochemical Stream Sediment Sample Results

APPENDIX 3

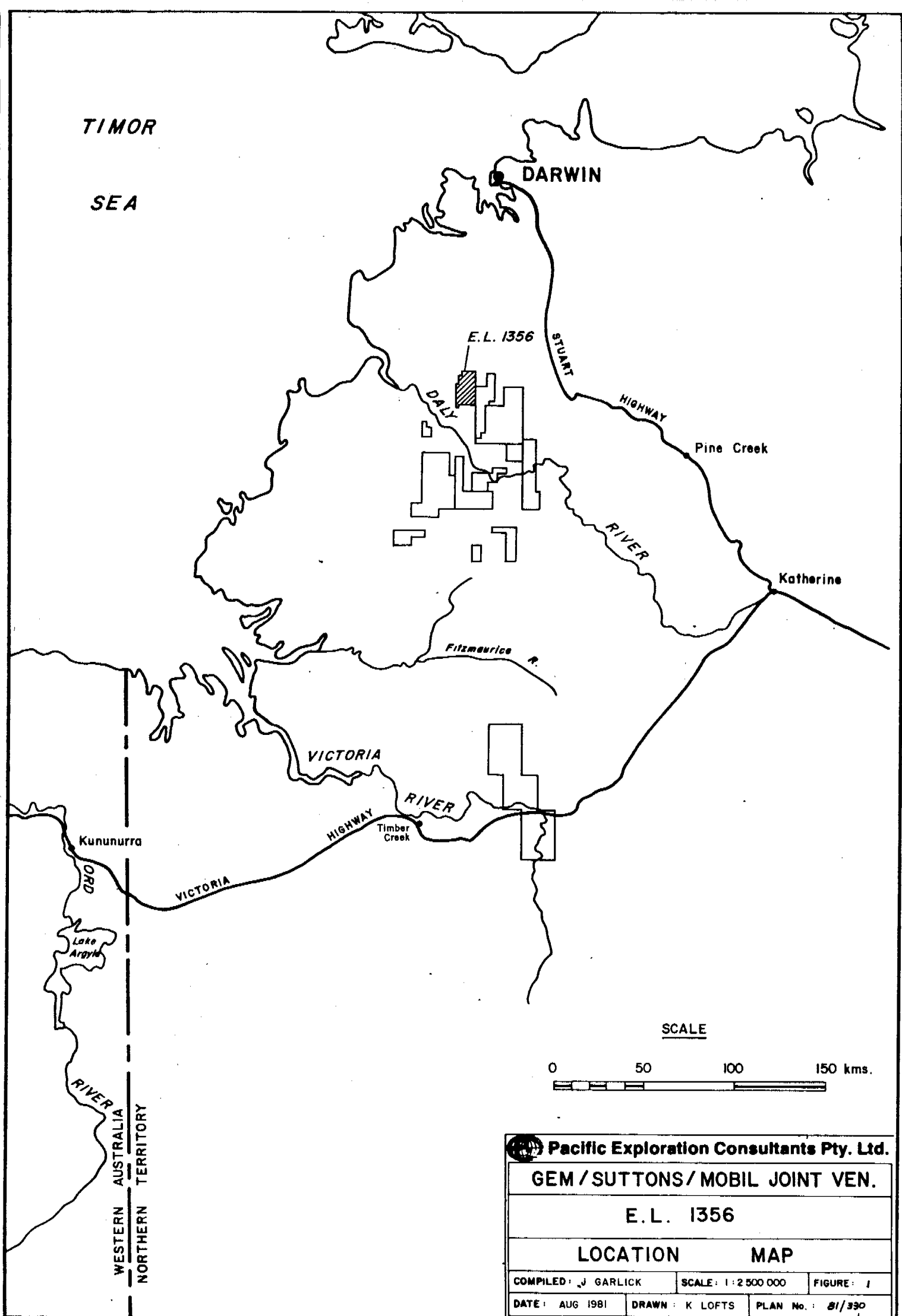
FINANCE: Exploration & Administrative Expenditure

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1.0 SYNOPSIS

Exploration Licence 1356 occupies approximately 150km^2 of terrain and is situated in close proximity to the Litchfield homestead locality, Daly River, Northern Territory (Pine Creek 1:250,000 sheet SD 52-8).

On a regional scale, the area was regarded as prospective for kimberlite exploration, based largely on the region's tectonic similarity with the Halls Creek Mobile Zone, Western Australia, where kimberlite is known to occur.

During the latter half of 1980, Gem Exploration & Minerals Limited entered into a joint venture with the Suttons Motors Group and Mobil Energy and Minerals Inc., which gave Gem the right to explore for kimberlite and diamond within E.L. 1356.

Essentially, the licence area occupies a marginal zone; the Archaean? - Lower Proterozoic Litchfield Province of granitoid terrain with a covering veneer of Cambro-Ordovician sediments occupies the northern sector of the area, and, to the south, the Lower Proterozoic metasediments of the Burrell Creek Formation represent the western side of the adjacent Pine Creek Geosyncline environment.

Exploration work took the form of a regional helicopter-borne gravel sample programme together with a geochemical stream sediment sampling programme. The gravel samples consisted of the collection of 20kg of minus 4mm sized gravel particulates, and, the geochemical samples comprised 20g of minus 80 mesh sized sediment.

The gravel samples were processed at the Company's mineral processing laboratory in Perth to provide a non-magnetic concentrate suitable for binocular microscope scanning for kimberlitic indicator minerals. The geochemical samples were analysed by a commercial laboratory for Co, Cu, Pb, Zn, Ni, Cr, Ag, As, Nb, La.

The sampling programme yielded 12 samples with an average density distribution of 1 sample per 12.5km^2 . The gravel sample results were reviewed for kimberlitic indicator minerals, and the geochemical results were appraised after statistical treatment to establish anomalous levels of elemental concentration for each element.

Both the gravel and geochemical sample programme results failed to detect evidence for kimberlite within the licence area. The low order geochemical anomalies in lead, silver, and detrital cassiterite detected as a result of the programme offer little encouragement for further work to be conducted.

It is recommended that any further investigation of the licence area for possible kimberlite occurrence excludes the traditional sampling techniques in favour of remote sensing and/or bulk sampling methods.

2.0 INTRODUCTION & OBJECTIVE

- 2.1 Exploration licence 1356 comprises an area of approximately 150km² and is situated in close proximity to the Litchfield homestead locality, Daly River, Northern Territory. The tenement is depicted on the western sector of the Pine Creek 1:250,000 map sheet (SD 52-8), and, occurs on the 1:100,000 Reynolds River (5071) and Daly River (5070) map sheets (Figure 1).
- 2.2 During the latter half of 1980, Gem Exploration & Minerals Limited entered into an agreement with the Suttons Motors Group and Mobil Energy & Minerals Inc., which gave Gem the right to explore for and mine diamonds within E.L. 1356 to the exclusion of any other minerals.
- 2.3 On a regional scale, the area was regarded as a prospective area for kimberlite occurrence, based largely on the region's tectonic similarity with the Halls Creek Mobile Zone, Western Australia, where kimberlite is known to occur.
- 2.4 The exploration programme managed by Gem Exploration was regional both in philosophy and methodology and consisted of a regional helicopter borne detrital mineral and geochemical stream sediment sampling programme over E.L. 1356 with a preferred sample density of 1 sample per 10km² or better.
- 2.5 The exploration programme formed part of a first pass appraisal of the licence area which also incorporated regional sampling within an area bounded by latitude 13°20'S - 14°20'S and longitude 130°20'E - 131°10'E but confined to the exploration licences held by the Suttons, and Suttons/Mobil, Group joint ventures.
- 2.6 The objective of this report is to present an annual report based on an appreciation of the geology of the area; document the exploration programme conducted, and based on a results assessment, make suitable recommendations for future work in areas which warrant further expenditure.

3.0 REGIONAL GEOLOGICAL SETTING

- 3.1 In a regional sense, the area under consideration consists of basement metamorphics of Archaean and Lower Proterozoic age, highly folded Lower Proterozoic geosynclinal rocks with associated Middle Proterozoic granitic intrusions, and relatively flat-lying and gently folded Proterozoic Platform sedimentary rocks and Palaeozoic sedimentary basin deposits.
- 3.2 In terms of the regional tectonic evolution of the area, the Daly River area appears to be linked with the north-north-eastern extension of the major strike-slip fault zone comprising the Halls Creek and Fitzmaurice Mobile Zones. These Mobile Zones are regarded as having a major role in the tectonic evolution of Northern Australia. In particular, in the Daly River area, the major strike-slip fault pattern has been interpreted as being the position of the western limb of a major rift structure which initiated the development of the Pine Creek Geosyncline (1). In view of this interpretation, the possibility exists within the area for mantle derived intrusives of the kimberlitic type.
- 3.3 The hiatus of metamorphism, deformation, and granitic emplacement in the region was associated with the cessation in the development of the Pine Creek Geosyncline and took place approximately 1800 m.y. ago. Following this major orogenic event the area has remained relatively stable apart from relatively minor uplifts followed by erosion and marine transgressions. The similarity in the tectonic evolution of the area with the Halls Creek Mobile Zone which is known to contain kimberlitic intrusives is believed to enhance the prospectivity of the Daly River area for kimberlite exploration.
- 3.4 The main tectonic units of the Daly River area include from west to east; the Litchfield Province which is generally regarded as an Archaean to Lower Proterozoic basement complex forming the western margin of the Pine Creek Geosyncline; a central zone representing part of the Pine Creek Geosyncline of Lower Proterozoic pelitic and psammitic sediments with interbedded tuffs and associated granite plutons of Middle Proterozoic age; an eastern and southern zone made up of cover rocks to the underlying Pine Creek Geosyncline sediments.

The latter cover rocks include; Upper Proterozoic sediments of the Tolmer and Auvergne Groups, Palaeozoic sediments, and minor Mesozoic outliers which form the Daly River Basin.

- 3.5 The Litchfield Province forms the western most sector unit of the Pine Creek Geosyncline and extends over an area of 8500 km² from the eastern boundary of the Bonaparte Gulf to the Giants Reef Fault. The Province is composed of a number of granitoids which have a compositional range from adamellite to granodiorite; and, an age range of Archaean for some of the granitoids in the southern portion of the Province to Middle Proterozoic in the northern portion (2). The granitoid margins are migmatized and transitional into large surrounding areas of metasediments, varying in metamorphic grade from greenschist to upper amphibolite/granulite grade. An Archaean age is postulated for the metasediments of the Hermit Creek Metamorphics located south of the Daly River whilst the metasediments north of the Daly are regarded as having an Early Proterozoic age and probably correlative with the Burrell Creek Formation of the Pine Creek Geosyncline (2,3).
- 3.6 Two periods of metamorphism affected the Litchfield Province; an older regional phase and a younger thermal phase which was related to the intrusion of the Mid Proterozoic granitoids. These granitoids were probably formed 1800 m.y. ago during the orogenesis known elsewhere in the Pine Creek Geosyncline (2).
- 3.7 In addition to the granitoid and metasedimentary areas, there are minor areas of unmetamorphosed gabbro, dolerite, and quartz-dolerite of Middle Proterozoic age. Cover rocks include quartz sandstones of Middle Proterozoic age and Cambro-Ordovician sandstones of the Daly River Basin sequence.
- 3.8 The Pine Creek Geosyncline which regionally is composed of metasediments and extrusives, is represented in the area by the Finnis River Group which forms the upper part of this Lower Proterozoic succession. Essentially, the Finnis River Group comprises a monotonous sequence of sandstone, slate, greywacke, and minor arkose, quartzite, conglomerate and schist. In the west, greywacke and conglomerate of the Burrell Creek Formation, made up largely of volcanic detritus, grade laterally and upwards to quartz sandstone and minor conglomerate of the Chilling

Sandstone (3). Apart from these sedimentary sequences, in the south west of the area, the Berinka volcanics overlie and possibly intrude the Burrell Creek Formation to form a sequence of felsic to intermediate lavas and intrusive derivatives.

- 3.9 Towards the end of sedimentation in the Pine Creek Geosyncline, a suite of continental tholeiites were intruded into the sedimentary pile. This suite of rocks, known as the Zamu Dolerite and its age equivalent Ti Tree Granophyre both occur as sills and minor dykes in the Burrell Creek and Chilling Sandstone Formations of the area.
- 3.10 Following the cessation of sedimentation in the Geosyncline there was a prolonged period of orogenesis which resulted in a tightly folded greenschist facies environment developed over the area under consideration. The final igneous event which is preserved in the area and associated with the Geosynclines' evolution, is the intrusion of late orogenic granites which have a consistent Middle Proterozoic age grouping (4).
- 3.11 Notable granitic intrusions within the central zone of the Daly River area include from north to south; a small exposure of Cullen Granite north-north-east of Daly River Mission, the Allia Granite of the central area, and the Soldiers Creek Granite in the Collia, Buldiva, and Muldiva tin areas.
- 3.12 The Cover Rock Formations which occupy the southern and eastern sectors of the area include those formations belonging to the Tolmer and Auvergne Groups of Upper Proterozoic age and the Palaeozoic sequence in the Daly River Group. Additionally, outliers of Late Jurassic to Early Cretaceous sediments remain preserved in certain areas.
- 3.13 The Tolmer Group crops out along the western margin of the Daly River Basin. The outcrop is bounded to the south by the Collia Fault. Although the age of the Group is in doubt, on the basis of the basal units' unconformable relationship with Mid-Proterozoic granite, the Group is currently designated as Upper Proterozoic in age.

- 3.14 Essentially, the Tolmer Group consists of sediments associated with a shallow water marine environment, yielding a sequence of sandstone, dolomite, and minor shale units to a total maximum thickness of 1000m.
- 3.15 The Auvergne Group crop out in the south west of the area. The Group consists of a shallow water sequence up to 600m thick of arenaceous and argillaceous sediments with minor dolomite units.
- 3.16 The Daly River Basin Group comprises an intermittently occurring basal conglomerate unit, superceeded by a tholeiitic basalt sequence regarded as part of the Eo-Cambrian Antrim Plateau Basalt unit which occurs both in the Daly River area, the Victoria River Basin region, and portions of the West and East Kimberley Region. Successive units in the Daly River Basin Group comprises a sequence of limestone, sandstone, and siltstone units which were deposited in shallow water associated with a regional marine transgression.
- 3.17 The Mesozoic outliers in the area consist of mainly sandstone and conglomerate units laid down under mainly terrestrial shallow lake conditions.

4.0 REGIONAL MINERAL OCCURRENCE AND PREVIOUS MINING ACTIVITY

4.1 Recorded mineral occurrence and previous mining activity in the region is centred around Daly River area and the Wingate Mountain area. The available recorded details are tabulated on Table 1 & 2.

4.2 In summary, the recorded mineral occurrences fall mainly within the Lower Proterozoic Pine Creek Geosyncline environment and have the following mineral and rock associations :

- 1) Daly River Area: Cu, Cu-Au, Ag-Pb-Cu mineral assemblages occurring along shear zones are associated with Lower Proterozoic sediments; notably the slate units of the Burrell Creek Formation. These occurrences are located 10-20 km north of Daly River Mission.
- 2) Wingate Mountain Area: Auriferous quartz reefs are associated with shear zones and anticlinal fold axes in the Burrell Creek Formation at Fletchers Gully.

Cassiterite is associated with quartz-mica-tourmaline pegmatites genetically linked with the Allia and Soldiers Creek Granite intrusions of Middle Proterozoic age. In addition to pegmatites located within granite terrain, surrounding metasediments of the Burrell Creek Formation are also mineralised with cassiterite bearing pegmatite intrusions. The notable tin centres of Muldiva, Buldiva, and Collia are located in the Wingate Mountains area where the majority of tin won was from eluvial and alluvial workings.

4.3 The evidence obtained from recorded mineral occurrence within the area strongly suggests that all the deposit types are vein type deposits associated mainly with early Middle Proterozoic granite intrusions. Within this category of deposits, it appears that vein-type deposits containing : Au, Sn, Ag-Pb, W, Ta, Cu, Bi associations are the most probable deposit types likely to be located by future exploration within the area based on previous exploration and prospecting results. However, more recent interpretations regarding the geological environment present, together with a consideration of the structural evolution of the region suggests that the area is prospective for uranium mineralisation on the one hand, and, a potential site for mantle derived plutons on the other.

TABLE 1 : RECORDED MINERAL OCCURRENCES : DALY RIVER AREA : NORTHERN TERRITORY

PROSPECT NAME	TONNE	GRADE	CONTAINED METAL TONNE	PRODUCTION PERIOD	ASSOCIATED METALS	COMMENTS
DALY RIVER	6000	20% Cu	1200 Cu	1884-1918		<p>Mineralisation occurs as bunches & stringers hosted to slate of Burrell Creek Formation and localised along a northward trending shear zone.</p> <p>Lode Material consists of malachite, azurite, chalcocite with quartz and limonite gangue.</p> <p>Workings consist of an open pit 70m long, 30m wide, 30m deep together with 5 shafts up to a depth of 36m.</p> <p>Comment: No zone of secondary enrichment recorded; primary ore consists of low grade disseminated chalcopyrite.</p>
WHEAL DANKS GROUP	500	28% Cu	140 Cu	1887-1904	Gold	<p>Mineralisation occurs along northward extension of Daly River Prospect shear zone.</p> <p>Workings consist of three separate small groups of excavations which include small open cuts and several shafts to a maximum depth of 30m.</p> <p>Assay Data from Wheal Danks & Wheal Danks South of lode and dump material yielded average assay values of from 2-4% Cu and 1.5 - 4.5 gms/tonne Au.</p>
EMPIRE	143	nd	nd	nd		<p>Mineralisation occurs along a north trending shear zone which has a surface expression of 46m over 1m wide.</p> <p>Workings consist of 2 shafts sunk to depths of 6 and 12m respectively.</p>

PROSPECT NAME	TONNE	GRADE	CONTAINED METAL TONNE	PRODUCTION PERIOD	ASSOCIATED METALS	COMMENTS
WALLABY	30	35% Cu	10 Cu	nd	Silver Lead	Mineralisation consists of two separate lodes developed along shear zones; one lode is associated with copper mineralisation, the other silver-lead mineralisation. Workings over the copper lode include a shaft sunk to 12m; workings over the silver-lead lode include several costeans and two shafts to 11m. Assay Data from the silver-lead lode range up to 5% Pb, 3 gms/tonne Au, and 120 gms/tonne Ag.
WARRS	nd	nd	nd	nd		Mineralisation Copper mineralisation in quartz filled shears hosted to slate of the Burrell Creek Formation. Workings consist of shallow prospecting pits and shafts over a total strike length of 152m.
KNOWLES FARM	nd	nd	nd	nd		Mineralisation recorded in surface gossan material yielded high silver-lead assays with subordinate copper and gold. Workings consist of several costeans only.
MARION HILL	nd	nd	nd	nd		Mineralisation: Recorded copper occurrence.

Information Source: Crohn, P.W., 1968:

The mines and mineral deposits of the Katherine-Darwin region. In Walpole, B.P., Crohn P.W., Dunn, P.R., & Randal, M.A., Geology of the Katherine-Darwin Region, Northern Territory. Bull. Bur. Miner. Resour. Geol. Geophys. Aust., 82, 171-282.

TABLE 2 : RECORDED MINERAL OCCURRENCES : WINGATE MOUNTAINS AREA : NORTHERN TERRITORY

PROSPECT NAME	TONNE	GRADE	CONTAINED METAL TONNE	PRODUCTION PERIOD	ASSOCIATED METALS	COMMENTS
FLETCHERS GULLY	nd	nd	75.09kg Au	1905-10 1922-29 1934-43 1945-46		Mineralisation: Auriferous quartz reefs filling fissures and tension-cracks are hosted to the basal shale unit of the Burrell Creek Formation. Mineralisation appears to be concentrated close to the axis of an anticline trending northwesterly. Workings consist of a number of adits, shafts and limited underground workings over a total strike length of 61m to a depth of 30m. Reef widths generally narrow and irregular.
FLETCHERS GULLY	nd	nd	6.5	1910 1922-23 1937-44		Mineralisation: Cassiterite occurs nearby Fletchers Gully Gold Mine in minor pegmatite dykes associated with the Allia Granite. Workings consist of minor excavations only.
MULDIVA	nd	nd	nd	1922-23 Mainly Alluvial		Mineralisation: Tin was won in small quantities from quartz-mica-tourmaline-cassiterite lodes intruded into metamorphosed sediments in close proximity to the Soldiers Creek Granite; the largest lode ranged from 0.3m to 0.6m in width, and was traced for 45m.

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PROSPECT NAME	TONNE	GRADE	CONTAINED METAL TONNE	PRODUCTION PERIOD	ASSOCIATED METALS	COMMENTS
BULDIVA	nd	nd	nd	1922-23 Mainly Alluvial		Mineralisation: Tin was won from numerous small pegmatite lenses in the Soldiers Creek Granite, from the basal unit of the Burrell Creek Formation; from a basal conglomerate in the overlying Cretaceous Mullaman Beds, more recently from unconsolidated eluvial and alluvial deposits.
COLLIA	nd	nd	85.6 Sn	1922-29 1948-53 1961 1966-67 Mainly Alluvial		Mineralisation: Although quartz-tourmaline-cassiterite dykes have been located in the Soldiers Creek Granite, production has come from selective mining of eluvial and alluvial pockets of detrital cassiterite concentrations.
COLLIA	nd	nd	nd	nd		Mineralisation: Native copper traces are recorded in Antrim Plateau Basalts located near Collia.
DALY RIVER BASIN	nd	nd	nd	nd		Mineralisation: Vein type barite occurrences have been recently worked in the Dorisvale area. These occurrences occur in Upper Proterozoic sediments regionally associated with the Dorisvale Fault-line. Lead occurrences are recorded in the Tindall Limestone unit of the Daly River Basin sequence.

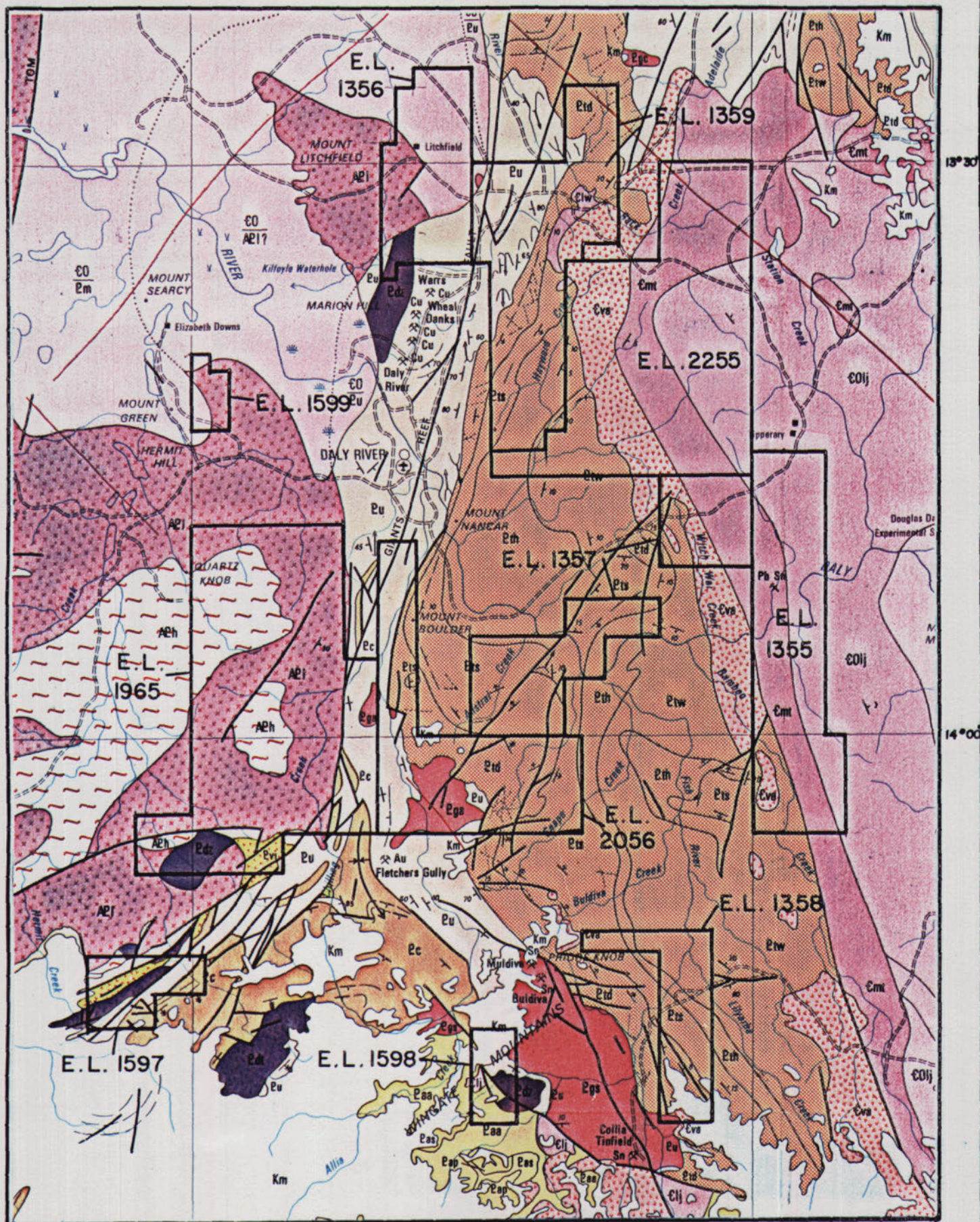
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GEM/SUTTONS/MOBIL JOINT VENT.

REGIONAL GEOLOGY OF E.L.'S

PINE CREEK PROJECT

COMPILED: J GARLICK

SCALE: 1:500 000

FIGURE: 2

DATE: SEPT 1981

DRAWN: K LOFTS

PLAN No.: 81/342

LEGEND

MESOZOIC	BATHURST TERRACE	Km : Petrel Formation : Medium to coarse sandstone, conglomerate; mainly terrestrial.
PALAEOZOIC	DALY RIVER BASIN GROUP	Olo : Oolloo Limestone : Flaggy Limestone, commonly silicified.
		Eo : Undivided Cambrian & Ordovician sediments.
		Eolj : Jinduckin Formation : Ferruginous sandstone & siltstone, minor marl, dolomite and chert.
		Eolm : Manbulloo Limestone : Limestone, partly silicified.
		Emt : Tindall Limestone : Crystalline limestone, chert nodules.
		Ewb : Buckingham Bay Sandstone : Coarse white sandstone, clayey sandstone.
		Eva : Antrim Plateau Volcanics : Massive & vesicular basalt.
		Elj : Jarong Conglomerate : Boulder and pebble conglomerate.
		Elw : Witch Wai Conglomerate : Ferruginous sandy boulder & pebble conglomerate.
ADELAIDEAN ?	VICTORIA RIVER BASIN AUVERGNE GROUP	Pae : Spencer Sandstone : Quartz sandstone, minor silty sandstone.
		Pal : Lloyd Creek Formation : Algal and oolitic dolomite.
		Pap : Pinkerton Sandstone : White massive quartz sandstone, minor shale and siltstone.
		Pas : Saddle Creek Formation : Basal blocky cross-bedded sandstone, upper flaggy quartz sandstone.
		Paa : Angalarri Siltstone : Grey-green siltstone and shale.
CARPENTARIAN	TOLMER GROUP	Ptw : Waterbag Creek Formation : Ferruginous sandstone & siltstone.
		Pth : Hinde Dolomite : Dolomite and minor limestone, dolomitic siltstone.
		BULDIVA SANDSTONE
		Pts : Stray Creek Sandstone : Flaggy quartz sandstone, siltstone & shale.
		Ptd : Depot Creek Sandstone : Massive quartz sandstone, pebble bands.
	PINE CREEK GEOSYNCLINE	Pga : Allia Creek Granite : Adamellite, granodiorite, tonalite.
		Pgc : Cullen Granite : Granite, adamellite, aplite dykes.
		Pgs : Soldiers Creek Granite : Coarse muscovite-biotite adamellite and granodiorite.

EARLY PROTEROZOIC

RIVER GROUP

- Pdz : Zamu Dolerite : Basaltic sills, olivine dolerite, quartz dolerite, dolerite and granophyre.
- Pdt : Ti-Tree Granophyre : Granophyre.
- Pc : Chilling Sandstone : White quartz sandstone, ripple-marked and cross-bedded, minor conglomerate, siltstone and tuff.

FINNIS

LITCHFIELD BLOCK

- Pvi : Berinka Volcanics : Acid and minor intermediate lava, minor sandstone and tuff interbeds, granophyric acid intrusive rocks.
- Pu : Burrell Creek Formation : Siltstone, shale, greywacke siltstone.
- Psk : Koolpin Formation : Ferruginous siltstone with chert bands and nodules, pyritic carbonaceous shale, silicified dolomite, minor phyllite, jasper & banded iron formation.
- Pm : Schist, gneiss.
- Aph : Hermit Creek Metamorphics : Quartz-mica schist, phyllite, tremolite schist, amphibolite, migmatite.
- Apl : Litchfield Complex : Granite, adamellite, granodiorite, tonalite, migmatite, pegmatite, gametiferous in places.



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GEM/SUTTONS/MOBIL JOINT VENTURE

REGIONAL GEOLOGY OF E.L.'S

PINE CREEK PROJECT

COMPILED: J GARLICK SCALE: FIGURE: 2

DATE: AUG 1981 DRAWN: K LOFTS PLAN No: 81/343

5.0 LOCAL GEOLOGICAL SETTING

- 5.1 Exploration Licence 1356 lies astride portions of the Litchfield Province and the Pine Creek Geosyncline. Physiographically, the area consists of low, gently undulating country drained by semi-mature rivers.
- 5.2 The northern and central portions of the area are formed by the Mt. Litchfield Granite which is a coarse grained muscovite-biotite granodiorite of Middle Proterozoic age. Surrounding areas to the granite outcrop are formed by cover rocks belonging to the Daly River Group of Cambro-Ordovician age.
- 5.3 The southern sector of the area, within the Pine Creek Geosyncline environment, is composed of mainly psammitic metasediments belonging to the Burrell Creek Formation of Lower Proterozoic age. Additionally, a large sill-like intrusion of Zamu Dolerite of early Middle Proterozoic age intrudes Burrell Creek Formation metasediments.
- 5.4 Structurally, the main trend of strike-slip faulting has a N.15°E orientation within the area; well exemplified by the Giants Reef Fault which is proximal to the eastern boundary of the area.

6.0 EXPLORATION PROGRAMME

- 6.1 Area selection for potential diamond and kimberlite environments within Australia has over the last ten years been largely based on conceptual models generated from knowledge of kimberlite geology from African, Russian, Indian, and North American occurrences. This logical approach to selecting prospective search areas therefore became a largely empirical exercise in Australia where until recently definitive kimberlite was unknown.
- 6.2 Within the last few years, discoveries of kimberlite in South Australia, and more recently, Western Australia, have aided in the refinement of area selection techniques based on Australian evidence.
- 6.3 The significant discovery of kimberlites within the Halls Creek Mobile Zone, Western Australia, and more particularly within the East Kimberley section of this tectonic zone, has enhanced the prospectivity of the prolongation of the zone into the Northern Territory. In this regard, the north-north-east trending Fitzmaurice Mobile Zone and its prolongation along the western side of the Pine Creek Geosyncline are of particular importance.
- 6.4 The selection of the Daly River area as a regional target area for kimberlite exploration was largely based on the following area characteristics:
- 1) The area comprises in a regional sense; the Litchfield Province, an area of Archaean metamorphics intruded by granitoids of ?Archaean to early Middle Proterozoic age; a central zone of Lower Proterozoic metamorphosed and highly deformed metasediments intruded by early Middle Proterozoic granites; an eastern zone of relatively undeformed cover rocks of Middle to Upper Proterozoic and Phanerozoic age. This area essentially stabilised during the Middle Proterozoic providing a suitable tectonic environment for kimberlite emplacement.
 - 2) The empirical significance of the tectonic link between the kimberlite-bearing Halls Creek Mobile Zone, and, the Fitzmaurice Mobile Zone noted in 6.3 above.

- 3) The significance of the eastern margin of the Litchfield Province, defined by the Giants Reef Fault, as marking the western limb of the regional rift structure which initiated the development of the Pine Creek Geosyncline early in the Lower Proterozoic. This major rift structure which developed across the northern Australian continent may have facilitated the development of mantle derived plutons within the marginal areas of the structure.

6.5 Based upon the above broad indicators, the area was regionally explored to test the efficacy of the points put forward. The following exploration programme, detailed below, was conducted over the area.

6.6 EXPLORATION PROGRAMME

PHASE 1 : REGIONAL DETRITAL MINERAL AND GEOCHEMICAL SAMPLING

OBJECTIVE : Definition of kimberlite indicator mineral and/or diamond distribution. Definition of detrital minerals of possible commercial interest, viz. gold, cassiterite and tantalum minerals.

METHOD & : Stream Gravel Sampling

SAMPLE : Collection of a minimum of 20 kg of deep-creek gravel from heavy mineral trap sites within current drainage channels. Screened on site to -4mm. Preferred sample density: 1 sample per 10km².

TYPE

: Geochemical Stream Sediment Sampling

Collection of a minimum of 20 g of -80 mesh material from current drainage channels. Preferred sample density 1 sample per 10km².

MANPOWER : 2 x 2 man sampling crew with both vehicle and helicopter support (Jet Ranger Series 2). Senior Geological supervision.

Support staff based in Kununurra providing transport vehicle for sample transportation, and supplies.

SAMPLE

PROCESSING

: Stream Gravel Processing

Sizing and gravitational minerals processing to provide a non-magnetic mineral concentrate for binocular microscope scanning and identification of anomalous detrital grains. Processing conducted at Gem Exploration Laboratory, Perth.

Methodology

- Wet screening of -4mm sample to yield a -2mm sizing.
- Rough concentration of -2mm material on a Wilfley table to yield a concentrate containing all heavy minerals.
- Concentration of heavy minerals with a specific gravity of 2.9 or greater by heavy liquid separation in TBE (Tetrabromoethane).
- Sizing of concentrate into -2 + 1mm; -1 + 0.8mm; -0.8 + 0.5mm size fractions.
- Magnetic separation.
- Non-magnetic fraction washed in ultrasonic bath.
- Non-magnetic fraction observed under binocular microscope.
- Anomalous grains electron probed for positive mineral identification at W.A.I.T., Perth.

: Geochemical Sample Processing

Geochemical trace-element analysis conducted by commercial laboratory, Perth.

Elemental Scan: Copper, lead, zinc, cobalt, nickel, chromium, silver, gold : Analytical Method : Atomic Absorption Spectrophotometry (AAS).

- : Niobium, Lanthanum, Strontium, Tantalum, Arsenic, Wolfram, Tin, and Uranium : Analytical Method : X-Ray Fluorescence Spectrometry (XRF).**

SAMPLE PREFIX
PCRR
REYNOLDS
RIVER
SHEET

SAMPLE PREFIX
PCDR DALY
RIVER SHEET

LEGEND

○ GRAVEL & STREAM SEDIMENT GEOCHEMICAL
SAMPLE LOCATION

SCALE

0 1 2 3 4 5 6 7 kms.

Pacific Exploration Consultants Pty. Ltd.

GEM/SUTTONS/MOBIL JOINT VEN.

SAMPLE LOCATION PLAN

E.L. 1356 NORTH. TERRITORY

COMPILED: J GARLICK

SCALE: 1:100 000

FIGURE: 3

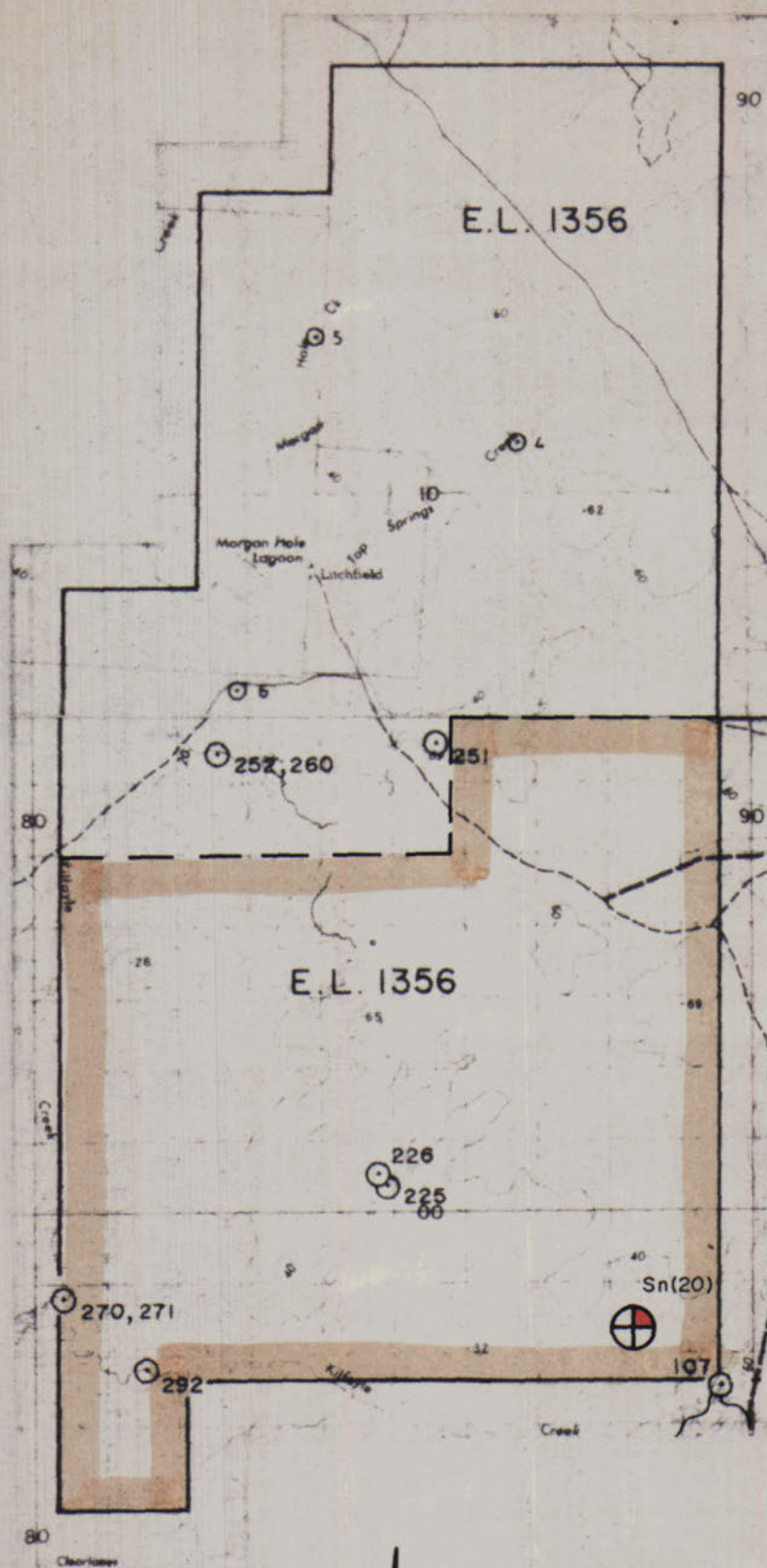
DATE: AUG 1981

DRAWN: K LOFTS

PLAN No.: 81/330

7.0 GRAVEL SAMPLE PROGRAMME RESULTS

- 7.1 The regional gravel sampling programme conducted over E.L. 1356 yielded a total of 12 twenty kilogramme samples with an average sample density distribution of 1 sample per 12.5km^2 .
- 7.2 The sample location distribution, together with the anomalous detrital mineral distribution are shown on figures 3 & 4. Detailed minerographic reports on each sample concentrate appear in Appendix 1.
- 7.3 The only sample for which a positive result was obtained was the detection of 20 grains of cassiterite from PCDR 107. This result indicates the occurrence of detrital cassiterite in Kilfoyle Creek, an east-west drainage proximal to the southern margin of E.L. 1356. The source of the anomaly appears to lie within the adjacent E.L. 1359.
- 7.4 No detrital minerals pertinent to the occurrence of kimberlite were detected within the area as a result of the gravel sampling survey.



LEGEND


Sn CASSITERITE

+ Sn(2) Anomalous mineral and No. of positive grains present.

● 12 Sample location and No

Boundary after AUGUST 1981

PREFIX TO SAMPLE Nos. SEE FIG 3.

 Pacific Exploration Consultants Pty. Ltd.

GEM/SUTTONS/MOBIL JOINT VEN.

DETRITAL MINERAL ANOMALIES

E.L. 1356 NORTH TERRITORY

COMPILED: J GARLICK

SCALE: 1:100 000

FIGURE: 4

DATE: SEPT 1981

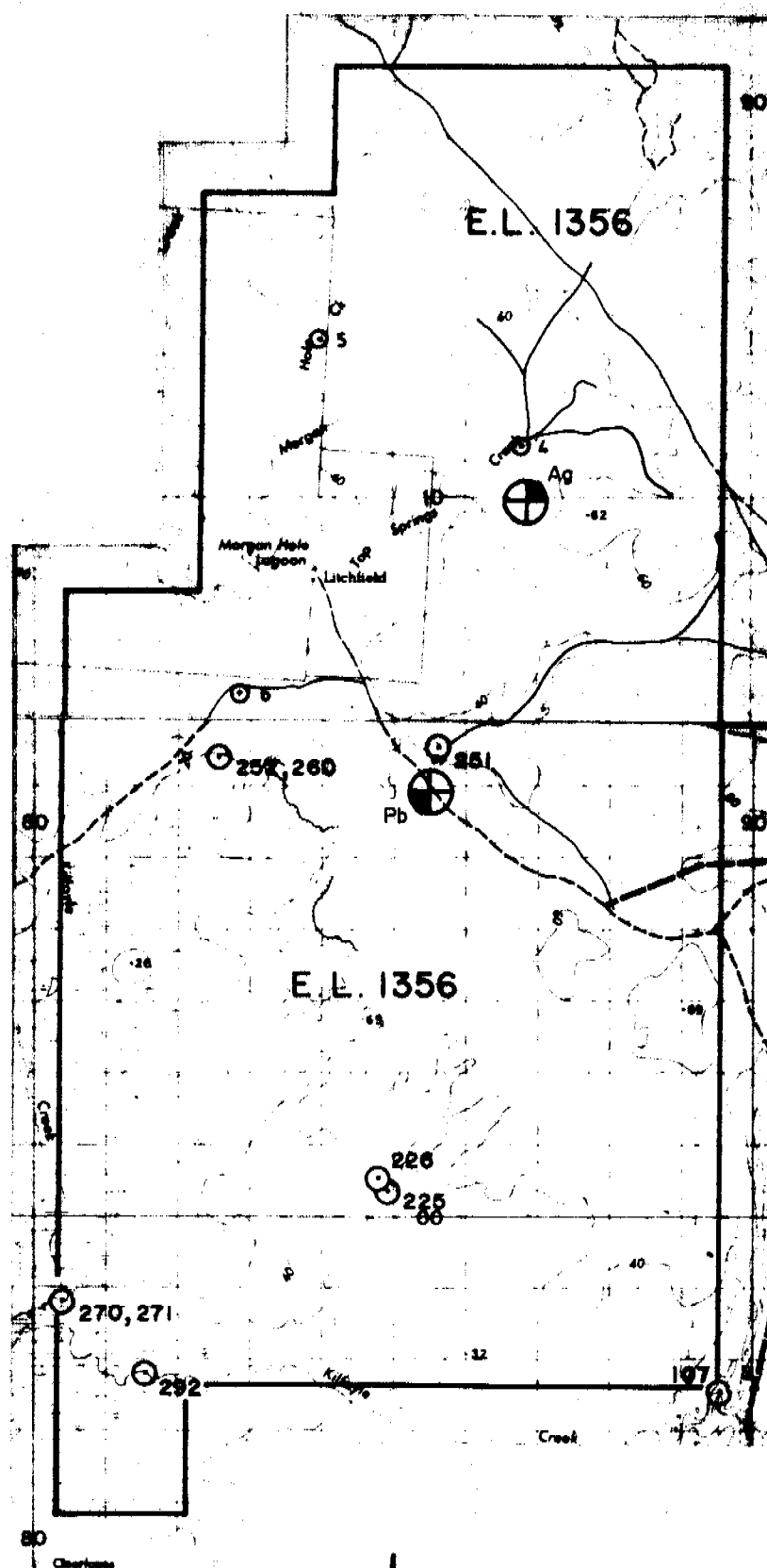
DRAWN: K LOFTS

PLAN No. 81/349

8.0 GEOCHEMICAL STREAM SEDIMENT SAMPLING PROGRAMME RESULTS

- 8.1 The geochemical sample distribution and the anomalous geochemical results pattern are shown on figures 3 & 5 respectively.
- 8.2 The majority of the geochemical samples were analysed for 10 elements, namely; Co, Cu, Pb, Zn, Ni, Cr, Ag, As, Nb, La. This partial scan, compared with the planned elemental scan, section 6, may be completed should the Company feel further expenditure is justified. The analytical results available are detailed in Appendix 2.
- 8.3 The geochemical analyses obtained from E.L. 1356 were incorporated with all the geochemical stream sediment data available from adjacent licences in the Gem/Suttons, Gem/Suttons/Mobil, joint ventured areas. These data were statistically treated following Lepeltier's methodology, with the objective of obtaining for each element, a background and threshold value (7). The incorporation of all the available data was necessary in order to give a meaningful value for both background and threshold values.
- 8.4 The statistical treatment of these data was completed by manual methods to produce the cumulative frequency distribution plots presented on log-probability graph-paper; Figures 1A - 6A, 13A, 14A. The number of values used per plot varied from 326 - 363; the variability being a function of the values available above analytical detection limit together with those values which were regarded as being representative. Additionally, because of the low population of arsenic and silver values recorded above detectable limits the indicated threshold value was subjectively selected at As 10ppm and Ag 1.5ppm.
- 8.5 The threshold values (background plus 2 standard deviations) derived from the cumulative frequency distribution plots were applied to the results obtained from E.L. 1356 and two anomalies were defined, namely; PCDR 251: 60 ppm lead (threshold 54ppm), and, PCDR 4: 2ppm silver (threshold 1.5 ppm).

- 8.6 It was concluded that the geochemical anomalies present, although of a low order, may indicate the presence of the Pb, Ag lode-type mineralisation northward of the known prospects in the Daly River area (Section 4.0 : Wallaby Prospect).
- 8.7 The geochemical survey failed to detect anomalies relevant to kimberlite exploration.



LEGEND



SILVER > 1.5 ppm



LEAD > 54 ppm



44 - Sample location & No.




Anomalous element concentration



Maximum influence of anomalous drainage channel

PREFIX TO SAMPLE Nos. SEE FIG. 3

 Pacific Exploration Consultants Pty. Ltd.		
GEM/SUTTONS/MOBIL JOINT VEN.		
ANOMOLOUS GEOCHEM STREAM SED. SAMPLE RESULTS		
E.L. 1356 NORTH. TERRITORY		
COMPILED: J GARLICK	SCALE: 1:100 000	FIGURE: 5
DATE: SEPT 1981	DRAWN: K LOFTS	PLAN No.: 81/353

9.0 CONCLUSIONS AND RECOMMENDATIONS

- 9.1 The regional gravel and stream sediment geochemical survey conducted over E.L. 1356 failed to detect any evidence for the presence of kimberlite within the area.
- 9.2 It is therefore recommended that no additional exploration for kimberlite intrusives is carried out over this exploration licence area using the traditional exploration techniques.

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APPENDIX I

REGIONAL GRAVEL SAMPLE RESULTS

EXPLORATION LICENCE 1356: PINE CREEK PROJECT:

NORTHERN TERRITORY

PINE CREEK PROJECT

WEEK ENDING 15-3-1981

SAMPLE OBSERVATION - WEEKLY SUMMARY

SAMPLE NUMBER	RESULTS	COMMENTS
PCRR 4	N.I.	Mainly limonite. Minor tourmaline, ilmenite. Trace of garnet, pyroxene, zircon, carbonate.
PCRR 5	N.I.	Mainly limonite, ferruginous sediments. Trace of ilmenite, tourmaline, andalusite.
PCRR 6	N.I.	Mainly limonite, tourmaline. Abundant topaz. Trace of garnet, zircon, monazite.
PCDR 107	Cassiterite (20)	Mainly limonite, tourmaline. Minor andalusite, clinozoisite, haematite. Trace of rutile, zircon, anatase, garnet.
PCDR 225	N.I.	Mainly limonite. Abundant tourmaline. Minor garnet. Trace of monazite, epidote.
PCDR 226	N.I.	Mainly limonite. Abundant tourmaline. Trace of garnet, epidote, andalusite, zircon.
PCDR 251	N.I.	Mainly limonite, tourmaline. Minor garnet, chlorite, andalusite. Trace of rutile, zircon, topaz, staurolite, fluorite.
PCDR 252	N.I.	Mainly limonite, ferruginous sediments. Abundant tourmaline. Trace of garnet, amphibole, pyroxene, barite, topaz, mica.
PCDR 260	N.I.	Mainly limonite, tourmaline. Abundant igneous fragments. Trace of garnet, zircon, amphibole, rutile, ilmenite, epidote.
PCDR 270	N.I.	Very Small Sample. Mainly limonite and tourmaline. Also alteration minerals, zircon, monazite, garnet and ilmenite.
PCDR 271	N.I.	Very Small Sample. Mainly limonite. Also andalusite, tourmaline, ilmenite, garnet and zircon, rutile and carbonate.
PCDR 292	N.I.	Very Small Sample. Mainly limonite. Also tourmaline, ilmenite, pyroxene, alteration minerals.

APPENDIX 2

REGIONAL GEOCHEMICAL STREAM SEDIMENT RESULTS

EXPLORATION LICENCE 1356: PINE CREEK PROJECT

NORTHERN TERRITORY

SAMPLE NO.	Zn	Co	Cu	Ni	Pb	As	Cr	Ag	Nb	La
PCRR 4	9	20	15	30	30	X	25	2.0	26	90
PCRR 5	14	25	25	40	30	X	30	1.0	30	90
PCRR 6	12	15	20	20	35	X	25	1.0	26	96
PCDR 225	8	15	5	20	25	X	35	0.5	35	123
PCDR 226	5	15	5	15	25	X	30	0.5	32	136
PCDR 251	19	15	20	25	60	X	30	1.0	36	177
PCDR 252	7	10	5	15	30	X	25	0.5	32	133
PCDR 260	7	10	10	15	30	X	20	0.5	27	180
BULK 270,1	5	10	5	10	25	X	15	1.0	15	130
BULK 292	2	10	X	10	20	X	10	X	34	124

APPENDIX 3

FINANCE : EXPLORATION AND ADMINISTRATIVE EXPENDITURE

E.L. 1356

EXPENDITURE TO 31st DECEMBER 1980

DIRECT EXPLORATION COSTS

	\$
1. MOBILISATION AND DEMOBILISATION	430.00
2. CONTRACT GEOLOGIST AND CONTRACT SAMPLING CREW PAYMENTS	688.00
3. VEHICLE AND HELICOPTER CONTRACT PAYMENTS	2,322.00
4. SAMPLE TRANSPORTATION COSTS TO PERTH LABORATORY	86.00
5. FIELD SUPPLIES AND CONSUMABLES	516.00

INDIRECT EXPLORATION COSTS

1. ADMINISTRATION COSTS	<u>201.00</u>
TOTAL	4,243.00

Since 31.12.80 there has been further expenditure for laboratory tests, analysis and review, also preparation of reports, applicable to this E.L. for approximately.

Total Expenditure by Gen. \$ 1,000.00.
\$ 5,243.00.

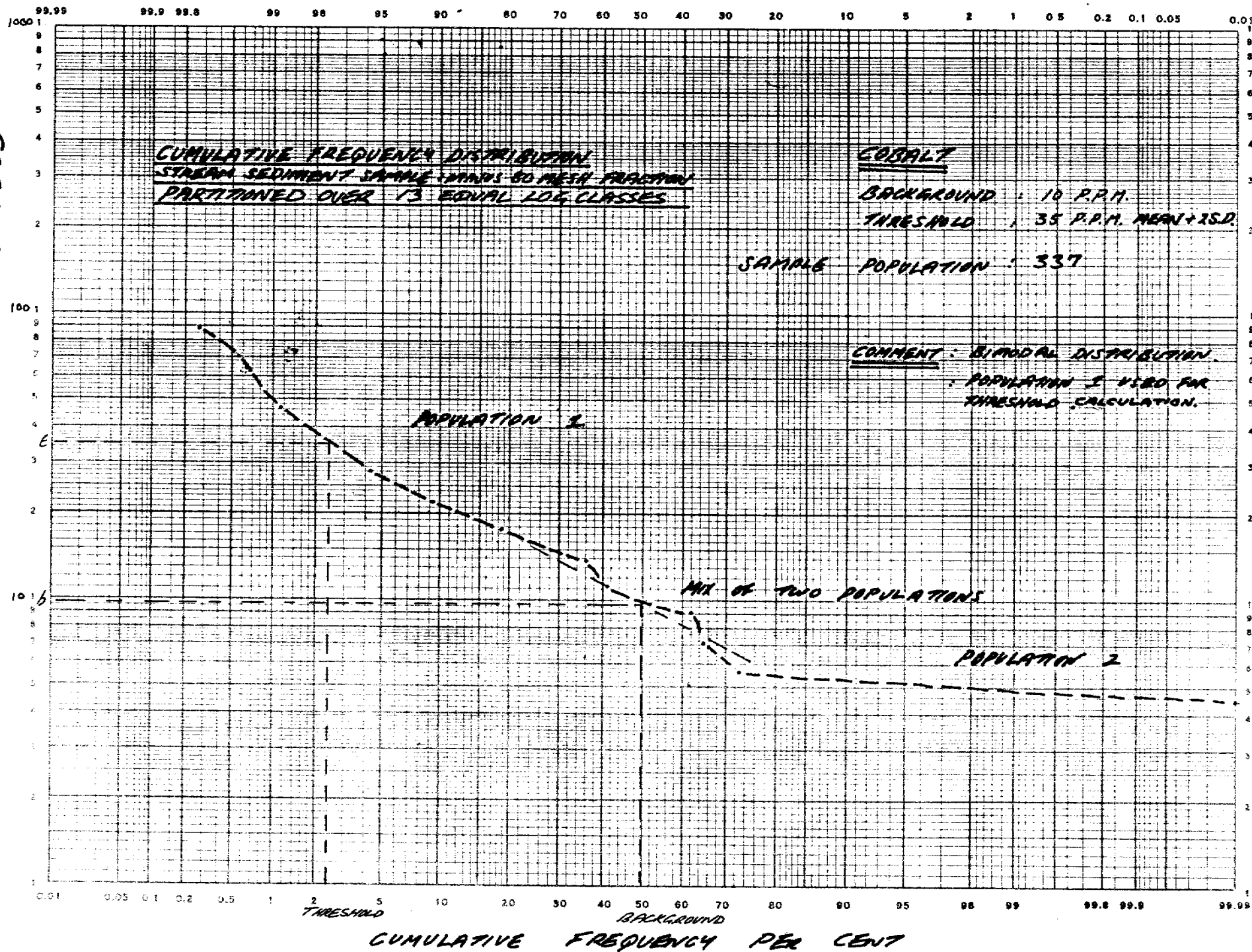
This E.L. is also being explored in a separate Joint Venture by Antlers/Whalish for which a separate report has been submitted with an expenditure of

TOTAL EXPENDITURE

\$ 120,148.00.

\$ 125,391.00

COBALT IN PARTS PER MILLION

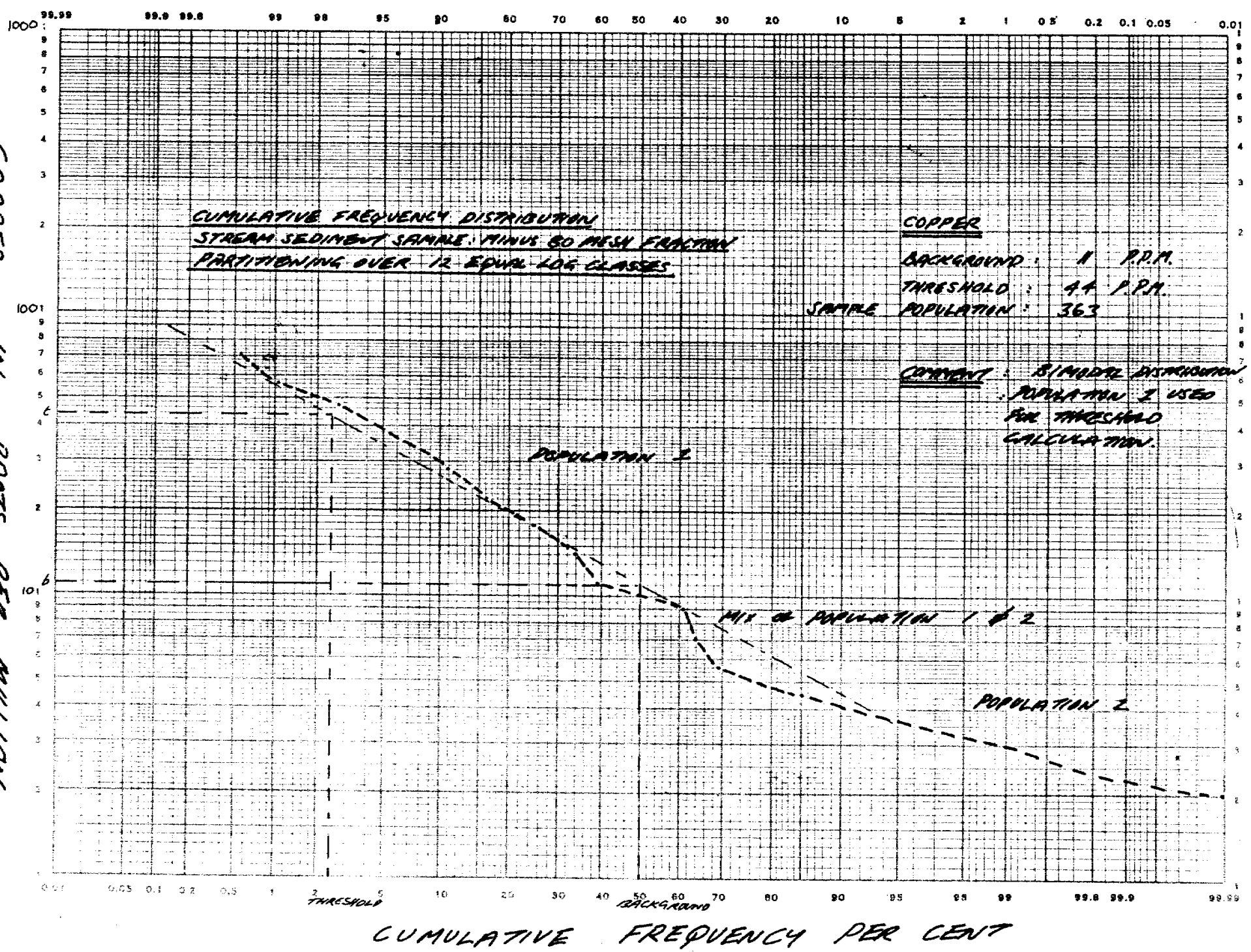


PINE CREEK PROJECT : NORTHERN TERRITORY

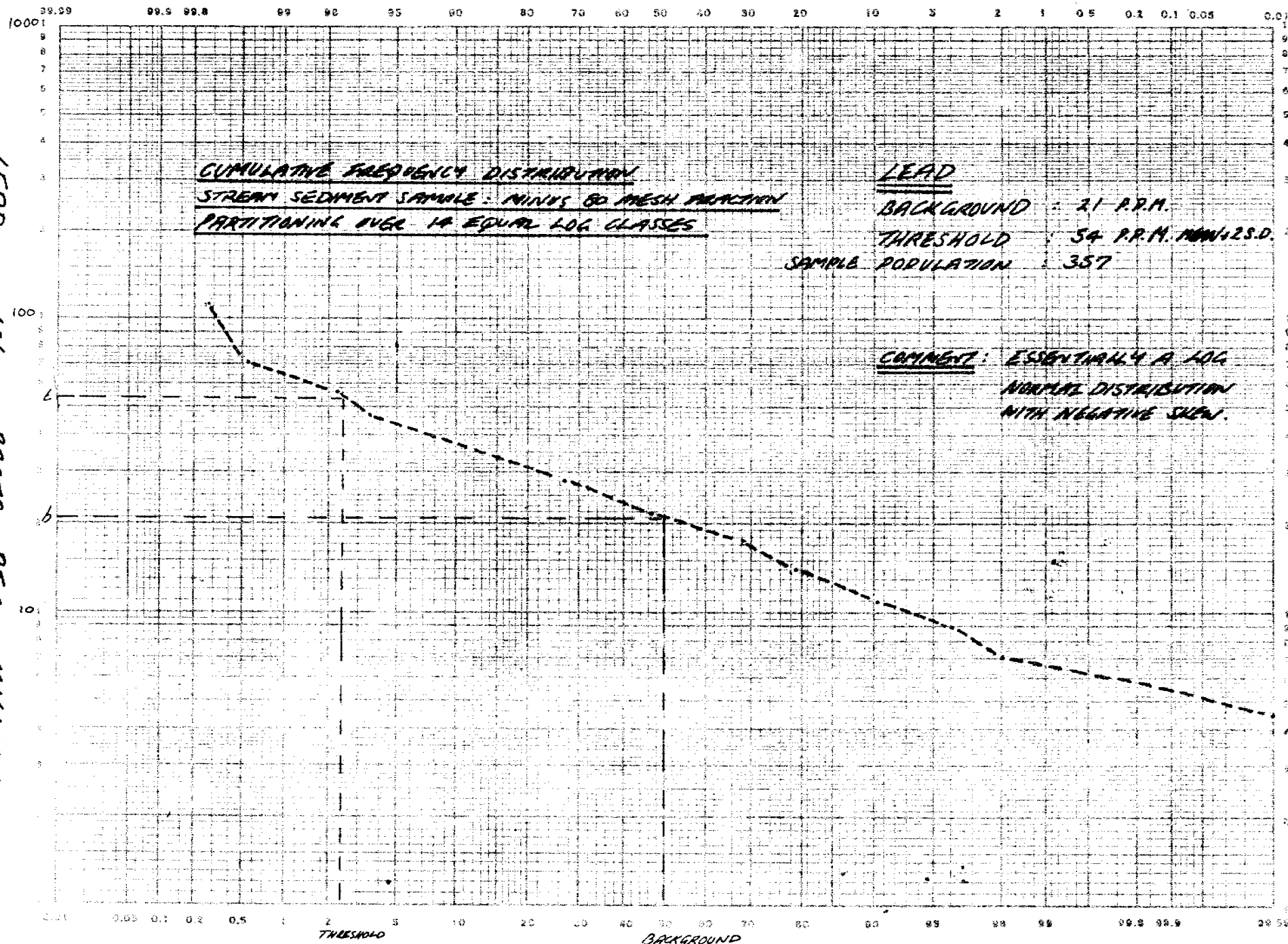
PLATE 1.17

COPPER IN PARTS PER MILLION

PINE CREEK PROJECT: NORTHERN TERRITORY



LEAD IN PARTS PER MILLION

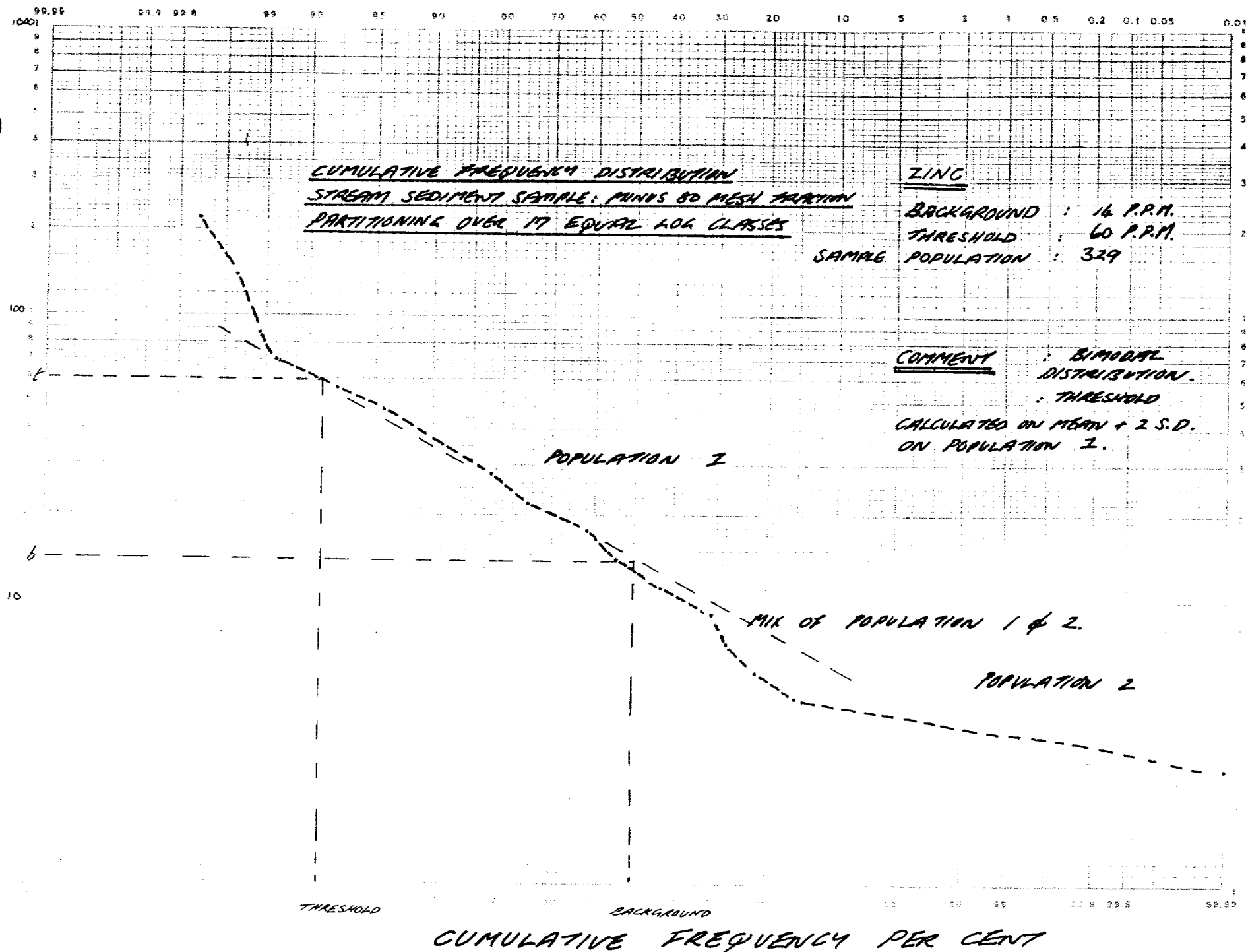


CUMULATIVE FREQUENCY PER CENT

PINE CREEK PROJECT : NORTHERN TERRITORY

FIGURE 3A

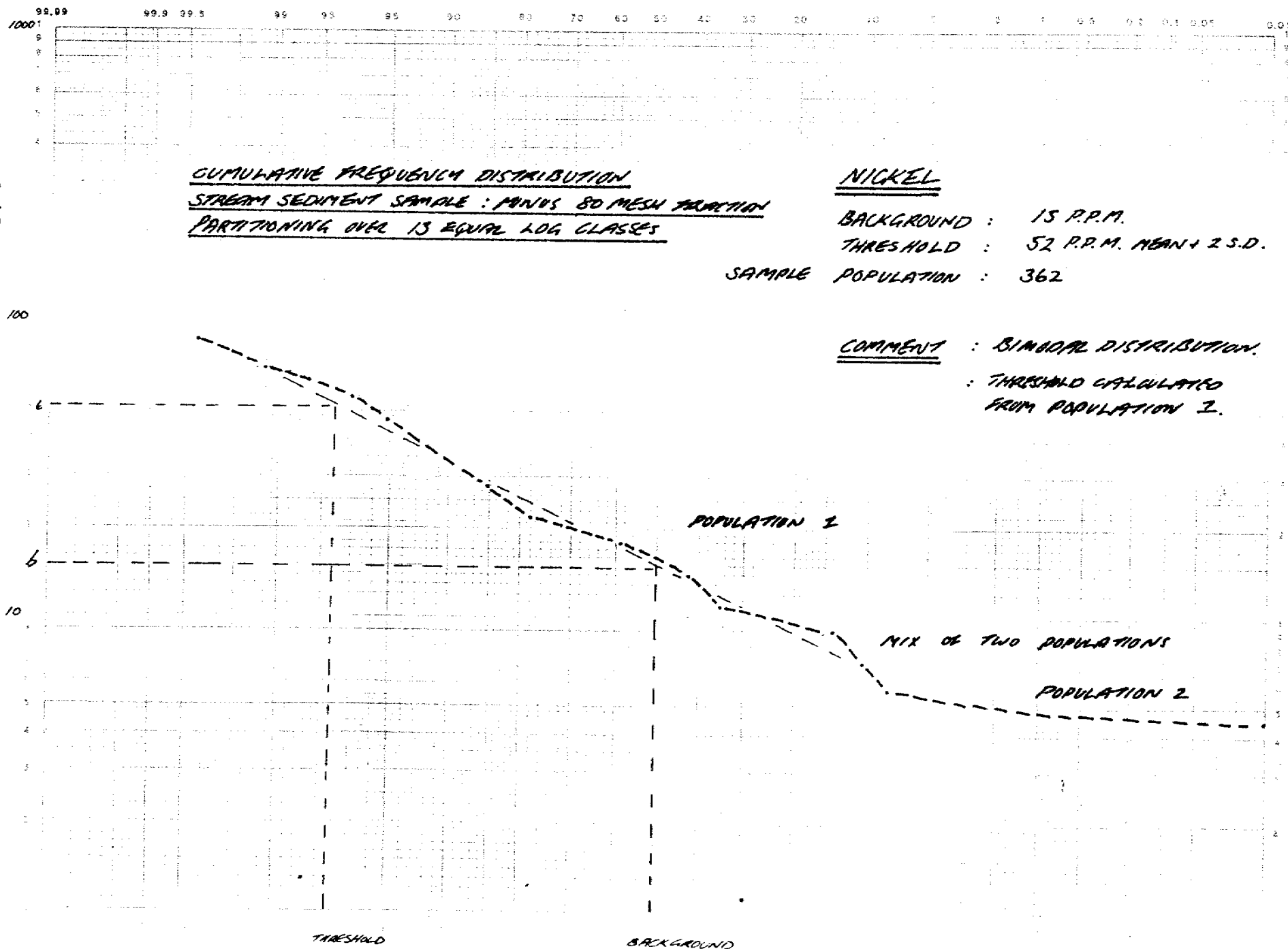
ZINC IN PARTS PER MILLION



PINE CREEK PROJECT : NORTHWEST TERRITORY

FIGURE 4-9

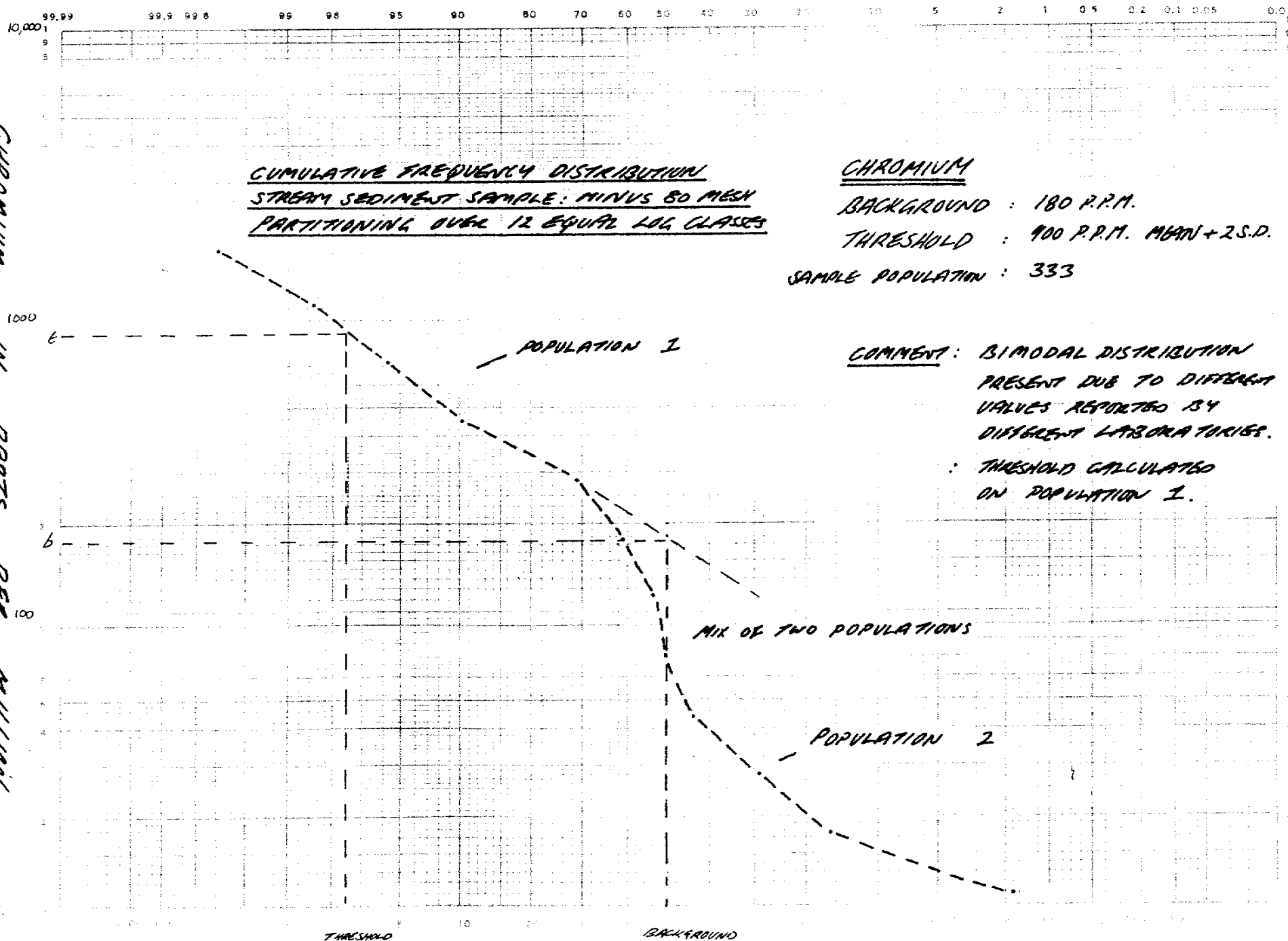
NICKEL IN PARTS PER MILLION



PINE CREEK PROJECT : NORTHERN TERRITORY

FIGURE 5A

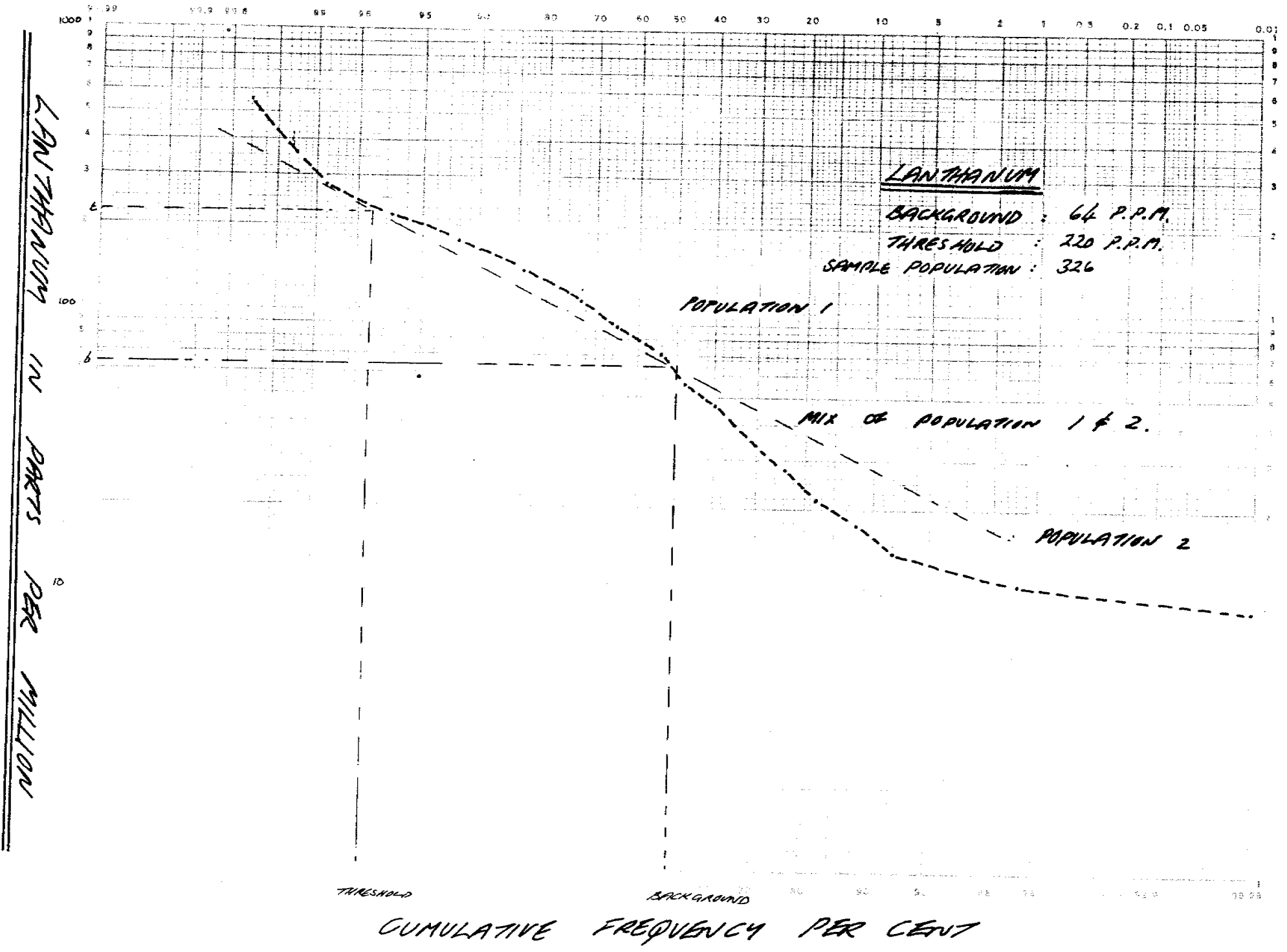
CHROMIUM IN PARTS PER MILLION



PINE CREEK PROJECT : NORTHEAST TERRITORY

FIGURE 6A

FIGURE 13A
PINE CREEK PROJECT : NORTHEAST TERRITORY



NIOBIUM IN PARTS PER MILLION

PINE CREEK PROJECT: NORTHERN TERRITORY

FIGURE 144

