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A STREAM SEDIMENT GEOCHEMICAL SURVEY OF THE WESTERN HALF OF THE BRINDABELLA 1:100 000 SHEET AREA

by

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SUMMARY

330 samples were collected during a stream sediment geochemical reconnaissance of the western half of the Brindabella 1:100 000 Sheet area. The samples were wet-sieved to -40 mesh and analysed for Cu, Pb, Zn, Ni, Co, Cr, Fe, Mn, Ag and Mo by atomic absorption spectroscopy and for As, Sn, W, Th, U and Se by X-ray fluorescence.

The results were grouped by stratigraphic unit, and frequency distributions were drawn for each element; means and standard deviations were calculated. Most elements fit a lognormal distribution with deviations due to too many high values. Theoretically anomalous results were calculated as greater than ($\bar{x}$ + 3s) and a number of these results could be true anomalies. Most are isolated values and probably not due to economic mineralisation, but an Sn-W-Th anomaly in the Tumorrama Swamp area deserves further sampling in any follow-up work in the area.

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INTRODUCTION

A stream sediment geochemical reconnaissance survey of the western half of the Brindabella 1:100 000 Sheet area was carried out as an adjunct to 1:100 000 scale geological mapping of the Brindabella Sheet area, and as an extension of stream sediment sampling in 1972 in the Tantangara 1:100 000 Sheet area (Fish & Shackleton, unpubl report in BMR Technical Files).

Access

The survey area is crossed by several major gravel roads connecting Yass, Canberra, and Tumut (Fig. 2), numerous minor roads and a network of fire trails and farm tracks, many of which require 4-wheel drive transport. In the north of the area access to most sampling sites is easy, but in the rugged southwest many sampling sites are several kilometres from the nearest track.

Climate

Rainfall data are available from three meteorological stations in the area - Burrinjuck, Brindabella, and a station in Wee Jasper State Forest (Fig. 2). Rainfall figures are listed in Table 1. The average annual rainfall for Wee Jasper State Forest is high because in 1939 1623 mm were recorded. If this year is omitted, the average then becomes 940 mm a year, which is similar to the figures for the other two stations. A few kilometres east of the area sampled, on the peaks of the Brindabella Ranges, the annual rainfall is much greater; for example Bulls Head (148°55'S 35°23'E) at 1300 m has an average of 1048 mm a year, and Brindabella Mountain (35°24'S 148°42'E) at 1240 m has 974 mm a year. Rain falls every month at Brindabella and Burrinjuck, with most falling in the winter months. In winter there is permanent snow on some mountain peaks to the east.

Figures are not available for temperature at stations, but an idea of the temperatures may be gained by comparing the data for Bulls Head and Canberra Forestry Station (35°18'S 149°06'E, altitude 580 m) (Table 2). Diurnal variation is high, owing to the inland position of the area. Summer temperatures are warm to hot, and the winter is cold, with a high incidence of frost.

The low temperatures and even distribution of rainfall mean that frost action is an important weathering agent in winter. The presence of water throughout the year means that chemical weathering is always taking place, although reactions proceed at a slow rate during winter.

TABLE 1. Average monthly and annual rainfall
(in millimetres)

	Brindabella	Burrinjuck	Wee Jasper State Forest
January	67.5	59	
February	64	53.5	
March	50.5	63	
April	62	66.5	Monthly
May	64	83	figures
June	91	103.5	unavailable
July	89	101.5	
August	111	96.5	
September	69	75.5	
October	92	85	
November	91	66	
December	68	59	
Total	919	912	1038
Period	1935-50	1908-64	1939-45

References: Rainfall Statistics of New South Wales. Bureau of Meteorology 1966.

Climatic survey Canberra and the A.C.T. Bureau of Meteorology 1968.
Bureau of Meteorology unpublished data.

TABLE 2. Days of frost, average January and July temperatures for Bulls Head and Canberra Forestry Station

	Bulls Head	Canberra Forestry Stn
Days frost/year	153	77
Av. Jan. max.	20.5°C	27.5°C
Av. Jan. min.	9°C	13.5°C
Av. July max.	5.5°C	11°C
Av. July min.	-1.2°C	1°C
Period	1945-54	1928-65

Reference: Climatic survey Canberra and the A.C.T. Bureau of Meteorology 1968.

Topography

The western half of the Brindabella 1:100 000 Sheet area can be divided into two main topographic regions (Fig. 2). The larger, which occupies most of the area sampled, is rugged mountain ranges, whilst the second is a swampy plateau west of the ranges.

The mountain ranges comprise the Brindabella Ranges to the east of the Goodradigbee River, the Fiery Ranges south of the Brindabella - Tumut road, and an unnamed area extending north to Burrinjuck Reservoir. They are cut by deeply incised valleys, so that local relief is often very great- valleys may be up to 600 m deep. The highest points are Big Dubbo Hill (G.R. 453796 on Brindabella 1:100 000 Sheet) at 1450 m and Mt. Bramina (G.R. 531813) at 1398 m. About 4 km east of the area is the major watershed between the Cotter and Goodradigbee rivers catchment areas, which forms part of the ACT/NSW border. Peaks along this divide reach 1857 m (Mt. Gingera). Towards the north of the Sheet area the mountain ranges begin to die out and relief is less; Mt. Hartwood (G.R. 595106) is 1172 m high and Burrinjuck Dam, at the northern extremity of the area, is 400 m above sea level.

The ranges are covered by fairly dense forest. The Buccleuch, or Wee Jasper, State Forest occupies a large part of the area between the two Tumut roads - some of this land has been cleared and replanted with pine trees. Land has been cleared in some of the larger valleys, such as the Brindabella Valley, and in a few flatter areas, such as around the Mount Vale Homestead.

The main rivers of the ranges are the Goodradigbee and the Goobarragandra, which are up to 20 m wide. Rivers in this area flow in steep-sided valleys, the gradient is high and rapids and waterfalls are common.

Many of the rivers contain very little sand, and in most it is impossible to gather a sample of -80 mesh material. The river beds are generally strewn with boulders and large pebbles or they may be bare outcrop. Sand only collects in quiet areas behind large boulders where the flow is decreased, and in places where the gradient is flatter, so that the load is dropped. Organic content is low except in very small streams where mosses and lichens that grew on the rocks become incorporated in the sediment. All the streams were flowing when the samples were collected, except for a few in the limestone country near Wee Jasper.

The second topographic unit is the swampy plateau which occupies a small portion of the sheet to the west of McPhersons Swamp Creek. The height of the land ranges from 600 m to 913 m (Cowrajago Hill) and is generally fairly flat-lying. The area is partly forested and partly cleared. Streams flow through gentle-sided valleys or in wide flat plains. The land is swampy and streams may have more than one channel. The larger streams, such as Turorrama Creek, have one or more well-defined channels with banks up to 2 m high and a wide flood plain beyond. The smaller streams flow in shallow depressions, and are covered with swamp grass and reeds. The gradients of the streams are low and the flow is sluggish or the water may be stagnant. Rock material is rare and when present consists of small pebbles. The organic content of the stream sediment is high, especially in the smaller streams. Most of these streams contain -80 mesh material, however -40 mesh material was collected to maintain uniformity since the unit forms only a small part of the sheet.

Summary of the Geology

The survey area is part of the Lachlan Geosyncline and consists mainly of Silurian and Devonian rocks. Figure 3 is adapted from the Brindabella 1:100 000 geological sheet.

The oldest rocks exposed in the area are Silurian sediments - The Peppercorn Beds, Blue Waterhole Beds, and Micalong Creek Beds. These are mainly sandstone and shale with minor limestone, and are part of a sedimentary belt which is more extensively exposed further south on the Tantangara 1:100 000 Sheet area. The Silurian Goobarragandra Volcanics are faulted against the sedimentary rocks in this area, but from evidence elsewhere appear to be older than the sediments. They consist mainly of porphyritic dacites which are remarkably constant in composition over a wide area. In the south of the area they appear to be subaerial, but further north the presence of intercalated sedimentary horizons suggests that the Volcanics grade into a submarine environment. At the end of the Silurian, and again in the mid-Devonian, folding and faulting resulted in the formation of dominantly north-south trending horsts and grabens.

The Young Granodiorite intrudes the Goobarragandra Volcanics and has been dated at 400 m.y. It consists mainly of granodiorite, containing both biotite and muscovite, with patches of leucogranite along the eastern margin, possibly representing the top of the batholith.

The Micalong Swamp Basic Complex, which consists mostly of basic to intermediate stocks with dykes radiating out into the country rocks, intrudes the Young Granodiorite and Goobarragandra Volcanics, and is probably mid-Devonian.

In the Early Devonian a conformable sequence, consisting of the Mountain Creek Volcanics (rhyolites and tuffs), Kirawin Shale, Sugarloaf Creek Tuff, Cavan Bluff Limestone, Majurgong Shale, Taemas Limestone and Hatchery Creek Conglomerate (red sandstone and conglomerates), was deposited in a shallow marine or estuarine environment. Folding took place in the Middle Devonian.

In the Tertiary alkaline plateau basalts were erupted. These have been partly eroded away, but still remain as flat-topped plateaus and as remnants in some pre-Tertiary river valleys.

A more detailed account of the regional geology can be found in Strusz (1971).

<u>Economic mineral occurrences</u>

Small deposits of alluvial <u>gold</u> have been worked in several areas during the last century; however, total production is insignificant. The headwaters of Wee Jasper Creek were proclaimed a goldfield in 1897. The gold was derived from quartz veins in the Young Granodiorite, and there are many small diggings in alluvial material in and around the streams. No published reports have been found which describe this area.

North of Koorabri Homestead in the Brindabella Valley a small alluvial gold deposit was worked intermittently from 1883 to 1928. A peak production of 1810 g was reached in 1889, but total production was only about 3600 g. From 1909 work was hampered by the prohibition of sludge in the Goodradigbee River because it would be carried into Burrinjuck Dam (Smith, 1963).

A <u>copper</u> prospect near Wee Jasper Creek (G.R. 467128) which was first examined in the 1890s was re-examined by 1970 by Bundarra Tin Pty Ltd (Bundarra Tin Pty Ltd, 1970). They found a vein containing chalcopyrite, haematite and magnetite in a limestone roof pendant in the Young Granodiorite. An assay on a sample from the mullock heap yielded 5.1% Cu, 25 ppm Ag and 0.5 ppm Au.

The Black Andrew mine was worked for tungsten and bismuth during 1914-18, 1934-37 and 1942-44 (Mulholland, 1943; Owen, 1944). The mineralization occurs in veins, which vary from a few centimetres to 1 m thick, in the Burrinjuck Granite. The main vein strikes N 40°W to N 60°W and dips 40° to 70°SW. The ore minerals are wolframite and bismutite with minor galena, arsenopyrite and scheelite in quartz gangue. A main shaft 50 m deep with a 50 m drive, several underlay shafts up to 13 m deep and one adit were dug. The ore value have been low throughout the mining history - 200 tons, averaging 0.3% WO_3 and 0.1% Bi, were raised up to March 1942 (Mulholland, 1950). There are 600 tonnes of reserves between the surface and the 20 m level, and 250 tonnes of probable ore lie between the 20 m level and the level of the adit. Ore may extend below the adit level.

A tungsten prospect was examined in 1970 by Bundarra Tin Pty. Ltd. - the exact location is not known however. Trenches previously dug showed quartz veins a few centimentre wide containing wolframite and scheelite in the Young Granodiorite. Assays of samples from the trenches gave 3.2% and 9.2% W. A geochemical soil survey showed a regional background of 2 to 5 ppm W, a local background of 5 to 10 ppm W, and probable anomalies of 20 to 30 ppm W.

Sapphires and corundum have been found in alluvium in Wee Jasper and McGregor Creeks (Rose, 1960). It is thought that they were formed by contact metamorphism of aluminous shales by Tertiary basalts.

SAMPLING AND ANALYTICAL METHODS

Sampling methods

Samples were collected at a density of one sample every three to four square kilometres, partly in accordance with other geochemical surveys (Plant, 1971; Howarth & Lowenstein, 1971), and partly because the sampling density of one sample every ten to fifteen square kilometres used in the 1972 Tantangara survey may have been insufficient to detect any mineralization. 330 samples were collected during the field season at a rate of six to twelve samples a day, depending on the accessibility of the sampling site. A few sites were left out because a whole day's walk would have been needed to collect one or two samples. Wherever possible another more accessible sample was substituted.

As in the Tantangara survey, the -40 mesh fraction was collected. Generally, -80 mesh material is preferred, as most of the metallic elements sought concentrate in this finer fraction. However, in the Brindabella/Tantangara area most streams contain very little or no -80 mesh material. Even so, between fifteen and thirty minutes was needed to collect fifteen grams of -40 mesh sediment.

As most streams were flowing, the samples were wet-sieved into plastic bags. Wet sieving results in the loss of some of the finest fraction, but the losses are assumed to be about the same for all samples and so comparison between samples can still be made. Also lost during sampling was any organic material, which is very fine-grained.

Analytical methods

In the Tantangara survey most elements were analyzed by semi-quantitative emission spectroscopy. This gave very poor results and some elements such as As, An, Cd, Te, Th, Tl, and Cs, were not detected in all or most samples because the detection limits were too high.

For the Brindabella survey, therefore, Cu, Pb, Zn, Fe, Mn, Co, Ag, Cr, Ni and Mo were analyzed by atomic absorption spectrometry, and As, Sn, Th, N, Se, and W by X-ray fluorescence spectrometry. The samples were not analyzed for V because of the high cost of an accurate analysis.

The analyses were carried out by Australian Mineral Development Laboratories (AMDEL).

To test sampling error, duplicate samples were collected at seven sites; the analytical results are listed in Table 3. Apart from the pair 73845195 and -5196 there is good agreement between the duplicate samples. Sampling error therefore seems to be low in this area.

Standard samples were also analyzed to test the accuracy of AMDEL's methods. These samples were collected from the Molonglo River at various sites downstream from the Captains Flat lead-zinc mine. The standards were sieved to -40 mesh and homogenized by tumbling in large glass bottles. Subsamples were obtained using a conventional splitter to ensure uniformity, and were then distributed throughout the second batch of ordinary samples. Generally the results from replicates were in good agreement, and checks by the BMR laboratory gave very similar results (Table 4).

TABLE 3. Analyses of Duplicate samples from same site

(Fe-%; other elements -ppm)

Sample number*	Cu	Zn	Co	Ni	Fe	Mn	Cr	As	Sn	Th	U	Se	W	Pb	Mo
5102	12	45	8	20	2.2	440	18	4	<4	.30	4	<2	10	16	3
5103	12	50	10	20	2.2	400	15	<4	4	12	<4	<2	10	18	3
5143	5	20	<5	10	1.0	160	10	<4	<4	10	<4	<2	10	6	<3
5144	5	25	<5	10	1.0	150	10	<4	<4	10	<4	<2	10	8	<3
5157	5	22	10	10	2.3	670	38	<4	8	20	<4	<2	10	16	<3
5158	5	20	10	10	1.9	480	28	<4	12	6	4	<2	10	14	<3
5163	8	12	<5	8	1.2	300	5	4	<4	6	<4	<2	10	8	<3
5164	8	18	<5	5	1.3	430	8	<4	4	10	<4	<2	10	12	<3
5192	2	22	<5	<5	1.2	650	15	<4	<4	12	<4	<2	15	4	<3
5193	5	20	<5	<5	1.2	600	15	<4	<4	14	<4	<2	10	6	<3
5195	5	100	12	8	6.5	4400	70	<4	<4	42	4	3	10	16	<3
5196	5	50	8	8	2.3	1400	38	<4	<4	16	4	<2	10	10	<3
5234	5	28	8	2	1.2	470	15	<4	<4	8	<4	<2	10	6	<3
5235	5	30	5	2	1.1	440	15	<4	<4	10	<4	<2	10	4	<3

* Prefix 7384

TABLE 4. Analyses of standards

(Fe - %; other elements -ppm)

Sample number*	Cu	Zn	Ni	Co	Cr	Mn	Fe	Ag	Mo	As	Pb	Sn	U	Th	Se	W
5218	320	750	15	10	18	140	7.0	5	3	190	3750	6	4	4	3	<10
5257	320	750	15	10	15	130	7.0	6.	5	250	3850	10	<4	12	4	<10
5218B	290	810				138					3600					
5229	95	340	8	8	18	150	2.8	<1	3	42	570	<4	4	6	<2	<10
5275	95	340	10	5	18	160	2.9	1	4	30	530	6	<4	8	<2	<10
5229B	91	380				152					568					
5275B	93	388				156					568					
5237	320	760	12	10	10	100	6.0	4	5	190	2500	10	<4	4	5	<10
5294	320	750	15	10	18	100	6.2	4	8	170	2550	<4	6	6	4	<10
5237B	315	855				103					2360					
5294B	310	840				102					2330					
5320	330	750	12	10	15	110	7.0	4	10	180	2300	10	<4	8	3	<10
5331	320	750	12	10	12	120	6.2	4	<3	150	2300	6	<4	10	4	<10
5320B	320	855				102					2260					
5331B	315	828				118					2160					
5247	440	1150	8	12	12	75	6.4	5	7	210	3150	8.	<4	10	3	<10
5310	430	1150	8	10	5	75	6.5	6	10	200	3000	6	6	14	3	<10
5247B	418	1340				65					2700					
5310B	418	1400				68					2830					
5323	440	1150	8	10	10	70	6.0	6	12	210	3050	12	4	12	4	<10
5342	440	1140	8	10	10	75	6.5	6	6	220	3200	6	4	14	3	10
5342B	424	1400				65					2750					

* - Prefix 7384

TABLE 5. Re-analyses of samples

(Fe -%; other elements - ppm)

Sample number*	Cu	Zn	Ni	Co	Cr	Mn	Fe	Mo	As	Pb	Sn	U	Th	W
5065	10	55	8	12	55	2150	5.2	<3	<4	12	920	<4	8	10
5343	38	110	10	12	35	2050	5.6	<3	20	270	4	6	8	<10
5161	5	28	<5	10	18	960	2.6	<3	<4	30	280	8	130	120
5344	10	38	5	10	22	820	2.6	<3	6	160	260	4	130	110
5162	5	15	<5	<5	15	440	1.4	<3	<4	16	285	<4	60	370
5345	8	20	5	5	22	400	1.5	<3	<4	38	240	6	55	340

* - Prefix 7384

Three samples giving high values for various elements were returned to AMDEL for re-analysis (Table 5). Two of these, 73845161 and -5162, gave similar values for all elements except Pb. From these results and those for the standards it appears that the second batch of samples sent to AMDEL could show lead values which are too high, and therefore, high Pb values in samples with numbers greater than 73845200 should be treated with caution. The third sample sent for re-analysis (73845065) appears to have suffered from a clerical error, as its high Sn value was not confirmed in sample 73845343. (Table 5). The latter sample follows a standard high in Cu, Zn, As, and Pb in its analytical batch and appears to have been contaminated because of the high Cu, Zn, As and Pb values compared to the original analysis of sample 73845065. Other samples which may have been contaminated are 73845258 and -5259 following standard 73845257 (these samples have high As and Pb values), and 73845295 and -5296, following standard 73845294 (with high Pb values). The results for the repeat analyses samples are not listed in the tables of analytical data for each stratigraphic unit.

DISCUSSION OF RESULTS

The most convenient way to discuss the analytical results is to group them by stratigraphic unit. The most extensive unit is the Goobarragandra Volcanics, which constitutes about half the sampled area, and from which 141 out of a total 330 samples were collected. The Young Granodiorite, the next most extensive unit provided 92 samples. Samples taken from near geological contacts have been included in both units, since their trace element content may be typical of both or either lithology.

Histograms have been drawn for all elements for which the results were above the detection limits, and means and standard deviations were calculated for the total sample population (Table 6) and for each stratigraphic unit. For units with less than 50 samples, the mean and standard deviation may not be representative of the total population, and they are used here as a convenient way of expressing the data, without inferring anything about the total population. On some of the histograms the class intervals change in width for the higher results, because the higher values tend to be fairly spread out. Scales for each histogram should therefore be read
NB carefully (class interval changes are shown by). With the exception of Pb, the scale for each element is the same

for each lithology so the histograms can be compared. The data used to draw the histograms are listed in the appendix. Curves were drawn on logarithmic-probability paper for the Goobarragandra Volcanics and the Young Granodiorite, to test the populations for lognormality. Lepeltier (1969) gives a concise description of the method of plotting the results and the interpretation of the curves. This has not been done for the other units because of the small number of samples. Anomalous results were calculated for the Goobarragandra Volcanics and the Young Granodiorite using ($\bar{x}$ + 2s) as the threshold value, and results greater than ($\bar{x}$ + 3s) as probable anomalies.

Some whole rock analyses of samples collected by the geological mapping party are also included to compare with the concentrations of elements in the stream sediments (Table 7).

TABLE 6. Means and standard deviations for the total sample population

(330 samples)

	Mean	Standard deviation
Cu	8.0	6.2
Zn	37.4	17.7
Pb	20.2	27.1
Ni	7.8	6.6
Co	7.8	5.8
Cr	20.7	18.7
Fe	2.26	1.32
Mn	798	763
Th	16.9	24.2

TABLE 7. Whole-rock analyses
(ppm)

Sample number*	Grid ref.	Cu	Zn	Ni	Co	Cr	Pb
Micalong Swamp Basic Complex							
Basic rocks							
0276	443966	40	669	20	40	35	<4
0314	402975	52	16	<5	38	22	<4
0350	463112	46	48	40	48	30	<4
0363	398049	10	4	65	18	240	<4
0367	362997	18	33	25	36	55	<4
0399	376956	40	100	10	30	20	32
0401	379960	18	52	55	42	140	<4
0402	380959	14	54	8	40	20	<4
0403	380957	30	58	45	44	120	<4
0406	386961	56	104	18	62	15	<4
0407	391970	40	52	70	48	135	<4
	Mean	33	54	33	40	76	
Intermediate rocks							
0347	499115	20	25	5	4	15	8
0397	451104	14	36	15	<2	10	4
Mountain Creek Volcanics							
0256		12	50	5	<2	15	16
Burrinjuck Granite							
0385	418245	12	39	10	4	15	14
Goobarragandra Volcanics							
0369	496970	24	84	13	12	35	14
0370	517966	20	67	15	10	35	20
0371	512994	24	73	20	12	40	10
0372	529032	20	56	13	8	30	14
0375	397217	18	69	10	10	35	20
	Mean	21	70	14	10	35	16

TABLE 7 (Cont'd)

Sample number*	Grid ref.	Cu	Zn	Ni	Co	Cr	Pb
Young Granodiorite							
0286	419860	14	47	8	14	35	18
0366	368998	10	2	5	14	10	<4
0368	413917	36	47	20	10	50	18
0409	400971	14	30	5	16	15	<4
0411	402976	18	11	5	4	15	<4
0412	402976	12	30	<5	4	15	<4
	Mean	17	28	7	10	25	~7

Goobarragandra Volcanics

Although the Goobarrangandra Volcanics is a very extensive unit, its composition is fairly constant throughout consisting mostly of porphyritic dacites. The main regional variation is the occurrence of sedimentary horizons intercalated with the volcanics in the north of the area. Anomalous values from the analyses are listed in Table 8.

Most of the Cu results are low (Fig. 5) with the mean being 8.2 ppm. Possible anomalous samples are 73845128 and -5179 ($\bar{x}$ + 3s = 23 ppm), but these values are still low. There may be a slight regional variation in that the six Cu values greater than 20 ppm are all in the northern half of the unit, but there is no grouping of these higher values. Sample 73845205 contains 25 ppm Cu, associated with high Ni and Co, but it lies near the contact with basic rocks, which explains the higher Cu content. The mean Cu value is the same as that for the total sample population (Table 7), but less than half that for the whole-rock analyses (Table 6), suggesting that Cu is concentrated in a fine size fraction which has been lost from the stream sediments over the Goobarragandra Volcanics. The data roughly fit a lognormal distribution; however, the class interval 6-10 ppm holds too many values. This could be the result of inconsistent rounding off of the analytical results in the interval 10-15 ppm.

The mean for the Zn distribution of 37.9 ppm is very similar to the mean for the sample population as a whole (Table 7), and the standard deviation is relatively small. Sample 73845128 was omitted from these calculations as it contains 340 ppm Zn, which would unduly weight the mean and standard deviation. Insufficient sample was available for re-analysis to check its accuracy, and so it may merely be an analytical or clerical error, but if it is correct it is not likely to indicate a deposit of economic importance as it lies amongst low values. Samples 73845036 and -5195 also have anomalously high values ($\bar{x} + 3s = 80$), and these samples also contain high iron and manganese, suggesting that the absorption of Zn on the Fe or Mn oxides may be an important process for the enrichment of Zn. There is no systematic regional variation in Zn content. The whole-rock Zn content (Table 6) is about double that of the stream sediments, again suggesting loss of the very fine fraction. The data are lognormally distributed, with most points falling right on the line.

Of the Pb results, 96.7% are less than 30 ppm; with a mean of 10.9 ppm, and a standard deviation of 5.1. On the basis of the chosen deviation criteria of $\bar{x} + 3s$, six samples show anomalous Pb values of 26 ppm. This is also shown by the pronounced bend in the line drawn on log-probability paper (Fig. 7). The samples showing anomalous Pb values are 73845251, -5268, -5296, -5318, -5324, and -5325, and they all occur in samples from the northern section of the Volcanics, suggesting that the Pb may be derived from the sedimentary horizons. The high values occur as isolated points scattered among lower results and may represent only small pockets of mineralization. The mean Pb value for the stream sediments is only slightly lower than that for the whole rock analyses (Table 6).

The means, variance, and histograms for Ni and Co are similar; however, the cumulative frequency/concentration plots are quite distinct; that for Ni is characteristic of a single lognormal distribution, while that for Co is bimodal. The threshold value for Co from the break of slope is 16 ppm and 20 ppm, calculated from $\bar{x} + 3s$. The anomalous Co population comprises three samples, namely 73845194, -5197, -5205. Sample 73845205 shows anomalous results for Cu and Ni as well as Co, but as it was collected from near the contact with basic igneous rocks, the higher values may be due to these rocks. There are no other Ni anomalies,and the Co anomalies in 73845194 and -5197 are not supported by anomalous values for any other element. The whole rock results for Ni and Co are slightly higher than the stream sediment means.

TABLE 8. Anomalous results from the Goobarragandra Volcanics

(Fe - %; other elements-ppm)

Sample number*	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Th	Sn	W
5016		**									
5020		**									
5023								**			
5025								**			
5031									**		
5035								***			
5036		***			**		**	***			
5051				**							
5078						***					
5079						***		***	**		
5080						**			**		
5083						***					
5126	**										
5128	***	***									
5170										+	
5179	***	**									
5183	***										
5186				**							
5191									**		+
5194					***						
5195		***				**	**	***	***		
5197							***				
5199								**			
5205	***			***	***	**					
5232		**									
5251			**								
5266									***		
5268			***								
5285				**							
5289				**							
5296			***								
5298				**							
5300				**							
5315				**	**						
5318	**	**	***								
5325			***						***		
5328									***		
($\bar{x}$ + 2s)	17	64	47	14	17	67	7	2350	31		
($\bar{x}$ + 3s)	22	78	63	17	23	88	9	3100	41		

* Prefix 7384

** = > ($\bar{x}$ + 2s)

*** = > ($\bar{x}$ + 3s)

\+ possible anomalies in Sn and W

Chromium values approximate a lognormal distribution with a geometric mean of 18.5 and equivalent standard deviation 2.52. The corresponding values for the normal data are $\bar{x} = 25.6$ and $S_x = 22.0$. On the basis of $\bar{x} + 3s$, the threshold value for the lognormal distribution is 298 ppm Cr, and there are no anomalous results. The arithmetic mean is 25.6 and is less than that for the whole rock samples.

The Fe and Mn distributions (Figs 11 & 12) are similar in that neither fits a normal or lognormal density function very well and both appear to be bimodal at least. The means for Fe and Mn are slightly higher than those for the total sample population (Table 7). The high Fe and Mn values occur in the same samples and are accompanied by relatively high Zn and Cr suggesting that absorption of Zn and Cr on Mn and Fe oxides is important in stream sediments over the Goobarragandra Volcanics. Samples 73845035, -5036, -5079, and -5195 are calculated as anomalous in Mn ($\bar{x} + 3s = 3650$), whilst 73845197 is anomalous in Fe. No regional variation in Fe or Mn was found.

The majority of Sn, As, W, U, and Mo results are below the detection limits, so the means cannot be calculated for these elements (Figs. 14 & 15). Possible Sn and W anomalies are indicated in Table 8. The value of 920 ppm Sn for sample 73845065 is highly suspect because in a re-analysis, (sample 73845343) the value is given as 4 ppm (Table 5). The results for Cu, Zn, As, and Pb are also significantly different, and it appears that there has been some mix up in the samples or the results. Se and Ag results were below detection in all samples.

The Th mean of 11 ppm is lower than that for the sample population as a whole (Table 7), and the standard deviation is quite high because of samples 73845325 and -5328 which contain 65 and 75 ppm Th respectively. Other anomalous samples ($\bar{x} + 3s = 41$) are 73845195 and -5266. The high values may represent the presence of rare-earth minerals in late-stage veins cutting the volcanics. The Th data fit a lognormal distribution (Fig. 13).

Although the samples from the Goobarragandra Volcanics make up approximately 40% of the samples collected, the means for all elements but Zn and Co are significantly different from the total sample population means, with Cr, Fe and Mn being higher, and Cu, Pb, Ni, and Th being lower in the Goobarragandra Volcanics. Most element distributions are lognormal with slight departures from the straight line generally indicating too many high results. A slight regional variation in trace element composition is seen in the northern part of the unit, which is higher in Cu and Pb, probably due to a higher Cu and Pb content of the sediments intercalated with the volcanics. Cr varies differently with higher values towards the west. Several anomalous results suggest more detailed sampling of these areas should be done in follow-up work.

Young Granodiorite

Samples 73845303 and -5304 were collected over the leucogranite, and have been included in the results for the Young Granodiorite. Anomalous results are listed in Table 9.

Copper values are normally distributed and are low. The mean of 5 ppm is considerably below that of the whole rock results (Table 6), suggesting that Cu is concentrated in some other size fraction of the stream sediments. The mean is also lower than that for the total sample population. The only result greater than the ($\bar{x}$ + 2s) figure of 16 ppm, is from sample 73845303, leucogranite collected from near its contact with basic rocks. It is not considered significantly anomalous. There is no systematic regional variation in Cu content.

The probability plot of the Zn results shows a normally distributed bimodal population (Fig. 17). The mean of 26 ppm is low compared to the total sample mean of 37 ppm. The threshold value from the probability plot is 45 ppm, and 92% of the samples have 45 ppm Zn or less and form the normal distribution of Zn in the Young Granodiorite. The remaining 8% (7 samples) form a second population, which is also generally high in Fe and Zn, and average in other trace elements, particularly Cu and Pb. This suggests the absorption of Zn onto Fe and Mn oxides as the factor responsible for the second population of above-threshold values rather than mineralization. A similar behaviour for Zn was noted for stream sediments derived from the Goobarragandra Volcanics. As these two units cover most of the area, the garnering of Zn by Fe and Mn oxides would appear to be common in the area. The whole-rock analyses show very variable results for Zn. The mean of 28 ppm is close to the mean for the stream sediments. There is no systematic regional variation in Zn content throughout the Young Granodiorite, and the leucogranite values are near to the mean for the whole unit.

The lead distribution is distinctly skewed to the right (Fig. 18), which has resulted in an unnaturally high mean of 14 ppm and a very high standard deviation of 16. Plotting the data on to log probability paper results in a line with a bend away from the frequency axis in the high values, indicating there are too many high results. Two samples are anomalous, 73845268 and -5312, and both are near to the contact with the Goobarragandra Volcanics. There is no systematic regional variation in Pb content. The whole-rock samples are also variable. The four samples containing undetectable amounts of Pb are surprising, since the average for felsic rocks is about 50 ppm Pb (e.g. Hawkes and Webb, 1962).

TABLE 9. Anomalous results from the Young Granodiorite

(Fe - %; other elements-ppm)

Sample number*	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Th	Sn	W
5026								**			
5034	**	***			***		***	***			
5035								**			
5036		***					**	***			
5054		**						***	***		+
5056									***		
5059						***					
5061									***		
5070									***		
5074								**			
5161									**	+	+
5162										+	+
5207	**			***	**	***					
5268	**		***								
5300						**					
5312	**		***	**							
5314			**	**	**						
5317					***		***	***			
5326					**						
5313	**			***	***						
5303	***		***	**	**						
5304	**		**		**						
($\bar{x}$ + 2s)	12	69	47	14	21	44	6.3	2750	107		
($\bar{x}$ + 3s)	15	91	63	19	28	57	8.2	3650	146		

* - Prefix 7384

** => ($\bar{x}$ + 2s)

*** => ($\bar{x}$ + 3s)

\+ possible Sn and W anomalies

Ni values are low (Fig. 19), the mean of 6 ppm being lower than the total mean of 7.8 ppm. The data fall into a lognormal distribution, and there is no systematic regional variation. Values greater than $(\bar{x} + 3s) = 19$ are 73845207, -5303, -5313, however, none of these is greater than 25 ppm so they are not significantly anomalous. The last two samples were collected from near the contact with basic rocks, and the Ni content of the samples is probably a background value from these rocks. The whole-rock analyses are similar to the stream sediment values.

The Co distribution is very similar to that for Ni (Fig. 20), although the mean and standard deviation are slightly higher. The whole-rock analyses and the mean for the total samples are close to the granodiorite mean, and no regional variation in Co was observed. Anomalous values are from samples 73845034, -5313 and -5317, the first two samples being taken from near the contact with basic rocks, which explains the relatively high results. The values are all below 35 ppm and are probably insignificant. There is a good correlation between the Co and the Ni content of the stream sediments.

The Cr results fall into an almost perfect lognormal distribution (Fig. 21). Possibly anomalous samples are 73845059 and -5207, and there is no regional variation in Cr. The mean is slightly lower than that for the total sample population and the whole rock analyses, but the variation in the whole-rock results is well within the range from the stream sediment results.

The Fe and Mn distributions are very spread out resulting in high standard deviations for these elements (Figs. 22 & 23). Fe follows a lognormal pattern, but the Mn results best fit a line which changes slope at about 1100 ppm, indicating that there are too many high results above this value. There is a fairly good correlation between Fe and Mn (visual observation only), and samples 73845034 and -5317 are anomalous in both elements. Sample 73845054 is also anomalous in Mn. Most of the samples which contain high amounts of Fe and Mn also contain relatively high amounts of many of the other elements, suggesting that absorption onto Fe and Mn oxides is important in the stream sediments over the Young Granodiorite. The area north of the Wee Jasper-Tumut road is lower in Fe and Mn than the rest of the Young Granodiorite. This is because the area is flat and swampy, producing acid reducing conditions which keeps the Fe and Mn ions in solution.

According to the literature (e.g. Hawkes & Webb, 1962; Levinson 1974) the metals tend to be reprecipitated at the edges of swamps where the environment becomes oxidizing. Not enough detailed sampling was done to observe this feature here. Most other elements are also in low concentrations in the swampy area.

The distribution of Th is erratic as shown by the shape of the histogram, the high standard deviation and the poor fit of the data to a lognormal line on log-probability paper (Fig. 24). There is a good correlation between Th and U as the higher Th values are generally accompanied by higher U results and probably represent the presence of rare earth minerals in pegmatites or late-stage veins. Samples with anomalous amounts of Th are 73845054, -5056, -5061, -5070, ($\bar{x}$ + 3s = 146). Several of the higher Th values occur in samples with relatively high Fe and Mn contents, indicating absorption of Th on to Fe and Mn oxides. There is no systematic regional variation in Th.

Se and Ag are below detection in all samples. Only a few As, Mo, Sn, U, or W results were above detection limits' (Figs. 25 & 26). However an interesting Sn-W anomaly was found in the Tumorrama Swamp area in samples 73845161 and -5162. The samples were re-analysed and the high Sn, W, and Th values confirmed. This area deserves further sampling to locate the source of the anomaly, and heavy mineral concentrates would probably yield wolframite, cassiterite and monazite. The Young Granodiorite therefore has low trace element values apart from Fe, Mn and Th, since all other means are lower than the mean for the whole sample population. The higher Th values are explained by the fact that this is the only large acid to intermediate intrusion in the area, and the high Fe and Mn means are biased by a few high values, which may represent favourable local pH and Eh conditions. This reason also acounts for the low Fe and Mn values in the swampy area north of the Wee Jasper - Tumut road.

The Young Granodiorite and Goobarragandra Volcanics are practically the same in major element composition, but the Volcanics are higher in all trace elements except for Th and Mn (Pb and Co are practically the same in both).

Most elements in samples from the Young Granodiorite follow a lognormal distribution with departures from a straight line due to too many high results. The Sn-W anomaly is the most interesting, but the anomalies in the other elements also deserve more sampling in any follow-up work.

Hatchery Creek Conglomerate

NB Only 23 stream sediment samples were collected over this unit, which is not enough to make any statistically valid conclusions, so although histograms have been drawn and means and standard deviations calculated (Fig. 27), these are merely a more convenient way of examining the data, and may not be representative of the total population of the Conglomerate. The same remarks apply to all the following stratigraphic units.

The calculated mean of most elements is higher than the total sample population mean, with the exception of Pb, Mn and Th. Fe is practically the same in both. These figures may not, however, represent the true means accurately, especially since the standard deviations are relatively high for Zn, Cr, Ni, Th, Fe, and Mn. Ni appears to be more abundant in the Conglomerate compared to the rest of the area - most values are over 10 ppm whilst in all other units except the Micalong Swamp Basic Complex most values are under 10 ppm. The Ni mean for the Conglomerate is also higher than that for the basic rocks.

As, Sn, and U results are very low or below detection whilst W, Mo, Se, and Ag results are all below detection.

Not enough samples were collected to determine if there is any regional variation.

Mountain Creek Volcanics

The calculated means for Fe, Co, Ni and Mn are similar to the total sample population means, whilst Cu, Pb and Zn are higher than the total means and Cr and Th are lower (Figure 28). However the standard deviations are high for all elements, especially Pb, Zn, Cu, and Mn, and the calculated means may not represent the true means for the whole of the Volcanics. Arsenic values are relatively high in the Mountain Creek Volcanics as compared to the stratigraphic units already discussed, and a mean of 12.8 ppm was calculated. Sn, W, U, Mo, Ag and Se results are all low or below detection.

Although the Mountain Creek volcanics are rhyolites and acid tuffs, the means for Zn, Cu, Pb, Co, As and Th are higher than the means for the intermediate Goobarragandra Volcanics. Cr, Fe and Mn results are lower.

Only one whole-rock analysis is available (Table 6). This sample contains similar Zn, Pb, Cu, Ni, higher Co, and lower Cr than the stream-sediment means for the same elements.

Micalong Swamp Basic Complex

This unit includes intrusive basic rocks and intermediate rocks - the latter mostly outcrop further north than the basic rocks. The unit is not very large in outcrop area, and many samples collected were taken from near contacts with other units and thus may reflect a different lithology. These samples are 73845034, -5154, -5303, and -5313 which were collected from near contacts with the Young Granodiorite, 73845205 and -5292 taken from near contacts with the Goobarragandra Volcanics, and 73845116 and -5121, collected from near contacts with the Hatchery Creek Conglomerate. Some of these results, e.g. 73845292, obviously reflect the trace element content of the other unit rather than the Micalong Swamp Basic Complex.

Generally the trace element concentrations are variable (Fig. 29) - some of this can be explained by contributions from other units, but other results cannot. For instance, Cu results vary from 10 ppm to 48 ppm and Cr from 18 ppm to 90 ppm. All the histograms have a wide spread and standard deviations are high. However the means for Cu, Cr, Co, Ni, Fe and Mn are higher than the total sample population means as would be expected from basic rocks. Zn is approximately equal and Pb and Th means are lower.

As, Sn, W, U, Mo, Se and Ag results are all low or below detection.

The variability in the stream sediment results is confirmed by the whole-rock analyses (Table 6). The whole-rock tend to be higher than the stream sediments (apart from Pb), but the range of values is even greater.

Kirawin Shale

Zn, Cu, Pb, As, Co, and Ni results are relatively high (Fig. 30) since the means for these elements are higher than the means for the total sample population. Cr, Fe, Mn and Th results are relatively low. The standard deviations for all elements except Pb and As are low, and this suggests that the calculated means may approximate to the true means. Pb and As results, however, are very variable, as can be seen from the spread-out shape of their histograms compared to those for the other elements.

Further more detailed sampling of the Kirawin Shale should be carried out to see whether the high Pb and As values are due to a high background in the rock or whether there are pockets of mineralization.

Sugarloaf Creek Tuff

Results from the Sugarloaf Creek Tuff are very similar to those from the Kirawin Shale - Zn, Cu, Pb, As, Co and Ni values are comparatively high, whilst Cr, Fe, Mn and Th means are lower than the means for the total sample population (Fig. 31). With only 13 samples it is difficult to make any meaningful comments about standard deviation, but there is a fairly high range in Cu, Pb, Ni, Cr and Mn values.

Sn, U, Mo, W, Ag and Se results are low or below detection.

Taemas Limestone, Cavan Bluff Limestone, Majurgong Shale

These units are grouped together because their outcrop area is so small that most samples collected would have their trace-element content affected by more than one of these units. The trace-element content of the samples is low, with means for Zn, Pb, Cr, Co, Fe, Mn and Th being lower than the total sample population means, and Cu and Ni means being similar. As, Sn, U, Mo, W, Se and Ag results were low or below detection. The frequency distributions, means, and standard deviations are shown in Figure 32.

Burrinjuck Granite

Only seven samples were collected from the Burrinjuck Granite. The results are similar to those for the Young Granodiorite - Cu, Zn, Pb, Ni, Co, and Cr are low, and Th is comparatively high.

Samples 73845108 and -5109 were collected near the Black Andrew tungsten - bismuth mine, but they do not contain detectable amounts of W or Bi. The dispersion train from the mine is therefore very short, because wolframite and bismuthinite are stable heavy minerals and do not travel far.

Peppercorn Beds and Micalong Creek Beds

Samples collected over these units contain low amounts of all trace elements determined. It is difficult to say whether these samples are typical of the units because so few samples were taken. Analytical results are listed in Table A10.

CONCLUSIONS

This stream sediment survey appears to have been more successful than the Tantangara 1:100 000 sheet survey in terms of analytical technique and choice of elements to be analysed. Only the more common elements were chosen, and elements which cannot be detected in most rock types were omitted. The background values for some of elements, such as Mo, Sn, W, U, As, Se and Ag were below detection or at the detection limits, but with the exception of Se and Ag there were many samples which contained higher concentrations of these elements. The atomic absorption and X-ray fluorescence techniques proved preferable to emission spectroscopy, because the greater accuracy of the results more than offset the higher cost. In general, the duplicate analyses of the standards showed good agreement with each other. It would have been preferable to use -80 mesh material as this fraction generally yields enhanced trace element values, but as this was unavailable -40 mesh material had to be used. Wet-sieving caused the loss of some of the fine material, which tended to make the analytical values lower.

Grouping the analytical results by stratigraphic unit enabled different background values to be established for each rock type, and allowed for anomalous values to be calculated on the basis of rock type. The highest concentrations of Ni, Co, Cr, Fe and Mn are in the Micalong Swamp Basic Complex, whilst the Th and Pb contents of this unit are low. This is to be expected since the Micalong Swamp Basic Complex is the only unit containing basic rocks in the area. The Hatchery Creek Conglomerate is characteristically high in Ni, and the other elements show average to low concentrations. Pb, Zn, and As are most abundant in the Kirawin Shale, and to a lesser extent in the Mountain Creek Volcanics and Sugarloaf Creek Tuff. Th is concentrated in the Young Granodiorite and Burrinjuck Granite. Cu is low in all the units.

Apart from variations in background due to lithology, Fe and Mn also vary due to pH and Eh conditions; for example, low values were recorded in a swampy area over the Young Granodiorite. Other elements, especially Zn and Th in this area, are concentrated with the Fe and Mn since they are absorbed on to Fe and Mn oxides, and these high values therefore do not represent siginficant anomalies due to mineralization.

A few anomalous results were found for most elements; however, most of these are geographically isolated from each other, and therefore probably do not represent any economic mineralization. The most interesting anomaly is the Sn - W - Th anomaly in the Tumorrama Swamp area. The high values probably represent cassiterite - wolframite - monazite bearing veins or greisens in the Young Granodiorite, and the area should be sampled in more detail.

More detailed analysis of the results, such as factor analysis and correlation of elements, will be left until sampling of the whole sheet has been completed.

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APPENDIX

ANALYTICAL DATA

Sample number	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
(prefix 7384)																
5001	2	25	6	< 5	< 5	8	0.9	130	< 3	< 1	4	6	8	< 4	< 2	< 10
5002	5	32	18	8	8	12	1.8	500	< 3	< 1	< 4	4	12	< 4	< 2	< 10
5003	5	28	14	< 5	12	8	2.0	730	3	< 1	< 4	6	10	4	< 2	< 10
5004	2	30	8	5	5	12	1.2	300	< 3	< 1	< 4	4	8	4	< 2	< 10
5005	5	40	10	5	8	18	1.5	330	< 3	< 1	< 4	< 4	< 4	4	< 2	< 10
5006	8	40	10	5	8	12	1.3	270	< 3	< 1	4	6	4	4	< 2	< 10
5007	5	42	10	8	8	15	1.4	360	< 3	< 1	< 4	6	6	4	< 2	< 10
5010	5	22	6	< 5	< 5	15	1.1	340	< 3	< 1	< 4	6	4	4	< 2	< 10
5011	8	55	12	< 5	< 5	12	1.2	490	< 3	< 1	4	4	6	< 4	< 2	10
5012	5	45	8	< 5	< 5	8	1.1	420	< 3	< 1	4	4	< 4	4	< 2	< 10
5013	5	55	10	8	5	12	1.6	410	< 3	< 1	< 4	10	8	< 4	< 2	10
5014	8	45	6	5	8	18	1.7	470	3	< 1	4	< 4	6	< 4	< 2	< 10
5015	5	40	6	< 5	< 5	12	0.9	160	< 3	< 1	< 4	4	< 4	< 4	< 2	< 10
5016	8	65	8	8	8	50	3.4	1800	< 3	< 1	< 4	6	8	< 4	< 2	< 10
5017	8	42	8	8	5	15	1.0	280	< 3	< 1	< 4	4	< 4	< 4	< 2	< 10
5018	10	38	6	8	5	20	1.4	330	< 3	< 1	< 4	< 4	< 4	< 4	< 2	< 10
5019	10	25	4	8	5	25	1.6	430	< 3	< 1	4	4	< 4	< 4	< 2	< 10
5020	10	65	8	8	8	35	2.2	650	< 3	< 1	4	< 4	12	4	< 2	< 10
5021	10	42	6	8	8	30	2.0	830	< 3	< 1	< 4	6	6	4	< 2	< 10
5022	8	38	4	5	5	18	2.0	1350	< 3	< 1	< 4	< 4	4	< 4	< 2	< 10
5023	10	42	8	8	10	65	4.1	2350	< 3	< 1	4	8	16	< 4	< 2	< 10
5024	15	45	6	8	15	25	4.3	2200	< 3	< 1	< 4	< 4	14	< 4	< 2	< 10
5025	15	60	8	8	15	28	5.3	2800	< 3	< 1	< 4	8	8	< 4	< 2	< 10
5027	10	40	8	5	10	20	3.1	1900	< 3	< 1	< 4	6	10	< 4	< 2	< 10
5031	8	38	14	5	10	30	4.2	1800	< 3	< 1	4	< 4	30	6	< 2	15
5035	5	48	12	< 5	12	25	4.7	3500	< 3	< 1	< 4	< 4	8	< 4	< 2	< 10
5036	10	100	12	8	20	25	6.5	4100	< 3	< 1	< 4	6	< 4	< 4	< 2	< 10
5050	8	22	8	5	8	22	1.6	510	< 3	< 1	< 4	< 4	14	4	< 2	< 10
5051	15	38	14	18	10	35	3.1	920	< 3	< 1	4	4	10	< 4	< 2	15
5057	5	20	8	10	5	20	1.7	500	< 3	< 1	< 4	6	6	4	< 2	< 10
5063	8	40	8	< 5	< 5	12	1.5	510	< 3	< 1	< 4	6	10	< 4	< 2	< 10
5064	5	30	6	< 5	< 5	20	1.8	750	< 3	< 1	4	4	14	4	< 2	< 10
5065	10	55	12	8	12	55	5.2	2150	< 3	< 1	< 4	920	8	< 4	< 2	10
5066	5	30	4	< 5	< 5	55	1.3	620	< 3	< 1	4	< 4	16	6	< 2	< 10
5067	10	40	4	5	5	15	1.8	530	< 3	< 1	< 4	< 4	< 4	< 4	< 2	< 10
5068	8	50	10	5	5	28	1.6	630	< 3	< 1	< 4	4	12	6	< 2	< 10
5076	5	45	4	5	5	40	1.8	770	< 3	< 1	< 4	4	6	< 4	< 2	< 10
5077	8	32	6	< 5	5	28	1.7	580	< 3	< 1	< 4	< 4	6	< 4	< 2	20
5078	8	32	10	< 5	< 5	170	1.8	910	3	< 1	< 4	< 4	24	4	< 2	< 10
5079	8	60	12	5	10	95	4.8	3500	< 3	< 1	< 4	4	40	6	< 2	< 10

TABLE A1 continued

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5080	10	50	10	5	5	80	2.0	2000	<3	<1	4	<4	30	4	<2	<10
5081	8	28	10	<5	<5	12	1.1	350	<3	<1	<4	<4	4	<4	<2	<10
5082	5	38	8	<5	<5	35	1.9	1200	<3	<1	<4	<4	12	4	<2	<10
5083	5	45	8	8	5	150	2.4	1600	<3	<1	<4	<4	20	6	<2	<10
5084	5	38	12	<5	<5	60	2.2	1300	<3	<1	4	4	23	6	<2	<10
5087	8	20	6	<5	<5	18	1.2	470	<3	<1	<4	<4	8	<4	<2	<10
5088	10	40	10	10	8	45	2.4	1350	3	<1	<4	4	18	4	<2	<10
5089	8	30	4	5	5	15	1.6	860	<3	<1	<4	4	12	4	<2	<10
5090	10	35	4	5	<5	18	1.8	1450	<3	<1	<4	<4	12	<4	<2	<10
5091	5	50	16	10	8	12	2.1	470	<3	<1	4	4	10	4	<2	<10
5126	20	40	10	8	12	12	3.2	590	3	<1	<4	<4	6	<4	<2	<10
5127	12	50	12	12	8	25	2.7	690	<3	<1	<4	<4	10	<4	<2	<10
5128	30	340	20	12	10	25	3.4	700	<3	<1	4	<4	8	<4	<2	<10
5149	5	40	4	8	<5	15	1.3	420	<3	<1	<4	<4	10	<4	<2	<10
5150	5	25	8	8	5	15	2.1	700	<3	<1	<4	<4	14	<4	<2	<10
5151	8	32	8	8	5	15	1.7	370	<3	<1	<4	<4	10	<4	<2	<10
5152	8	30	8	8	5	28	1.8	350	<3	<1	<4	<4	12	<4	<2	<10
5169	5	30	14	<5	<5	5	1.6	520	<3	<1	4	4	10	<4	<2	<10
5170	5	55	12	<5	5	22	3.5	2000	<3	<1	<4	60	20	<4	<2	15
5171	2	38	8	<5	8	15	1.4	660	<3	<1	<4	18	16	4	<2	<10
5172	5	38	12	5	8	15	1.5	550	<3	<1	<4	4	10	4	<2	<10
5173	2	30	6	<5	<5	15	1.6	790	<3	<1	<4	8	16	4	<2	<10
5174	2	20	8	<5	<5	12	1.3	590	<3	<1	<4	<4	18	4	<2	10
5175	2	25	12	<5	<5	25	1.8	970	<3	<1	<4	4	18	6	<2	<10
5176	8	30	10	<5	<5	15	1.9	530	<3	<1	<4	<4	6	4	<2	10
5177	5	32	8	5	<5	15	1.5	680	<3	<1	<4	6	8	<4	<2	<10
5178	5	35	6	<5	<5	25	1.9	890	<3	<1	<4	8	14	<4	<2	<10
5179	38	70	28	10	18	22	3.8	740	<3	<1	12	<4	16	<4	<2	<10
5180	5	20	6	<5	<5	12	1.2	610	3	<1	<4	14	12	4	<2	10
5181	8	32	10	5	<5	15	1.6	530	<3	<1	<4	6	12	4	<2	15
5182	18	32	14	8	10	15	2.1	470	<3	<1	<4	<4	28	<4	<2	<10
5183	25	45	8	10	10	18	2.8	750	<3	<1	<4	<4	10	4	<2	<10
5184	5	12	8	<5	<5	8	0.8	280	<3	<1	<4	<4	6	4	<2	<10
5185	5	20	6	<5	<5	10	1.1	290	<3	<1	<4	<4	10	4	<2	10
5186	15	50	18	15	12	18	3.3	630	<3	<1	4	<4	14	4	<2	<10
5187	5	18	8	<5	<5	12	1.2	310	<3	<1	<4	<4	10	<4	<2	15
5188	5	30	10	<5	5	15	1.0	310	<3	<1	4	6	12	4	<2	<10
5189	5	22	10	<5	<5	10	1.2	520	<3	<1	<4	<4	10	4	<2	10
5190	5	18	8	<5	<5	12	1.3	550	<3	<1	4	4	12	<4	<2	10
5191	5	28	14	8	5	38	2.6	1500	<3	<1	<4	12	30	4	<2	40
5192	2	22	4	<5	<5	15	1.2	650	<3	<1	<4	<4	12	<4	<2	15

TABLE A1 continued

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5193	5	20	6	<5	<5	15	1.2	600	<3	<1	<4	<4	14	<4	<2	<10
5194	8	60	16	12	35	25	3.1	1800	<3	<1	<4	10	12	6	<2	10
5195	5	100	16	8	12	70	6.5	4400	<3	<1	<4	<4	42	4	3	<10
5196	5	50	10	8	8	38	2.3	1400	<3	<1	<4	<4	16	4	<2	<10
5197	5	50	8	10	28	18	9.7	3700	<3	<1	<4	<4	<4	<4	<2	<10
5198	8	32	10	10	12	22	3.4	1250	<3	<1	<4	6	8	<4	<2	<10
5199	10	40	8	5	12	18	4.8	2350	<3	<1	<4	6	8	4	<2	10
5204	10	42	4	10	12	18	2.3	500	<3	<1	6	<4	10	<4	<2	<10
5205	25	55	8	22	32	65	5.4	920	<3	<1	4	6	4	<4	<2	<10
5231	10	60	10	5	10	15	2.1	450	<3	<1	<4	<4	<4	<4	<2	<10
5232	8	65	12	8	10	15	2.2	750	<3	<1	4	<4	<4	<4	<2	<10
5233	10	60	10	8	10	18	2.1	480	<3	<1	4	<4	<4	<4	<2	<10
5234	5	28	6	2	8	15	1.2	470	<3	<1	<4	<4	8	<4	<2	<10
5235	5	30	4	2	5	15	1.1	440	<3	<1	<4	<4	10	<4	<2	<10
5236	8	35	8	5	10	8	1.9	260	<3	<1	<4	<4	6	<4	<2	<10
5238	10	48	18	10	10	18	2.4	250	3	<1	<4	<4	10	<4	<2	<10
5251	8	32	50	5	10	20	1.9	950	<3	<1	6	<4	8	<4	<2	10
5252	8	32	14	5	10	18	1.8	800	3	<1	<4	<4	8	4	<2	<10
5253	5	32	22	5	10	22	1.9	1100	3	<1	<4	<4	10	<4	<2	<10
5254	8	30	10	5	8	22	1.8	830	<3	<1	<4	<4	10	<4	<2	<10
5255	5	32	14	2	5	35	2.1	1350	<3	<1	<4	4	14	<4	<2	<10
5265	10	38	22	10	15	48	2.0	410	3	<1	4	12	12	<4	<2	10
5266	5	30	12	8	10	20	2.1	740	3	<1	<4	<4	42	<4	<2	<10
5267	5	28	14	5	10	18	2.2	810	4	<1	<4	<4	12	<4	<2	<10
5268	15	40	85	10	15	25	2.9	920	3	<1	8	<4	4	<4	<2	<10
5269	5	22	16	5	8	10	1.2	400	3	<1	<4	<4	6	4	<2	<10
5270	5	22	10	2	8	12	1.1	650	<3	<1	<4	<4	6	<4	<2	<10
5271	8	28	12	8	10	22	2.3	730	<3	<1	<4	6	10	<4	<2	<10
5272	8	28	8	8	5	8	1.7	540	3	<1	<4	<4	8	<4	<2	<10
5273	8	30	4	12	5	35	2.7	730	<3	<1	<4	<4	<4	<4	<2	<10
5274	8	30	10	10	10	25	3.0	900	<3	<1	<4	6	18	4	<2	10
5281	8	30	12	10	8	28	1.8	430	3	<1	<4	<4	6	<4	<2	<10
5282	5	25	12	8	5	12	1.3	300	<3	<1	<4	<4	6	<4	<2	<10
5283	5	25	14	8	8	18	1.4	400	<3	<1	<4	<4	6	<4	<2	<10
5284	8	30	8	6	8	25	1.7	400	<3	<1	<4	4	<4	<4	<2	<10
5285	10	28	10	15	12	30	2.2	440	[illegible]	<1	<4	<4	4	<4	<2	<10
5286	8	25	8	10	10	32	1.9	440	4	<1	<4	<4	<4	<4	<2	<10
5287	10	42	16	12	12	22	2.6	510	3	<1	<4	<4	12	<4	<2	<10
5288	8	55	18	10	10	15	1.7	320	3	<1	<4	<4	12	4	<2	<10
5289	8	35	12	15	12	20	1.9	380	3	<1	<4	<4	4	<4	<2	<10
5290	12	48	18	12	8	15	2.0	600	3	<1	<4	<4	10	4	<2	<10
5291	10	42	18	10	8	18	2.0	570	<3	<1	<4	<4	8	<4	<2	<10

TABLE A1 continued

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5292	8	25	8	8	8	30	2.1	760	4	<1	<4	<4	<4	<4	<2	<10
5296	8	32	80	10	10	40	1.9	500	3	<1	4	<4	6	<4	<2	<10
5297	8	38	18	10	8	25	1.8	420	3	<1	<4	4	4	<4	<2	<10
5298	10	32	28	15	10	38	1.9	500	<3	<1	<4	<4	4	4	<2	<10
5299	8	38	20	12	10	50	2.2	370	3	<1	<4	<4	10	<4	<2	<10
5300	8	30	20	15	8	45	1.7	480	3	<1	<4	<4	8	<4	<2	<10
5301	10	28	10	12	15	30	2.4	920	3	<1	<4	<4	<4	<4	<2	<10
5302	8	28	12	10	10	35	2.4	710	<3	<1	<4	10	4	<4	<2	<10
5315	12	32	16	18	20	35	3.0	860	4	<1	<4	4	8	<4	<2	<10
5318	22	65	145	5	8	15	1.9	480	5	<1	12	4	8	<4	<2	<10
5319	18	55	12	10	12	15	2.9	400	5	<1	<4	<4	6	<4	<2	<10
5324	8	32	38	8	8	15	1.6	340	4	<1	4	<4	16	<4	<2	<10
5325	5	48	125	8	10	20	2.9	1650	4	<1	14	<4	65	6	<2	<10
5328	5	38	18	8	5	55	3.0	1800	<3	<1	<4	6	75	6	<2	<10
5329	2	30	14	2	8	18	1.8	980	3	<1	4	<4	18	<4	<2	<10
5330	2	22	12	2	2	8	1.2	450	<3	<1	<4	4	20	<4	<2	<10
5334	8	45	16	10	10	15	2.3	450	<3	<1	4	<4	6	6	<2	<10
5339	8	45	26	8	8	20	1.9	570	<3	<1	4	<4	8	<4	<2	<10
5343	38	110	270	10	12	35	5.6	2050	<3	<1	20	4	9	6	<2	<10
$\bar{x}$	7.15	36.57	13.62	6.33	7.36	24.59	2.68	852.9					11.21			
s	5.21	13.86	16.67	3.81	5.20	21.26	2.11	749.6					10.14			

TABLE A2. YOUNG GRANODIORITE

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5026	8	50	10	5	12	20	4.7	3250	<3	<1	<4	6	26	6	<2	<10
5027	10	40	8	5	10	20	3.1	1000	[illegible]	<1	<4	6	10	<4	<2	<10
5028	10	40	12	5	8	15	1.7	360	3	<1	<4	<4	16	4	<2	<10
5029	8	18	6	5	<5	15	1.5	330	<3	<1	<4	4	20	<4	<2	<10
5030	8	38	14	5	8	25	2.9	1750	3	<1	<4	4	65	6	<2	<10
5032	10	25	6	5	8	15	1.7	310	<3	<1	6	<4	8	<4	<2	10
5034	12	90	20	10	32	38	13.5	6600	<3	<1	<4	<4	16	<4	<2	<10
5035	5	48	12	<5	12	25	4.7	2500	<3	<1	<4	<4	8	<4	<2	<10
5036	10	100	12	8	20	25	6.5	4100	[illegible]	<1	<4	6	<4	<4	<2	<10
5037	2	10	6	<5	<5	5	0.8	570	<3	<1	4	4	36	<4	<2	<10
5038	5	22	12	<5	<5	15	1.6	710	<3	<1	<4	<4	32	<4	<2	<10
5039	2	20	6	<5	<5	8	1.2	470	<3	<1	<4	4	26	<4	<2	<10
5040	5	12	8	<5	<5	8	1.0	320	<3	<1	<4	6	14	<4	<2	<10
5041	5	20	8	<5	<5	8	1.0	400	<3	<1	<4	<4	20	<4	<2	<10
5042	5	20	8	<5	<5	12	1.4	620	3	<1	<4	<4	16	<4	<2	<10
5043	2	20	8	<5	<5	15	1.2	640	<3	<1	4	4	18	<4	<2	10
5044	5	20	10	<5	<5	12	1.8	620	<3	<1	<4	4	20	6	<2	<10
5045	5	22	8	8	<5	12	2.0	400	<3	<1	<4	4	38	4	<2	<10
5046	5	40	6	5	<5	12	1.8	270	<3	<1	<4	4	10	<4	<2	<10
5047	5	30	10	8	<5	20	2.2	960	<3	<1	<4	4	8	<4	<2	<10
5052	5	18	8	<5	<5	8	1.0	550	3	<1	<4	<4	40	<4	<2	<10
5053	5	8	<4	<5	<5	8	0.6	210	3	<1	<4	4	26	<4	<2	<10
5054	10	65	18	8	10	22	5.7	5500	<3	<1	<4	4	200	8	<2	70
5055	8	38	10	10	8	12	2.5	400	<3	<1	4	6	48	6	<2	<10
5056	5	30	12	8	5	10	2.2	1750	<3	<1	<4	<4	155	8	<2	10
5058	5	28	8	<5	5	15	2.6	1450	<3	<1	<4	6	55	<4	<2	<10
5059	8	55	14	10	8	75	2.0	950	<3	<1	<4	4	70	4	<2	<10
5060	8	38	10	<5	10	15	4.2	2450	<3	<1	4	4	28	<4	<2	<10
5061	5	15	10	<5	<5	5	1.1	740	<3	<1	<4	<4	200	10	<2	<10
5062	10	32	12	10	8	12	2.3	350	<3	<1	4	<4	38	<4	<2	<10
5063	8	40	8	<5	<5	12	1.5	510	<3	<1	<4	6	10	<4	<2	<10
5069	8	20	10	<5	<5	15	1.7	700	<3	<1	<4	<4	55	4	<2	10
5070	5	38	20	<5	8	18	3.6	2250	<3	<1	<4	<4	230	8	<2	<10
5071	5	18	10	<5	<5	5	1.2	350	<3	<1	<4	<4	28	<4	<2	<10
5072	5	28	12	<5	5	8	2.1	800	<3	<1	<4	<4	24	6	<2	<10
5073	5	15	6	<5	<5	15	1.1	480	<3	<1	<4	4	18	<4	2	<10
5074	8	50	22	<5	10	30	5.8	3000	<3	<1	<4	<4	42	<4	<2	<10
5075	5	30	14	5	5	18	2.1	730	<3	<1	<4	<4	70	6	<2	<10
5085	8	25	8	8	8	10	1.6	500	<3	<1	<4	<4	10	<4	<2	<10
5086	10	28	10	8	8	15	1.8	590	[illegible]	<1	<4	<4	10	<4	<2	<10
5092	2	22	4	5	<5	30	1.4	720	<3	<1	<4	4	12	<4	<2	<10
5093	5	20	10	<5	<5	10	1.0	460	<3	<1	<4	<4	40	4	<2	<10

TABLE A2 continued

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5094	2	20	12	<5	<5	15	1.9	1150	3	<1	<4	<4	70	8	<2	<10
5111	5	25	12	8	<5	30	2.7	920	<3	<1	<4	4	26	<4	<2	<10
5114	5	22	12	8	<5	15	2.2	500	<3	<1	<4	4	24	<4	<2	<10
5115	5	20	12	8	<5	12	1.4	300	<3	<1	<4	<4	14	<4	<2	<10
5118	8	28	14	8	5	15	2.3	430	<3	<1	<4	<4	18	4	<2	<10
5119	10	20	18	5	<5	10	1.3	300	<3	<1	<4	8	24	4	<2	<10
5130	5	30	16	8	8	18	2.9	1000	<3	<1	<4	16	6	<4	<2	10
5131	2	15	20	<5	5	10	2.9	300	<3	<1	<4	<4	28	<4	<2	<10
5132	5	10	10	<5	<5	10	0.9	200	3	<1	<4	6	14	4	<2	<10
5133	2	8	4	<5	<5	8	0.5	120	<3	<1	<4	4	10	<4	<2	<10
5134	2	8	4	<5	<5	5	0.5	120	<3	<1	4	<4	18	<4	<2	<10
5135	2	5	6	<5	<5	8	0.7	190	<3	<1	<4	<4	6	<4	<2	<10
5140	5	18	8	<5	5	10	1.8	370	<3	<1	<4	<4	10	<4	<2	<10
5141	2	10	8	5	<5	10	1.0	150	<3	<1	<4	4	14	<4	<2	<10
5142	2	18	8	5	<5	8	0.8	120	<3	<1	<4	<4	14	4	<2	<10
5143	5	20	6	10	<5	10	1.0	160	<3	<1	<4	<4	10	<4	<2	<10
5144	5	25	8	10	<5	10	1.0	150	<3	<1	<4	<4	10	<4	<2	<10
5145	2	32	8	<5	<5	5	0.4	180	<3	<1	<4	4	4	<4	<2	<10
5146	2	40	16	8	15	18	4.4	1400	<3	<1	<4	<4	10	<4	<2	<10
5147	5	28	10	5	10	15	3.2	1250	<3	<1	<4	<4	10	<4	<2	<10
5148	5	12	4	<5	<5	8	0.6	240	<3	<1	<4	4	8	<4	<2	<10
5157	5	22	16	10	10	38	2.3	670	<3	<1	<4	8	20	<4	<2	<10
5158	5	20	14	10	10	28	1.9	480	<3	<1	<4	12	6	4	<2	<10
5159	2	15	14	<5	<5	12	1.3	400	<3	<1	<4	4	16	<4	<2	15
5160	5	32	16	5	10	18	2.5	1150	3	<1	<4	10	38	<4	<2	20
5161	5	28	30	<5	10	18	2.6	900	<3	<1	<4	280	130	8	<2	120
5162	5	15	16	<5	<5	15	1.4	440	<3	<1	<4	285	60	<4	<2	370
5199	10	40	8	5	12	18	4.8	2350	<3	<1	<4	6	8	4	<2	10
5206	10	38	4	12	12	35	2.4	710	<3	<1	4	<4	16	4	2	<10
5207	15	38	12	25	22	55	2.5	560	<3	<1	6	<4	10	<4	<2	<10
5208	10	30	6	12	12	25	1.7	400	3	<1	<4	<4	4	4	<2	<10
5209	10	32	6	12	12	20	1.9	440	<3	<1	<4	<4	14	4	<2	<10
5268	15	40	85	10	15	25	2.9	920	3	<1	8	<4	4	<4	<2	<10
5273	8	30	4	12	15	35	2.7	730	<3	<1	<4	<4	<4	<4	<2	<10
5300	8	30	20	15	8	45	1.7	480	3	<1	<4	<4	8	<4	<2	<10
5303	18	28	10	20	25	55	3.1	1450	4	<1	<4	<4	<4	<4	<2	<10
5304	12	25	14	15	12	42	3.5	720	3	<1	<4	4	8	<4	<2	<10
5307	8	22	14	10	9	30	1.9	640	3	<1	<4	4	6	<4	<2	<10
5308	5	25	24	5	10	25	3.1	970	3	<1	<4	<4	14	<4	<2	<10
5309	5	12	14	2	10	25	3.1	920	3	<1	<4	<4	8	<4	<2	<10
5311	5	18	14	2	2	15	1.0	[illegible]	3	<1	<4	<4	18	<4	<2	<10
5312	12	45	140	15	20	35	3.0	630	3	<1	10	12	6	<4	<2	<10

TABLE A2 continued

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5313	12	45	16	22	32	32	5.6	1800	4	< 1	6	14	8	< 4	< 2	15
5314	10	38	42	15	22	22	5.0	1700	5	< 1	4	6	8	< 4	< 2	< 10
5316	5	30	20	8	10	18	3.3	1300	5	< 1	< 4	6	8	< 4	< 2	< 10
5317	8	45	28	10	28	38	9.0	3700	5	< 1	< 4	4	8	< 4	< 2	< 10
5321	5	25	32	2	5	12	1.9	650	3	< 1	< 4	< 4	14	< 4	< 2	< 10
5326	10	38	18	10	25	15	2.8	1200	3	< 1	4	4	6	< 4	< 2	< 10
5327	2	22	32	2	2	10	0.9	380	< 3	< 1	< 4	< 4	14	< 4	< 2	< 10
5340	8	28	26	8	15	15	3.6	1100	< 3	< 1	< 4	4	16	4	< 2	< 10
$\bar{x}$	5.44	26.27	14.4	5.93	7.62	18.24	2.43	957.5					28.3			
s	3.35	21.59	16.37	4.33	6.8	13.05	1.91	898					39.4			

TABLE #?. HATCHERY CREEK CONGLOMERATE

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	V
5095	15	60	12	32	12	22	2.8	460	<3	<1	4	<4	6	4	2	<10
5096	15	70	14	30	12	15	2.6	620	3	<1	8	<4	10	<4	<2	<10
5097	12	55	18	20	10	20	2.1	450	<3	<1	4	<4	8	4	<2	<10
5098	10	70	12	20	8	20	2.0	200	<3	<1	4	<4	12	<4	<2	<10
5099	10	32	10	18	8	18	1.8	420	<3	<1	6	<4	8	<4	<2	<10
5100	18	90	40	10	8	25	2.3	970	<3	<1	4	8	20	8	<2	<10
5101	8	42	10	12	8	100	2.0	340	<3	<1	4	4	8	4	<2	<10
5102	12	45	16	20	8	18	2.2	440	3	<1	4	<4	30	4	<2	<10
5103	12	50	18	20	10	15	2.2	400	3	<1	<4	4	12	<4	<2	<10
5104	15	70	20	40	15	32	3.0	570	<3	<1	6	4	8	6	2	<10
5105	20	60	14	60	22	90	3.2	1250	3	<1	6	<4	8	4	<2	<10
5106	20	55	20	42	25	65	3.7	850	3	<1	6	<4	12	4	<2	<10
5107	10	30	8	15	5	25	1.6	630	3	<1	6	<4	<4	[illegible]	<2	<10
5110	8	30	10	12	<5	18	1.9	490	<3	<1	<4	6	18	<4	<2	<10
5111	5	25	12	8	<5	32	2.7	920	<3	<1	<4	4	26	<4	<2	<10
5112	10	75	16	28	18	18	2.1	1300	<3	<1	<4	<4	10	<4	<2	<10
5116	8	15	8	8	5	12	1.2	400	<3	<1	<4	<4	28	6	<2	<10
5117	10	18	10	12	<5	18	1.7	780	<3	<1	4	<4	10	<4	<2	<10
5121	20	22	8	5	8	15	2.8	700	<3	<1	<4	<4	6	<4	<2	<10
5122	12	60	16	25	10	25	2.1	690	<3	<1	6	<4	12	4	<2	<10
5125	10	55	8	8	<5	12	1.8	460	<3	<1	<4	4	4	4	<2	<10
5129	10	20	10	10	<5	25	1.5	300	<3	<1	4	<4	26	<4	<2	<10
5139	10	60	12	28	8	25	2.0	490	<3	<1	6	4	10	4	<2	<10
$\bar{x}$	12.3	48.2	14.0	21.0	8.9	28.9	2.23	627.8					12.7			
s	4.1	20.9	6.8	13.4	6.4	23.4	0.59	277.3					8.0			

TABLE 44. MOUNTAIN CREEK VOLCANICS

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5048	5	45	8	10	< 5	15	2.1	770	< 3	< 1	6	5	10	< 4	< 2	< 10
5219	10	70	44	8	8	15	1.9	720	3	< 1	28	< 4	16	6	< 2	< 10
5220	5	45	120	5	8	8	1.6	720	< 3	< 1	15	4	12	4	< 2	< 10
5227	12	70	75	2	5	8	1.9	470	< 3	< 1	12	< 4	14	4	< 2	< 10
5250	8	28	14	8	10	18	1.7	500	< 3	< 1	< 4	< 4	10	4	< 2	< 10
5258	10	65	60	8	10	5	1.9	1150	4	< 1	36	4	14	4	< 2	< 10
5259	5	45	110	5	8	8	1.8	600	3	< 1	24	4	14	4	< 2	< 10
5260	8	50	24	5	10	5	2.6	1100	3	< 1	4	< 4	14	6	< 2	< 10
5261	8	48	42	6	8	5	1.9	660	3	< 1	6	< 4	12	4	< 2	< 10
5262	35	65	34	10	20	10	3.5	820	5	< 1	18	4	14	4	< 2	< 10
5263	12	60	50	8	12	8	2.4	790	3	< 1	12	4	10	< 4	< 2	10
5264	10	65	30	8	15	8	2.9	1000	4	< 1	8	4	12	< 4	< 2	< 10
5277	12	70	80	12	12	8	2.6	1550	3	< 1	16	4	12	4	< 2	< 10
5278	8	48	26	8	5	5	1.7	740	3	< 1	6	< 4	12	4	< 2	< 10
5322	5	50	180	5	5	8	3.0	610	4	< 1	22	< 4	12	4	< 2	< 10
5332	5	45	30	2	2	8	1.5	600	< 3	< 1	6	< 4	10	< 4	< 2	< 10
5336	25	38	12	8	8	15	2.1	320	< 3	< 1	4	4	8	4	2	< 10
5341	8	50	32	2	5	8	2.0	650	< 3	< 1	6	16	16	< 4	< 2	20
$\bar{x}$	10.6	53.2	53.9	6.7	8.4	9.2	2.17	740.5			12.8		12.3			
s	7.7	12.2	44.7	2.9	4.5	3.9	0.55	309.7			9.6		2.2			

[illegible]

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5033	8	25	8	5	8	18	1.9	600	< 3	< 1	4	< 4	14	< 4	< 2	< 10
5034	12	90	20	10	32	38	13.5	6600	< 3	< 1	< 4	< 4	16	< 4	< 2	< 10
5049	12	30	10	28	22	90	5.2	1600	3	< 1	< 4	6	6	< 4	< 2	10
5120	48	40	6	15	22	22	4.2	660	< 3	< 1	4	< 4	12	< 4	< 2	< 10
5137	12	38	14	12	10	22	2.8	800	< 3	< 1	< 4	< 4	10	6	< 2	< 10
5154	5	25	12	8	5	18	2.3	450	< 3	< 1	< 4	8	30	6	< 2	< 10
5205	25	55	8	22	32	65	5.4	[illegible]	< 3	< 1	4	6	4	< 4	< 2	< 10
5202	8	25	8	8	8	30	2.1	760	4	< 1	< 4	< 4	< 4	< 4	< 2	< 10
5293	35	38	16	18	12	42	4.1	720	3	< 1	< 4	< 4	8	4	< 2	< 10
5295	20	55	95	18	28	60	3.9	1100	3	< 1	4	< 4	6	< 4	< 2	< 10
5303	18	28	10	20	25	55	3.1	1450	4	< 1	< 4	< 4	< 4	< 4	< 2	< 10
5305	10	28	16	10	15	35	3.2	1380	< 3	< 1	< 4	< 4	4	< 4	< 2	< 10
5306	10	28	14	12	15	42	3.0	970	4	< 1	< 4	4	< 4	< 4	< 2	< 10
5313	12	45	16	22	[illegible]	[illegible]	5.6	1800	4	< 1	6	14	8	< 4	< 2	15
5338	12	38	10	12	25	60	3.6	980	< 3	< 1	4	4	4	< 4	2	< 10

b) Intermediate rocks

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5116	8	15	8	8	5	12	1.2	400	< 3	< 1	< 4	< 4	28	6	< 2	< 10
5121	20	22	8	5	8	15	2.8	700	< 3	< 1	< 4	< 4	6	< 4	< 2	< 10
5136	5	18	6	5	< 5	[illegible]	[illegible]	310	< 3	< 1	4	4	8	< 4	< 2	< 10
5137	12	38	14	12	10	22	2.8	800	< 3	< 1	< 4	< 4	10	6	< 2	< 10
5138	12	30	8	10	10	32	2.4	1200	< 3	< 1	4	4	10	4	< 2	< 10
$\bar{x}$	15.4	35.4	15.4	13.0	16.6	27.0	3.8	1231					9.3			
s	10.8	17.2	19.7	6.6	10.2	20.9	2.6	1262					8.1			

KIRAWIN SHALE

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5210	12	70	38	10	10	8	2.2	230	<2	<1	44	<4	14	4	<2	<10
5211	12	80	30	15	12	15	2.4	1100	<3	<1	50	6	14	4	<2	<10
5214	15	90	38	15	12	18	2.4	1150	<3	<1	32	6	12	4	<2	<10
5215	20	80	170	10	10	15	2.3	660	<3	<1	26	6	12	4	<2	<10
5216	8	45	22	8	10	8	1.7	510	<3	<1	24	6	12	4	<2	<10
5217	12	75	40	12	10	12	2.2	960	<3	<1	50	<4	18	4	<2	<10
5221	12	48	22	10	10	22	2.2	520	<3	<1	10	6	10	4	<2	<10
5222	15	75	100	8	10	15	1.9	560	<3	<1	14	4	14	6	<2	<10
5223	10	60	40	10	8	18	2.1	500	<3	<1	14	<4	12	6	<2	<10
5224	10	50	38	8	8	15	1.8	690	3	<1	14	4	16	4	<2	<10
5227	12	70	75	2	5	8	1.9	470	<3	<1	12	<4	14	4	<2	<10
5228	18	60	36	12	12	15	2.2	920	<3	<1	24	4	14	6	<2	<10
5230	8	48	60	5	8	10	1.8	400	<3	<1	20	<4	16	<4	<2	<10
5239	18	60	120	10	10	15	2.3	550	3	<1	36	<4	14	<4	<2	<10
5240	28	100	20	12	10	28	2.2	770	10	<1	18	4	12	12	<2	<10
5241	22	55	38	10	8	15	2.2	450	3	<1	24	<4	12	6	<2	<10
5242	22	75	28	18	20	18	2.3	900	3	<1	46	<4	16	6	<2	<10
5248	12	65	34	8	10	12	1.8	670	<3	<1	10	4	16	<4	<2	<10
5249	10	60	130	8	18	15	2.3	920	<3	<1	20	4	12	<4	<2	<10
5276	8	50	22	8	5	8	1.8	640	<3	<1	10	4	10	6	<2	<10
5333	15	65	220	10	12	12	2.0	810	4	<1	18	<4	16	4	<2	<10
5335	12	60	65	8	8	10	2.0	820	<3	<1	14	<4	14	4	<2	<10
5337	18	75	32	12	10	10	2.8	650	3	<1	55	8	16	4	<2	<10
$\bar{x}$	14.3	65.9	61.6	10.0	10.3	14.0	2.12	680			25.4		13.7			
s	5.2	14.1	52.5	3.4	3.4	4.[illegible]	0.26	217			14.4		[illegible].1			

TABLE A7. SUGARLOAF CREEK TUFF

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5200	8	60	24	8	10	5	1.8	560	< 3	<1	24	4	12	<4	< 2	<10
5201	10	48	24	12	12	10	2.4	510	3	<1	10	<4	14	6	<2	<10
5202	8	42	26	5	10	10	1.9	380	<3	<1	12	<4	16	4	<2	<10
5203	8	45	22	8	10	5	2.3	510	<3	<1	10	4	14	<4	< 2	<10
5212	8	60	20	8	10	8	2.1	600	<3	<1	8	8	16	4	<2	<10
5213	5	38	16	5	10	8	2.2	740	<3	<1	14	<4	16	6	<2	<10
5220	5	45	120	5	8	8	1.6	720	<3	<1	16	4	12	4	<2	<10
5225	5	65	32	5	8	12	1.7	510	<3	<1	16	<4	14	<4	<2	<10
5226	8	55	30	5	8	15	1.8	600	<3	<1	14	<4	14	4	<2	<10
5243	42	85	130	20	20	28	2.9	1500	<3	<1	12	4	16	<4	<2	<10
5244	15	55	28	10	12	12	2.3	780	<3	<1	20	4	14	4	<2	<10
5245	12	60	38	10	12	8	2.0	710	<3	<1	12	8	16	<4	<2	<10
5246	15	60	100	8	10	10	1.8	400	<3	<1	14	<4	16	4	<2	<10
$\bar{x}$	11.5	55.2	46.9	8.4	10.8	10.7	2.06	655.4			14		14.6			
s	9.8	12.3	40.6	4.2	3.1	5.9	0.36	283.3			4.3		1.5			

TABLE 18. TAEMAS LIMESTONE, CAVAN BLUFF LIMESTONE, MAJURGONG SHALE

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5123	10	25	8	10	< 5	35	1.6	270	3	< 1	4	8	4	< 4	< 2	< 10
5124	10	20	12	10	< 5	15	1.4	310	< 3	< 1	4	4	6	< 4	< 2	< 10
5163	8	12	8	8	< 5	5	1.2	300	< 2	< 1	4	< 4	6	< 4	< 2	< 10
5164	8	18	12	5	< 5	8	1.3	430	< 3	< 1	< 4	4	10	< 4	< 2	< 10
5165	8	15	12	8	< 5	8	1.4	350	3	< 1	4	4	8	< 4	< 2	< 10
5166	5	25	8	5	5	20	2.1	720	< 3	< 1	< 4	< 4	< 4	< 4	< 2	< 10
5167	10	42	18	10	8	12	2.5	630	< 3	< 1	6	< 4	8	< 4	2	10
5168	5	22	12	< 5	< 5	5	1.3	280	< 3	< 1	< 4	< 4	8	4	< 2	10
5279	12	55	44	10	8	5	2.1	510	4	< 1	6	4	14	8	< 2	< 10
5280	10	42	24	10	10	5	1.9	400	2	< 1	4	4	14	4	< 2	< 10
x	8.6	27.6	15.8	7.7		11.8	1.68	420					7.9			
s	2.3	14.0	11.1	3.1		9.6	0.44	155					4.1			

TABLE A9. BURRINJUCK GRANITE

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
5108	10	85	10	22	<5	20	1.4	310	3	<1	<4	16	28	8	<2	<10
5109	8	22	18	<5	<5	<5	1.2	370	<3	<1	4	6	46	14	<2	10
5113	8	32	10	20	12	28	2.2	790	<3	<1	<4	4	30	6	<2	<10
5153	15	55	12	<5	10	18	4.0	760	3	<1	4	4	12	4	<2	<10
5154	5	25	12	8	5	18	2.3	450	<3	<1	<4	8	30	6	<2	<10
5155	5	30	18	8	5	18	2.4	480	3	<1	<4	6	46	10	<2	<10
5156	8	50	10	35	20	60	3.2	520	3	<1	<4	<4	30	4	<2	<10

TABLE A10 SILURIAN SEDIMENTARY ROCKS

	Cu	Zn	Pb	Ni	Co	Cr	Fe	Mn	Mo	Ag	As	Sn	Th	U	Se	W
a) Peppercorn Beds																
5008	8	45	8	12	8	12	1.5	220	< 3	< 1	6	4	8	4	< 2	< 10
5009	8	55	16	10	8	18	1.6	230	< 3	< 1	4	4	6	< 4	< 2	10
b) Micalong Creek Beds																
5169	5	30	14	< 5	< 5	5	1.6	520	< 3	< 1	4	4	10	< 4	< 2	< 10
5176	8	30	10	< 5	< 5	15	1.9	530	< 3	< 1	4	< 4	6	4	< 2	10
5256	8	14	38	8	8	10	1.8	450	< 3	< 1	< 4	< 4	10	< 4	< 2	< 10

TABLE A11. Total sample population

(330 samples)

Cu class (ppm)	Cu freq	Zn class (ppm)	Zn freq	Pb class (ppm)	Pb freq	Ni class (ppm)	Ni freq
0-5	122	0-10	7	0-5	18	0-5	139
6-10	141	11-20	43	6-10	129	6-10	128
11-15	41	21-30	86	11-15	66	11-15	36
16-20	13	31-40	67	16-20	47	16-20	13
21-25	6	41-50	55	21-25	12	21-25	5
26-30	2	51-60	37	26-30	14	26-30	4
31-35	2	61-70	19	31-35	7	31-35	2
36-40	1	71-80	7	36-40	10	36-40	1
41-45	1	81-90	5	41-45	4	41-45	1
46-50	1	91-100	3	46-50	2	46-50	
	330			51-60	2	51-55	
		340	1	61-70	1	56-60	1
			330	71-80	3		330
				81-90	1		
				91-100	3		
				101-120	3		
				121-140	4		
				141-160	1		
				161-180	2		
				181-200			
				201-220	1		
					330		

Co

class (ppm)	freq
0-5	130
6-10	131
11-15	43
16-20	10
21-25	9
26-30	3
31-35	4
	330

Cr

class (ppm)	freq
0-5	17
6-10	56
11-15	95
16-20	57
21-25	33
26-30	18
31-35	17
36-40	8
41-50	8
51-60	8
61-70	5
71-80	2
81-90	2
91-100	2
101-150	1
151-200	1
	330

Fe

class (%)	freq
0-0.5	3
0.6-1	20
1.1-1.5	56
1.6-2	100
2.1-2.5	68
2.6-3	32
3.1-3.5	19
3.6-4	8
4.1-4.5	7
4.6-5	5
5.1-5.5	4
5.6-6	3
6.1-6.5	2
6.5-7	
7.1-9	1
9.1-11	1
11.1-13	
13.1-15	1
	330

Mn

class (ppm)	freq
0-200	12
201-400	65
401-600	92
601-800	66
801-1000	34
1001-1200	13
1201-1400	12
1401-1600	7
1601-1800	9
1801-2000	3
2001-2500	7
2501-3000	1
3001-3500	3
3501-4000	2
4001-4500	2
4501-5000	-
5001-5500	1
5501-6000	-
6001-6500	
6501-7000	1
	330

TABLE A11 (Cont'd)

As class (ppm)	As freq	Sn class (ppm)	Sn freq	Th class (ppm)	Th freq	U class (ppm)	U freq
0-5	260	0-4	262	0-5	38	0-4	287
6-10	30	5-8	49	6-10	120	6	32
11-20	24	9-12	8	11-15	73	8	8
21-30	8	13-16	5	16-20	47	10	2
31-40	3	17-20	1	21-25	4	12	1
41-50	4	21-24	1	26-30	20		330
51-60	1			31-35	1		
	330	60	1	36-40	7		
		280	1	41-45	3		
		285	1	46-50	3		
		920	1	51-60	3		
			330	61-70	5		
				71-80			
				81-90			
				91-100			
				101-150	1		
				151-200	3		
				201-250	1		
					330		

TABLE A11 Cont'd)

W

class (ppm)	freq
0-10	315
15	8
20	3
40	1
70	1
120	1
370	1
	330

Mo

class (ppm)	freq
0-3	305
4	18
5	6
10	1
	330

TABLE A12. Copper

Class ppm	GV freq	GV cum%freq	YG freq	YG cum%freq	HCC freq	MCV freq	MSBC freq	KS freq	SCT freq	TL freq
0-5	57	40.4	55	59.7	1	5	2		3	2
6-10	68	88.6	30	92.3	11	8	5	6	6	7
11-15	8	94.2	6	98.8	7	3	6	10	3	1
16-20	3	96.3	1	99.8	4		3	4		
21-25	3	98.4				1	1	2		
26-30	1	99.1						1		
31-35		99.1				1	1			
36-40	1	99.8								
41-45									1	
46-50							1			
	141		92		23	18	19	23	13	10

GV = Goobarragandra Volcanics
YG = Young Granodiorite
HCC = Hatchery Creek Conglomerate
MCV = Mountain Creek Volcanics
MSBC = Micalong Swamp Basic Complex
KS = Kirawin Shale
SCT = Sugarloaf Creek Tuff
TL = Taemas Limestone, Cavan Bluff Limestone, Majurgong Shale

TABLE A13. Zinc

Class ppm	GV freq	GV cum%freq	YG freq	YG cum%freq	HCC freq	MCV freq	MSBC freq	KS freq	SCT freq	TL freq
0-10		0	7	7.6						
11-20	9	6.3	27	36.9	3		2			4
21-30	43	36.7	29	68.4	4	1	9			3
31-40	44	67.9	19	89.0	1	1	4		1	
41-50	25	85.6	6	95.5	3	8	1	5	4	2
51-60	12	94.1	1	96.5	7	2	2	6	6	1
61-70	5	97.6	1	97.5	3	6		4	1	
71-80		97.6		97.5	1			6		
81-90		97.6	1	98.5	1		1	1	1	
91-100	2	99.0	1	99.5				1		
		99.0								
		99.0								
340	1	99.7								
	141		92		23	18	19	23	13	10

Abbreviations as in Table A12

TABLE A14. Lead

Class ppm	GV freq	GV cum%freq	YG freq	YG cum%freq	HCC freq	MCV freq	MSBC freq	KS freq	SCT freq	TL freq
0-5	13	9.2	7	7.6						
6-10	69	58.1	39	49.9	9	1	11			3
11-15	30	79.3	22	73.8	6	2	3			4
16-20	18	92.0	14	89.0	7		4	1	2	1
21-25	2	93.4	2	91.1		1		3	3	1
26-30	3	95.5	3	94.3		3		2	3	
31-35		95.5	2	96.4		2		2	1	
36-40	1	96.2		96.4	1			7	1	
41-45		96.2	1	97.4		2				1
46-50	1	96.9		97.4		1				
51-60		96.9		97.4		1		1		
61-70		96.9		97.4				1		
71-80	1	97.6		97.4		2		1		
81-90	1	98.3	1	98.4						
91-100		98.3		98.4			1	1	1	
101-120		98.3		98.4		2		1	1	
120-140	1	99.0	1	99.4				1	1	
141-160	1	99.7								
161-180						1		1		
181-200						1		1		
201-220								1		
	141		92		23	18	19	23	13	10

TABLE A15. Nickel

ppm	GV freq	GV cum%freq	YG freq	YG cum%freq	HCC freq	MCV freq	MSBC freq	KS freq	SCT freq	TL freq
0-5	67	47.5	54	58.6	1	7	3	2	5	3
6-10	58	88.6	27	87.9	5	110	66	14	6	7
11-15	13	97.88	8	96.5	4	1	4	6	1	
16-20	2	99.2	1	97.5	5		3	1	1	
21-25	1	99.9	2	99.6	1		2			
26-30					3		1			
31-35					1					
36-40					1					
41-45					1					
46-50										
51-55										
56-60					1					
	141		92		23	18	19	23	13	10

TABLE 16. Cobalt

ppm	GV freq	GV cum%freq	YG freq	YG cum%freq	HCC freq	MCV freq	MSBC freq	KS freq	SCT freq	TL freq
0-5	57	40.4	48	52.1	7	6	3	2		7
6-10	59	82.2	24	78.1	10	8	5	15	9	3
11-15	19	95.6	11	90.0	3	3	3	4	3	
16-20	3	97.7	2	92.1	1	1		2	1	
21-25		97.7	4	96.4	2		4			
26-30	1	98.4	1	97.4			1			
31-35	2	99.8	2	99.5			3			
	141		92		23	18	19	23	13	10

TABLE A17. Chromium

ppm	GV freq	GV cum%freq	YG freq	YG cum%freq	HCC freq	MCV freq	MSBC freq	KS freq	SCT freq	TL freq
0-5	1	0.7	5	5.4		4			2	4
6-10	10	7.7	20	27.1		10		7	7	2
11-15	44	38.9	27	56.4	4	3	3	11	3	2
16-20	26	57.3	14	71.6	8	1	2	3		1
21-25	20	71.4	7	79.2	6		2	1		
26-30	10	78.4	5	84.6	1		1	1	1	
31-35	9	84.7	6	91.1	1		3			1
36-40	5	88.2	3	94.3			1			
41-50	5	91.77	2	96.4			2			
51-60	4	94.5	1	97.4			3			
61-70	3	96.6	1	98.4	1		1			
81-90		97.3			1		1			
91-100	1	98.0			1					
101-150	1	98.7								
151-200	1	99.4								
	141		92		23	18	19	23	13	10

TABLE A18. Iron

%	GV freq	GV cum%freq	YG freq	YG cum%freq	HCC freq	CV freq	MSBC freq	KS freq	SCT freq	TL freq
0-0.5		0	3	3.2						
0.6-1	4	2.8	15	19.5						
1.1-1.5	31	24.7	13	33.6	2	1	2			5
1.6-2	49	59.4	17	52.0	8	9	1	9	7	2
2.1-2.5	23	75.7	12	65.0	6	3	2	14	5	3
2.6-3	12	84.2	10	75.8	5	4	3		1	
3.1-3.5	9	90.5	7	83.4	1	1	3			
3.6-4	1	91.2	3	86.6	1		2			
4.1-4.5	3	93.3	2	88.7			2			
4.6-5	3	95.4	4	93.0						
5.1-5.5	3	97.5		93.0			2			
5.6-6		97.5	3	96.2			1			
6.1-6.5	2	98.9	1	97.2						
6.6-7		98.9		97.2						
7.1-9		98.9	1	98.2						
9.1-11	1	99.6		98.2						
11.1-13				98.2						
13.1-15			1	99.2			1			
	141		92		23	18	19	23	13	10

Abbreviations as in Table A12

TABLE A19. Manganese

ppm	GV freq	GV cum%freq	YG freq	YG cum%freq	HCC freq	MCV freq	MSBC freq	KS freq	SCT freq	TL freq
0-200	2	1.4	9	9.7						
201-400	25	19.1	18	29.2	5	2	2	2	2	6
401-600	44	50.3	17	47.6	8	4	2	8	6	2
601-800	26	68.7	14	62.8	5	7	5	5	4	2
801-1000	15	79.3	10	73.6	3	2	3	6		
1001-1200	3	81.4	4	77.9		2	2	2		
1201-1400	6	85.6	3	81.1	2		1			
1401-1600	1	86.3	2	83.2		1	2		1	
1601-1800	6	90.5	4	87.5			1			
1801-2000	3	92.6	1	88.5						
2001-2500	4	95.4	3	91.7						
2501-3000	1	96.1	1	92.7						
3001-3500	2	97.5	2	94.8						
3501-4000	1	98.2	1	95.8						
4001-4500	2	99.6	1	96.8						
4501-5000				96.8						
5001-5500			1	97.8						
5501-6000				97.8						
6001-6500				97.8						
6501-7000			1	98.8			1			
	141		92		23	18	19	23	13	10

Abbreviations as in Table A12.

TABLE A20. Arsenic

ppm	GV freq	YG freq	HCC freq	MCV freq	MSBC freq	KS freq	SCT freq	TL freq
0-5	135	87	15	3	18			8
6-10	3	5	8	6	1	3	3	2
11-20	3			5		9	9	
21-30				3		4	1	
31-40				1		2		
41-50						4		
51-60						1		
	141	92	23	18	19	23	13	10

Abbreviations as in Table A12

TABLE A21. Tin.

ppm	GV freq	YG freq	HCC freq	MCV freq	MSBc freq	KS freq	SCT freq	TL freq
0-4	108	72	20	16	15	17	11	9
5-8	24	13	2	1	3	6	2	1
9-12	5	3						
13-16	1	2		1	1			
17-20	1							
21-24			1					
60	1							
280		1						
285		1						
920	1							
	141	92	23	18	19	23	13	10

Abbreviations as in Table A12

TABLE A22. Thorium

	GV		YG		HCC	MCV	MSBC	KS	SCT	TL
ppm	freq	cum%freq	freq	cum%freq	freq	freq	freq	freq	freq	freq
0-5	29	20.5	6	6.5	2		6			2
6-10	64	65.5	29	38.0	11	5	8	2		6
11-15	25	83.2	9	47.7	4	11	2	14	7	2
16-20	14	93.1	16	65.0	2	2	1	7	6	
21-25	1	93.8	3	68.2						
26-30	5	97.3	8	76.8	4		2			
31-35		97.3	1	77.8						
36-40	1	98.0	6	84.3						
41-45	2	99.4	1	85.3						
46-50		99.4	1	86.3						
51-60		99.4	3	89.5						
61-70	1	100.1	4	93.8						
71-80	1	100.8		93.8						
81-90				93.8						
91-100				93.8						
101-150			1	94.8						
151-200			3	98.0						
201-250			1	99.0						
	141		92		23	18	19	23	13	10

Abbreviations as in Table A12

TABLE A23. Uranium

ppm	GV freq	YG freq	HCC freq	MCV freq	MSBC freq	KS freq	SCT freq	TL freq
0-4	130	80	20	16	16	16	11	9
6	11	6	2	2	3	6	2	
8		5	1					1
10		1						
12						1		
	141	92	23	18	19	23	13	10

Abbreviations as in Table A12.

TABLE A24. Tungsten

ppm	GV freq	YG freq	HCC freq	MCV freq	MSBC freq	KS freq	SCT freq	TL freq
0-10	133	86	23	17	18	23	13	10
15	6	2			1			
20	1	1		1				
40	1							
70		1						
120		1						
370		1						
	141	92	23	18	19	23	13	10

Abbreviations as in Table A12

TABLE A25. Molybdenum

ppm	GV freq	YG freq	HCC freq	MCV freq	MSBC freq	KS freq	SCT freq	TL freq
0-3	132	87	23	14	15	21	13	9
4	7	2		3	4	1		1
5	2	3		1				
10						1		
	141	92	23	18	19	23	13	10

Abbreviations as in Table A12

APPENDIX

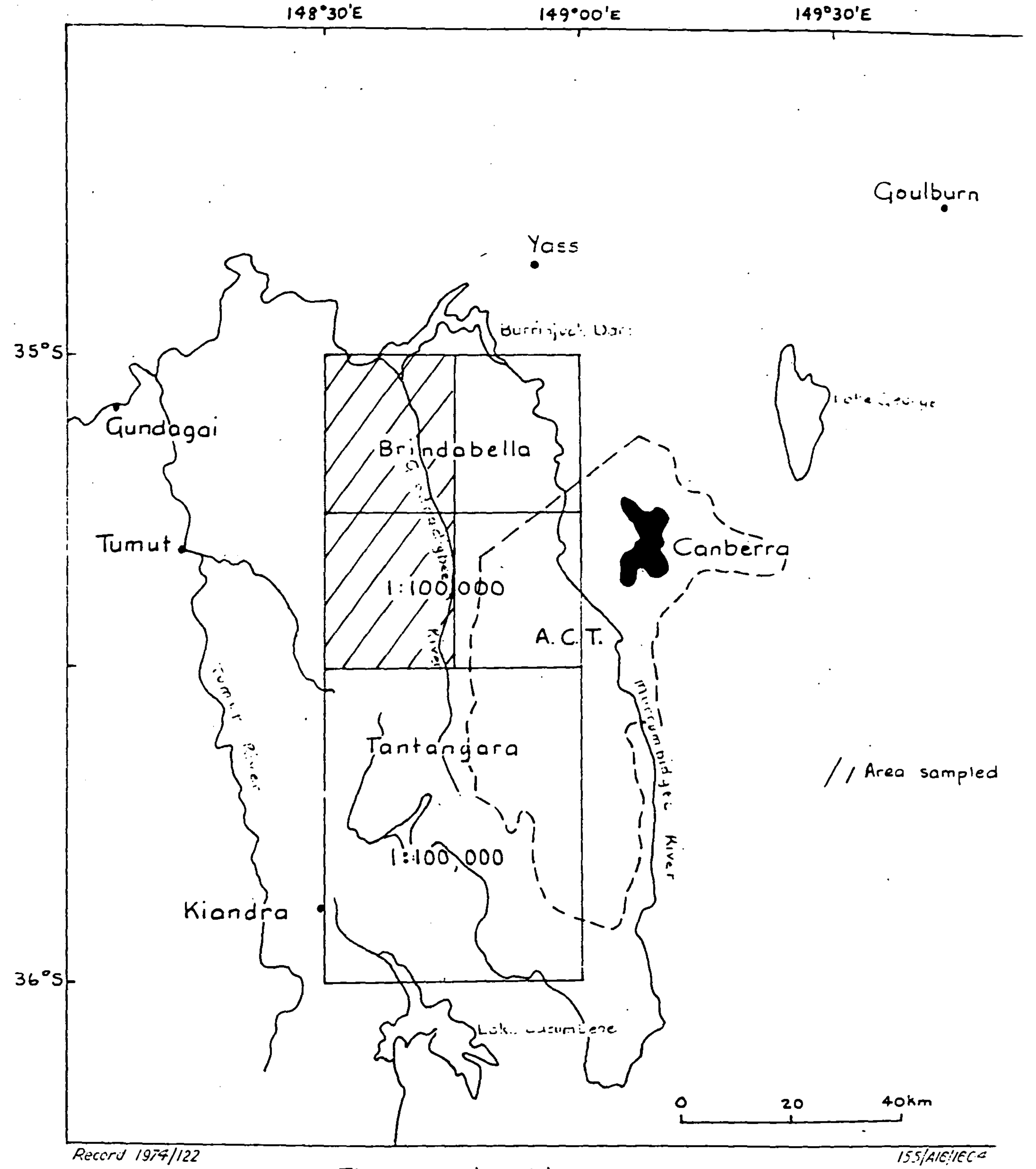
ANALYTICAL DATA

FIGS. 1-32 THIS CARD

TABLES A1 - A25 CARD Nº 2

LIST OF FIGURES

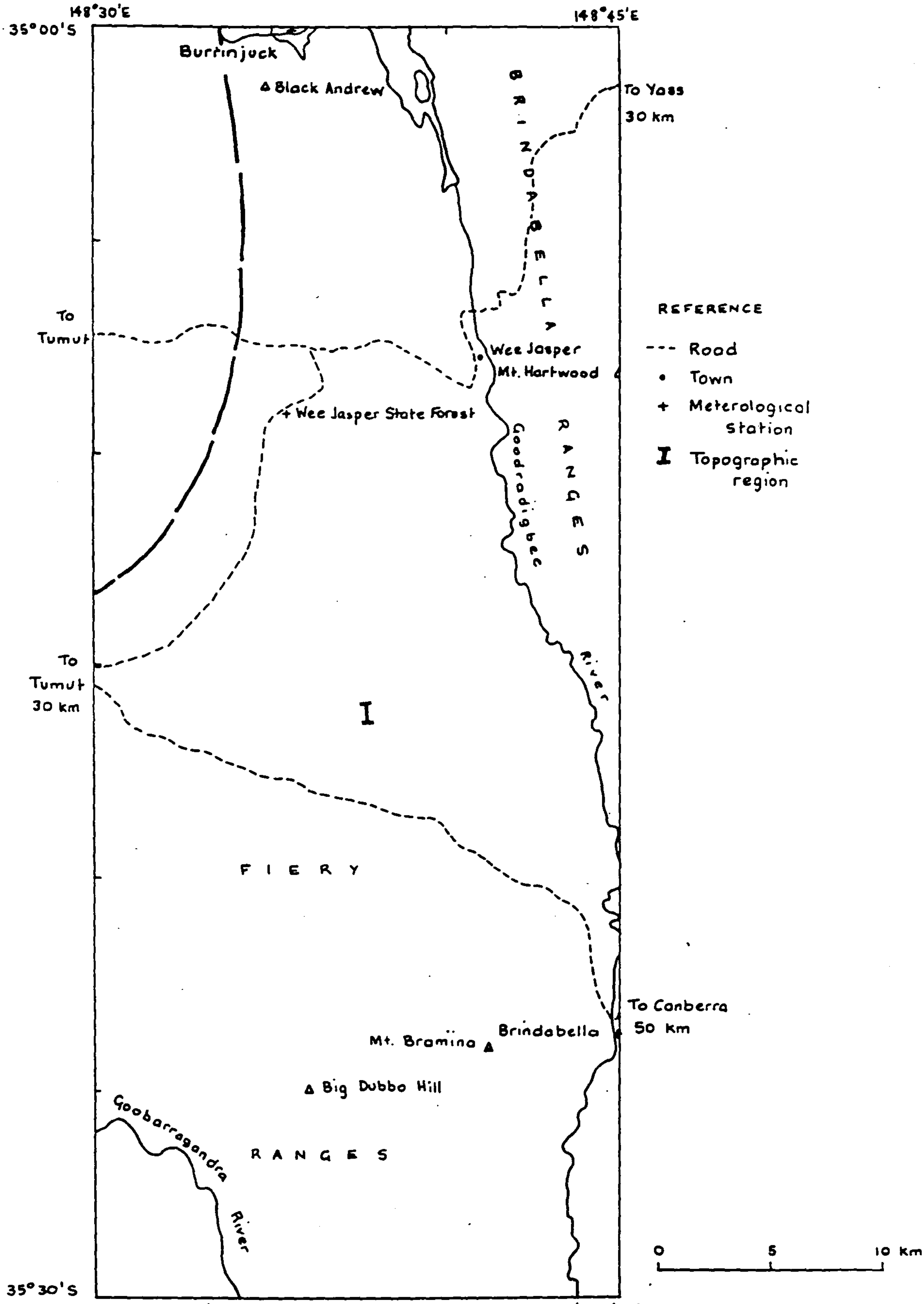
APPENDIX: ANALYTICAL DATA



Record 1974/122

155/A16/1EC4

Figure 1 Location map.



Record 1974/122

155/A16/1605

Figure 2 Locality map

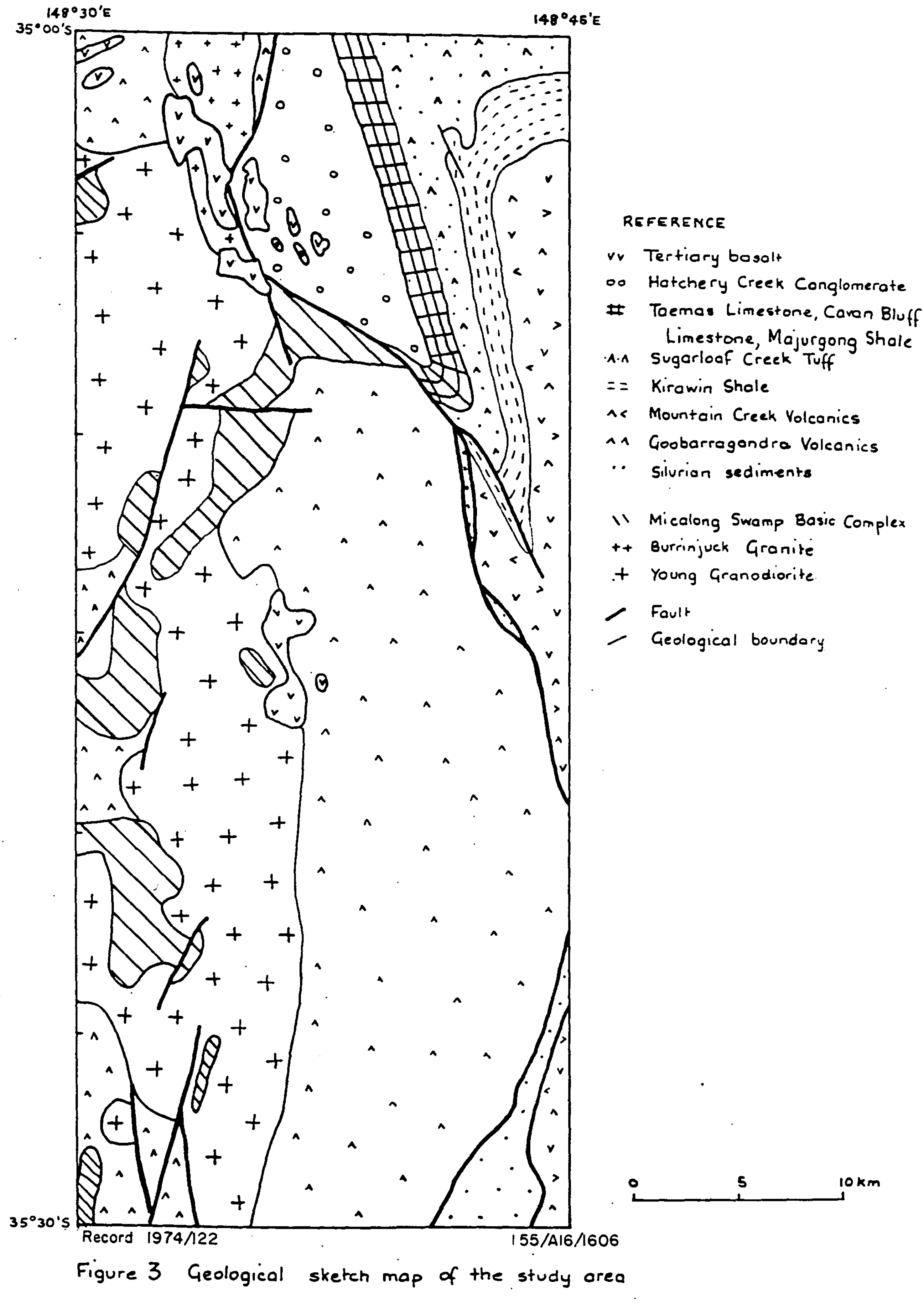


Figure 3 Geological sketch map of the study area

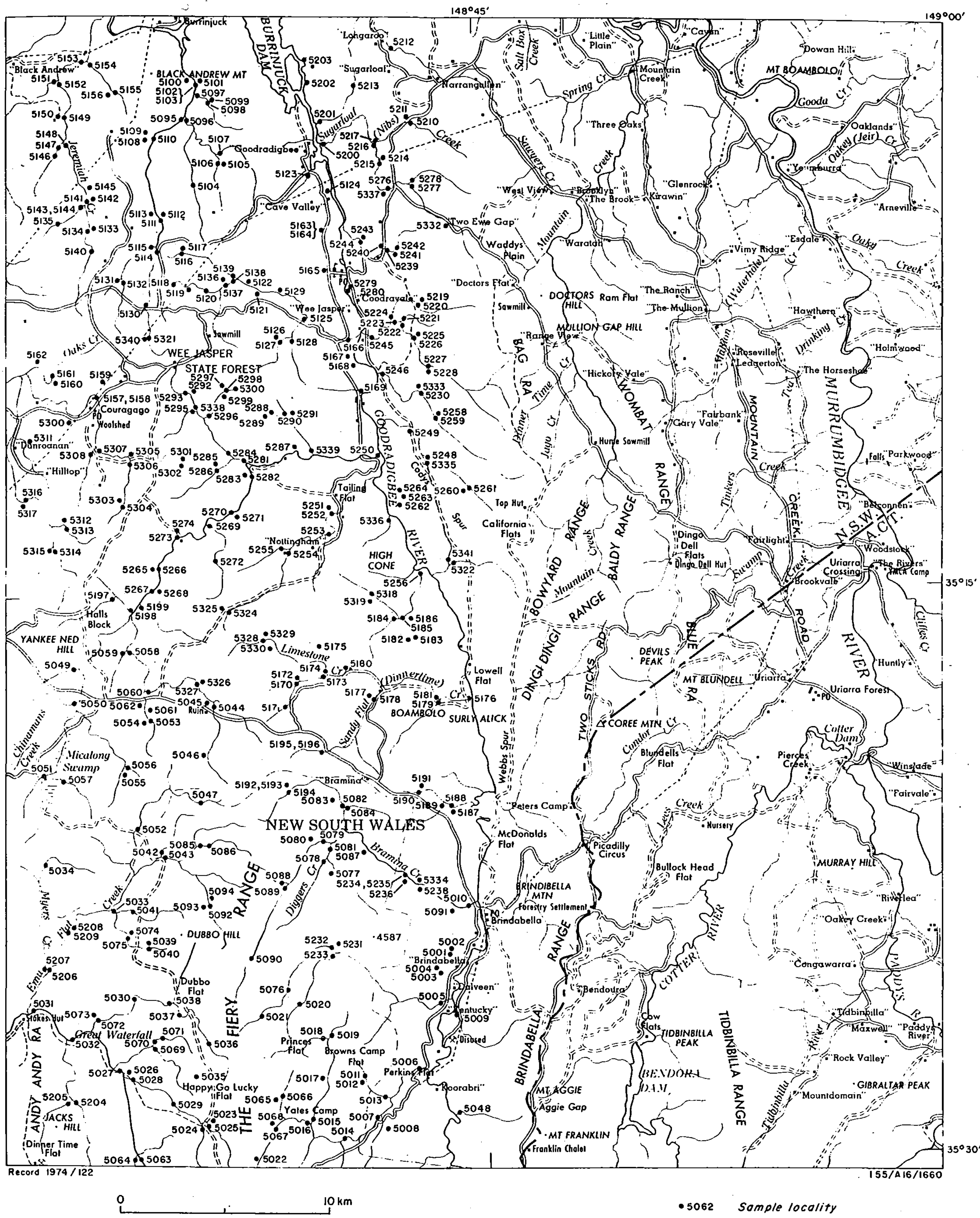
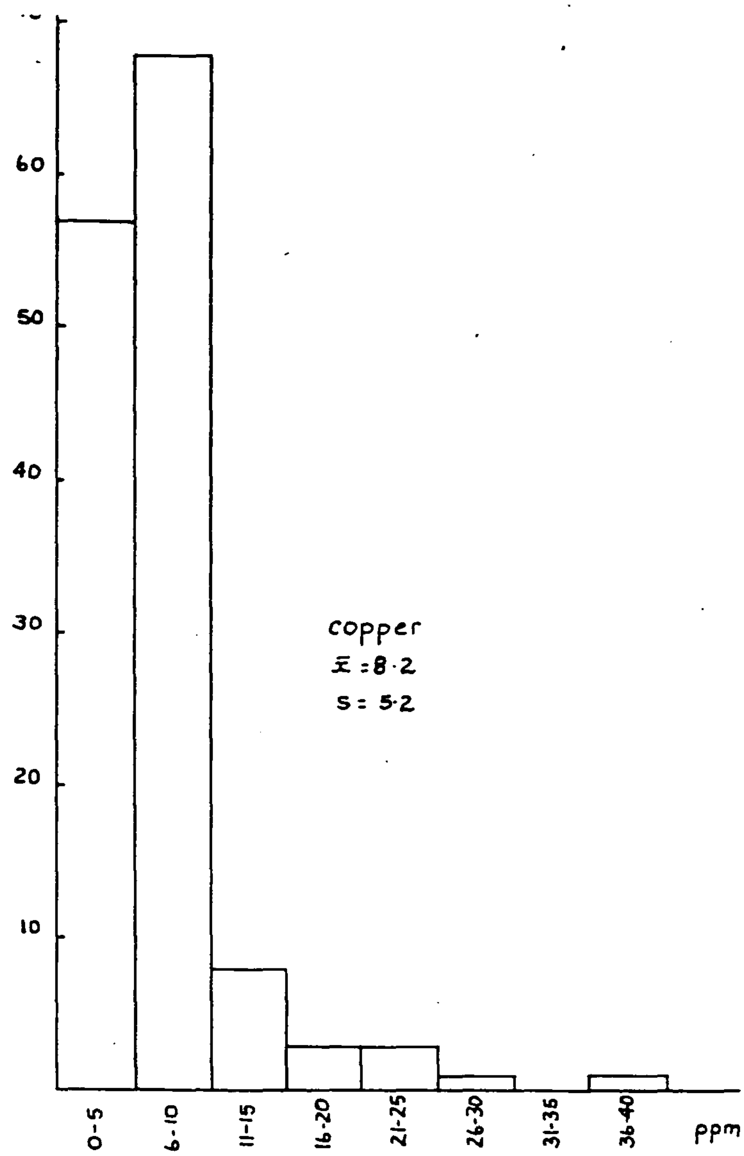
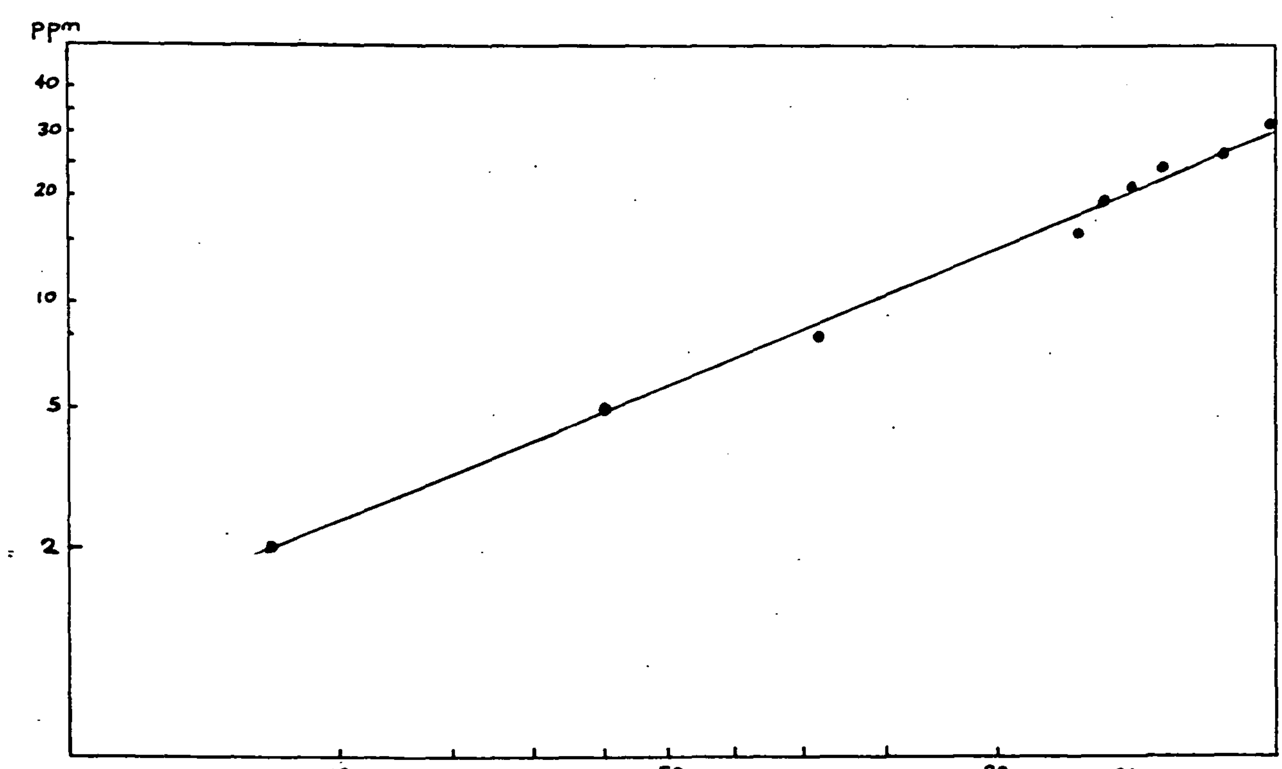


Fig. 4 Sample localities

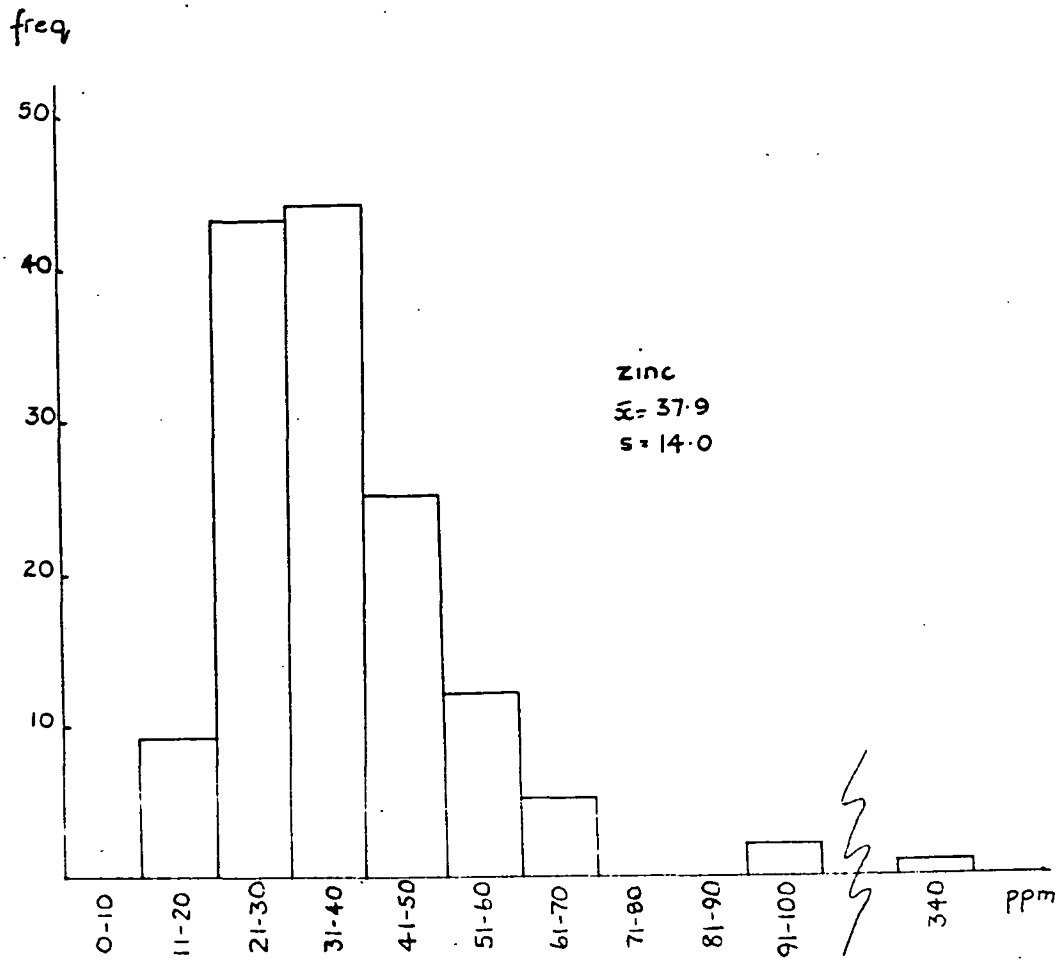




Record 1974/122

155/A16/1607

Figure 5 Distribution of copper in the Goobarragandra Volcanics



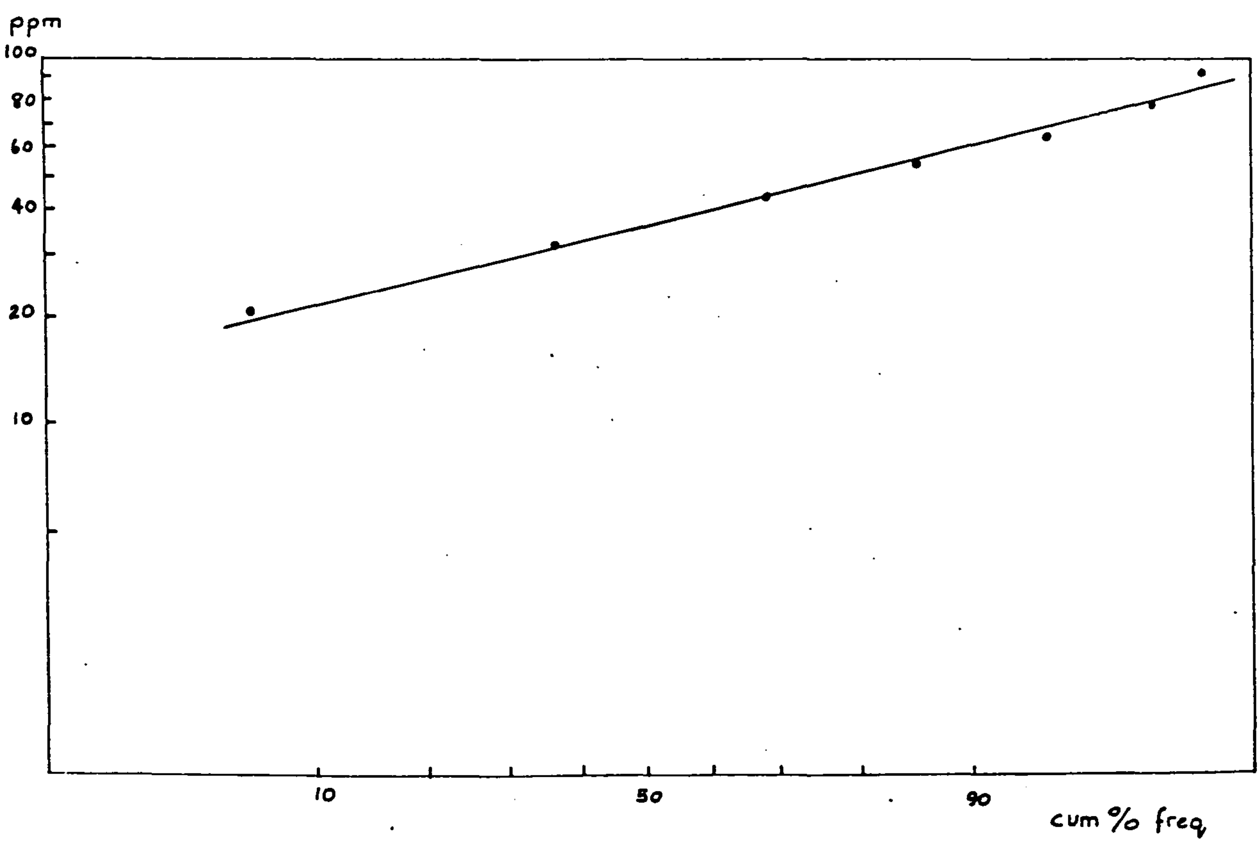


Figure 6 Distribution of zinc in the Goobarragandra Volcanics

Record 1974/122 I55/A16/1608

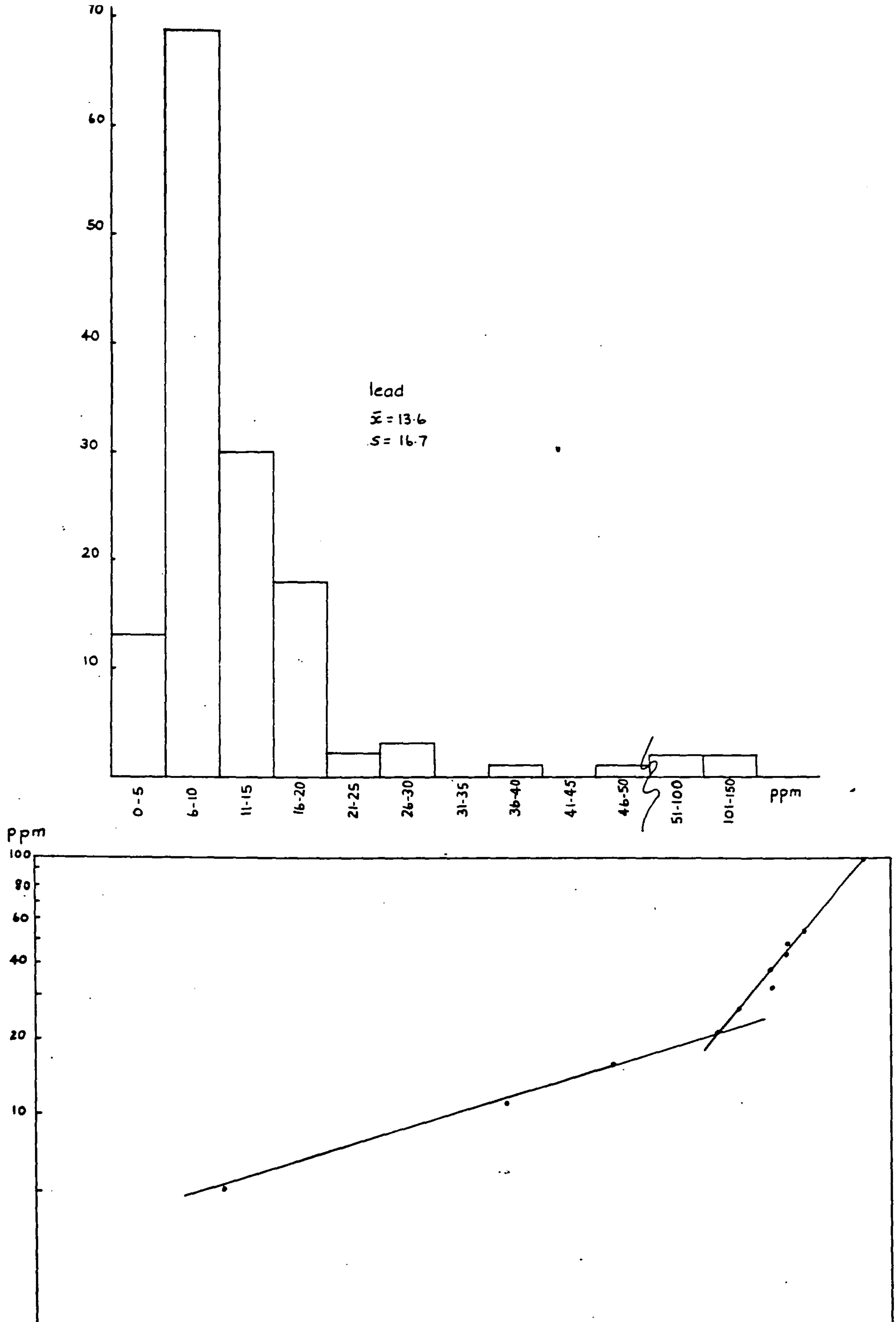
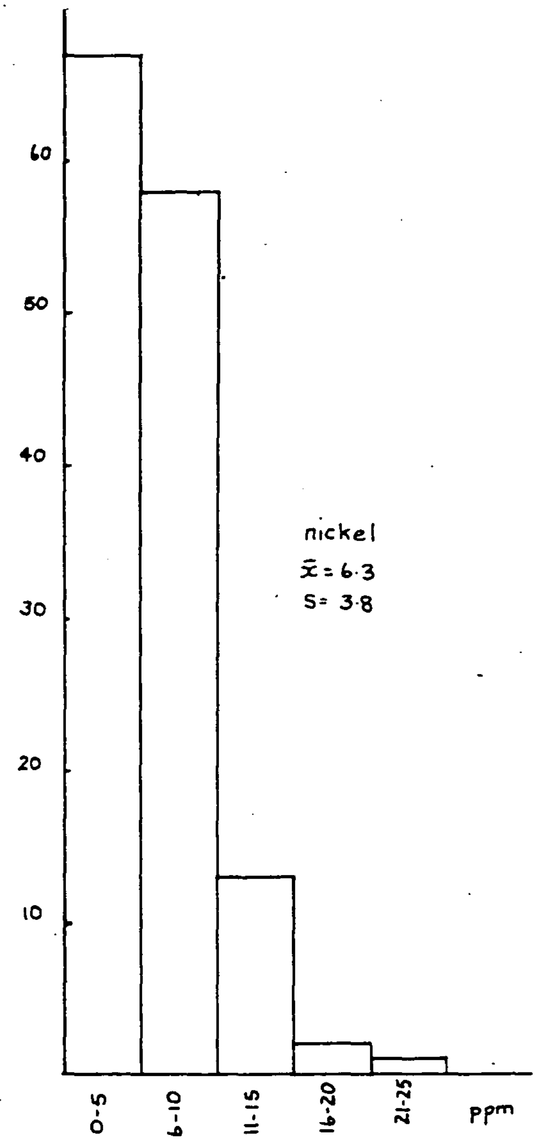


Figure 7 Distribution of lead in the Goobarragandra Volcanics

Record 1974/122

155/A16/1609



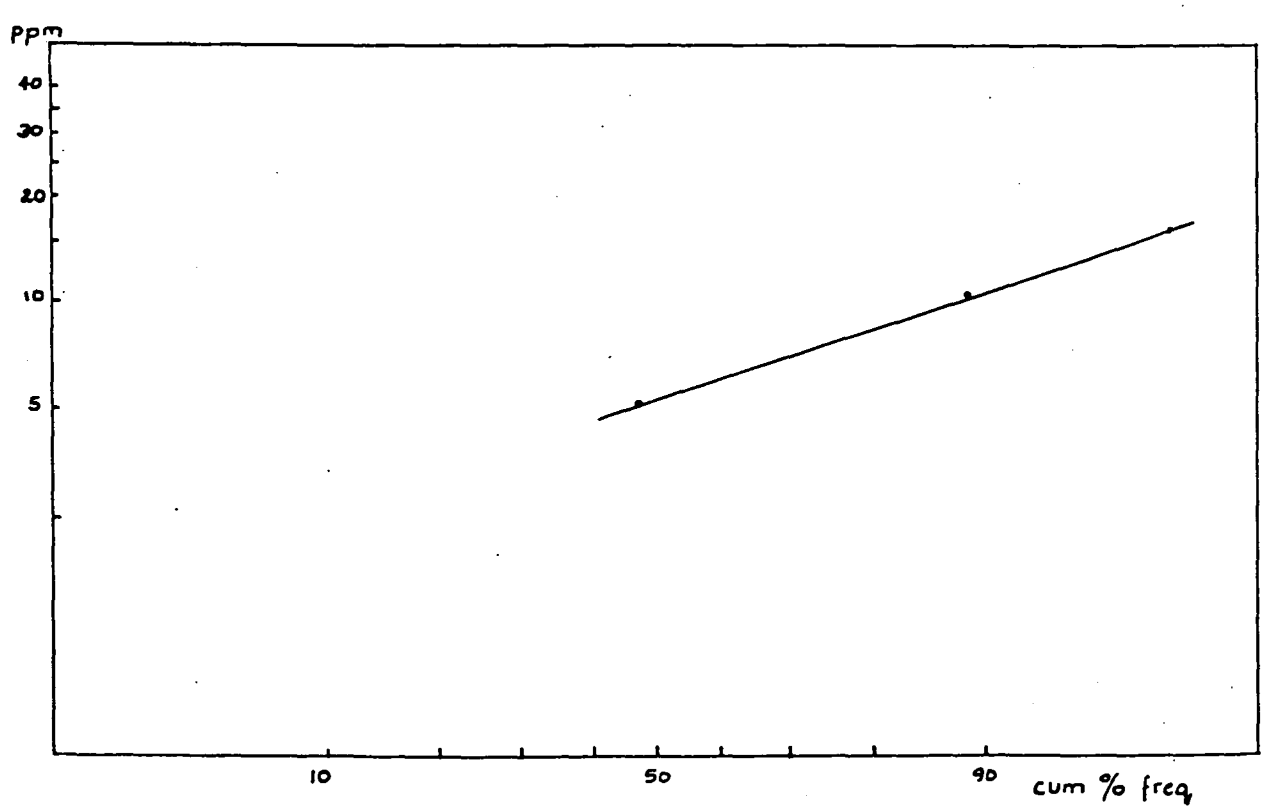
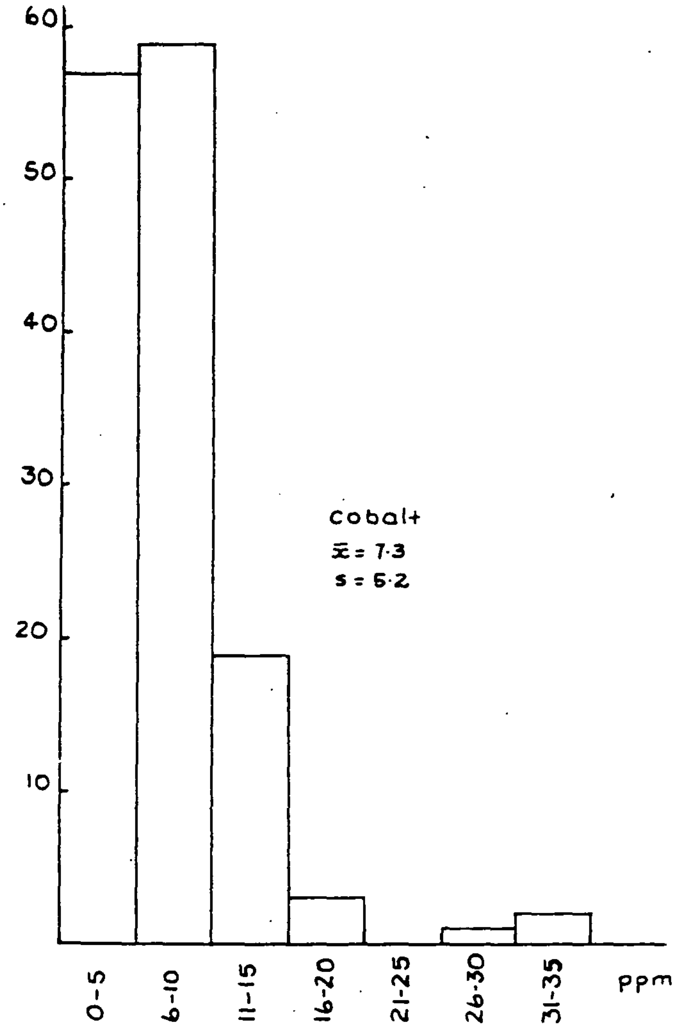


Figure 8 Distribution of nickel in the Goobarragandra Volcanics

Record 1974/122 155/A16/1610



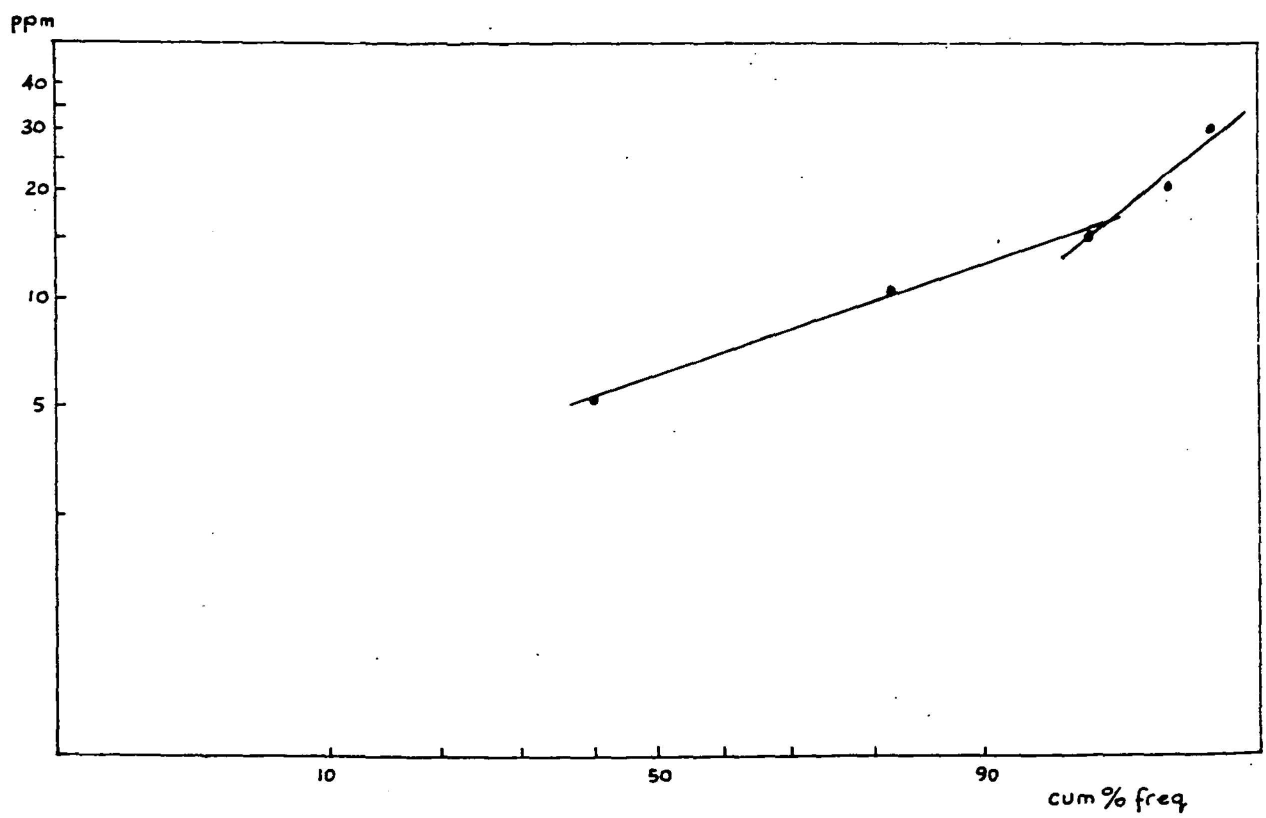
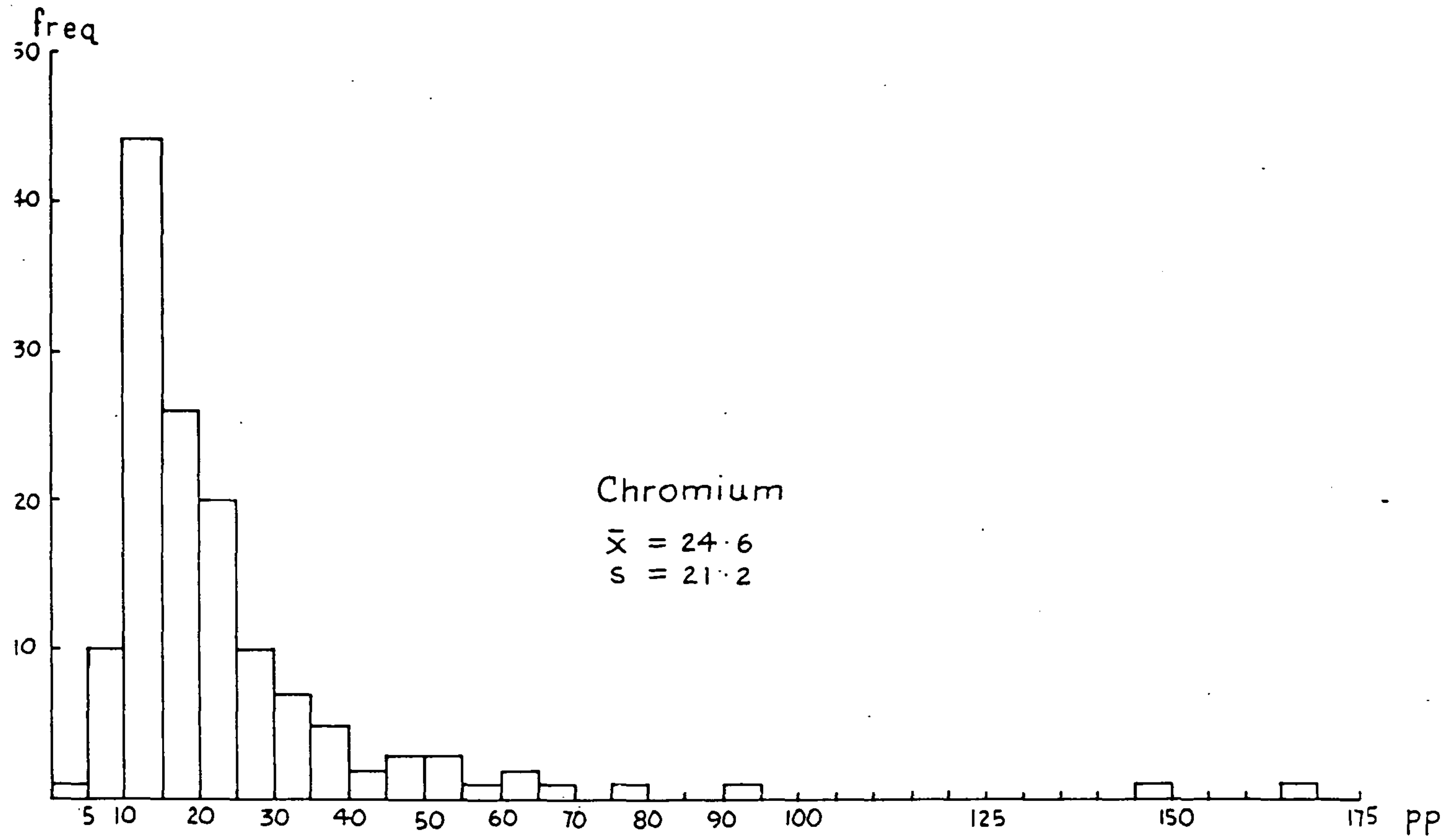


Figure 9 Distribution of cobalt in the Goobarragandra Volcanics

Record 1974/122 155/A16/1610



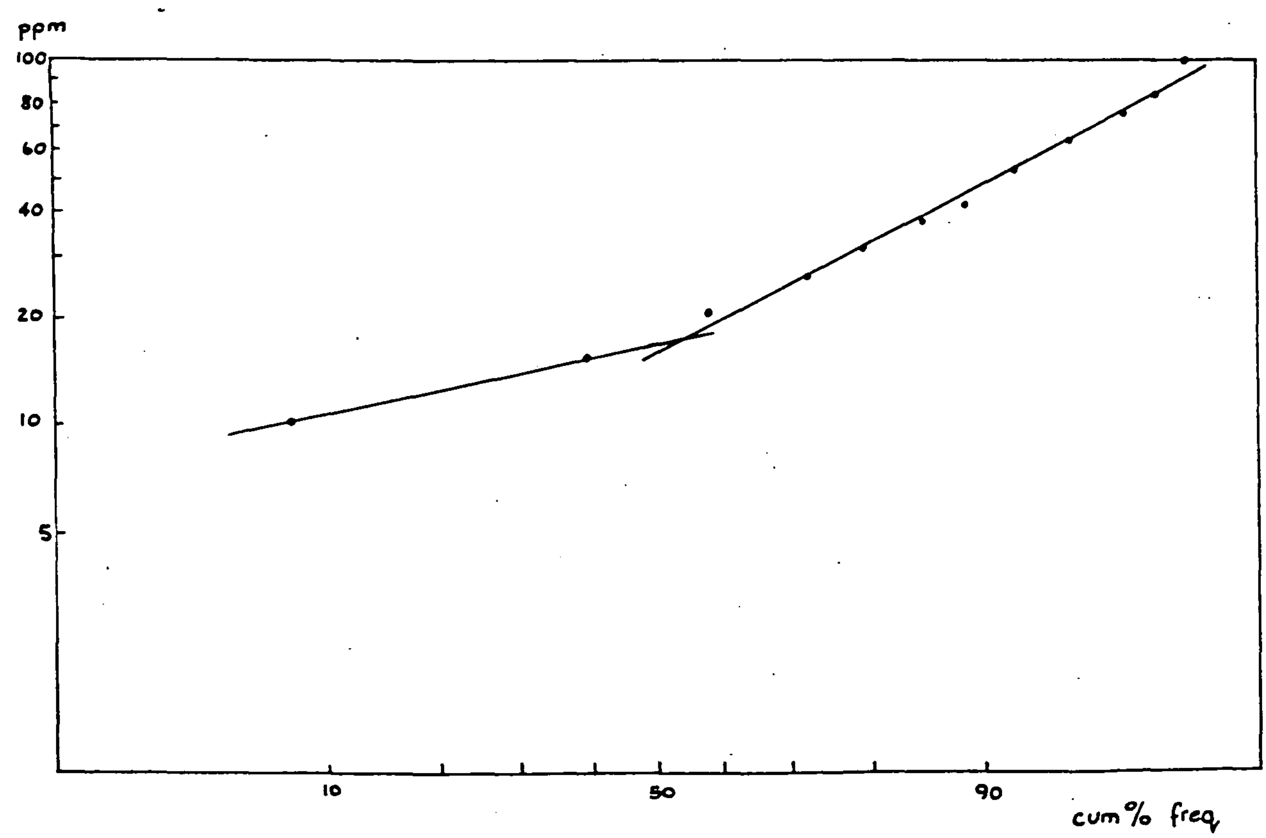


Figure 10 Distribution of chromium in the Goobarragandra Volcanics

Record 1974/122 155/A16/1612

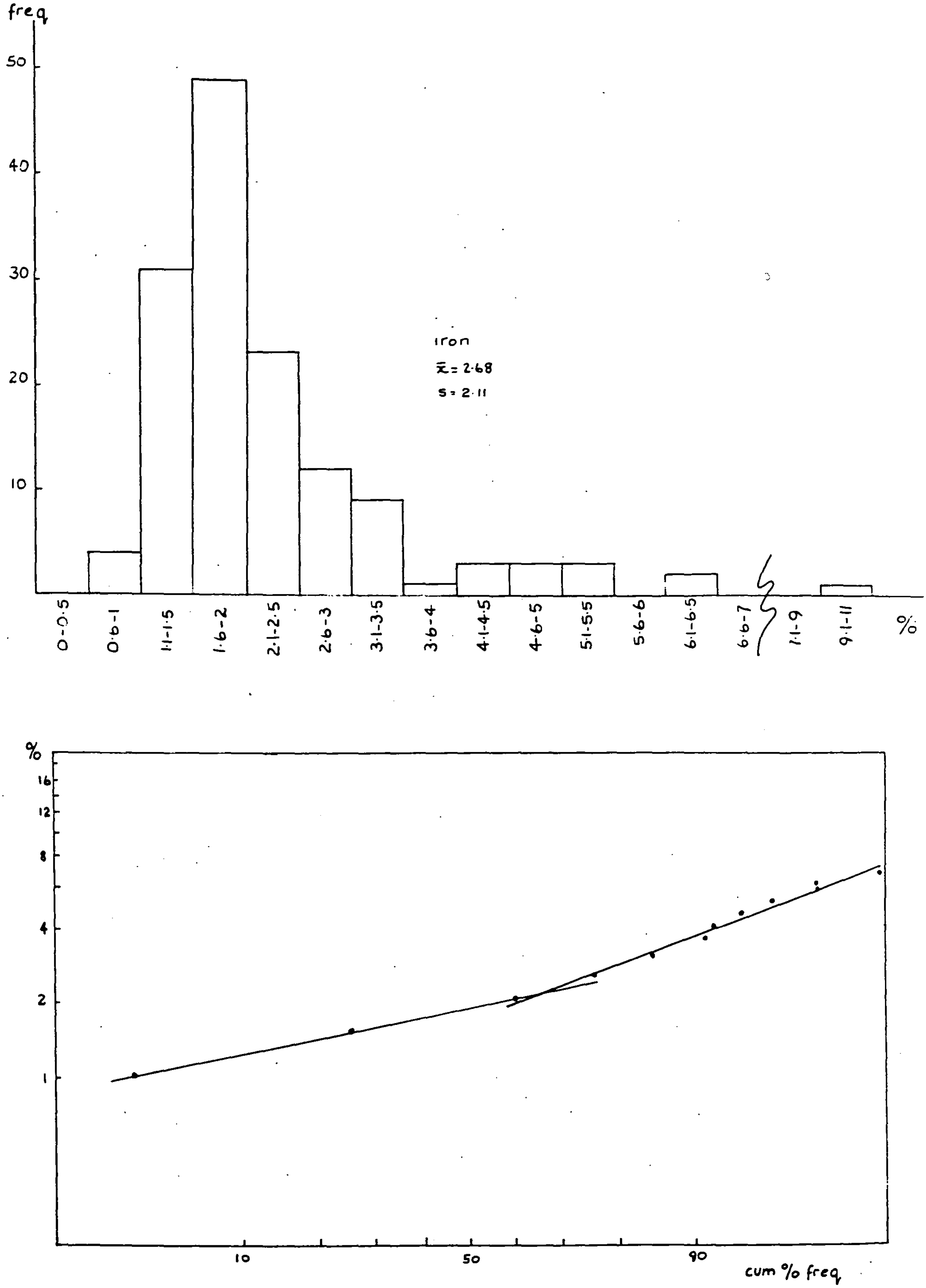
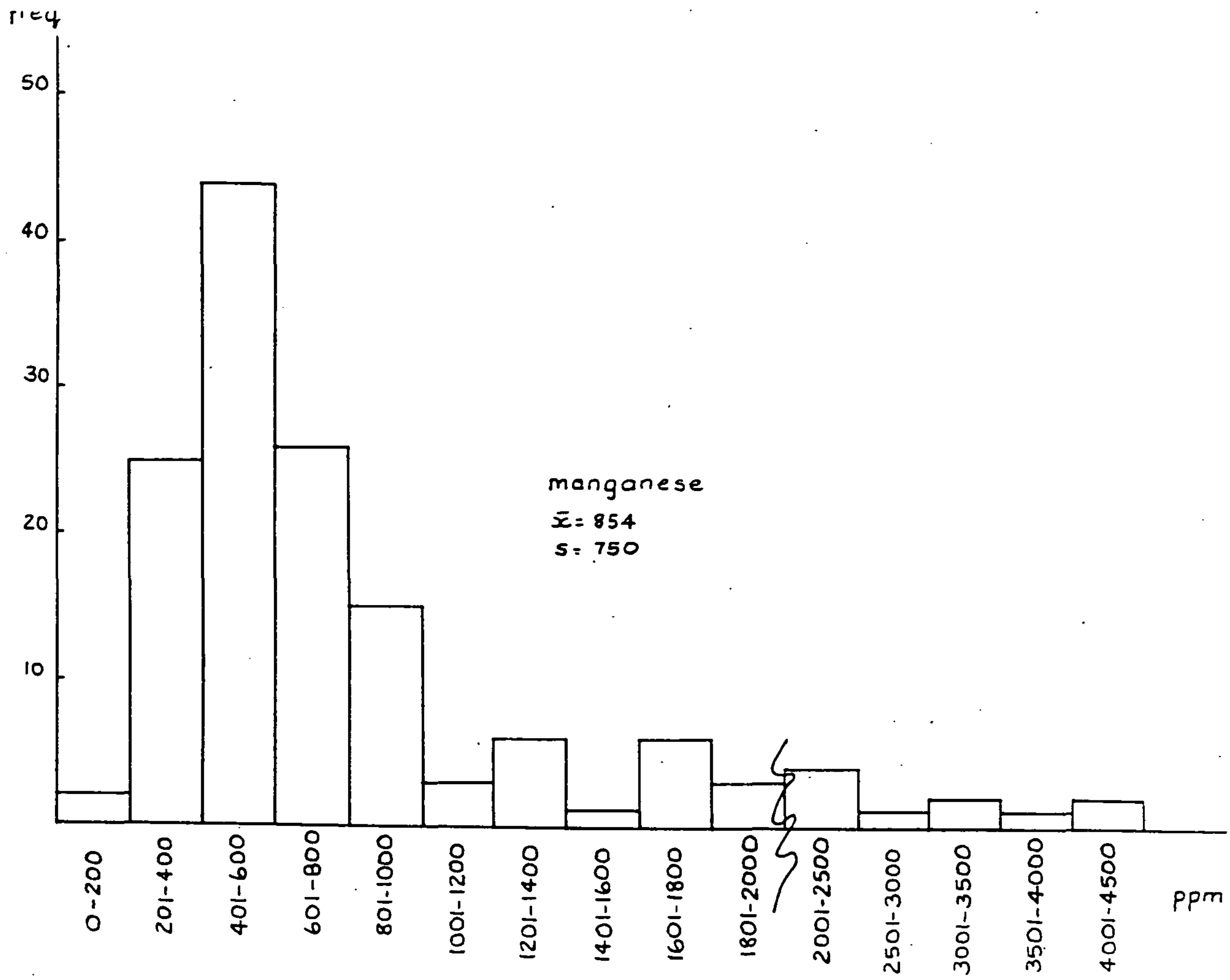


Figure 11 Distribution of iron in the Goobarragandra Volcanics

Record 1974/122 155/A16/1613



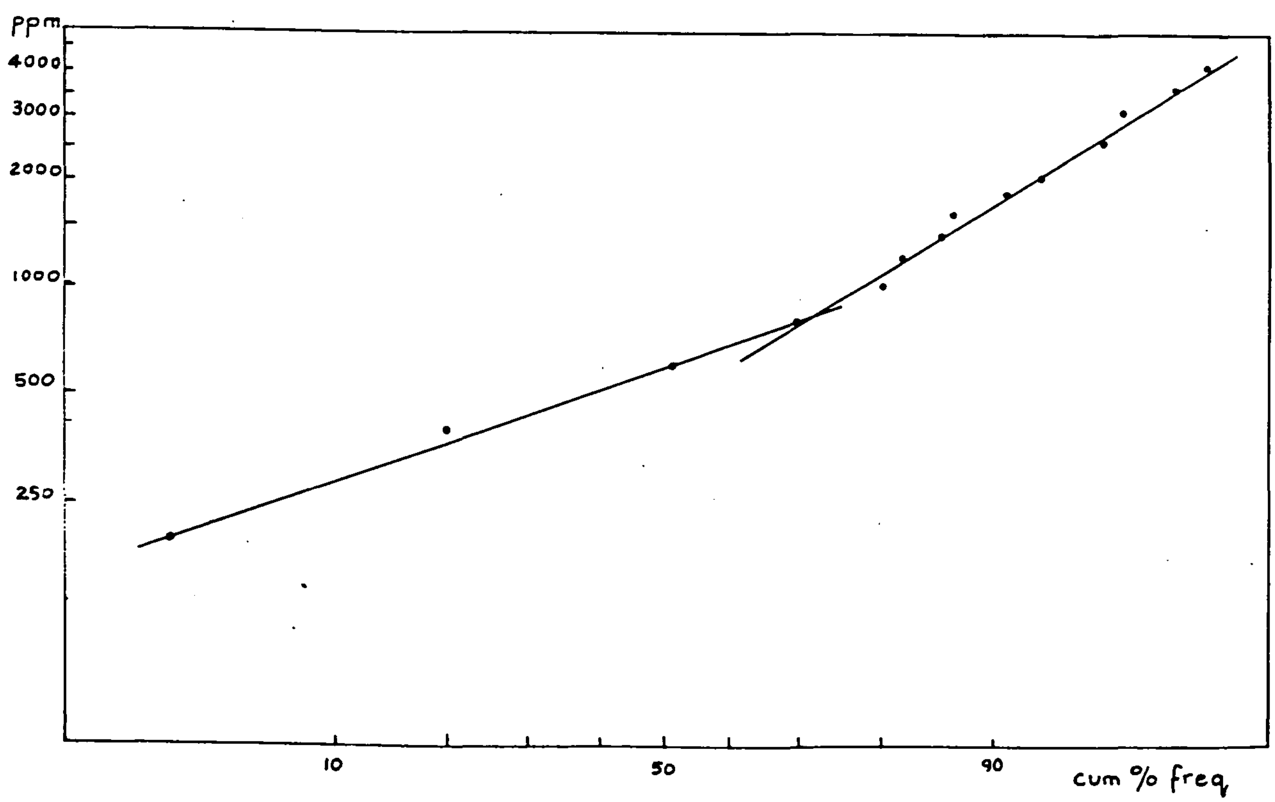


Figure 12 Distribution of manganese in the Goobarragandra Volcanics

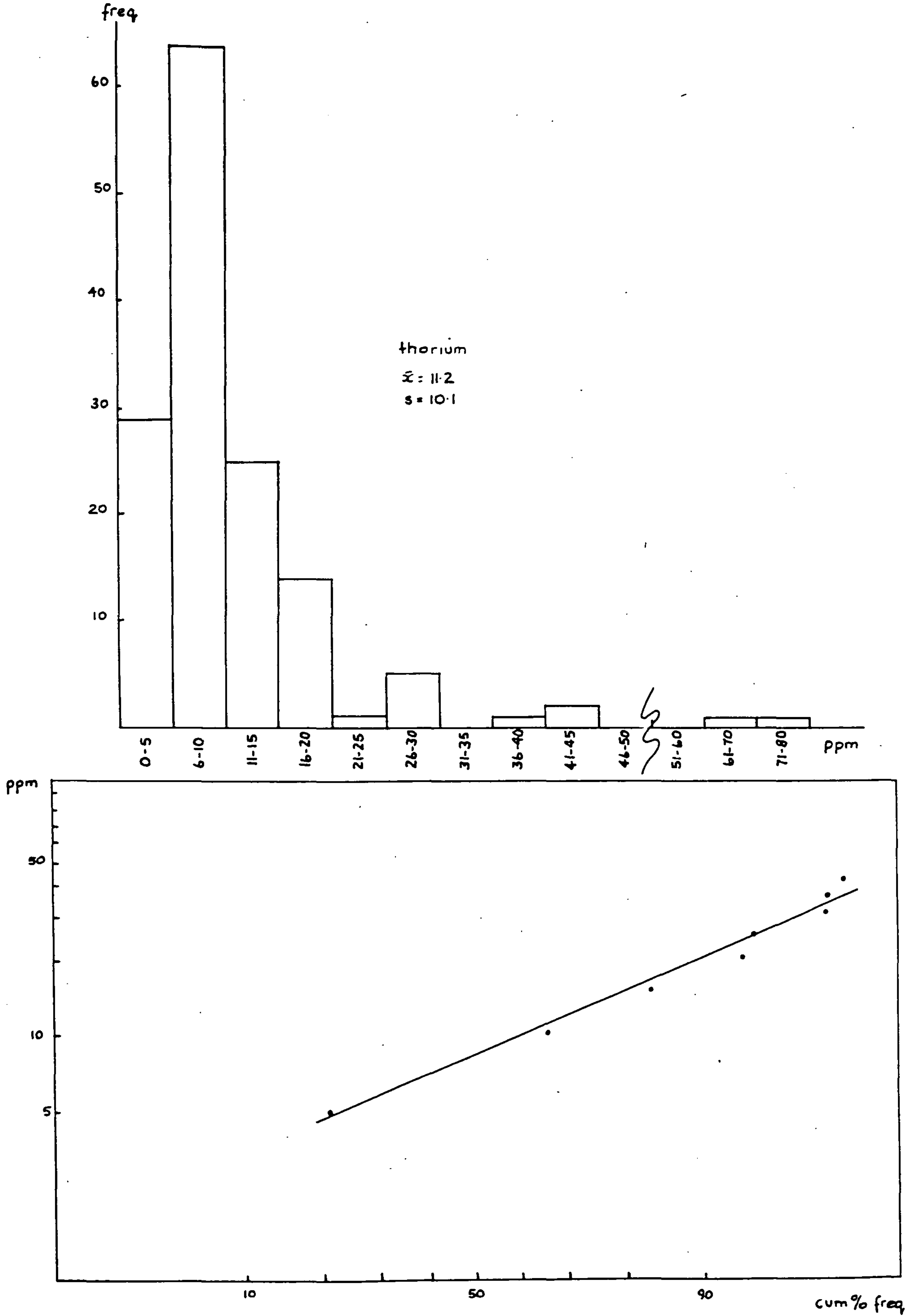
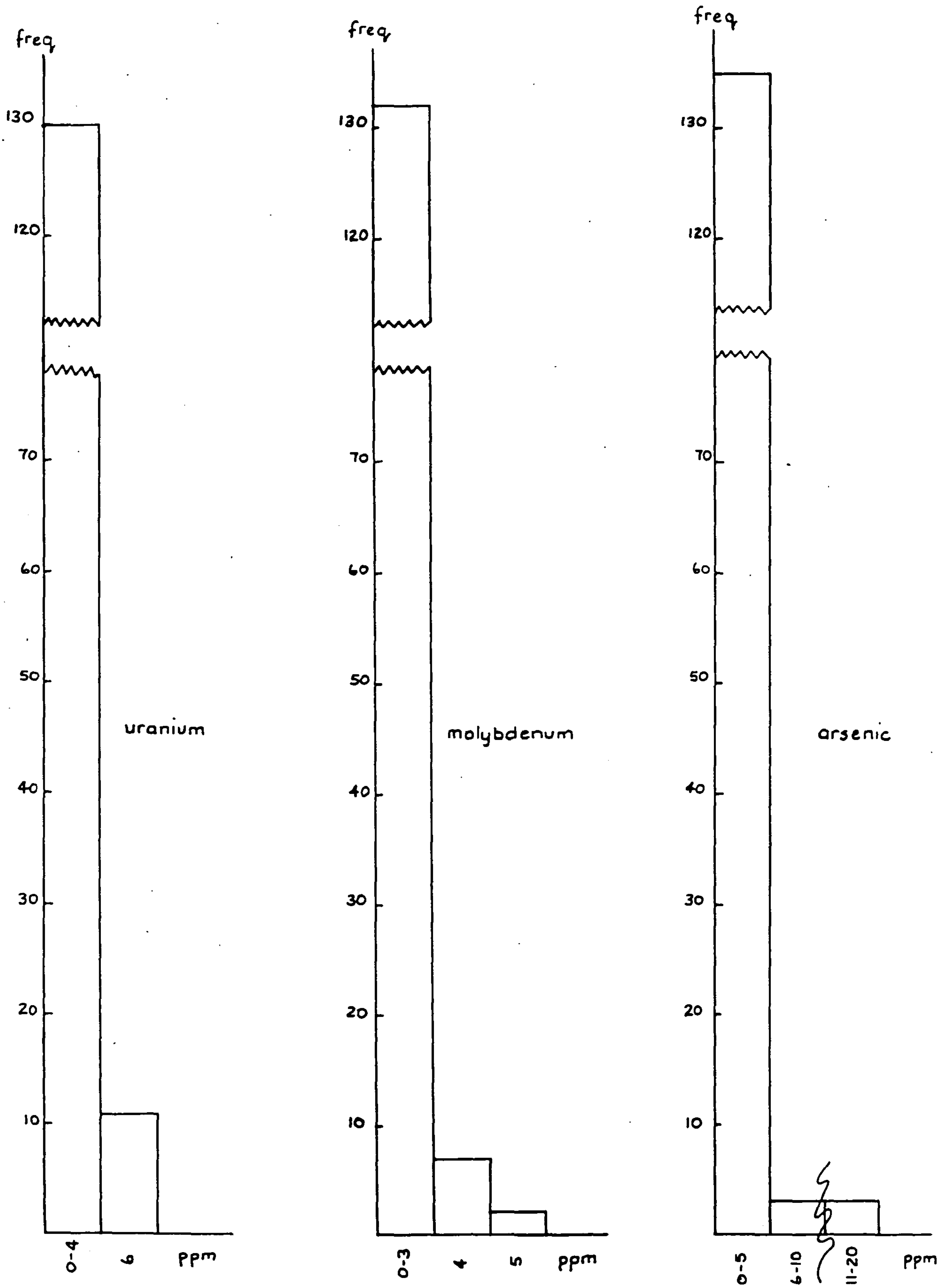


Figure 13 Distribution of thorium in the Goobarragandra Volcanics

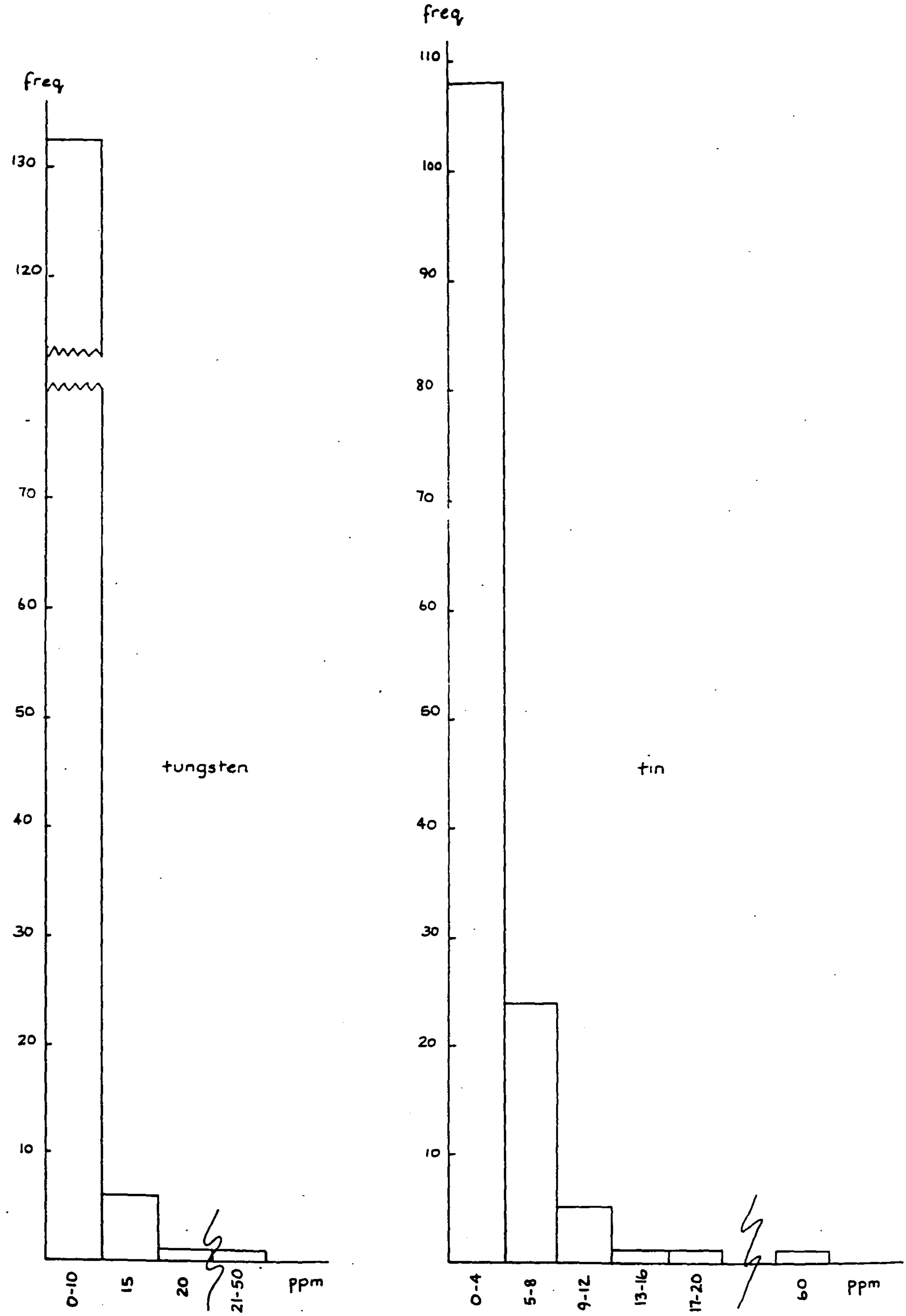
Record 1974/122 155/A16/1615



Record 1974/122

155/A16/1616

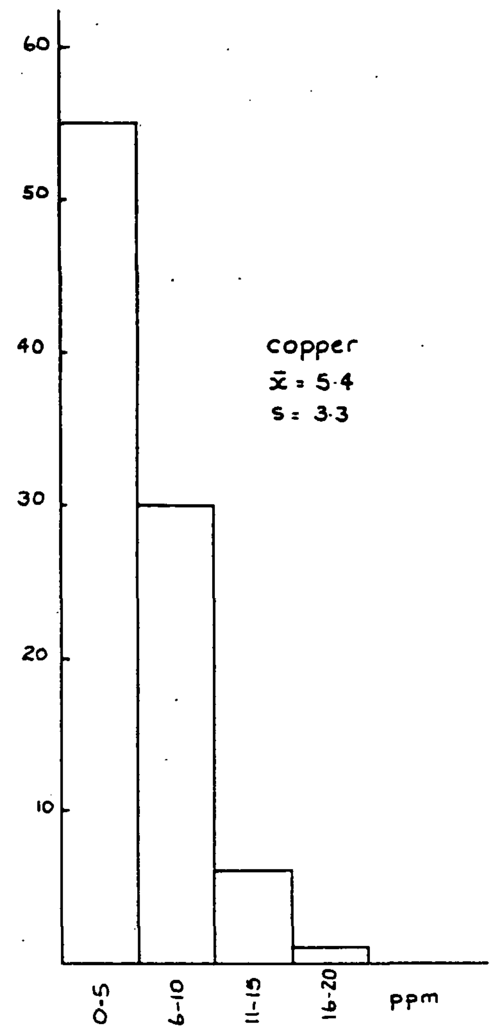
Figure 14 Frequency distributions of uranium, molybdenum and arsenic in the Goobarragandra Volcanics



Record 1974/122

155/A16/1617

Figure 15 Frequency distributions for tungsten and tin in the Goobarragandra Volca



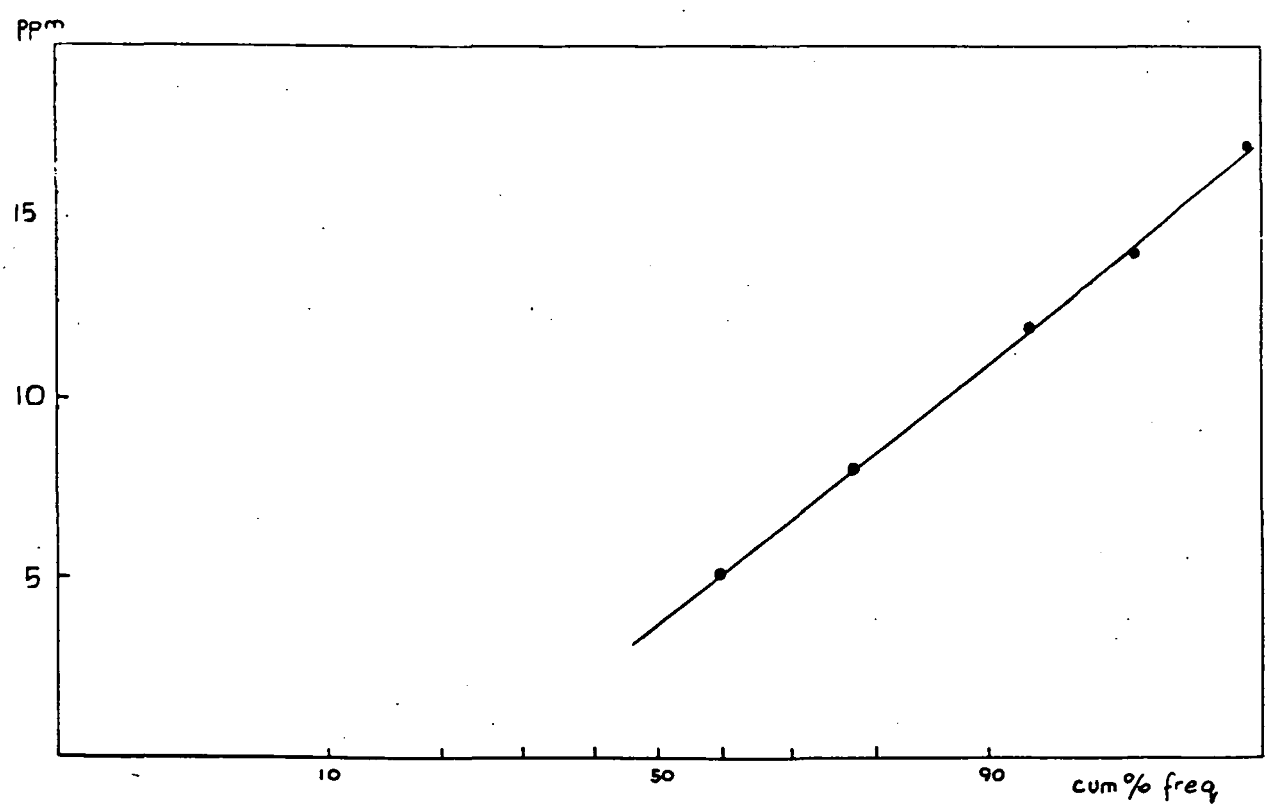
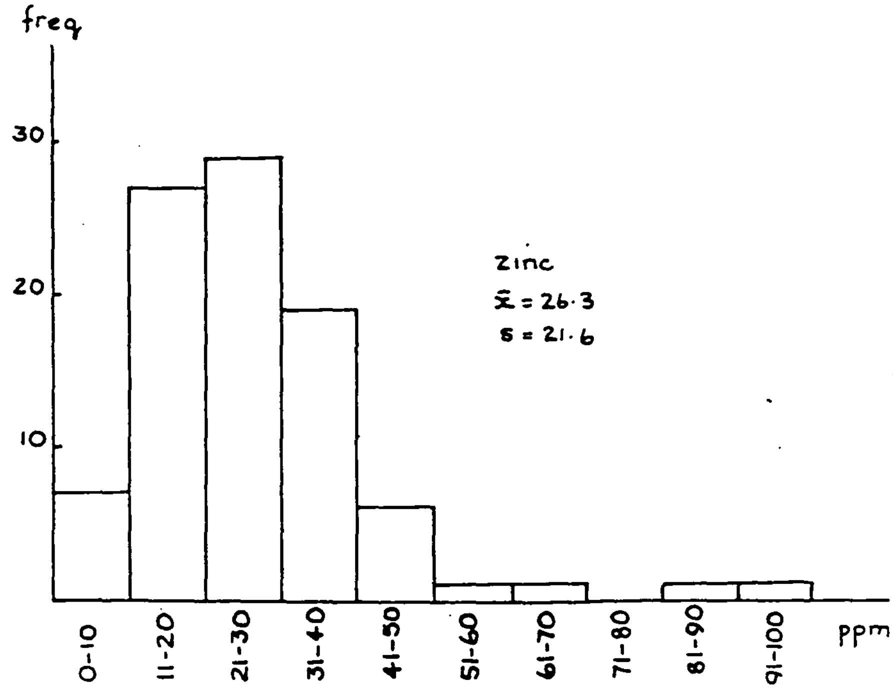
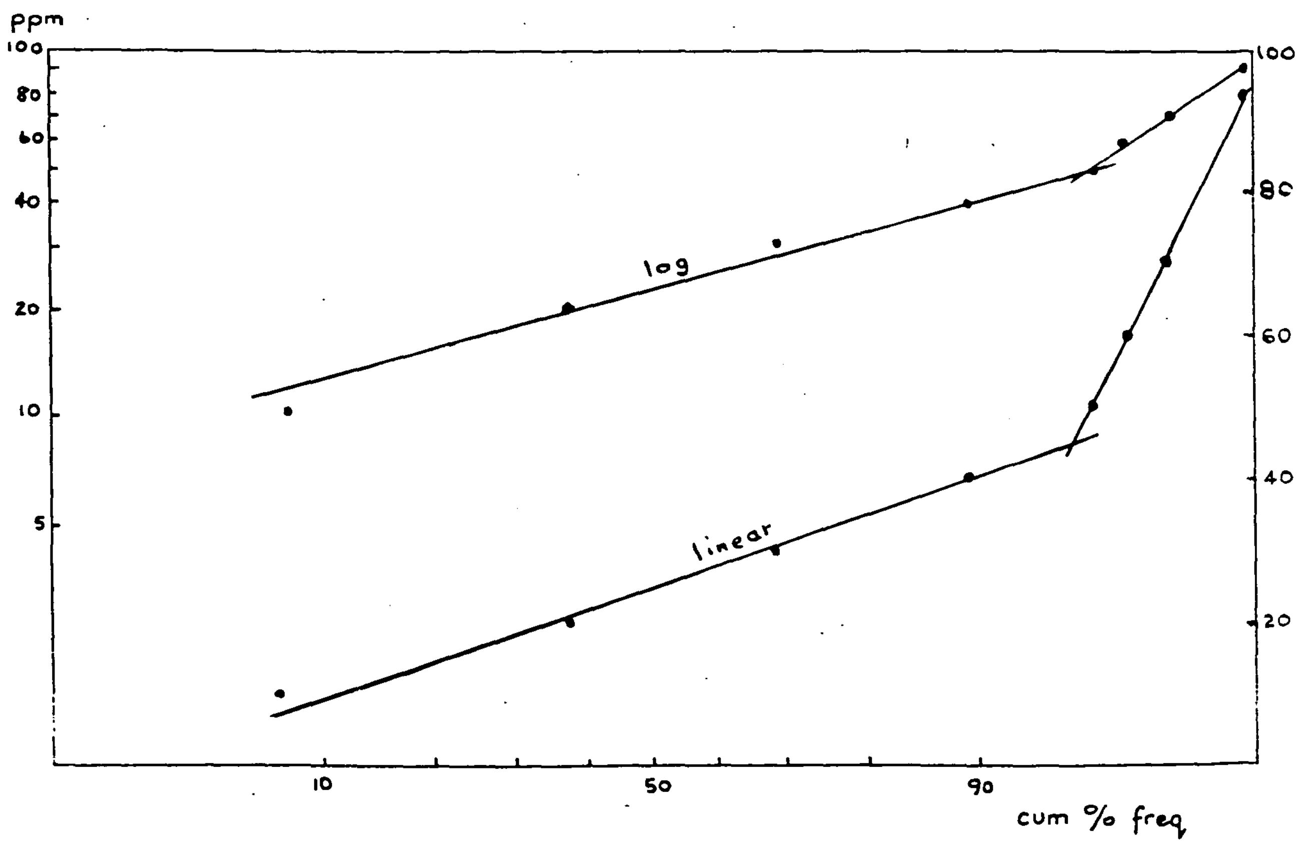


Figure 15 Distribution of copper in the Young Granodiorite

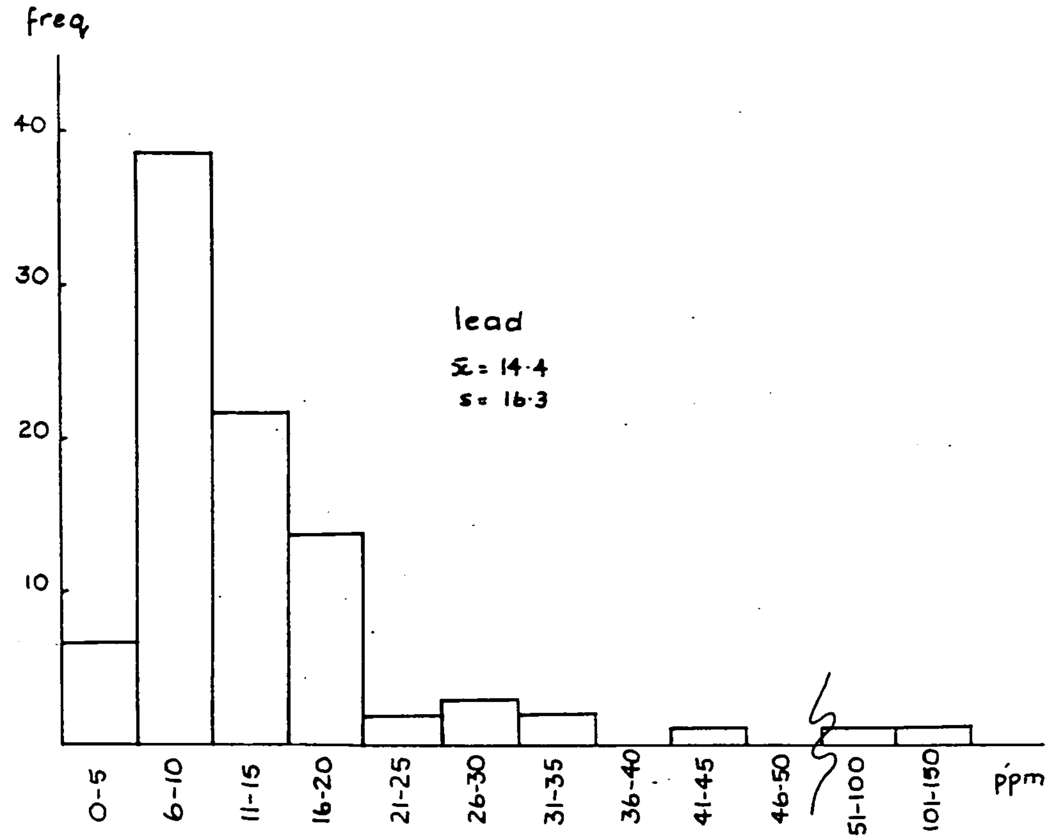


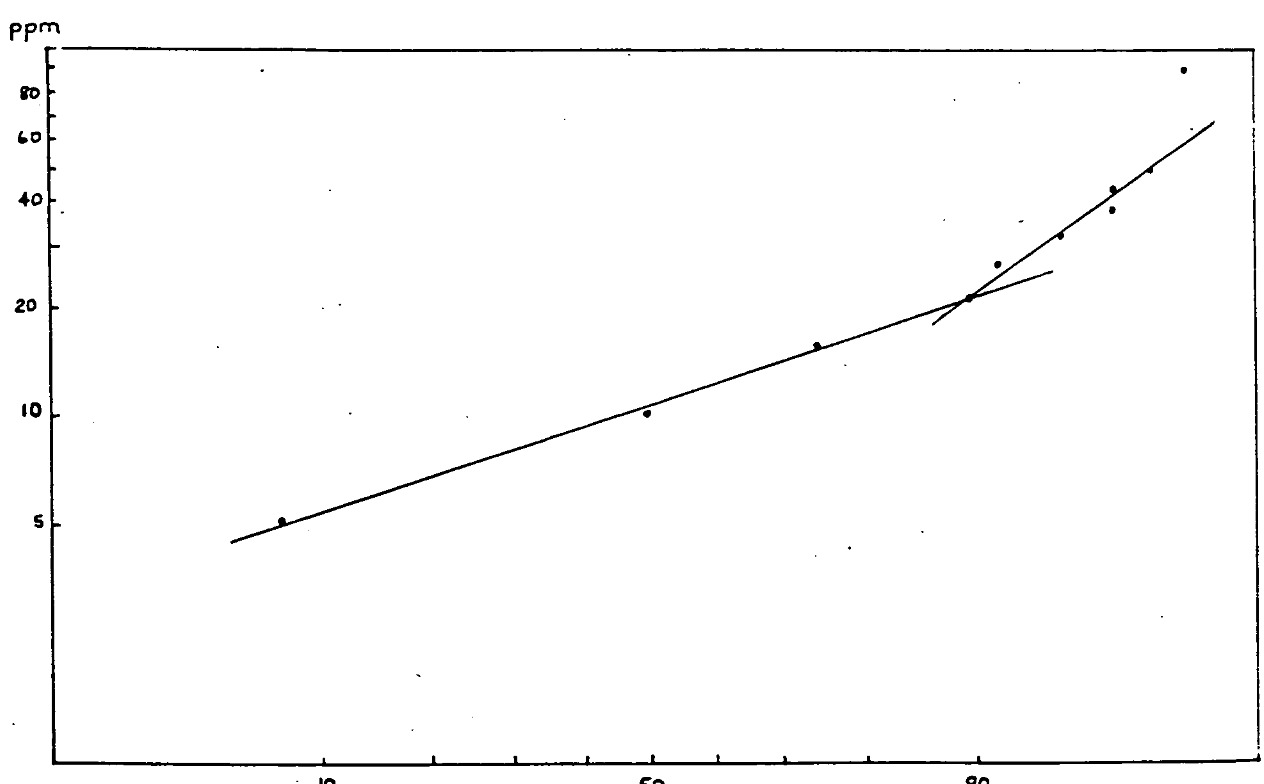


Record 1974/122

155/A16/1619

Figure 17 Distribution of zinc in the Young Granodiorite

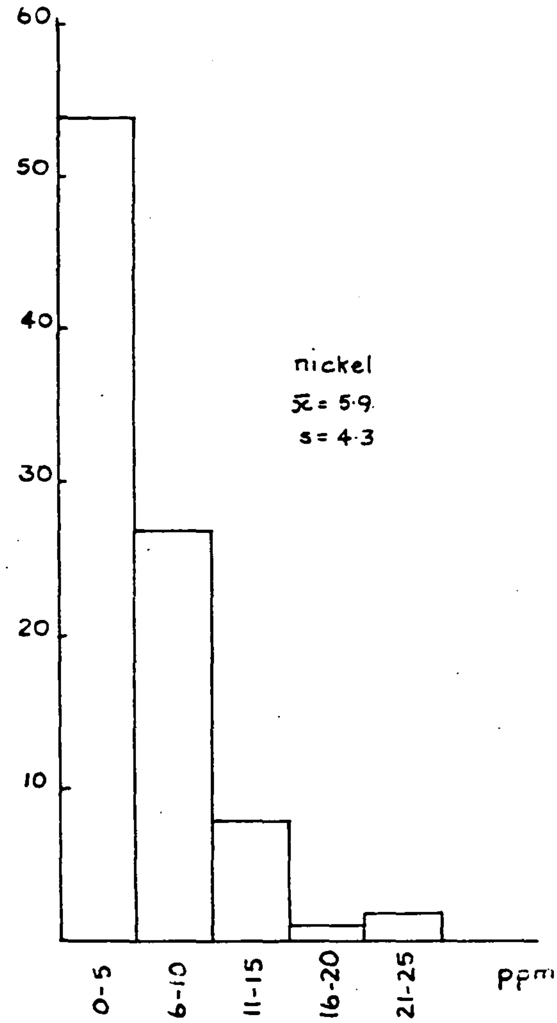


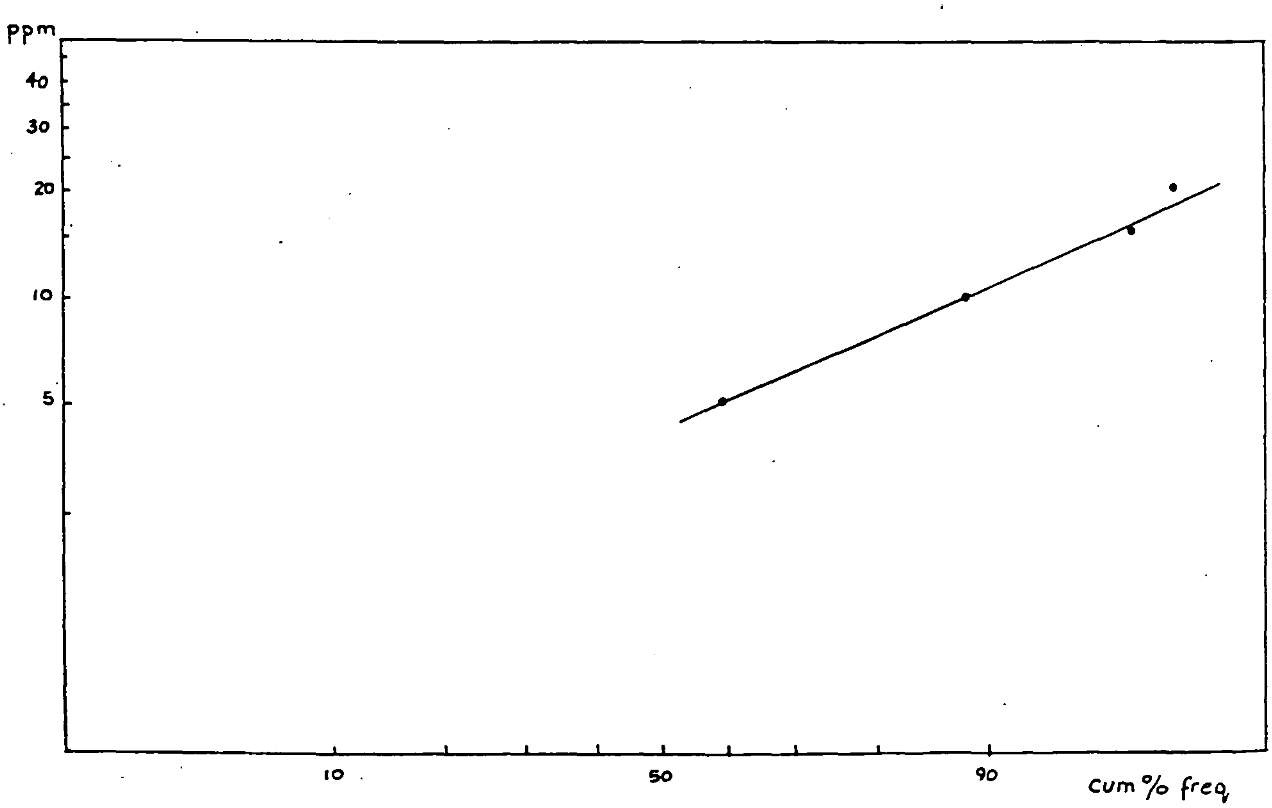


Record 1974/122

I 55/A16/1620

Figure 18 Distribution of lead in the Young Granodiorite

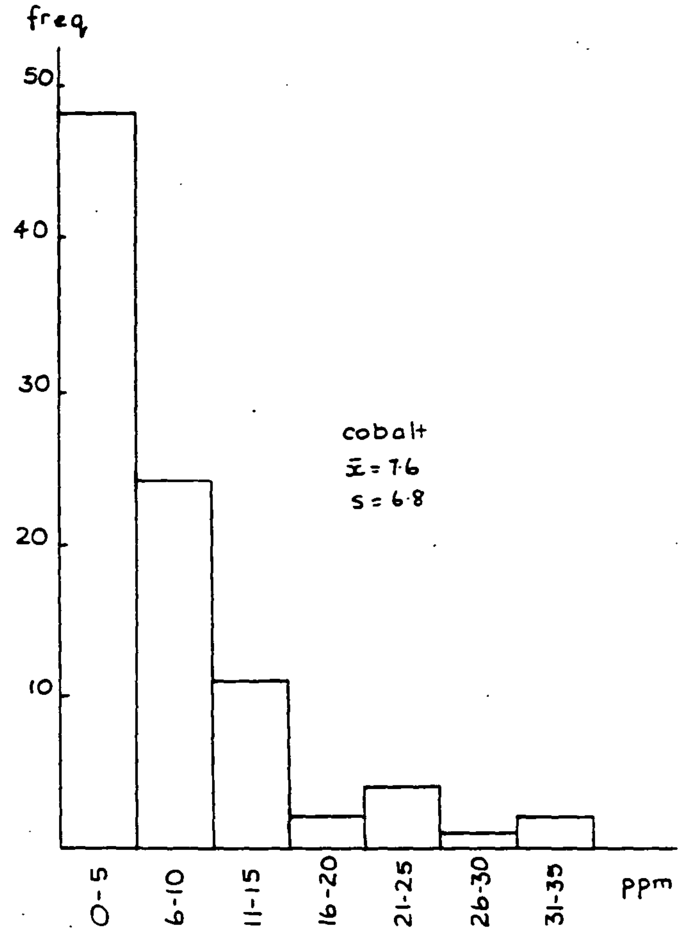


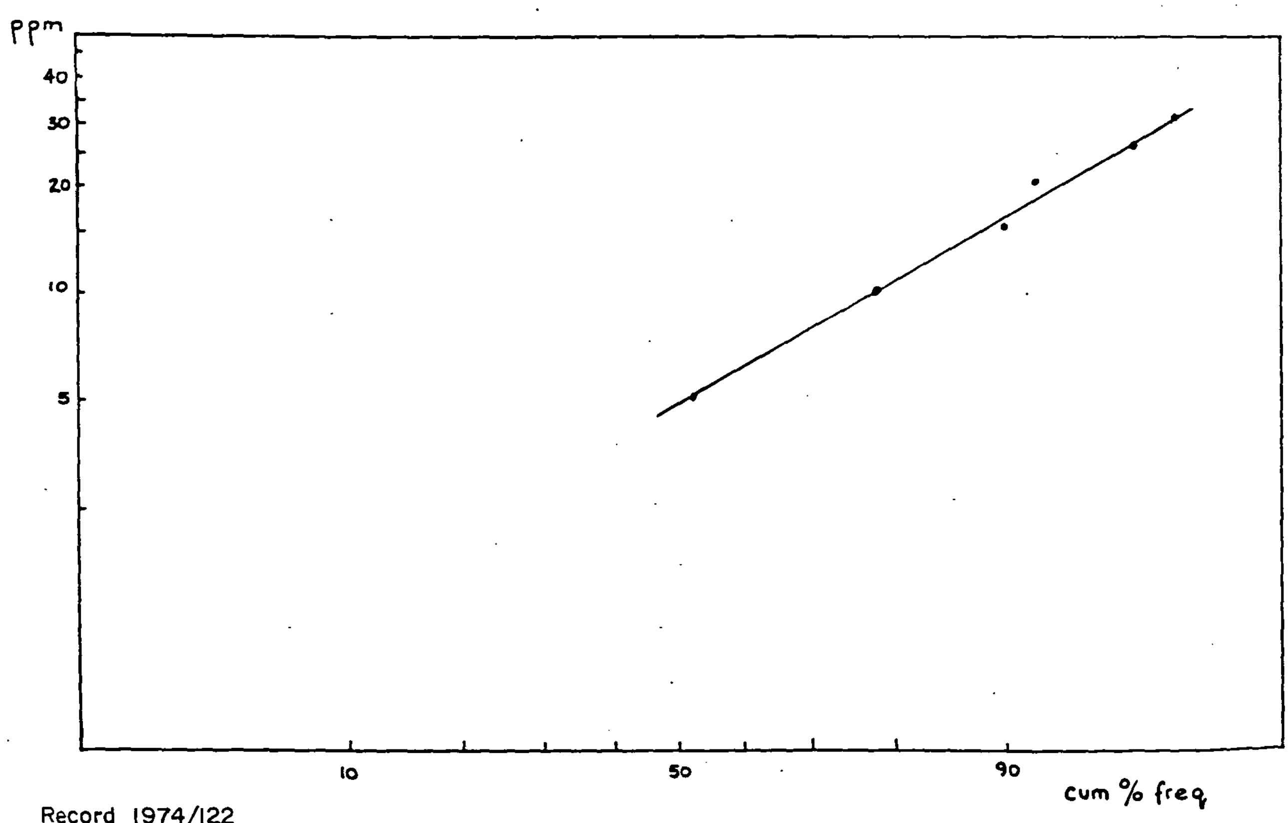


Record 1974/122

I 55/A16/1621

Figure 19 Distribution of nickel in the Young Granodiorite





Record 1974/122

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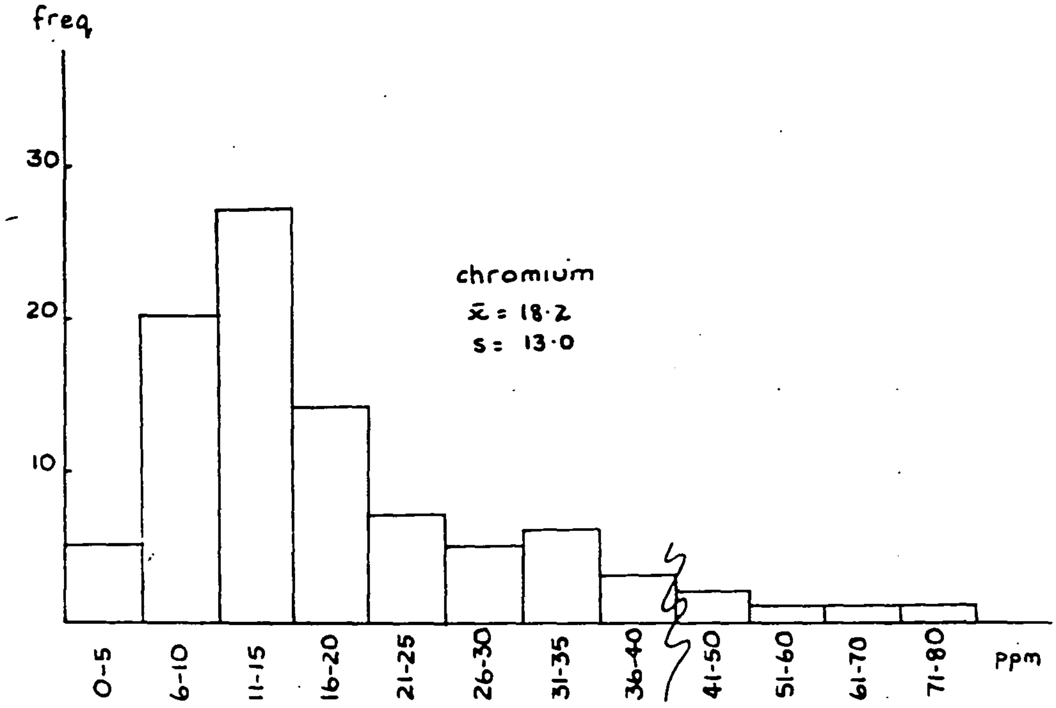
Figure 20 Distribution of cobalt in the Young Granodiorite



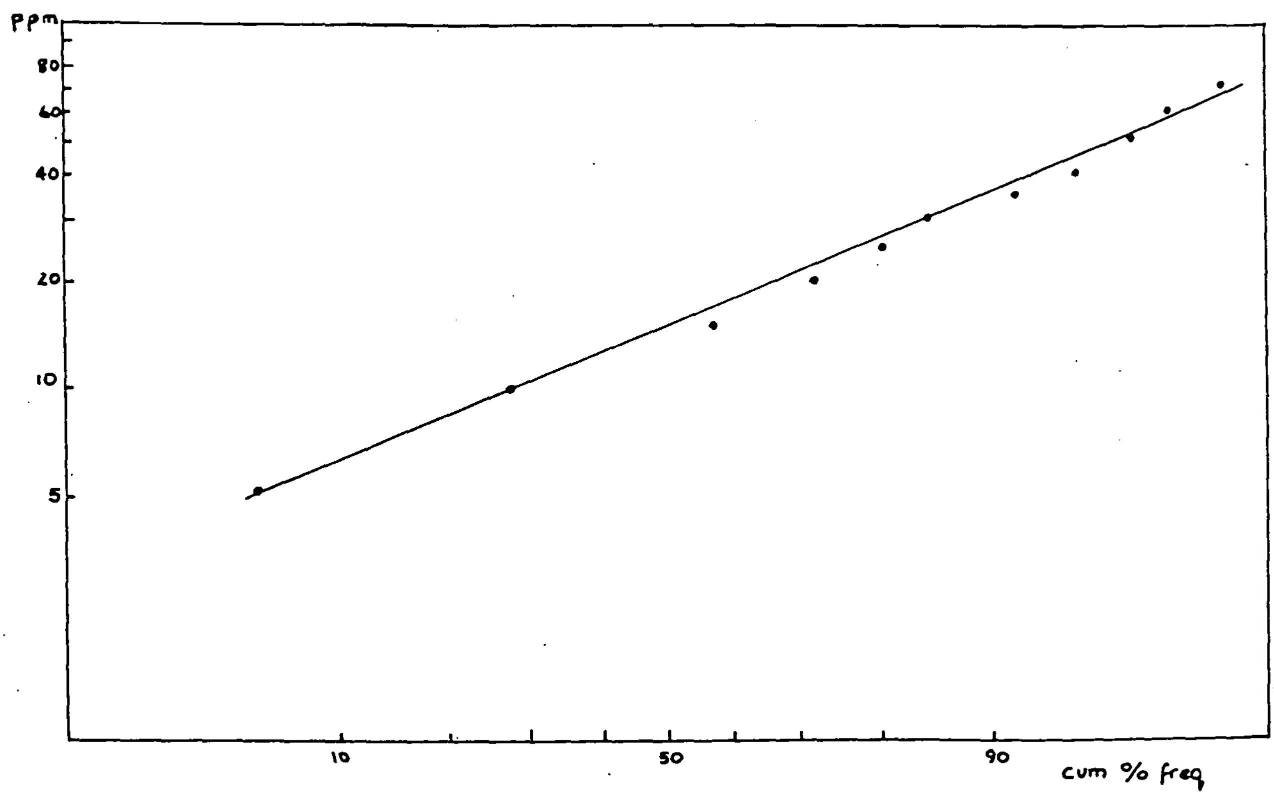


Figure 21 Distribution of chromium in the Young Granodiorite

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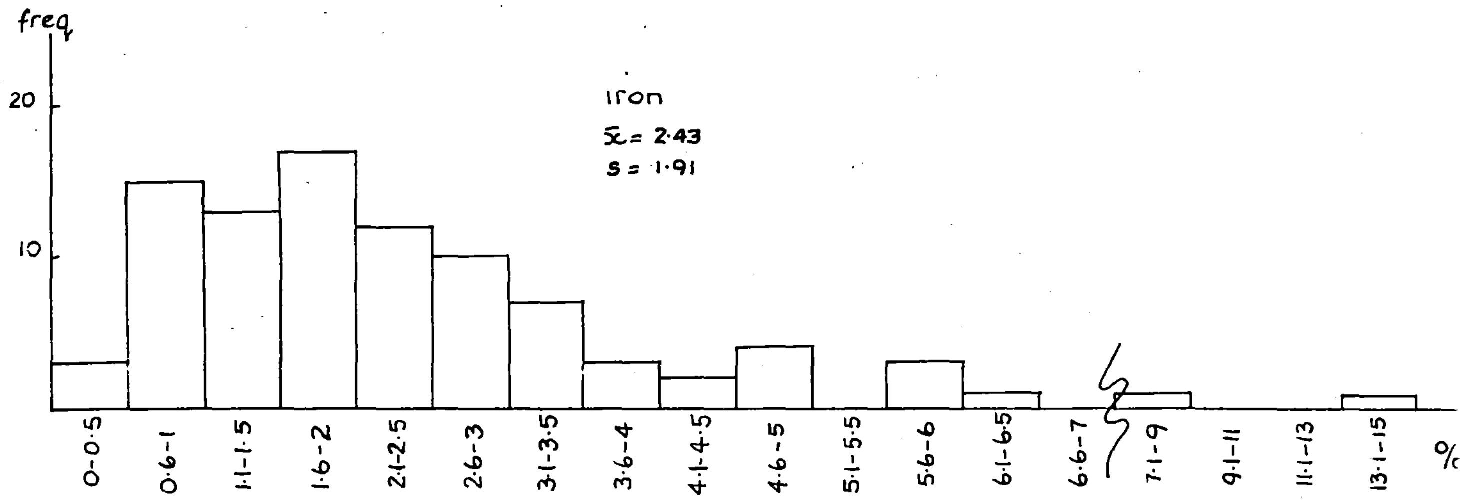

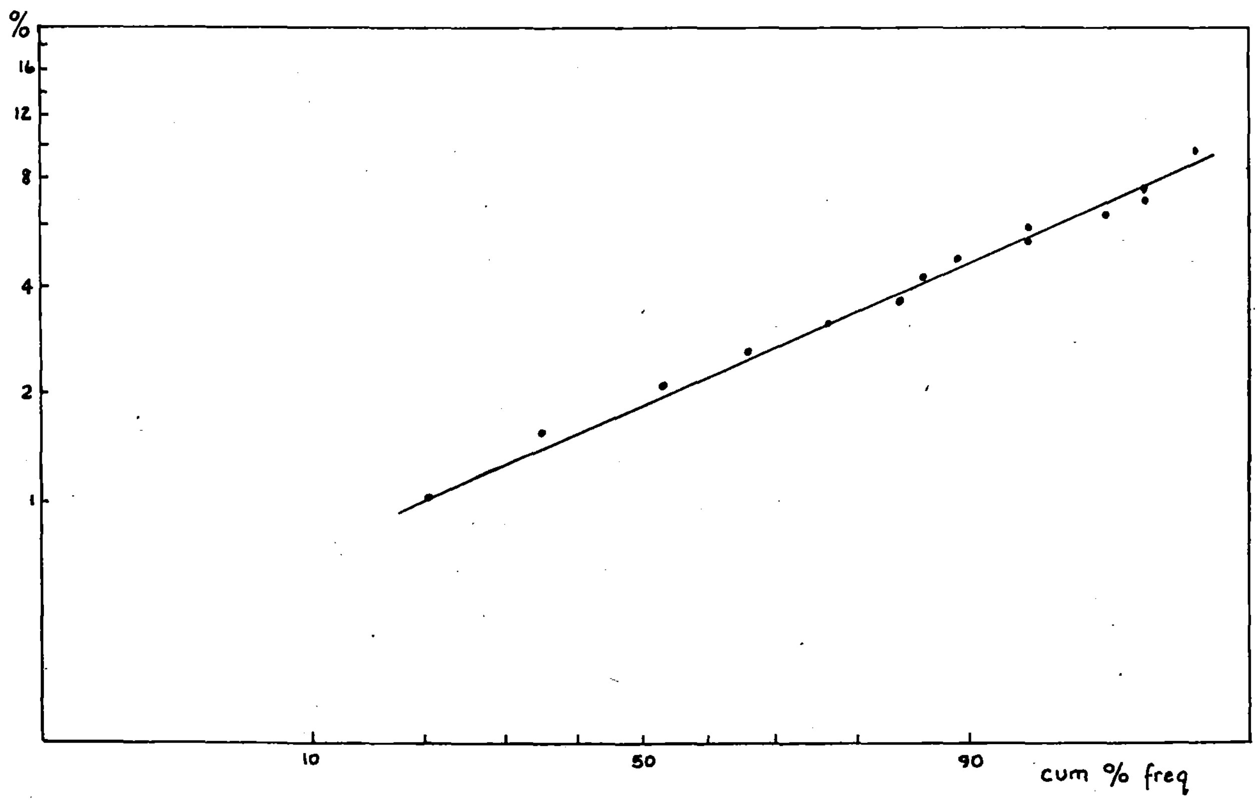

Figure 22 Distribution of iron in the Young Granodiorite

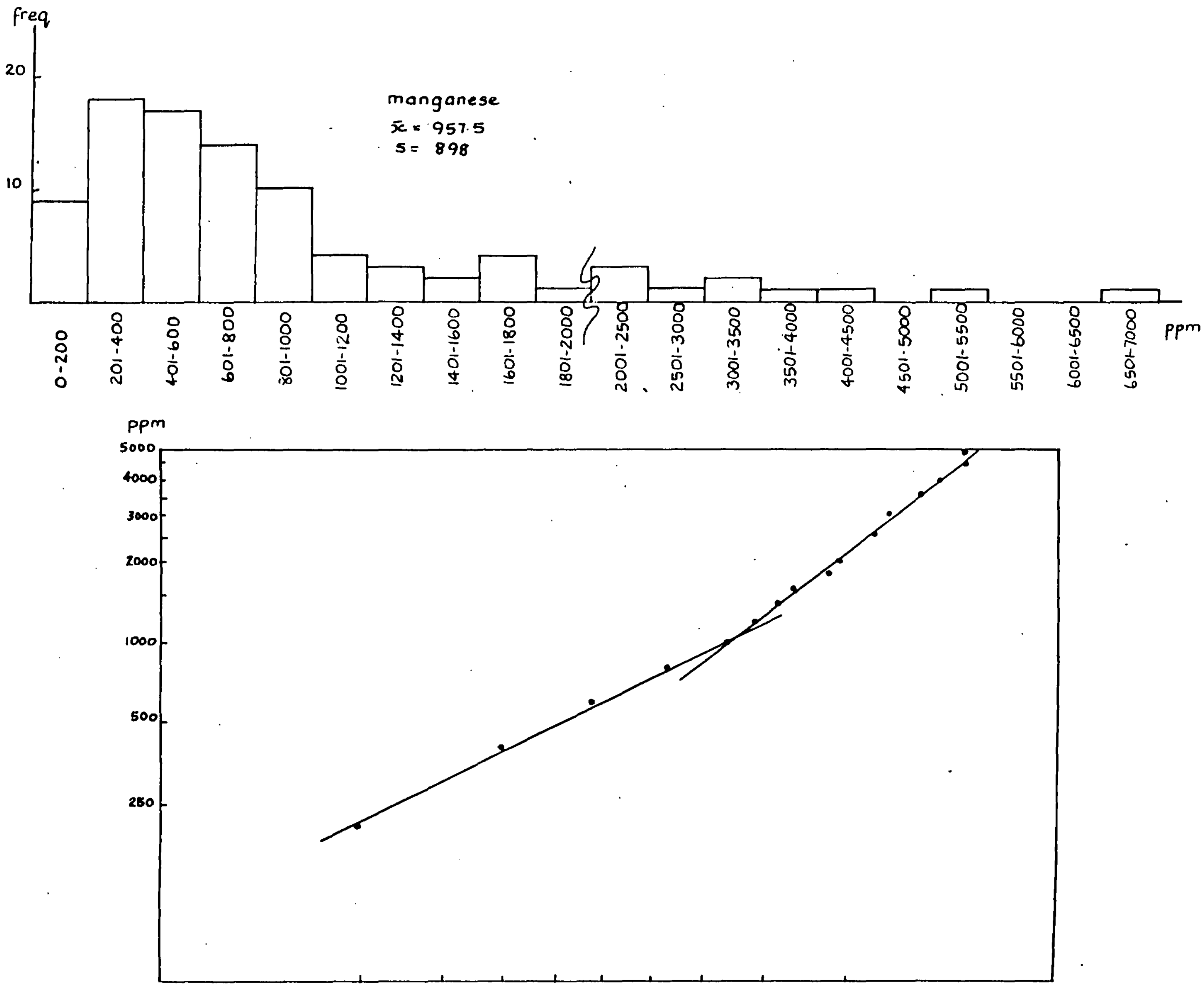

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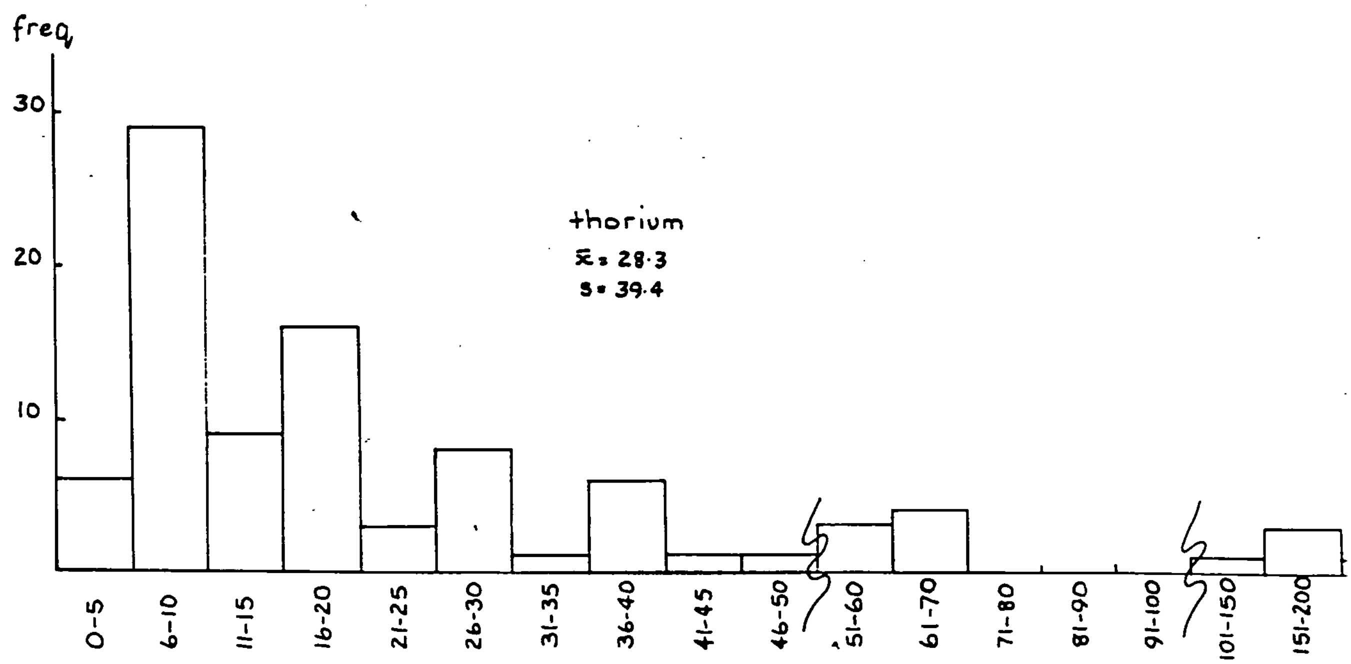
Figure 23 Distribution of manganese in the Young Granodiorite



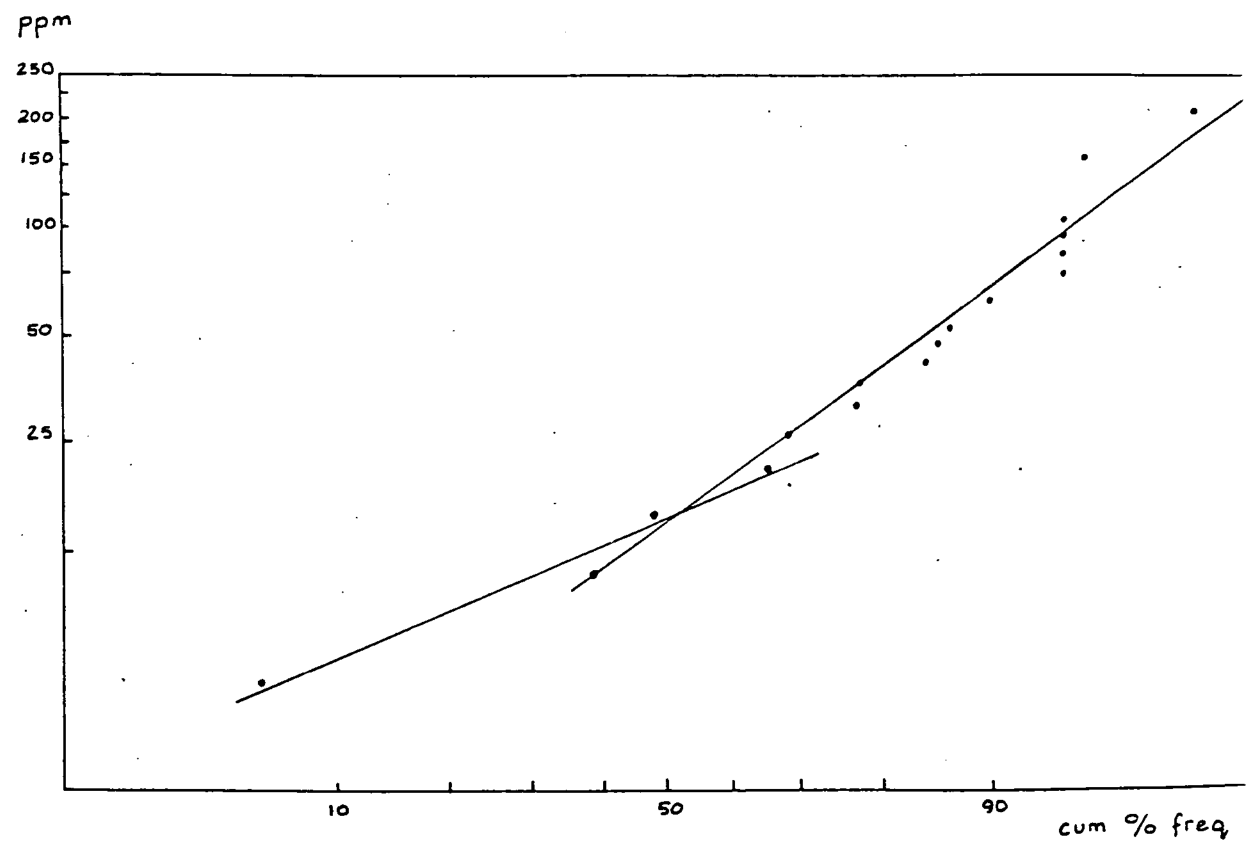


Figure 24 Distribution of thorium in the Young Granodiorite

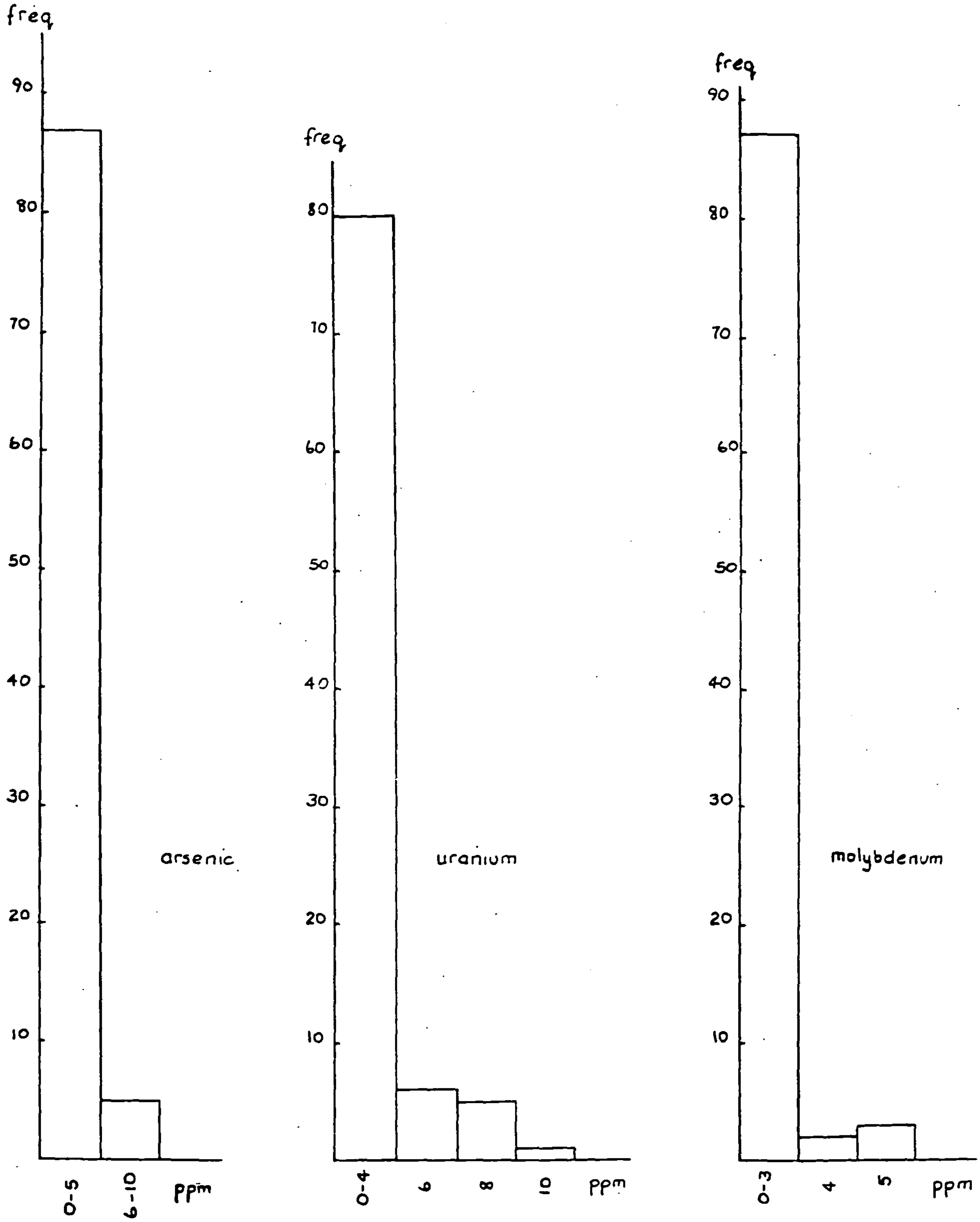


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Figure 25 Frequency distributions of arsenic, uranium and molybdenum in the Young Granodiorite

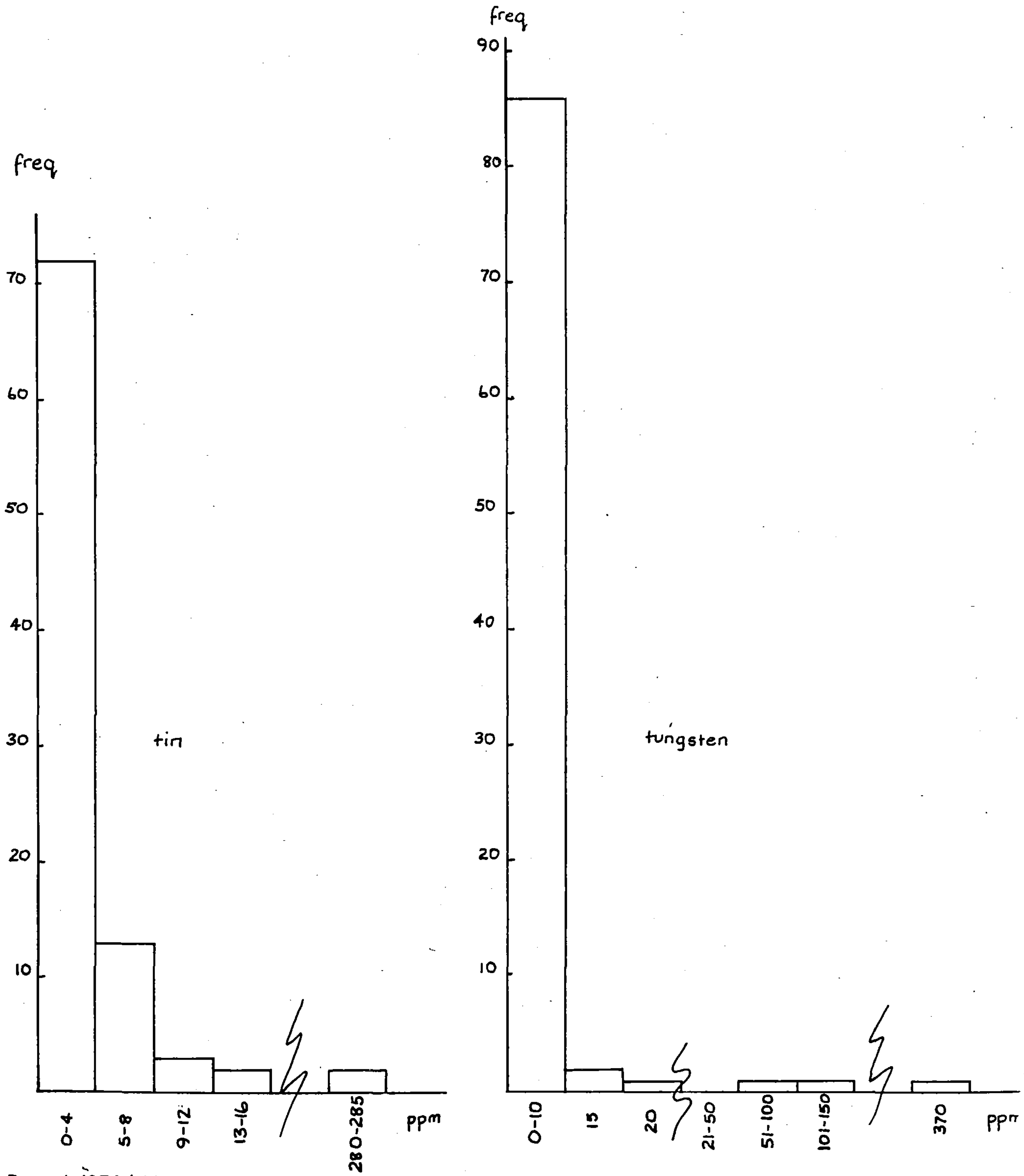

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Figure 26 Frequency distributions for tin and tungsten in the Young Granodiorit

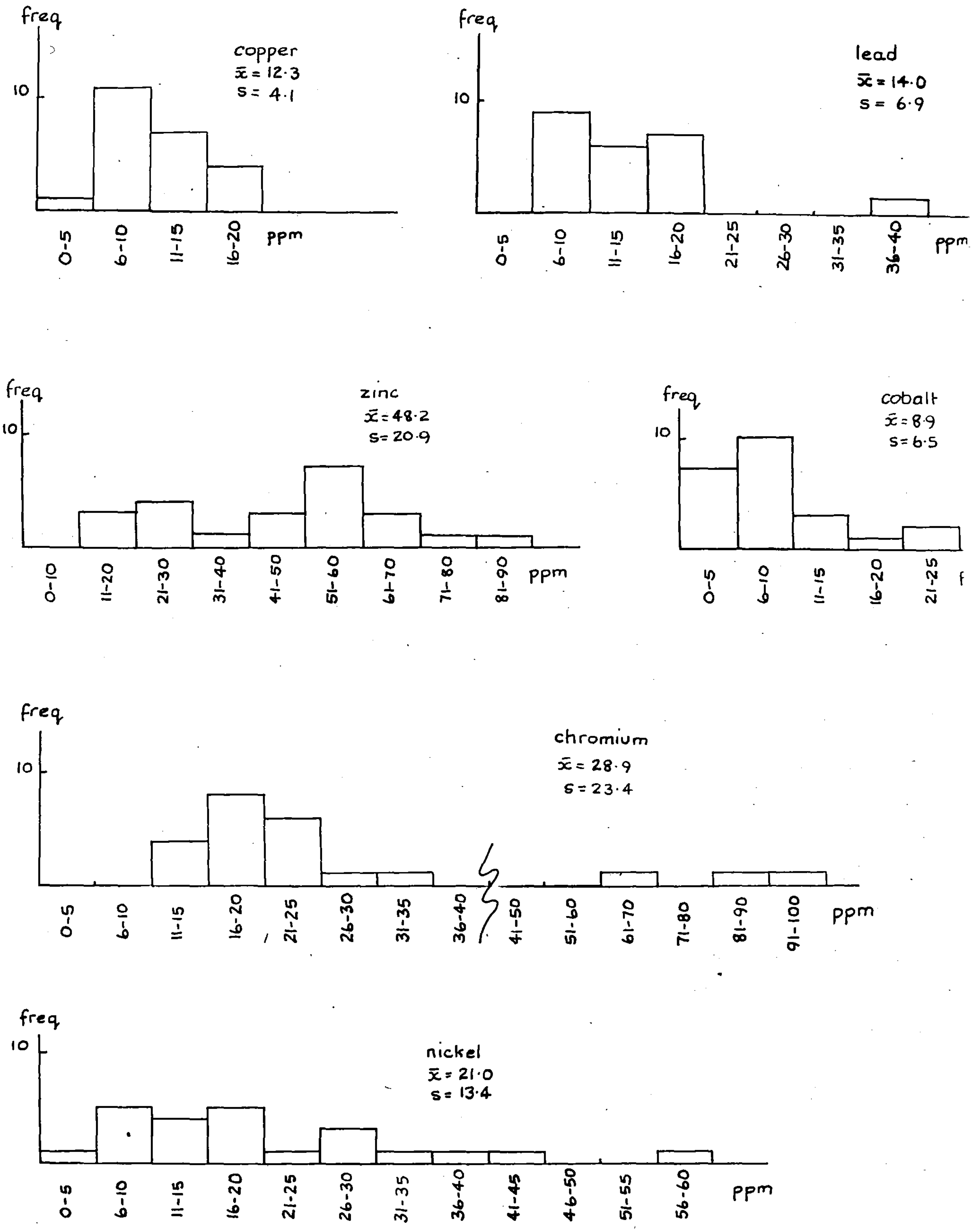

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Figure 27 Frequency distributions for the Hatchery Creek Conglomerate

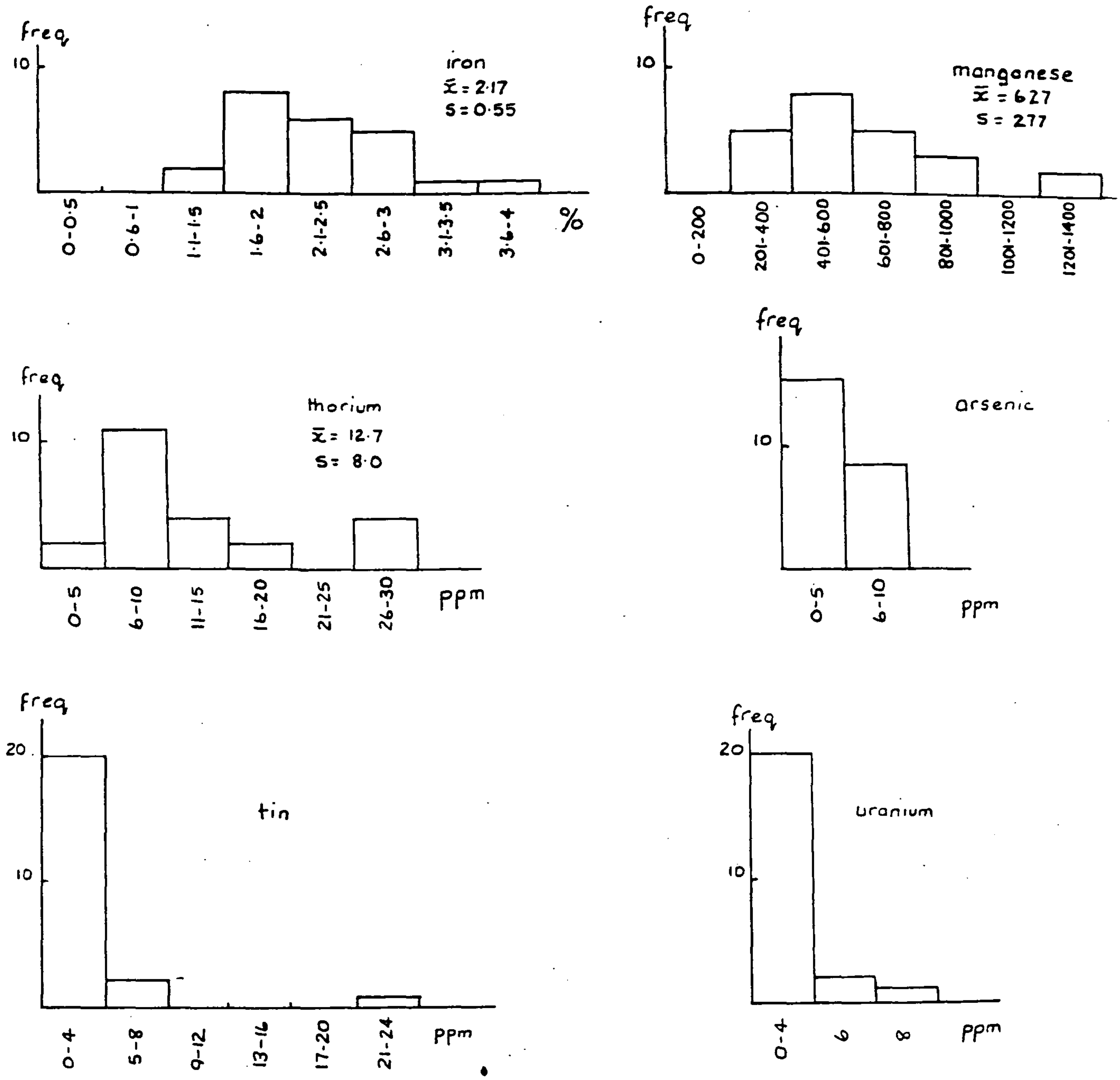

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Figure 27 continued

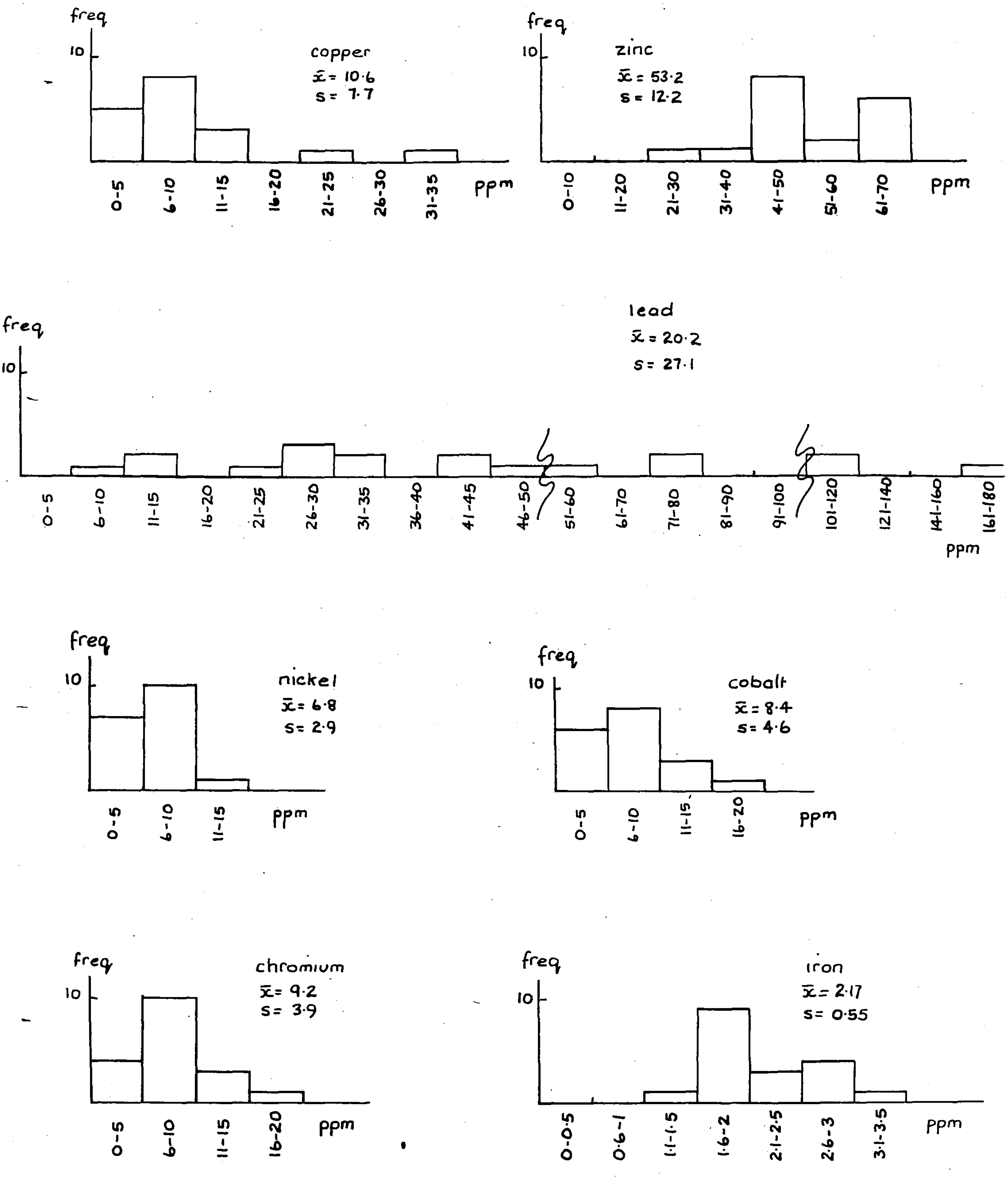

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Figure 28 Frequency distributions for the Mountain Creek Volcanics

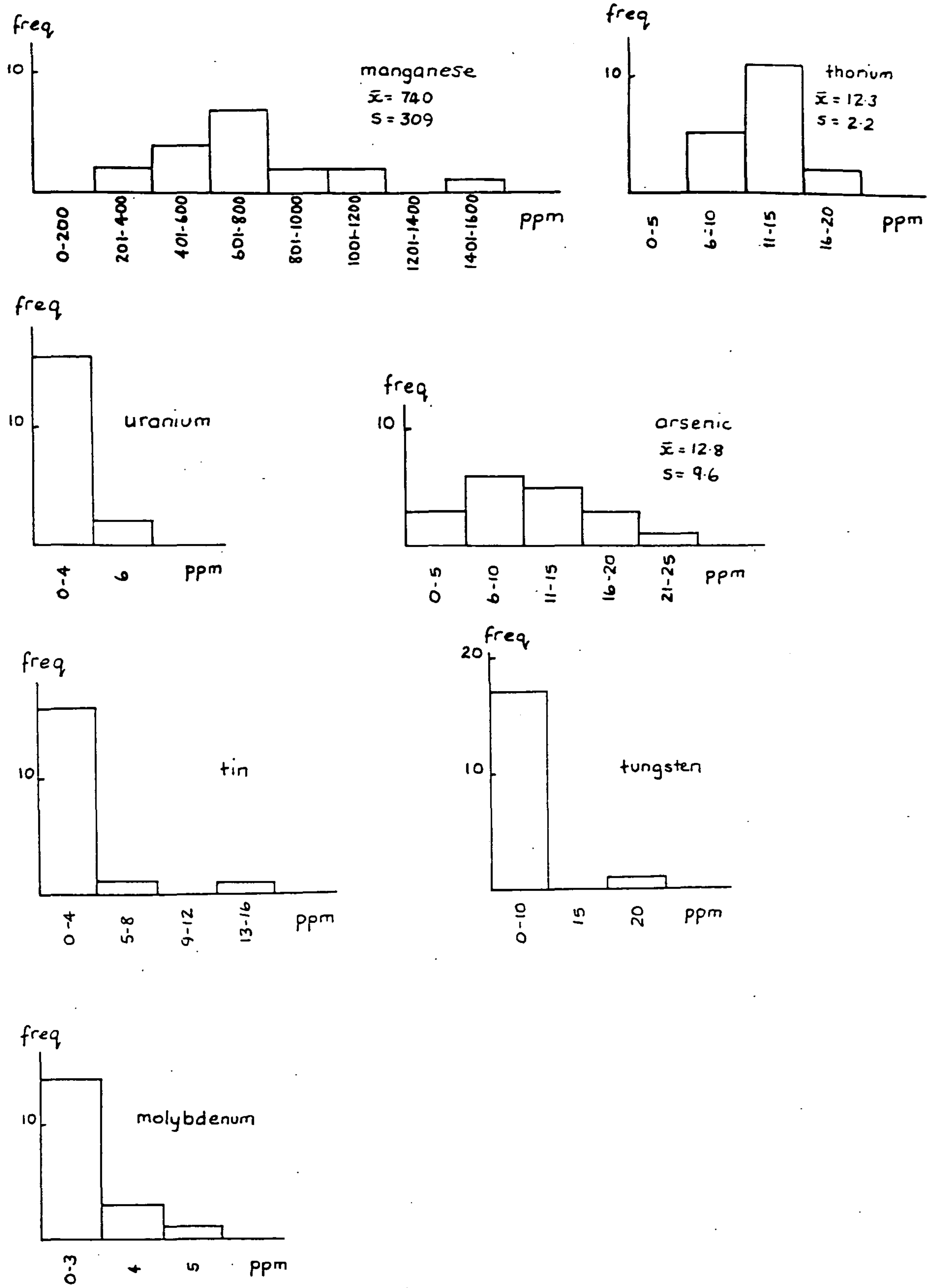

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Figure 28 continued

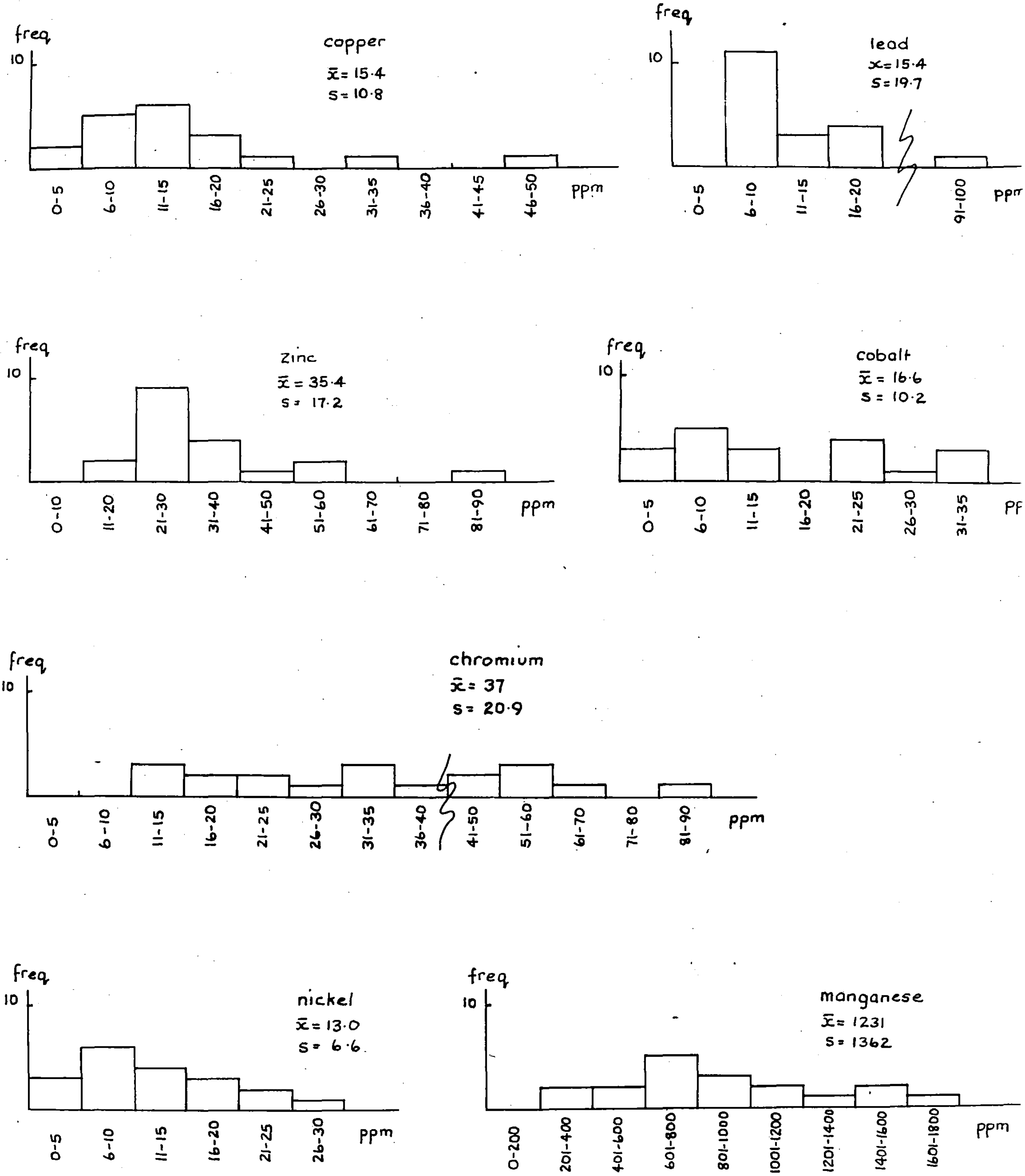

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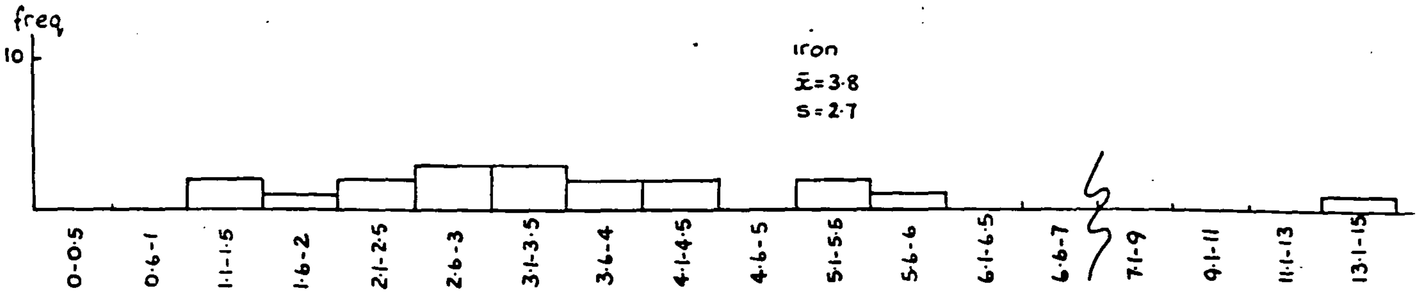
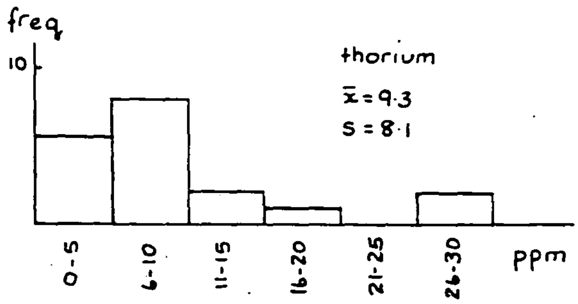
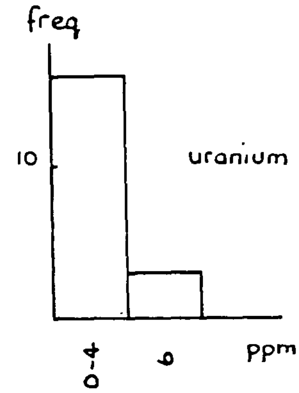
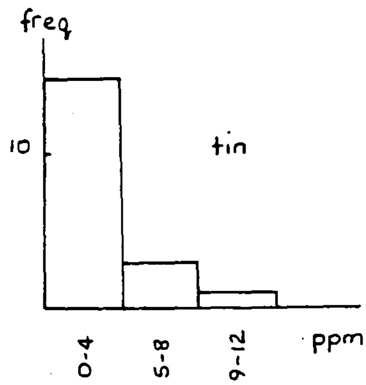
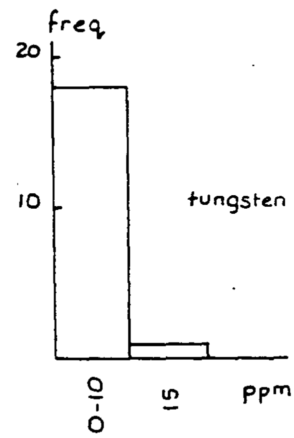
Figure 29 Frequency distributions for the Micolong Swamp Basic Complex

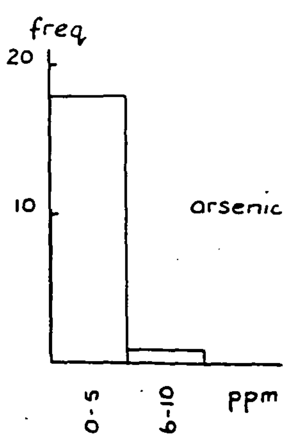












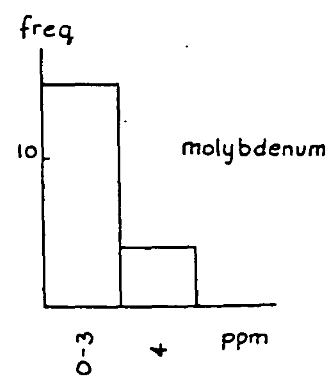


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Figure 29 continued

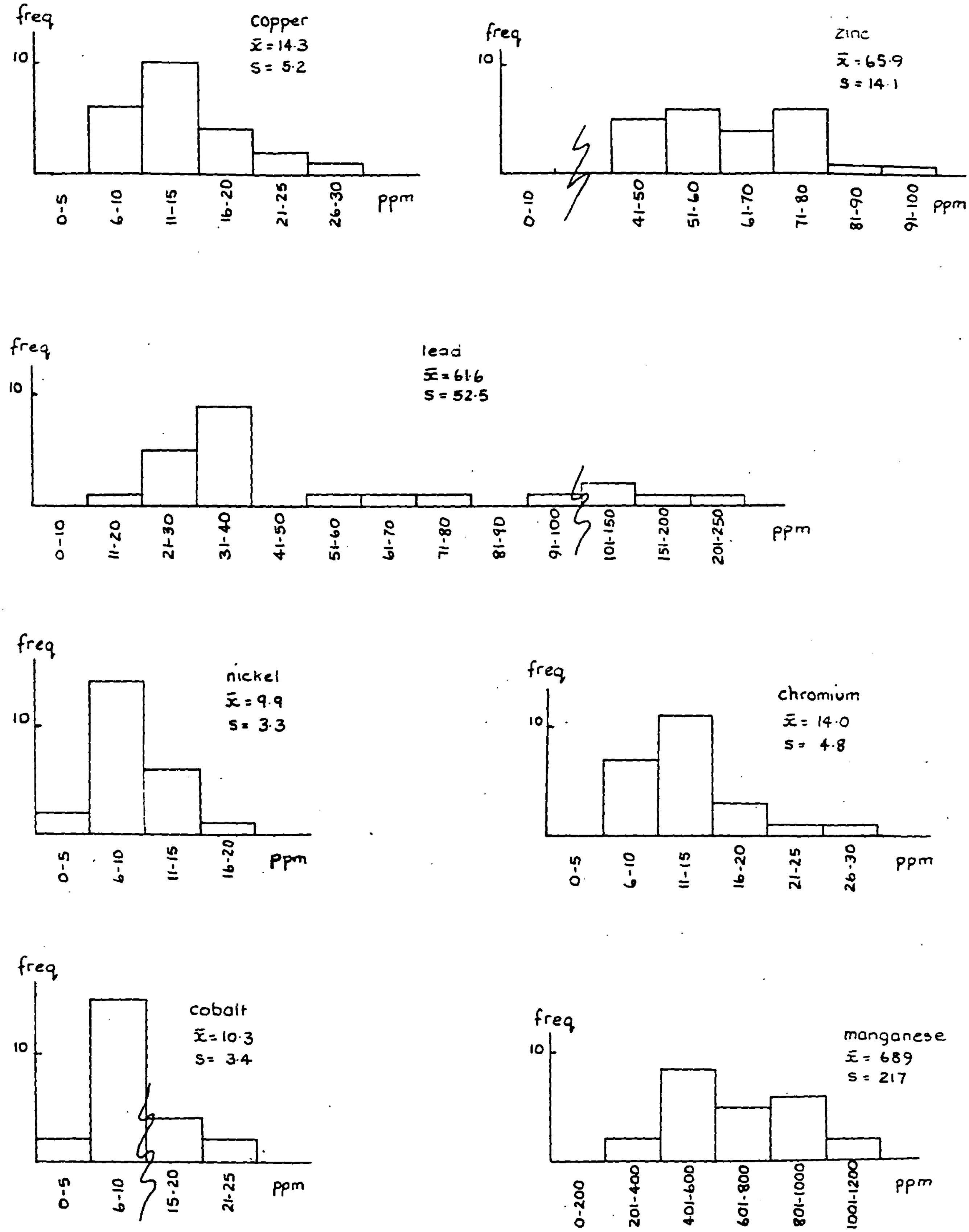

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Figure 30 Frequency distributions for the Kirawin Shale

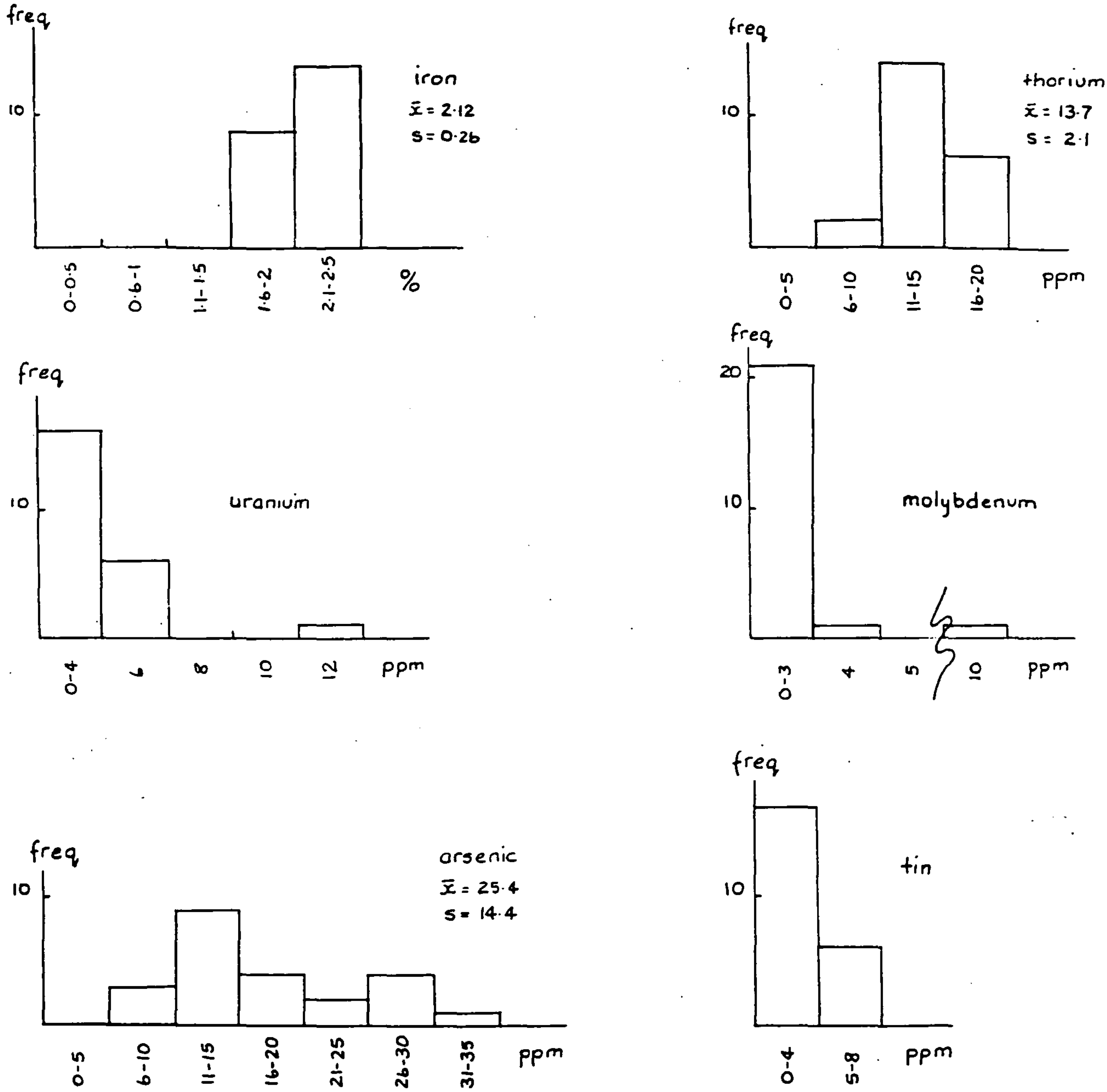

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Figure 30 continued

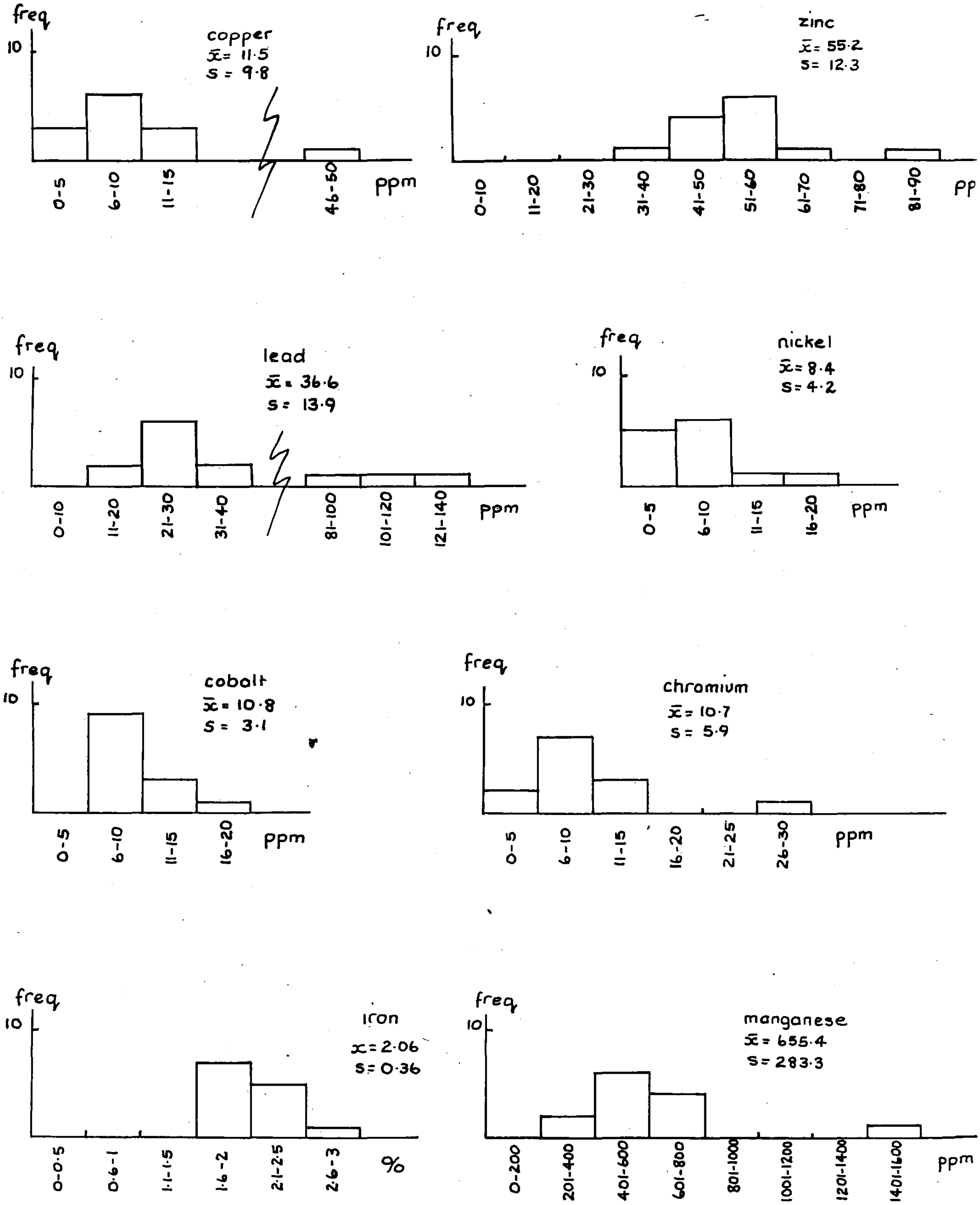

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Figure 31 Frequency distributions for the Sugarloaf Creek Tuff

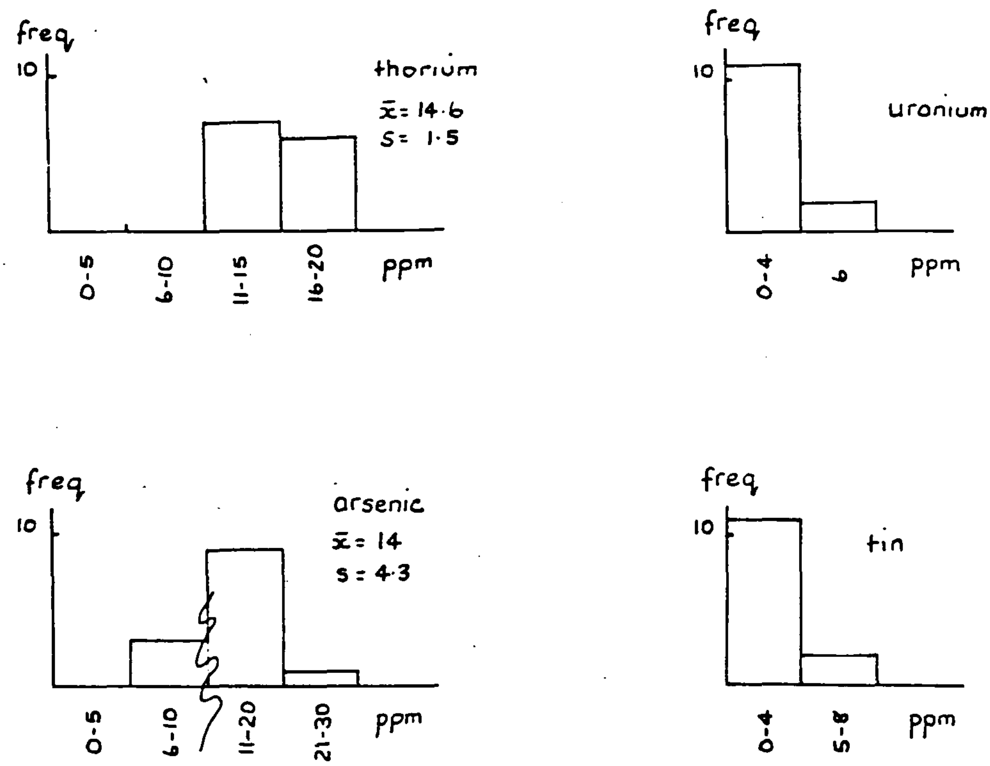

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Figure 31 continued

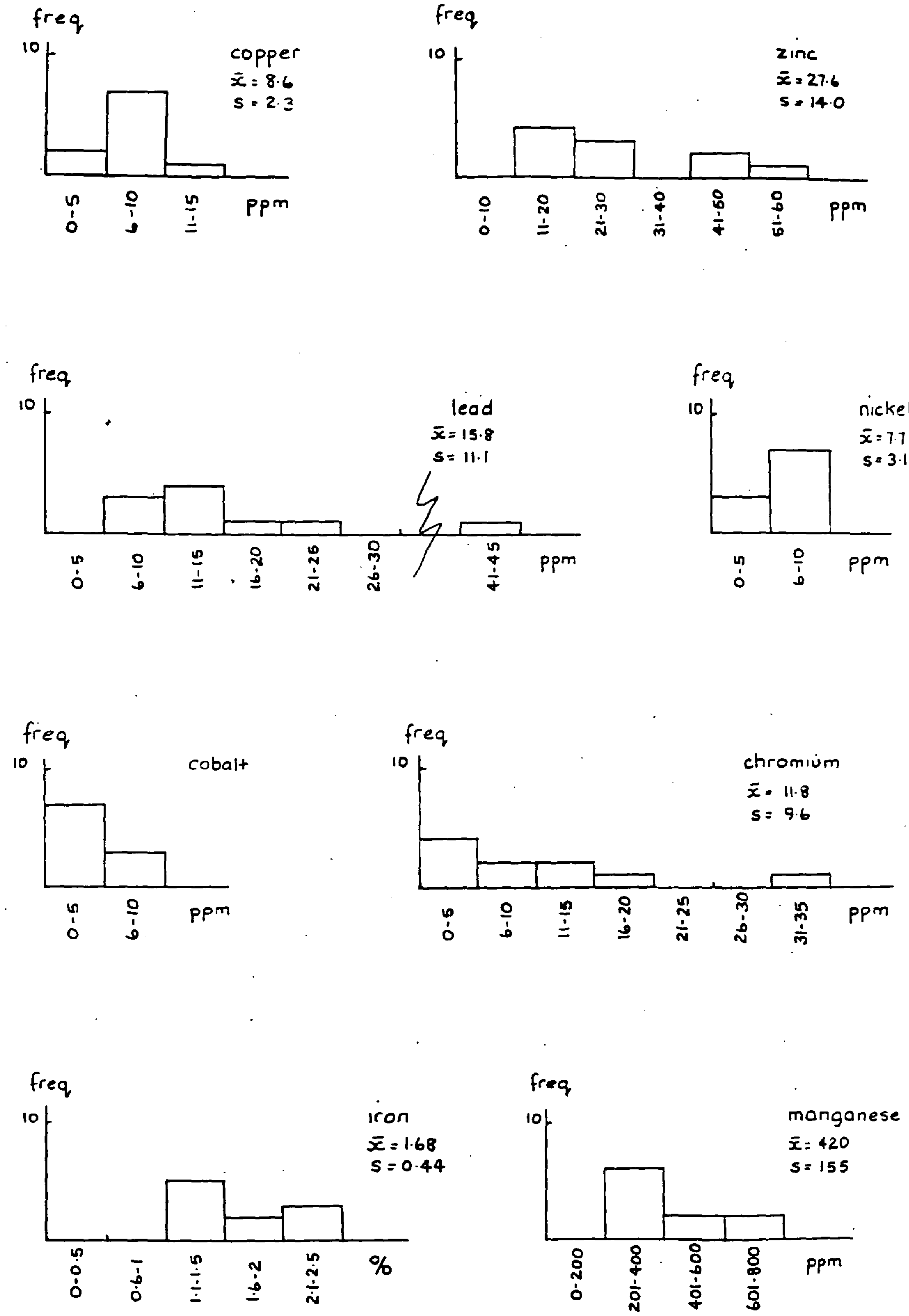

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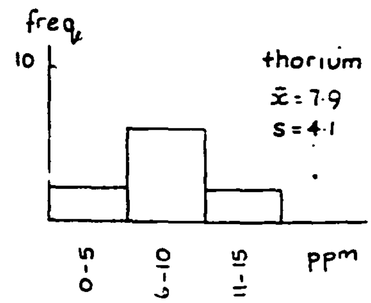
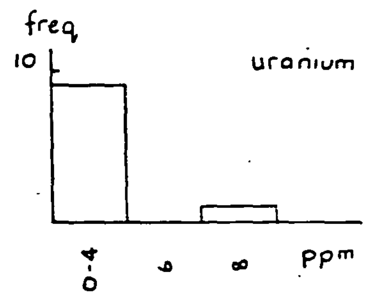
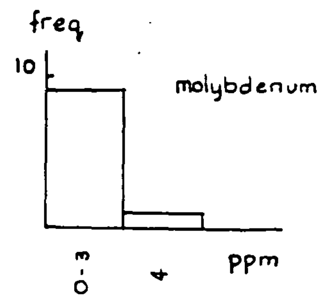
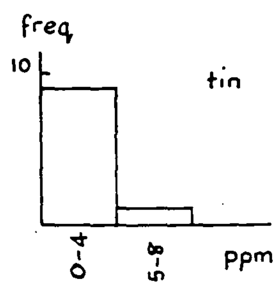
Figure 32 Frequency distributions for the Taemas Limestone, Cavan Bluff Limestone, Majurgong Shale









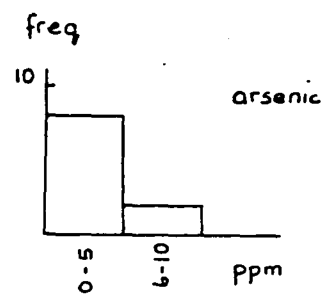


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Figure 32 continued