REPUBLIC OF THE PHILIPPINES

DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES

BUREAU OF MINES

REPORT ON GEOLOGICAL SURVEY OF EASTERN MINDANAO

PHASE I

GEOLOGICAL AND GEOCHEMICAL SURVEYS

NOV. 1972.

OVERSEAS TECHNICAL COOPERATION AGENCY

METALLIC MINERALS EXPLORATION AGENCY

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PREFACE

The Government of Japan, in response to a request by the Government of the Republic of the Philippines, decided to investigate the potential of mineral resources in Eastern Mindanao of the Philippines, and entrusted the survey works to the Overseas Technical Cooperation Agency. The Agency, considering the importance of technical nature of the survey work, in turn sought the cooperation of the Metallic Minerals Exploration Agency of Japan(MMEAJ) to accomplish the task.

The survey works are expected to be carried out over a period of three years, beginning in 1972. MMEAJ organized a 26-man survey team headed by Mr. Tōru Miura, Director of Overseas Department of the MMEAJ, and sent to the Philippines from February 17 to June 19, 1972. During this period, the team, with the help of the Government of the Republic of the Philippines and its various agencies, was able to complete survey work on scheduled for the current year.

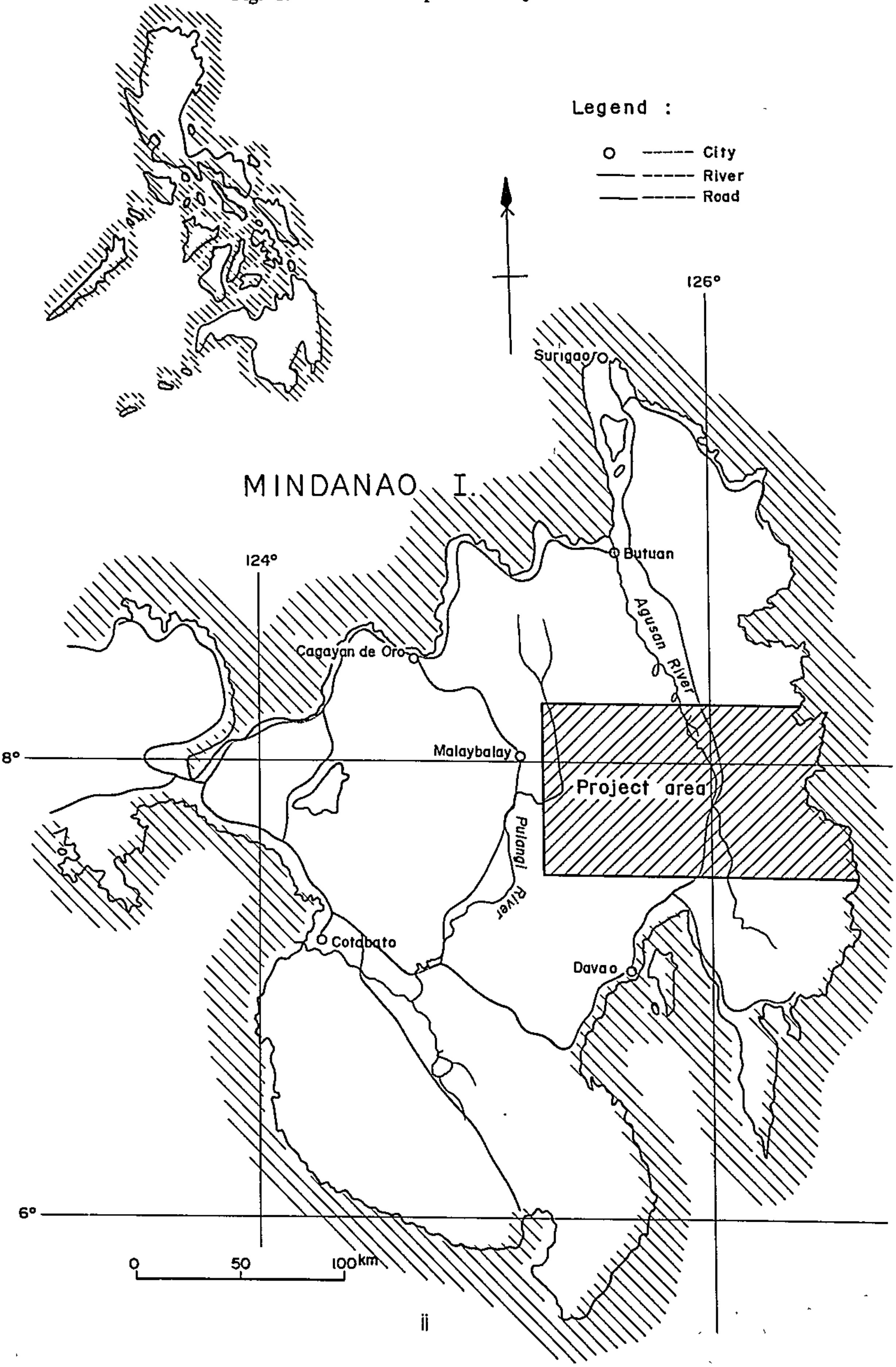
This report summarizes the results of the survey, and will form a portion of the final survey reports that will be prepared with regard to the results obtained in 1973 and 1974.

Finally, I wish to take this opportunity to express my heartfelt gratitude to the officials of the Government of the Philippines for their wholehearted cooperation and support extended to the Japanese survey team.

November 1972

Keiichi Tatsuke,
Director General,
Overseas Technical Cooperation Agency

Fig. 1. Location map of the Project area



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ABSTRACT

The geological and geochemical surveys were carried out for selecting the area of high potentiality for mineral resources in Eastern Mindanao.

The survey area is composed of so-called Cretaceous volcanic and sedimentary rocks, Tertiary sedimentary rocks and Quarternary rocks. The volcanisms, peculiar to the geological times, occured remarkably.

The Central Lowland Area, including the Philippine Fault zone, divides the survey area into the Eastern and the Western Areas. The Eastern Area remained as an intermittently subsided block during Tertiary.and Pleistocene times, with the resulting deposition of marine sediments accompanied by thick limestone beds. These sediments overlie a large part of Cretaceous basalt and andesite lavas unconformably. In the andesite area near the Philippine Fault zone, dioritic rocks, closely related to the porphyry copper deposits, occur as small stocks.

The Western Area consists of Cretaceous marine sedimentary rocks with andesite pyroclastic ones over 20,000m in thickness. Two periods of orogenies subsequently uplifted the area. The first occurred during upper Cretaceous time and the other during upper Miocene time. Following the first orogeny, the ultrabasic or basic rocks such as peridotite, pyroxenite, gabbro and dolerite were intruded at the central part of the uplifted zone. The Cretaceous rocks in the area are unconformably overlain by the Tertiary rocks as well as in the Eastern Area.

Geochemical survey by stream sediment sampling and determination of copper, zinc and nickel disclosed some anomalies of copper and zinc in the Cretaceous volcanic rocks of the Eastern Area, and nickel and copper anomalies in the ultrabasic rocks of the Western Area.

The anomalies of both areas are not so high but they appear geologically to be excellent indications for ore deposits. Therefore, it is desirable to carry on the follow-up survey.

From the geological and the geochemical results, three (3) promising areas are selected for further detailed surveys.

One area in the Western side is underlain by Cretaceous rocks. It is limited to Bukidnon province and the west side of the Davao River. The two (2) selected areas in the Eastern side are likewise in the Cretaceous rocks.

INTRODUCTION

This report summarizes the results of the regional geological and geochemical surveys in the Philippines carried out jointly by the Philippine and the Japanese Governments for the period from April to May, 1972.

This survey area is located within the government forest reservation in East Mindanao, which covers all the area of about 11,000km^2 as to be encircled by the following lines:

in the north:	the latitude 8°15' North
in the south:	the latitude 7°30' North
in the west:	the longitude 125°15' East
in the east:	the coastal line of east Mindanao

The purpose of the survey for this year is to determine the area of the highest potentiality for mineral resources within the limit of 30 percent of the distinct area.

Including the preparatory period, duration of the stay in the Philippines was 124 days, from February 17 to June 19, 1972. 33 days, from April 28 to May 30, were spent for the actual field work.

The Central Lowland Area divides the survey area into the Eastern and the Western Mountain Areas.

Four and five survey parties were assigned to the Eastern and the Western Mountain Areas respectively, and helicopters, small airplanes and jeeps were used for communications between these two areas.

Each party consisted of one Philippino and two Japanese geologists. This project was governed by two leaders (one Philippino and the other Japanese) and was also staffed by the Philippino photogeologist and draftman.

The survey routes were selected to cross the general geological trend as far as possible.

Topographical maps in scale of 1:50,000, available on the market, were used as a rule, but airphotos in scale of 1:40,000 or 1:18,000 were used substitutionally in the irreconcilable area.

In the Eastern Area, cars were fully used because of the good roads. While in the Western Area, the survey was carried out almost on foot.

In the mountains which lie between Davao Province and Bukindnon Province, the uncivilized tribes often quarrel. Especially in the upper part of the Umayan River in the north and the upper part of the Lassang River in the south, the survey was forced to be suspended because of much danger.

The total length of the survey routes and the number of samples for the geochemical analysis are shown below.

Table 1. Length of survey route and number of samples for geochemical analysis

	Length of survey route	Number of Samples	Remarks
Eastern Area	380 km	2, 581	Samples include +100 mesh and -100 mesh fractions of stream sediments, bank sediments and soil samples
Western Area	450 km	3, 107	
Total	830 km	5, 688	

This report consists of three parts, namely, Part 1 on geology, Part ll on geochemistry and Part lll on the conclusions and the future problems.

We are deeply indebted to the Ministry of Philippine Foreign Affairs, the Bureau of Mines, the Bureau of Forestry and the timber companies concerned for their kind assistance rendered in connection with our survey.

We were instructed by Dr. Yasumochi Matoba, Akita University and Dr. Kuniaki Matsumaru, Saitama University on identifying of fossils, and technical official Tokuo Tono, Geological Survey of Japan, of the method of geochemical analyses.

We would like to express our gratitude to these people.

According to the mutual agreement between the two Governments, all the geological data, half the rock specimens and the samples for geochemical survey obtained by this work have been submitted to the Philippines Bureau of Mines.

The list of members engaged in the survey is as follows.

JUAN PILAC	Bureau of Mines Philippines	TŌRU MIURA	Metallic Minerals Exploration Agency of Japan
MAXIMO GARCIA	ditto	YASUSHI KANBE	ditto
WENCELAO ARGAÑO	ditto	MICHIHISA SHIMODA	Overseas Technical Cooperation Agency of Japan
NARCISO BAUTISTA	ditto		
IRENEO OSCILLADA	ditto	YUTAKA EDA	ditto
EMIL AVILA	ditto	TŌRU ŌTAGAKI	ditto
MARIO TORRES	ditto	AKIRA SATŌ	(planning only) ditto
DONNO CUSTODIO	ditto	HIROSHI FUCHIMOTO	ditto
JOSE ALMASCO	ditto	TERUYUKI TAKEDA	ditto
ALBERTO ISSAC	ditto	TAKASHI ONO	ditto
ELADIO ARIATE	ditto		

BERNECITO BALLESTEROS	Bureau of Mines Philippines	KATSUO ARAI	Overseas Technical Cooperation Agency of Japan
PAUFILO MONTERO (photogeologist)	ditto	HARUHIKO HIRAYAMA	ditto
BENJAMIN PINGOL (draftman)	ditto	KAZUHARU UMETSU	ditto
		JUNICHI KŌNO	ditto
		YASUYOSHI UEKI	ditto
		MASAKAZU KAWAI	ditto
		KŌJI NAGASHIMA	ditto
		MASAO HORI	ditto
		TAKASHI KATANO	ditto
		TATSUO NIIMURA	ditto
		KEIICHI KUMITA	ditto
		SHUSUI URAI	ditto
		MANABU YAMAGUCHI	ditto
		MASAHIRO HASE	ditto
		HIDETOSHI TAKAOKA	ditto
		TETSUO TAKAGI	ditto
		KAZUHIRO TAKAHASHI	ditto

PART I GEOLOGY

1 Location and Tranportation

1-1 Location

The survey area lies in the eastern part of the Mindanao Island and about 50km north of Davao city. It covers an area totaling about 11,000km^2 illustrated in Figure 1. This area is within the forest reservation area of the Philippine Government and extends over six Provinces, that is, Agusan del Sur, Surigao del Sur, Davao del Norte, Davao Oriental, Bukidnon and Cotabato.

1-2 Transportation and Accessibility

The Mindanao Island, about 95,000km^2 in area, is the greatest island after the Luzon Island in the Philippines but sparsely populated with about 9,960,000 people. Therefore the island is left behind in its development in spite of abundant natural resources. For example, northern Mindanao is rich in lumber products. Many kinds of underground resources such as gold, silver, copper, nickel, chromium, iron, manganese, sulfur, oil and coal are also promising there.

Davao City where equipments and foods for this survey were purchased has a population of 350,000. Vast coconut and banana plantations and virgin forests extend on the outskirts of this city. Davao City has also a good natural harbor with the deep depth of water.

The regular air-service is available between Manila and Davao or Cagayan de Oro several times a day. In Malaybalay, Bislig and Bagganga, there are private airfields for small airplanes.

The national road from Davao to Butuan runs through the center of the survey area. A network of the logging roads is available on the east side of this national road except the southern mountain area. On the west side, however, there are scarcely any roads, obstructed by the rugged topography. At present, the logging road is under construction at both foots of the bordering mountain range between Davao and Bukidnon Provinces, but it is impossible for a jeep to pass through except some sections along the Libuganon and the Pulangi Rivers for the time being. In the west of the survey area, another national road links Kagayan de Oro with Cotabato. However, due to few roads, which cross the above mentioned mountain range, there is no other way than to take this national road via Kagayan de Oro or Kabacan proceed to the Eastern Area from Bukidnon Province. It takes more than one full day by car in either way.

2. Topography and Climate

2-1 Topography

Controlled by the geological structure, the topography of NNW-SSE direction predominates in the Mindanao Island. From the topographical feature, the survey area can be divided into the following units from the east to the west.

1 Eastern Mountain Area

2 Central Lowland Area

3 Western Mountain Area

The Eastern Mountain Area, a mountainous region ranging from NNW to SSE, is the southern extension of the Diuata Mountains which borders Surigao and Agusan Provinces. The Bislig region, the northern part of the survey area, is a hill with an elevation of about 300m and is covered by coral reef limestone. On the contrary, in the southern part with an average elevation of 1,000 to 1,500m, some of the peaks attain over 2,600m. The limestone area shows karst topography with deeply trenched narrow valleys.

The Central Lowland Area extends from the Butuan Bay at the north to almost the Davao Gulf at the south with an elevation of 100 to 200m. Most of the drainage system in this area belongs to the Agusan River. This area, through which a large structural line (the Philippine Fault) runs from the Luzon Island, has been subsiding remarkably since the Neogene period. Therefore, a thick pile of terrigenous Quaternary sediments transported by those rivers which come from the southern or the western mountain area is accumulated in this area.

The Agusan River originates from Mt. Mayo in Davao Oriental and meanders down southwards. It has a large discharge, and in the lower stream below Santa Josefa, many lakes and old stream courses are formed in the low, flat swampy area.

The Western Mountain Area is a part of the central range which extends the entire length of Mindanao from Diuata Point on the north coast to Tinaka Point on the south coast. Mt. Apo (2,955m in elevation), one of the highest peaks in the Philippines, also rises in the southern part of this range. This area generally shows rugged topography with an average elevation of 1,000 to 1,200m and is characterized by deeply dissected narrow valleys with steep cliffs.

On the western wing of this mountain area, two big rivers, that is, the Davao and the Pulangi Rivers flow down gently along the structural lines of N-S direction. River terraces are recognized at places and limestone cliffs at the western end of this area. The drainage system in the Western Mountain Area shows trellis pattern constructed by the big rivers of NNW~NS direction, that is, the Libuganon, the Umayan, the Davao and the Pulangi, and the small creeks which flow into the above rivers.

2-2 Climate

The area belongs to the climate of tropical-rain-forest-type, but there is a great difference in the precipitation and the temperature between the mountainous area and the plain. The temperature, in the vicinity of Davao City, varies from 38°C to 22°C with an annual mean temperature of 28°C. And the average fluctuation throughout the year is from 2 to 4 degrees.

The mean annual precipitation amounts to 2,000mm. On the plain, tropical squall is very frequent in the afternoon and the night. On the contrary, intermittent rains fall throughout year in the mountainous area. Therefore, for this area there is no so-called dry or rainy season, but it is rather dry from March to April in the Eastern Area and from January to March in the Western Area. As typhoons are born in this area and develop on the way to the north, it is rare to suffer damage caused by them.

2-3 Vegetation

Except the Central Lowland Area, almost all the mountainous area is covered by a jungle of tropical-rain-forest-type large trees such as lauan, apitong and tangile grown to ridges luxuriantly. Viewed from a plane, the jungle consists of a great variety of broad broadleaved trees, and evergreen trees with brownish green colored leaves grow around the western side reflecting the geological feature. The trees mostly stand straight and have few lower branches. The large ones have their trunks supported by wide-spreading buttresses. Undergrowth is not very dense for want of direct sun-light but it is quite difficult to pass without cutting off rattans or thorny vines. Mangrove trees grow thick along the coast and mouths of rivers.

3 Geology

3-1 General Setting

3-1-1 Previous works

The geological study of the Philippines has been carried out by many people since F.G. Becker (1899), but relatively few reports have been published officially. The geology and the structure of the Philippines was firstly made clear as a whole by the Geological Map of the Philippines in scale of 1: 1,000,000 published in 1963, which was compiled by the Geological Survey Division and the National Committee for the Preparation of Geologic and Tectonic Maps, incorporating unpublished data.

F.C. Gervacio (1966, 1967) described in detail the geological structure, the age and character of Orogenesis in the Philippines. He distinguished two geotectonic cycles which were more or less synchronous with the "Variscan" (late Paleozoic to Jurassic) and the "Alpine" (Cretaceous to Recent) geotectonic cycles. The former is represented by the "Basement Complex" which consists of ophiolite, ultrabasic intrusives and thick flysh type sediments successively formed in the Carboniferous geosyncline. The latter, the orogenesis from late Mesozoic to Cenozoic, was accompanied by igneous activities represented by a large amount of intrusive and effusive rocks, and consequently the "Mobel belt" transformed into a platform.

In 1955, H.H. Hess discussed serpentines, orogeny and epirogeny in the world, and pointed that the Circum-Pacific orogenic belt is a part of the Alpine orogenic belt in a wide sense. Further, he presumed a tectonic history from the distribution of serpentinites on the basis of the fact that serpentinites intrude in the early stage of the orogenic period. He guessed that the serpentinites distributed continuously from the Samar Island to the Mindanao Island intruded in the Cretaceous period with the permission that it is not so clear as in the North America.

Recently, regular zonal distribution of submarine deeps, negative gravity anomaly, axes of island arc, active volcano and considerably deep seismic activity from the ocean to the continent has been recognized commonly with the island arcs, viz., the Kurile Islands, the Japan Islands, the Philippine Islands and the East Indian Islands from the north to the south by the geophysical studies on gravity, magnetism, earthquake, heat flow, geodesy and others. The hypothesis of the "Plate Tectonics" is advocated to interpret the origin of above-mentioned regularity.

A. R. Ritsema (1961) presented the distribution of the maximal pressure obtained from the initial motions of the earthquakes which occurred around the Circum-Pacific region. He said that the direction of pressure trends to maka a right angle with the island-arc system in general and S80°W in the vicinity of the Mindanao Island. McKenzie and Parker(1967) reached the same conclusion by the study of slip vector of the earthquakes, and showed that the bottom of the Pacific Ocean is moving as a rigid body.

As for ore deposits, description was made about all the copper deposits in the Philippines, including those under prospecting, by the Philippine Bureau of Mines in 1956, and Mineral Distribution Map (1:2,500,000) was published in 1964. Further recently, L. Bryner (1969) introduced the typical ore deposits and their neighboring geology in the Philippines.

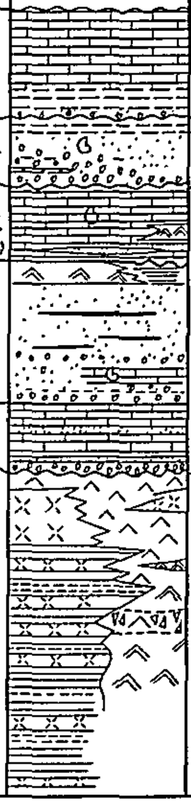
Some large-scale porphyry copper deposits are known in the Philippines. J.A. Wolf (1970) discussed the age of quartz diorites which have close relationship with those deposits. According to his interpretations of Potassium-Argon (K/Ar) dating, the earliest cycle of diorite intrusion was about 60,000,000 years ago (close of the Paleocene), and datings of andesites and diorites are scattered throughout the Eocene, Oligocene and Miocene with a concentration of datings of 9,000,000 years on diorite indicating a period of active intrusion in Late Miocene–Early Pliocene time. He reasoned, furthermore, that the movement of an oceanic plate caused formation of ore deposits in Early Tertiary time followed by renewal of drift and magma generation at the close of the Miocene.

Though some comprehensive reports on the geology of the Philippine Islands were presented as above-mentioned, there are few concrete descriptive ones especially on the Mindanao Island. In 1941, F. E. Merchant described the geology of the area along the Davao-Agusan national road which runs through the survey area from the north to the south for the purpose of exploration of oil. J. F. Vergara et al. (1957) also surveyed the Bislig-Lingig region for coal resources. The object of both surveys, however, was the Tertiary formations and the survey areas were limited. So there are few geological works in the mountainous area consisted of older rocks.

3-1-2 Stratigraphy

Cretaceous andesitic volcanic rocks and Tertiary sedimentary rocks compose the main part of the survey area followed by Quarternary terrace deposits and alluvium. Generalized stratigraphic section in this area is shown in Table 2.

Table 2. Generalized stratigraphic section in the Project area



Geological age		Formation	Columnar section	*	Rock facies	Structural morement	Igneous activity	Mineralization
Quaternary	Recent	Aluvium		R		Epeirogenetic movement; Philippine fault		
	Pleistocene	Batiano F Saug F. (300~500m)**		N3+Q1	Coral reef Limestone, Siltstone and Sandstone. Small amount of dacite lava			
Tertiary	Pliocene	Baganga & Kapalong F (1,000~2,000m)		N2	Conglomerale		Dioritic rocks	Porphyry copper type (Cu)
	Miocene.	Agtuucan F. (1,000~2,000m)		N1	Reef Limestone with thin Basalt lava and Pyroclastics		Basalt ~ andesite	
		Bislig F. (1,000~2,000m)			Silt, Sandstone, Conglomerate with thin bedded Limestone ,Basalt lava and Coal.			
		Mangagoy F (0~1,000m)						
	Paleocene			UV & KPg	(Eastern Area) Andesite, Basalt lava and Pyroclastics.	Orogenic movement	Ultrabasic ~ basic rocks	Orthomagmatic type (Ni, Cu,)
Cretaceous					(Western Area) Shale, Sandstone, Pyroclastics and Andesite lava.			

Remarks: * ------- geological symbols used in 1/1,000,000 Philippine geological map
** ------- thickness of the formations
ɕ ------ animal fossil

The Cretaceous rocks consisting of andesitic volcanic rocks and normal sedimentary rocks, such as shale and sandstone, occur in the Eastern and the Western Mountain Areas. The accurate age of the rocks are not known yet, because no fossils have been found in them. According to the previcus works, most of these rocks are estimated as Cretaceous and partly as Paleocene.

The Tertiary rocks are observed chiefly in the Eastern Mountain Area unconformably overlying the Cretaceous rocks. They are the products of the marine transgression which started from early Miocene, maximum 10,000m in thickness.

In the Eastern Mountain Area, the Tertiary rocks are grouped into four formations, viz., Mangagoy, Bislig, Agtuucan and Baganga in ascending order. On the whole, they are rich in limestone, but poor in the pyroclastic rocks. Besides, some coal beds are intercalated in these formations. The sedimentary facies of the formations suggest that they were formed in a shallow marine environment.

The Baganga formation in the Eastern Area is contemporaneous heterotopic facies of the Kapalong formation in the Western Area. The former is rich in sandstone, but the latter is molasse and rich in conglomerate.

As for the intrusive rocks, dioritic rocks which presumably intruded in late Miocene to early Pliocene are observed in a narrow extent in the Eastern Area and a large-scale ultrabasic to basic rocks which intruded in Late Cretaceous period, are in the Western Area.

The Quarternary rocks consist of elevated coral reef, argillaceous rocks, terrace deposits and alluvium.

3-1-3 Igneous rocks

The igneous rocks of the area consist of Cretaceous volcanic and dyke rocks, Neogene volcanic and plutonic rocks and Quarternary volcanics .

The Cretaceous volcanic rocks are basaltic to andesitic in composition and mostly occur as lava flows. Alteration of these rocks is uneven but most of them are green in color. They have wide distribution in the Philippine Islands, called "Metavolcanics", which correspond to the greater part of igneous rocks in this area.

Most of the Cretaceous intrusive rocks are basic to ultrabasic ones such as gabbro, monzonite, dolerite, peridotite and pyroxenite. Some small dykes of andesite or porphyrite are also observed. There are few outcrops showing the relation between these intrusives, so the order of their intrusions is somewhat obscure. But, first of all, ultrabasic rocks intruded in the time of folding of Cretaceous rocks, and gabbro and andesite followed. Therefore it appears that the character of igneous activities changed from basic to intermediate as time went by.

Volcanic rocks probably of the Neogene period are lava flows or andesite dykes which crop out in some parts of the Eastern and the Western Areas. The dykes suffering intense alteration, their original textures are not clear. On the contrary lava flows are apparently fresh.

Plutonic rocks are small stocks of quartz diorite or granodiorite which scatter in the eastern mountain district adjacent to the Philippine Fault zone. In the south, beyond the survey area, many diorite masses are distributed in the belt on the east side of the Fault zone, while in the survey area they are observed locally in a narrow extent, because they are probably covered by wide newer limestone. This diorite is 6,700,000 years (uppermost Miocene) in age according to the study of J. A. Wolf.

Quarternary volcanic rock is dacite which crops out partially in the Eastern Area covering diorite masses.

3-2 Cretaceous rocks

The Cretaceous rocks are distributed about 10km in width and 50km in length adjacent to the Philippine Fault zone in the Eastern Area. They are also observed in a strip along the coast of Bislig-Lingig region, northern part of the area. In the Western Area, the Cretaceous rocks extend all over the west side of the Libuganon River.

3-2-1 Eastern Area

The Cretaceous rocks in the area consist mainly of basaltic to andesitic lava flows with intercalated pyroclastic rocks of the same composition and a small amount of normal sedimentary rocks.

3-2-1-1 Lingig region

Volcanic rocks observed in this region are mainly basalt or dolerite, which crops out typically along the Taon River. They are dark-gray or blackish-gray in general. But the fresh ones are black and rarely bluish. The grain sizes also vary from coarse to fine. Generally they are massive, but partly autobrecciated. Further, sometimes they look agglomeratic. The presence of columnar and pillow structures in these flows suggest they were formed in a sub-aerial and subaqueous environment (probably in a shallow sea). As a whole, they presumably incline about 30^{o} southwestward judging from the dip of intercalating sedimentary rocks. Microscopically, the basalt shows basaltic or doleritic texture. The phenocrysts consist of plagioclase and clino-pyroxene. The former is 1 to 2 mm long and show albite or carlsbad twinning. The groundmass has usually intersertal texture consisting of plagioclase laths, granular clino-pyroxone and magnetite. Some of them have glassy texture. Chlorite, sericite, carbonate and zeolites are observed as the secondary minerals.

3-2-1-2 East side region of the Philippine Fault.

Andesitic volcanic rocks are widely distributed in the upper basins of the Bahayan, the Mamunga, the Ngan, and the Cateel Rivers. They are dark grey or blackish-grey (rarely dark greyish-blue), and massive with many irregular fissures. Sometimes platy or columnar joints are observed. Hematite veinlets are often recognized. Some of them are fine and aphanitic but generally porphyritic, and have abundant phenocrysts of plogioclase, pyroxene and amphibole. Microscopically, phenocrysts of twinned plagioclase (2 ~ 3 mm long), augite and magnetite occur in a matrix of plagioclase laths and pyroxene showing pilotaxitic texture. As quartz is rarely observed in groundmass, they are more acidic than those of the Lingig region. The rock alteration is almost chloritization.

From their occurrence, most of these andesites are considered as lava flows, and are disturbed by the later tectonic movements. Dykes of porphyritic andesite and basalt are also seen in this region. Usually the porphyritic andesite contains plagioclase only as phenocryst, but some of them are accompanied by amphibole or pyroxene. The color is grey to yellowish-grey or purplish-grey by weak argillization.

Basalt is macroscopically greyish-black compact rock. Under the microscope, it is hollocrystalline and consists of plagioclase laths, granular pyroxene and magnetite, showing intergranular texture.

The Cretaceous rocks in the Eastern Area are unconformably overlain by the Mangagoy and Agtuucan formations which are Miocene series.

3-2-2 Western Mountain Area

The Cretaceous rocks in the Western Mountain Area are observed in the whole area west of the Libuganon River. They are roughly consistent with the extent of undifferenciated volcanics (UV) in the Geological Map of the Philippines in scale of 1 : 1,000,000.

It consists chiefly of andesitic tuff, tuff-breccia and agglomerate with sandstone and shale, dipping steeply east-or west-wards.

The andesitic tuff and tuff-breccia are dark grey or dark green compact rocks with some striations. Lithic fragments, such as porphyritic or aphanitic andesite and occasionally mud, and chips of plagioclase, clino-pyroxene, common hornblende and magnetite are in a matrix of glass and chlorite. Zeolite and carbonate minerals are always observed as secondary minerals. They are poorly sorted and contain many angular rock fragments. The thickness of the clastic sedimentary rocks, intercalated in sandstone, shale and reddish brown tuff, is about 10m. The reddish brown tuff, which might be called tuffaceous mud, is a fine grained rock. Microscopically, fragments of amphibole, quartz, plagioclase and clinopyroxene are observed in a fine, well sorted matrix.

This sedimentary series crops out not along the Taumo River but in the drainage basins of the Simon, the Pipisan, the Langilang and the Umayan Rivers widly.

Sandstone and shale are thinly alternated from 5 to 10cm in thickness. The sandstone, medium to coarse grained, is well sorted. In the upper stream of the Simon River, the inversion structure of the strata has been confirmed.

This sedimentary sequence is intruded by peridotite and is displaced by the Davao-Pulangi Fault.

Attaining over 20,000m in thickness, the Cretaceous rocks in the area show monotonous rock facies from the lower to the upper. Usually poorly sorted tuff means the depositional surface is shallow and fine,well sorted sediment is deep. Therefore, the repetition of two rock facies mentioned above suggests that the sedimentary basin, as a whole, had continued sinking with rhythmical uplift and subsidence movements.

As for volcanic rocks intercalating in the sedimentary rocks, altered andesite lavas (partly dykes) are seen locally along the Taumo River. But in the western mountainous area adjacent to the Davao-Pulangi Fault-zone, pyroxene andesites affected by little greenerization are found in a small area. Microscopically, phenocrysts of carlsbad or albite twinned plagioclase and augite are recognized in a matrix of plagioclase laths, pyroxene, granular ore mineral and brown glass.

As this andesite is similar to that of the Eastern Area in respect of the mineral assemblage or the texture, they are probably derived from the same volcanism.

The Cretaceous rocks are unconformably overlain by the Kapalong formation of the Pleiocene period in the Eastern Area, and by limestone of the Miocene period in the the Western Area.

3-3 Tertiary rocks

Tertiary rocks unconformably overlies the Cretaceous rocks both in the Eastern and the Western Areas. They are rich in limestone in the Eastern Area, while rich in conglomerate in the Western Area.

3-3-1 Eastern Mountain Area

More than two-thirds of the Eastern Mountain Area is covered by the Tertiary rocks. They consist of limestone, conglomerate, sandstone and siltstone dipping from 10° to 30° in general. They can be divided into the following four formations by some characteristic limestone beds.

3-3-1-1 Mangagoy formation

A typical exposure of this formation is at the south of Barrio Mangagoy, Bislig region. This formation consists of conglomerate, siltstone, mudstone and thick limestone occurred in the upper horizon. Siltstone and mudstone are bluish and calcareous rocks, and are usually intercalated in the dark gray limestone. This formation trends N-S direction and dips from 10° to 30° W in general.

The texture of the limestone is medium to coarse crystalline and its color is light grey. Many fragments of larger foraminifera and coral indicate that it was deposited in a shallow marine environment. The thickness of the limestone increase gradually from the south to the north, and attains more than 500m. Limestone, presumed to be the same as mentioned above, crops out in the upper stream of the Cateel River. It is massive and partly recrystallized with more than 200m thickness. This formation unconformably overlies Cretaceous rocks every where.

3-3-1-2 Bislig formation

The Bislig formation consists of a sequence of conglomerate, sandstone, siltstone, mudstone and occasionally limestone, and conformably overlies the Mangagoy formation. In the upper stream of the Bislig River, alternations of conglomerate and sandstone or siltstone can be seen. The former contains rounded pebbles of andesite, andesitic pyroclastic rocks and a little amount of diorite. This formation has monoclinic structure striking N50°E and dipping from 20° to 30°NW, but in the northern and southern parts of the Bislig River, it trends E-W and folds gently.

In the vicinity of the Bislig River, conglomerate is deposited in the lower horizon and gradually changes to sandstone upwards, while in the upper stream of the Cateel River, sandstone, siltstone and/or alternation of them develop substituting for conglomerate.

In this place, not only andesitic agglomerate and lapilli-tuff but also basaltic lava flows are intercalated in limestone. The age of the igneous activities represented by these volcanic rocks is probably the same as that of altered andesite dykes intruding into the Bislig formation in the upper stream of the Bislig River. Besides, more than 30 coal beds are reported in this formation.

3-3-1-3 Agtuucan formation

The Agtuucan formation consisted of limestone covers more than two-thirds of the Eastern Area. The axial mountain range including Mt. Agtuucan is mostly composed of this formation. Macroscopically, this limestone is yellowish grey and crystalline in texture with unclear bedding. Microscopically, it mainly consists of many kinds of microfossils replaced by carbonate, and mixes with a few fragments of plagioclase, pyroxene and hornblende. The maximum thickness of this limestone probably attains 1,000m.

3-3-1-4 Baganga formation

The Baganga formation is typically observed in the drainage basin of the Baganga and the Mahanob Rivers. The most common rock type in the formation is dark-yellowish, tuffaceous sandstone. It is poorly sorted and loosely consolidated, with occasional siltstone. It is almost flat or dips about 5^{o} eastward, and probably overlies the Agtuucan formation clinounconformably.

Since no fossils can be found, the age of this formation is not clear. But from the rock facies, the Baganga formation seems to be correlated with the Kapalong formation of Pliocene to Pleistocene in the Western Area.

3-3-2 Western Mountain Area

Kapalong formation

The Kapalong formation is molasse and is typically distributed along the Kapalong River. It mainly consists of conglomerate, siltstone and sandstone overling the Cretaceous rocks clinounconformably.

Marine fossils indicating Pliocene, occur often in this formation. The formation develops at the eastern foot of the Western Mountain Area and crops out in the form of belt surrounding the Cretaceous rocks. It is also found along the Pulangi-Davao Fault zone on a small scale. The strike is in N-S direction in general. But the dip is from 10^{o} to 20^{o}E on the west side of the Libuganon and the Magimon Rivers, while in the neighborhood of the Kapalong River, toward west. Therefore, a synclinal structure with an axis of NNW-SSE direction can be presumed around there. The thickness of this formation attains probably 5,000 to 20,000m.

Conglomerate in the formation consists of subrounded pebbles from 1 to 5cm in diameter and sandy or muddy matrix. A variety of pebbles are peridotite, gabbro, dolerite, andesite, andesitic tuff, black shale, red chert, and limestone, which belong mostly to Cretaceous rocks. It is loosely consolidated as a whole and is saved from alteration. The conglomerate often alternates with siltstone or sandstone, and develops in the lower horizon.

The conglomerate found along the Pulangi River is quite similar to that of the Kapalong River in the size and the variety of pebbles, but is slightly different in the degree of consolidation. It is overlain by Quarternary terrace deposits. But when weathered, it is difficult to distinguish the former from the latter.

The siltstone is pale-greenish-grey and loosely consolidated. The medium-grained sandstone is greyish white in color while the coarse-grained one is brown. The siltstone and the sandstone usually form a thin alternation.

At the Kapalong River, thin beds of limestone from 1 to 5m in thickness are intercalated in the lowest horizon of this formation accompanied by limestone-conglomerate, containing a very few pebbles of granite.

From the fossils, the geological age of the Kapalong formation is Pleiocene to Pleistocene.

3-4 Intrusive rocks

3-4-1 Ultrabasic rocks

The ultrabasic rocks are found only in the Western Area. One of them forming the Pantaron Rangeis serpentinized two-pyroxene peridotite, and cuts the survey area in a N-S direction as a large-scale dyke. The width varies from 5km to 2km.

Microscopically, it is hollocrystalline rock and consists of ovivine, clinopyroxene and orthopyroxene, which are almost altered to serpentine showing mesh texture. As accessory minerals, a large amount of chromite and spinel are recognized. Magnetite and brown hornblende are sometimes observed.

Large-scale shear zones are often found in the dyke, so it clear that the strong fault movements have occurred after its intrusion. Besides, the small-scale dykes of peridotite crop out along the Pipisan Creek and the Pulangi River. All of them stretch in the N-S direction and are intensively argillized.

Ultrabasic rock, distributed from the west of the Tigua River to the Matinbas River, is pyroxenite forming a small-scale stock. The texture is hollocrystalline and its color is dark grey. It intrudes into the Cretaceous rocks same as peridotite. Under the microscope, it consists of euhedral, granular clino pyroxene, intersertal-brown -anhedral amphibole and magnetite, and shows a mosaic texture.

Garnet-bearing pyroxenite intrudes into the above-mentioned peridotite as a small dyke, about 10m in width, at the headwaters of the Taumo River. It consists chiefly of diopside and red garnet. The latter is usually surrounded by the kelyphite composed of tremolite, plagioclase, serpentine, augite and rarely spinel.

3-4-2 Gabbro

The gabbro intrudes into the above-mentioned pyroxenite and tuff which are distributed in the upper stream of the Tigua River.

Macroscopically, it is a dark greenish gray, coarse grained rock, and occurs as a dyke (1 ~ 5m in width). Microscopically, phenocrysts of plagioclase, clinopyroxene, greenish-brown amphibole, magnetite and intersertal biotite show a mosaic texture. Sericite is recognized partly as a secondary mineral along the cleavage of plagioclase. Granular apatite is also observed in mafic minerals as an accessory.

3-4-3 Dolerite

The dolerite dyke is exposed near Barrio Bonacao in the upper stream of the Naunam River. It intrudes into green sandstone belonging to the Cretaceous rocks, at a steep angle. It is microscopically dark compact rock and has typical ophitic texture with a large amount of chlorite (probably formed by mineralization as the secondary minerals).

A small dolerite dyke, 1 ~ 30m wide, intrudes also into andesitic tuff in the upper stream of the Tigua River.

The above-mentioned ultrabasic intrusive rocks were formed by a series of igneous activities in spite of there being a time lag more or less among them.

3-4-4 Monzonite

The monzonite occurs in the upper stream of the Taumo River on a small scale and is intruded by the peridotite. It is white, greysh-green or dark-green rock and has a weak schistosity with brown or white spots. Petrographic studies show that this rock consists mainly of orthoclase and plagosclase with brownish-green hornblende, biotite, fibrous muscovite and prismatic apatite.

The monzonite is the oldest rock in the survey area and probably intruded into the Cretaceous rocks prior to the peridotite. Otherwise it might have been intruded at the same time (pre-Jurassic ?) as the granite which forms the base of the Cretaceous rocks in Zamboanga Peninsula.

3-4-5 Porphyrite

The porphyrite intrusion is found near the contact of pyroxenite and gabbro in the upper stream of the Tigua River. It is leucocratic rock with dark-green or pale-green prismatic crystals.

Under the microscope, phenocrysts of plagioclase, clinopyroxene, biotite and magnetite are observed with intersertal albite. The accessory mineral is a little amount of apatite, and calcite and sericite occur as the secondary minerals along the cleavage of plagioclase.

3-4-6 Dioritic rocks

In the survey area, the dioritic rocks crop out at three places near the Philippine Fault intruding into the Cretaceous andesite as small stocks.

Dioritic rocks consist of granodiorite-porphyry, quartz-diorite and trondhjemite.

3-4-6-1 Granodiorite-porphry

The granodiorite-porphyry crops out about 2km in extension along the river near Mambalili Municipality located at the northern end (the latitude 8°15' North) of the national road running through the Central Lowland.

Usually it is grey-colored and hollocrystalline. The textures vary from place to place. For example, sometimes it shows porphyritic and rarely volcanic.

Under the microscope larger crystals are plagioclase and amphibole. The former is subhedral and calsbad and albite twinning are common. Potash-feldspar rims on some plagioclase and the hornblende is almost altered from the pyroxene. On the other hand, smaller crystals are plagioclase, quartz, potash-feldspar, amphibole, magnetite, apatite and biotite. Plagioclase phenocryst from 0.5 ~ 1.0mm long are lath-shaped and twinned. Quartz and potash-feldspar occur intersertally among plagioclase laths. Brown biotite is probably formed as the secondary mineral. Most of opaque minerals are magnetite, but partly pyrite. The adjacent andesite is thermallyaltered by this rock.

3-4-6-2 Quartz-diorite

The quartz diorite is distributed in the upper stream of the Agusan River nearly in the western end of the survey area.

It intrudes into andesite or dolerite and partly assimilates with andesite. It is medium-grained and holocrystalline in texture and chiefly consists of amphibole, quartz and plogioclase. But occasionally, because of intensive alteration, it is difficult to presume the original mineral compositions and texture. The alteration mineral assemblage is epidote-chlorite-quartz-sericite-calcite.

3-4-6-3 Trondhjemite

The trondhjemite is observed in the branch of the Agusan River, about 5km south-west of the above-mentioned quartz-diorite area.

The locality of outcrop is slightly outside of the survey area. It intrudes into andesite, and the contact plane shows N80°W direction. Silicification and pyritization are clearly observed. Many epidote veinlets are also found there.

More than 1km in the upper reaches of this river, Manat mine is under prospecting by drilling for the porphyry copper deposits.

The rock is grayish white, medium-grained, holocrystalline with visible quartz, plagioclase and biotite. Petrographically, plagioclase laths,maximum 3mm long,are twinned but they are not clear because of strong sericitization. A large amount of anhedral quartz is observed. Biotite flakes, maximum 2mm long, are usually curved and altered into chlorite or hydromica.

3-4-7 Altered andesite

The altered andesite dykes occur in the Bislig formation of the Eastern Area and are gray porphyritic rocks. The phenocrysts of plagioclase, altered pyroxene, magnetite and rutile are in matrix of plagioclase laths, quartz and magnetite. Generally, the alteration is intense so that the pyroxene has almost changed to carbonate minerals.

3-5 Quaternary rocks

Quaternary rocks consists of dacitic lavas, probably formed by Pleistocene igneous activities, and Pleistocene to Recent sediments. The latter covers the Central Lowland Area widely and can be divided into Saug formation, Batiano formation and Alluvium. Besides, terrace deposits are seen locally.

3-5-1 Dacite

The dacite is found, in the upper stream of the Agusan River, the western end of the survey area. It is distributed above 800m elevation covering the Cretaceous andesite.

It is medium grained, leucocratic in texture. Microscopically, plagioclase phenocrysts, 2mm long, are remarkable and fine grained amphibaoe and proxene are also scattered in a glassy matrix. In addition, the obscure flow structure can be recognized.

The mode of occurrence suggests it is a lava flow.

3-5-2 Saug formation

The Saug formation, distributed in the Central Lowland Area, consists of siltstone and sandstone. The best exposure crops out along the road leading from Tagum city to Sawata camp. It seems that the formation belongs to Pleistocene.

3-5-3 Batiano formation

The Batiano formation consists of coral reef limestone beds. It can be seen at Barrio Batiano in the Eastern Area, and at the distributaries of the Umayan River in the Western Area. As it forms a plateau with numerous dolines, it is very easy to know the distribution area on the 1 : 50,000 topographycal map. By the map more than 1,000km^2 of this formation is presumed along the eastern seashore, north of the survey area. The thickness is 300m to 500m.

3-5-4 Terrace deposits

In the Western Area the terrace deposits are found locally along the main stream of the Plungi River. The wide plateau encircled by the Pulangi River and its branch, the Bodonowan creek, is composed of terrace deposits. It covers an area of 150km^2 with an elevation of 400m.

In the vicinity of Barrio Paradise, the terrace gravel bed, 50 to 60m in thickness, chiefly consists of sandstone and mudstone gravels up to 5cm in diameter. Here the red-soil and the humus beds overlie the terrace gravel.

3-5-5 Alluvium

The vast alluvial plain formed by the Agusan and the Libuganon River has about 35km^2 in width from the east to the west and make it difficult to clarity the geological structure and correlation between the Eastern and the Western Areas.

Alluvium is distributed at the mouths of some big rivers such as the Bislig and the Cateel Rivers, on the east coast.

3-6 Geological structure and Geological history

3-6-1 Geological structure

The Mindanao Island has a typical island arc structure, which consists of the older aged mountain belt (non-volcanic arc), the shallow depression belt and the Cenozoic volcanic mountain belt (volcanic arc) from the east to the west, but the last one is beyond the limits of the survey area. The major structural trend, is N-S or NNW-SSE direction. The survey area can be divided into three Areas mentioned below from the structural point of view.

The Eastern Mountain Mountain Area, called the outer arc, is the place where basaltic or andesitic submarine volcanic activities were intensive during the Cretaceous time.

Generally speaking, the area has intermittently subsided since the Tertiary period. Consequently the shallow marine sediments attain over 4000m in thickness. But in this subsided zone two uplifted zones with NE-SW direction are locally deduced from the distribution of the volcanic rocks. The one stretches from Barrio Barcelona to Camp Kalao, the other is in the vicinity of Kotalogan. The uplifting age is supposed to be upper Miocene from the folding of Miocene formations and the lacking of Baganga formation (Pliocene ~ Pleistocene). And the dioritic rocks are clearly related with this uplifting movement.

The faults prevailing in the Area are classified into two systems, viz., NE-SW and NW-SE directions. The amount of dislocation of these faults is rather small, and all of them are cut by the Philippine Fault, which is the left lateral active fault formed in early Tertiary (P. B. Kingetal, C. R. Aleen). Some dioritic masses occurred close to this fault, and this suggests that there is a causal relation between the two.

The Central or Agusan-Davao Lowland Area has a large-scale of synclinal structure embracing the Tertiary system of N-S trend. Although it is considered as the subsiding area, the Cenozoic sediments are rather thin judging from the Geological Map of the Philippines, scale of 1 : 1,000,000, in which the Tertiary rocks are dottedly drawn on the western side of the Philippine Fault.

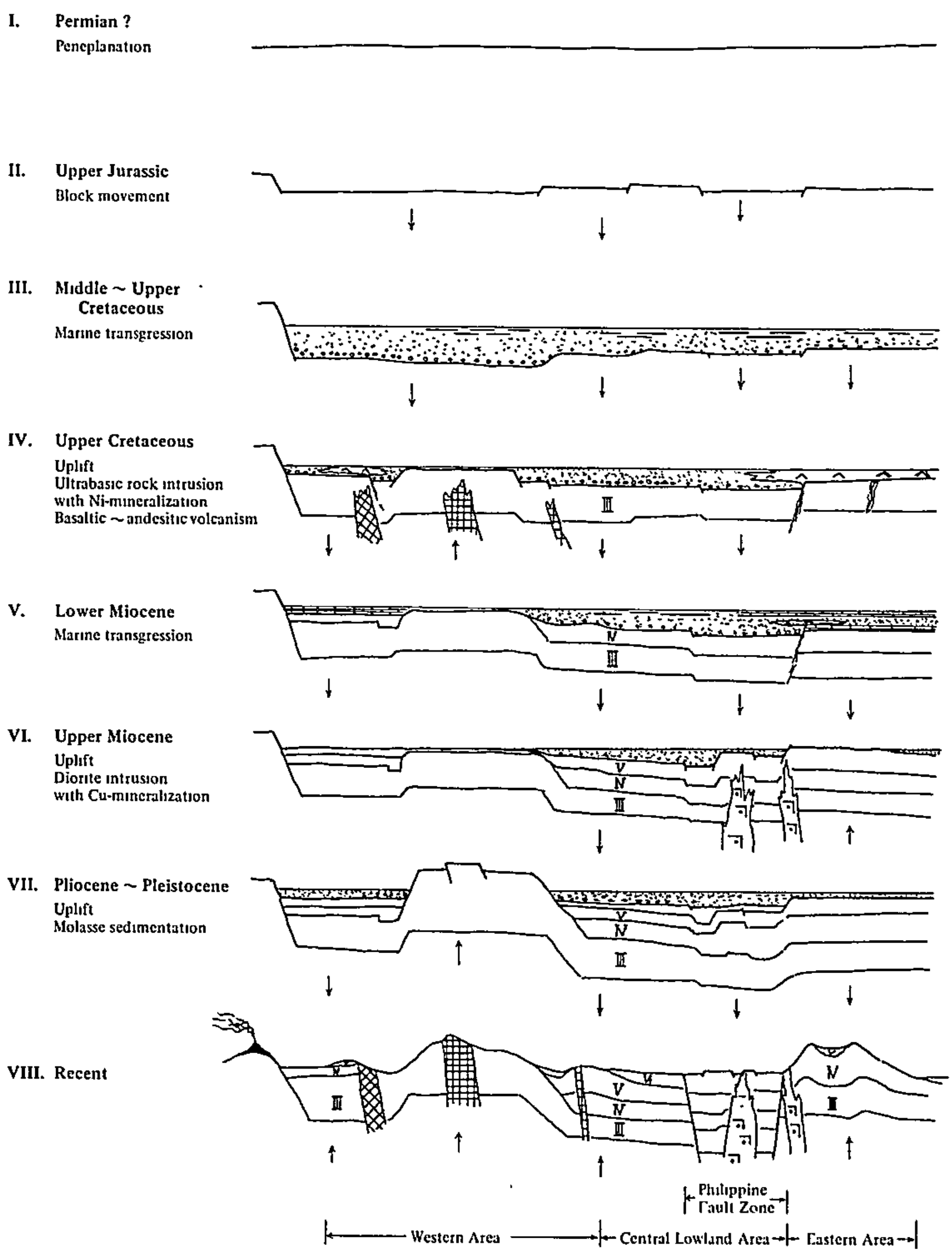
The Western Area consists of eugeosynclinal sedimentary rocks, which are partly folded intensively, accompanied by a large quantity of volcanic rocks (chiefly andesitic tuff with andesite and basalt) formed by the Cretaceous igneous activities. As a whole, the area forms a geoanticline and is intruded by a large-scale of peridotite dyke at the anticlinal axis. From the existence of molasse (Kapalong formation), this area has been lifted since the Pliocene period, and many anticlines and sysclines of N-S trend are recognized. Most of the faults have also N-S direction and a large-scale one is distinguishable on the topographycal map. The basin-like lowland continuing from the Davao to the Pulangi Rivers is a fault-line valley, and its extension is recognizable to Gingoog in the north and to the Apo Volcano in the South, therefore it traverses the Mindanao Island almost completely. Paleozoic metamorphic rocks, called the Basement complex, probably forms the core of the folding district, but do not crop out in the survey area. The volcanic mountain belt stretches near the west of this area and the basement metamorphic rocks can be observed in the western foot of the belt on a small scale. These facts tell that some differential block movements occur in the basement rocks and form the uplifted area, (the folding district), the volcanic belt and the subsiding area (the basin-like lowland).

The Pliocene detrital sediments distributed along the eastern rim of the folding zone are molasse, which buried the fore-deeps formed in the uplifting period of the folding zone.

3-6-2 Geological history

Geology of the survey area is very different between the Eastern and the Western Areas. Besides, in the Central Lowland Area including the Philippine Fault, there are few geological data for the area extending about 40km in width, and it seems very difficult to correlate the geology of the two areas. Therefore, the following working hypothesis is presented on the geologic development of this area for the purpose of making clear the future problems on the basis of the data obtained from this survey and the general interpretation in the past. According to F. C. Gervacio, two geotectonic cycles are recognized in the geologic history of the Philippine Islands. The survey area was probably a platform at the end of the early geotectonic cycle. At the end of Jurasic, N-S trending faults were formed by the local block movements. Sedimentary basins in Cretaceous and the Philippine Fault were in embryo in this period. Marine transgression began in middle Cretaceous. In the Western Area, a thick pile of non-volcanic sediments with andesitic pyroclastics over 20,000m in thickness were accumulated as a result of repetition of rhysmic uplifting and subsiding. In the Eastern Area, basaltic or andesitic volcanic activities were vigorous. Thereafter there followed a short period of folding and uplifting accompanied by the intrusion of copper and nickel bearing ultrabasic rocks. In Miocene epoch, the Tertiary era, marine transgression began to take place over the whole area and shallow marine sediments were accumulated. In the Eastern Area, a local uplifting of NE trend occurred in late Miocene to Pliocene followed by the intrusion of diorite. The Philippine Fault moved briskly in this period and the fault swarm of NE and NW direction developing in the Eastern area were also formed in this period. In the Western Area, at the same time, a thick pile of molasse was deposited along the eastern rim as a result of intensive uplifting of the basement Cretaceous rocks. N-S trending faults such as the Pulangi-Davao Fault were generated in this period. In Pliocene chiefly limestone with sandstone and siltstone was deposited, and further in Pleistocene, Aegean Sea-like environment appeared as a result of marine retrogression accompanied by the deposition of thick limestone. The Central Lowland Area appeared above the sea level after the continuing retrogression, and a thick pile of the Recent terrigenous sediments were deposited there. Fig. 2 shows the geologic development of the survey area as above mentioned schematically.

Fig. 2. Schematic sections showing geologic development of the Project area



4. Economic Geology

4-1 General Setting

Main ore deposits in Mindanao are nickel iron deposits in the ultrabasic rocks and porphyry copper deposits in the dioritic rocks. Among the producing mines are the Sibuguey Iron Mine, White Eagle Mine and the Sibugey Mine in Zanboanga del Sur.

Nickel laterite deposits on Nonoc Island have been under development and will be in operation by summer of 1974. Average grades of the ore reserves are 1.27% nickel and 0.1% cobalt.

Porphyry copper deposits are accompanied by the diorite intrusions in the eastern area of Philippine Fault, and exploration work is underway at the Cobadbaran area in Agusan Del Norte.

The Masara Mine is no longer in production. Drillings are being carried out at Sabena Mine and at Manat Mine.

There are also dioritic rocks, from north to south, in the western part of the survey area. Drillings are conducted at the Malaybalay area in Bukidnon Province.

Therefore, from the geological point of view, the potentiality of the nickel and copper deposits in the survey area, can be expected.

4-2 Ore Deposits and Mineralized Zone

Ore deposits and mineralized zone are limited in Cretaceous system.

4-2-1 Eastern Area

In the Eastern Area of andesite, there are pyritization zones with argillization and silisification at the Bahayan River and the Manunga River, and sometimes trend over 20m long, but copper contents are not enough (max. 0.02% Cu).

Pyrite impregnation and network bearing chalcopyrite (max. 0.1% Cu) are seen in diorite and in its contact with andesite, at the northern and the southern parts of the survey area. These mineralized zones are almost parallel to the Philippine Fault.

4-2-2 Western Area

Mineralized zones in Bukidnon Province can be seen in basic ~ ultrabasic rocks. Pyrite veinlets at the Tigua River can be seen in pyroxenite or in gabbro with the widths of 1 ~ 5cm in general, and silicification, carbonatization and epidotization are common.

The grade of the veinlets of 50 to 70cm width is 0.05% Cu. Pyrite network zone can be seen also at the contact of dolerite and sandstone at the Naunam River near Barrio Bonacao. It is 10m width and malachite can be recognized.

The wall rock is intruded by magnetite bearing epidote veinlets and affected by chloritization.

Sample	Width	Grade	
Massive pyrite	0.05 - 0.1m	0.02% Cu	21.34% S
Pyrite impregnation	10 m	0.01% Cu	0.53% S

These mineralized zones may be affected by diorite intrusion rather than by ultrabasic rock, because diorite intrusions are common in the western part outside of the survey area.

Floated ore sample was taken at the Naunam River near Harapitan Municipality. It shows the grades of 0.07% Cu and 0.28% Ni, and the wall rock is peridotite. By microscopic observation, the ore is made of troilite, pentlandite and chalcopyrite. Both of troilite and pentlandite are massive and exsolution lamella (structure) in form.

4-3 Coal

Coal is common in Bislig Formation, lower Miocene. In the reports of B. O. M. and U. S. G. S., more than 20 coal beds are recognized in Bislig - Lingig region.

The thickness is between 0.35 m to 1.00 m and 45,000,000 tons of ore reserves are calculated. Coal bed is trended to south, and it can be seen in limestone at the Cateel River, but the thickness is maximum 0.5 m.

PART II GEOCHEMISTRY

1 Field Operations

Geochemical survey method by stream sediment is commonly used for selecting effectively the promising area of mineral resources from the large area. This time geochemicl survey was carried out with geological survey. The main purpose of this project is to discover ore deposits, therefore, the Central Lowland Area where new sediments accumulate thickly after mineralization was omitted from the geochemical as well as geological surveys.

Geochemical method was as follows.

1-1 Planning

From the 1 : 50,000 topographical maps, the drainage systems seemed to be suitable for geochemical survey because many small creeks flow in the main streams trending N-S in this area. So it was expected to get homogeneous sampling pattern at the time of the planning. From the aerial observations and local informations, the following facts were disclosed.

1. There are no roadways and no trails in the mountainous area.
2. The whole area is covered by a dense forest and there is no landing place for helicopter even along the large streams.
3. The condition of air current is bad because of rugged and steep topography. It is, therefore, very hard to carry one party from a certain creek to the adjacent one over the ridge by helicopter.
4. There being no villages in the mountainous area, it is impossible to buy food on their way.

From these facts, all survey equipment and foodstuffs were forced to carry by porters, therefore, it appeared impossible to cover the area with homogeneous sampling density from the start. Considering a porter's transporting ability, one survey tour should be finished within 2 weeks if there is no food supply. For example, in case that any course is chosen to cross the Western mountain range, it is impossible to take a detour because 2 weeks are surely needed on one way. After careful discussions, sampling sites were limitted only along the rivers chosen as the main survey routes.

As a rule, samples of stream sediment are taken every 1km in a long river and also from its main branches. But in view of the condition mentioned above, it was established as the principle to collect samples every 500 m in a long river and one sample from each side of the stream. Soil samples were also collected at the meeting for comparing the metal contents in the soils with those of the top from where it was difficult (or impossible) to collect stream sediments.

The practical sampling pattern, thus obtained, was quite different from the initial plan and the samples concentrated along the survey routes. Although the pattern was not satisfactory, enough samples were collected from the main streams to select the promising area except the dangerous areas of uncivilized inhabitants.

1-2 Sampling and Preparation of Samples

Generally very fine-grained silty sediments (under 80-mesh fraction) were sampled by hand in the active channels of streams and creeks. Care was taken to avoid organic material which is probably enriched in trace elements. In case that the samples were forced to collect from banks, they were distinguished by marking X.

About 20 grams of sediment were collected in vinyl bags and dried in the sun at the base camp after survey tours.

For the sample marking and identification, different letters were assigned to each party, viz., from A to I, and the serial number was also used on the sample with mark W (for stream sediments) or Z (for soils).

When three geologists of one party surveyed creeks separately, a capital letter was given to the party chief and small letters to others. Thus, a sample marked B-123W means a stream sediment sample collected by B-party chief at site 123.

Every party was requested to plot the correct location of sampling point on the map and mark the sample number with bright yellow paint spray on a permanent landmark near the sampling site for checking, resampling or follow-up work.

2 Analytical Methods

In geochemical prospecting there are many analytical methods, such as atomic absorption spectrometry, X-ray fluorometry, colorimetry, spot tests and paper chromatography. As each method has a different advantage, the most suitable one should be shosen for the purpose.

In order to decide the effective 3 elements for pathfinder of ore deposits, about one-tenth of all stream sediment samples, viz. 558 samples, were selected at random and analyzed by emission spectrometry. After selecting 3 elements, all analyses were done by atomic absorption spectrometry. Each analytical procedure is as follows.

2-1 Emission Spectrometry

Determination of Spectrometry

1. Put 40 mg of sample prepared in the base camp into the hole of electric discharge.
2. Vaporize and ionize the sample in the intense heat of an electric arc.
3. Record emit radiation of characteristic wavelengths on a photographic plate.
4. Measure macroscopically the intensity of lines for 10 elements, viz., Cu, Zn, Pb, Mo, Ni, Co, Ti, Sn, Cr, Ag and represent the intensities with ranks 0 to 6 (from the weakest toward the strongest).

These 10 elements are usually used for the pathfinder of ore deposits.

The results are shown in Table 5 of appendix.

2-2 Atomic Absorption Spectrometry

The analytical method of Geological Survey of Japan was used for the determination of Cu, Zn and Ni which were selected by the emission spectrometry.

2-2-1 Sample Attack

(a) Stream sediment and bank sediment

1. Weigh 1.0 g into Pyrex beaker.

2. Add 5 ml of concentrated HNO_3 and digest on a sandbath.

3. Add 3 ml of $HClO_4$ and heat till white vaper goes up.

4. Add 5 ml of HNO_3 (1+2). Solve and adjust with distilled water exactly to 20 ml mark, mix and let settle till solution is clear.

(b) Soil

1. Weigh 1.0 g into Pyrex beaker.

2. Add 10 ml of aqua regia (HNO_3 - HCI 1 + 3) and heat on a sandbath till near-dryness.

3. Proceed to the above mentioned step 4.

2-2-2 Determination

1. Decent clear solution into test tube.

2. Aspire solution into flame and record concentration meter reading.

3. Establish working curves with Cu, Zn, Ni-standard solutions (HCl 1 + 100) in the range of 2-10 ppm.

3 Presentation of the Results

3 - 1 Results of Emission Spectrometry

The histograms were constructed for 10 elements and analyzed by emission spectrometry (Fig. 1 of apendix). 3 elements, viz, Ag, Mo and Sn, being not recognized in all samples, their histograms were omitted.

Exactly speaking, the histogram shape of each element is quite different but may be grouped into the following 3 types.

(A) Normal distribution type ——— bell-shaped distribution with sharp kurtosis

. . . . Cu, Ti.

(B) Normal distribution type ——— bell-shaped distribution with gentle kurtosis

. . . . Ni, Co.

(C) Complex distribution type ——— dual distribution, consequently, with two peaks

. . . . Zn, Cr.

In order to select 3 elements from 10, it looks most reasonable to choose one element from each type. Thus, Cu, Ni and Zn were decided for the pathfinders. Its main reasons were as follows.

1. Ti of type (A) has close relations with magnetite which occurs much in the sedimentary rocks in common. As porphyry copper deposits are expected in this area, Cu is more effective than Ti.
2. Both Ni and Co of type (B) are effective. But the ultrabasic rocks are accompanied by Ni in the Mindanao Islands and actually Ni laterite in poridotite has been under development. Therefore, Ni seems to be more important than Co.
3. Cr of type (C) commonly associates with Ni and Co in ultrabasic rocks. So that Zn is better to be selected as the last element in case of choosing Ni. Besides

Zn generally occurs in all kinds of mineralization.

4. Pb has been recognized only 8% of the analyzed samples. It is, therefore, not suitable for the regional survey.

3-2 Results of Atomic Absorption Spectrometry

Prior to analysis of all samples, each sample from the Tigua River in the Western Area were divided into two parts by screen, that is –80 ~ +100mesh and –100 ~ +200mesh fractions, in order to check the variation of metal contents in grain size. The statistical results of analysis are shown in Table 3.

Table 3. Statistical results on Tigua River samples

Number of Samples	Element		Mean (ppm)	Standard deviation	Test of variance ratio	Test of mean difference	Remarks
(A) 65	Cu	(A)	74	32. 36	Significant	Significant	(A): data on -80 ~ +100-mesh fraction
		(B)	90	44. 62			
(B) 65	Zn	(A)	32	14. 62	not Significant	not Significant	(B): data on -100 ~ +200-mesh fraction
		(B)	38	12. 14			
	Ni	(A)	10	10. 36	not Significant	not Significant	
		(B)	10	9. 09			

It is clearly evident from the Table that the significance is recognized with 95% probability between (A) and (B) fractions of Cu but those of Zn and Ni are not significant. Contents of Zn and Ni being generaly low, their significance might not have been recognized. So that the double samples were analyzed for Cu, Zn and Ni.

Finally 4,966 geochemical results of stream sediments were accumulated.

In order to treat these data statistically and extract the essential information from them, they should be homogeneous, that is, being part on one population. Usually a drainage system consists of many creeks which cross many lithological units, so it is difficult to collect homogeneous data from the drainage. Therefore, the best way to get rid of heterogenous data is to divide the survey area into drainages and lithological units, and after that the statistical interpretation must be made for each of them separately.

This time, however, it was impossible to get the homegeneous sampling pattern for the whole area because of many difficulties. The data were split, for convinience's sake, into four groups, that is, Eastern Cretaceous, Eastern Tertiary, Western Cretaceous and Western Tertiary Areas. The geology of the Eastern Area greatly differs from that of the Western Area and mineralizations are limited in both Cretaceous Areas. The split mentioned above, therefore, is somewhat resonable. The simplified statistical treatment of geochemical data by graphical representation (C. Lepeltier, 1969) has been used in this report.

3-2-1 Outline of the statistical treatment

A detailed description of the statistical method can be found in "Economic Geology vol. 64". Only the outline is described in this paragraph.

It is accepted that the data from the natural phenomena are usually distributed in the lognormal distribution pattern. And this pattern fits the one most applicable to the results of most geochemical surveys (L. H. Ahrens, 1957).

Thus, lognormal graphpaper is used for the method of graphical treatment.

a) Selection of the class intervals

For geochemical purposes, it is convenient to work with 10 to 20 classes.

The width of the classes expressed logarithmically (log. int.) are given the following formula:

$$\text{log. int.} = \frac{\text{log. R}}{n}$$

Where n is the number of classes and R is the ratio of the highest to the lowest value of the population.

In most cases, R varies from 6 to 300 (experimental average value), then, the extreme value for logarithmic interval will be 0.039 ~ 0.25. Therefore 0.10 is the best suited logarithmic interval for the classes.

This time, 0.10 has been mostly used for the intervals, but the Ni-values dispersion in the Western Area is so large (from 2 ppm to 1,830 ppm) that 0.20 has been chosen. For example 0.1 log. int. classes table is given below:

class limit (log.)	0.10,	0.20,	0.30,	0.40,	0.50,	0.60, ...
class limit (ppm)	1.26,	1.58,	2.00,	2.51,	3.16,	3.96, ...

b) Construction of the cumulative frequency distribution

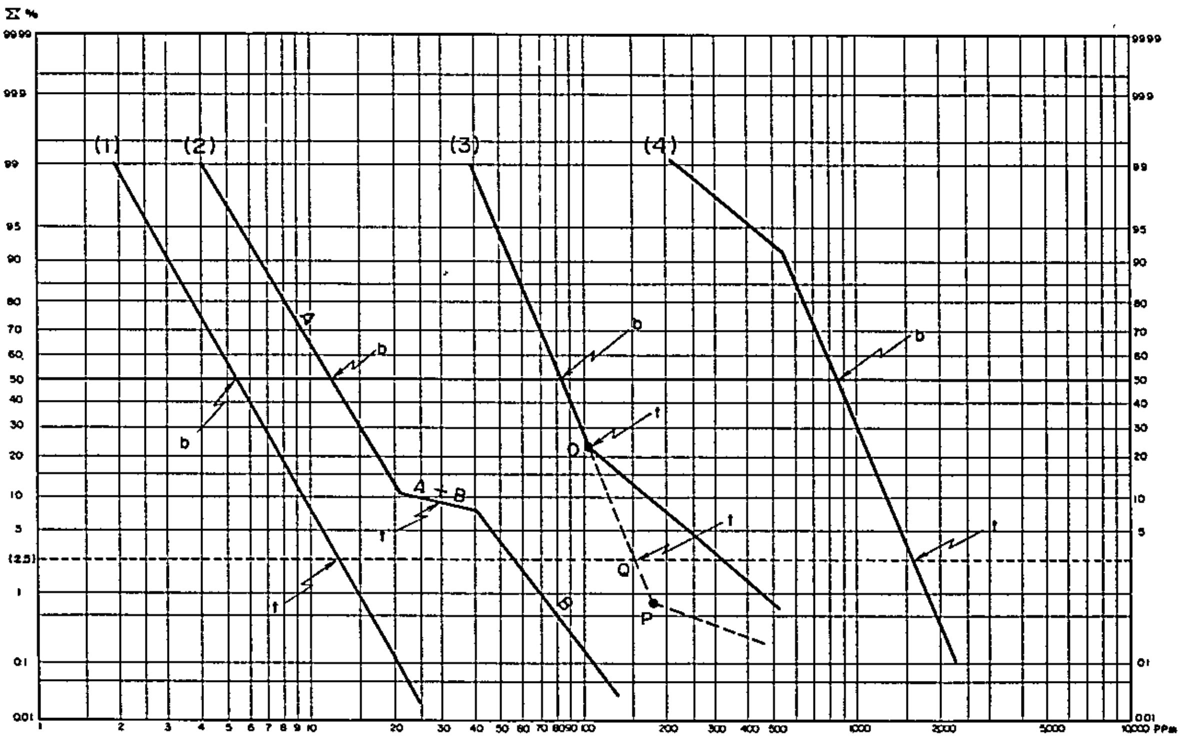
After selecting the class table, the values are grouped and the cumulative frequencies (from highest value toward the lowest) are calculated in percentage; then the frequencies are plotted against the lower class limits on the probability-logarithmic scaled graphpaper. If the population is distributed lognormally, the points fit well along a straight line.

c) Reading the mean background and the threshold values

When the diagrammatic expression of cumulative frequency is a straight line (Fig. 3 (1)), the mean background value (b) is given by the intersection of the line with the 50% ordinate. The threshold value (t), upper limit of the normal background fluctuations, is conventionally taken 2.5%-value from the highest. The (t) as well as (b), can be read directly on the graph as the abscissa showing the intersection of distribution line with 2.5% ordinate.

Practically, it is very rare to get the data from a single population. Usually they are from complex populations. Therefore, the cumulative frequency lines are frequently skewed.

Fig. 3. Cumulative frequency distribution of complex populations



1) When there is an excess of high value in the population, the line will be skewed toward these high values (Fig. 3 (3)). The abscissa of the breaking point may be conveniently taken as (t) if the break occurs above the normal threshold level of 2.5% (at point 0 for instance). If, however, the break occurs below 2.5% level (at point Q for instance) the threshold should be taken as usual (abscissa of point Q).

2) When there are two distinct populations in the set of data, the cumulative distribution line will show two breaks (Fig. 3 (2)). In this case, the threshold will be taken as the abscissa of the middle of branch (A + B).

3) When there is an excess of low value, the line is skewed toward these low values (Fig. 3 (4)). In this case, it does not interfere in the interpretaion, and the threshold will be taken in the usual way.

4. Interpretation of the Results

Geochemical data of the stream sediments were divided into two main groups, —— the Eastern and the Western Areas.

What is more, each group was split into two small groups, the one the Cretaceous area and the other the Tertiary area. Investigations were carefully made on the four small groups.

As the intrusion age of dioritic rocks, closely related with porphyry copper deposits, is considered as upper Tertiary, it is in itself problem to distinguish the Cretaceous system from the Tertiary one. But in the survey area, dioritic rocks occur only in the Cretaceous system, so that four groups mentioned above were selected for interpretation. When the samples were grouped, a sample was put in the group represented by the sample site geology.

After determination of the mean background and the threshold value by Lepeltier's method, the geochemical anomalies were divided into the following three ranks. They are 1) (t – 10%) ~ t, 2) t ~ 2t, 3) 2t where t is the threshold value.

The results are shown in PLATE IV (in pocket). On these maps they are represented more or less schematically so that one symbol shows not always one anomaly.

4-1 Eastern Area

The mean background and the threshold values of three elements in the Eastern Area are shown in Table 4.

Table 4. Mean background and threshold values in the Eastern Area

(ppm)

	Geological Age	Number of Samples	Cu Content		Zn Content		Ni Content	
			b	t	b	t	b	t
-80 ~ +100- mesh fraction	Cretaceous	780	70	170	89	135	16	25
	Tertiary	434	44	130	80	160	17	40
-100 ~ +200- mesh fraction	Cretaceous	757	75	185	98	190	14	20
	Tertiary	433	49	135	89	213	17	31

Remarks b: mean back ground value
t: threshold value

What is evident from the Table is as follows.

1) The variance of the metal contents is very small in grain size.

2) The mean background and the threshold values are about the same in the Cretaceous and the Tertiary areas.

3) Both mean background and threshold values of Cu in the Cretaceous area are somewhat higher than those in the Tertiary area.

In the eastern coast region of the Cretaceous volcanics the anamalous zone, extending more than 5km in length, occurs along the Taon River, where Cu, Zn and Ni contents are much over the threshold values. The highest values of them are 637ppm in Cu, 345ppm in Zn and 80ppm in Ni. The means are also high showing 193ppm in Cu, 181ppm in Zn and 50ppm in Ni.

Along the Boston River flowing into the Cateel Bay, three metal contents are more than twice the threshold values. Furthermore, along the small creek about 8km north of this river, Ni anomaly is recognized.

In the western andesite region, Zn anomaly is remarkable at the headwaters of the Bahayan River. And Cu-anomaly is also seen. This area,affected by pyritization and silicification, will require the detailed survey. At the upper stream of the Agusan River, weak Cu-anomaly has been obtained on + 100-mesh fraction in diorite zone. But in the same zone of northern area, there is no anomaly. Although Ni-anomaly exists at the upper reaches of the Cateel River, it does not appear to be important because Ni-thresold value itself is very low.

In the Tertiary area, there are two anomalous zones. One is located in the upper reaches of the Bislig River with 150 to 200ppm in Cu or Zn and 40ppm in Ni. These values are not so high but it can be considered that there is some effect of mineralization, because the background values are relatively low here. Many narrow dykes of altered andesite intrude in the Tertiary rocks around here, therefore the mineralization might have relation with them. The other anomaly is Zn of the Cateel River. Its values range from 200ppm to 500ppm but it is not accompanied by Cu anomaly. Considering few volcanic activities, the potentiality for ore deposits is not so high in this limestone area.

From the geochemical facts described above, the promising areas in the Eastern Area are limited within the Cretaceous rocks. Especially the basins of the Taon, the Boston, the Bahayan and the upper stream of Agusan Rivers are important.

4-2 Western Area

The mean background and the threshold values of three elements in the Western Area are shown in Table 5.

Table 5. Mean background and threshold values in the Western Area (ppm)

	Geological Age	Number of Samples	Cu Content		Zn Content		Ni Content	
			b	t	b	t	b	t
-80 ~ +100-mesh fraction	Cretaceous	804	51	100	56	108	83	127
	Tertiary	482	47	103	57	100	100	670
-100 ~ +200-mesh fraction	Cretaceous	803	52	113	56	108	78	135
	Tertiary	463	48	92	62	90	92	580

Remarks b: mean back ground value t: threshold value

What is evident from the Table is as follows.

1) The variance of the metal contents is very small in grain size.

2) The mean background and the threshold values of Cu and Zn are nearly the same in both systems but slightly lower than those in the Eastern Area.

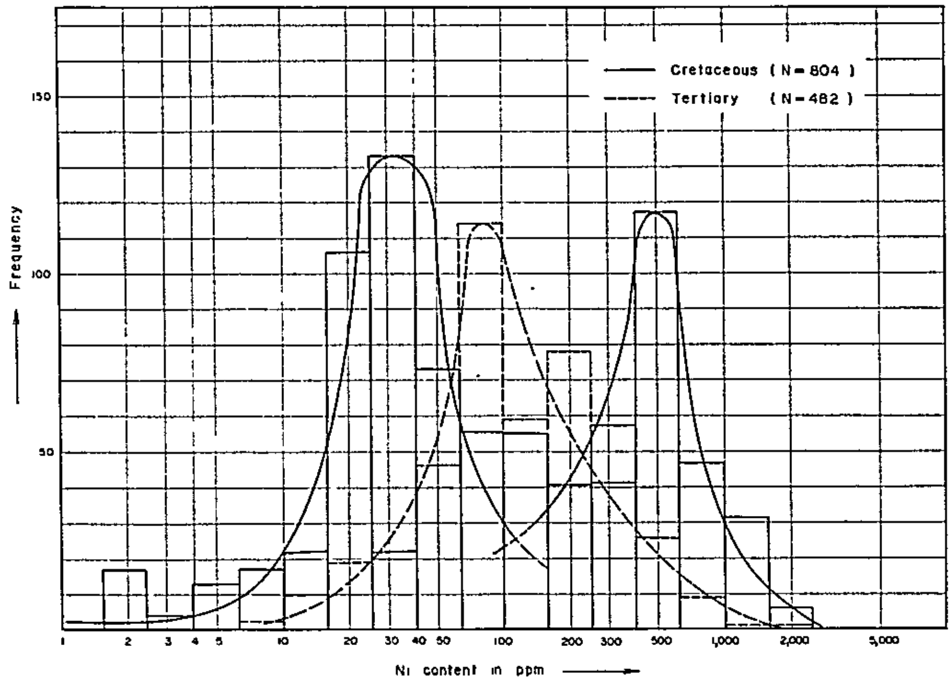
3) Although the background values of Ni in both systems are about the same, the threshold values differ very much. Compared to the Eastern Area, both of them are absolutely high.

The reason for the Ni-threshold values in the Teartiary Area being higher than those in the Cretaceous area, is due to the method described in the 3-2-1 c) paragraph. In this regard, the following explanation can be given.

The data of Ni from the Tertiary area distribute lognormally. On the contrary, those from the Cretaceous area come from the complex populations, that is, the population with higher values means the peridotite zone and the lower means the

Cretaceous sediments. (See Fig. 2-3 (A) and 2-4 (A) of APPENDIX and Fig. 4.)

Fig. 4. Hislogram and frequency curve of Ni



The treashold values in the Cretaceous area are very low compared with those in the Tertiary area. As mentioned earlier the main purpose of the survey is not to find out the geochemically anomalous places, but to select the anomalous areas. Therefore, especially high values have not been used in this report. (If taking 2.5%-values from the highest, they attain 1,200ppm in the Cretaceous area).

In the Cretaceous area, Ni anomalies occur clearly in the peridotite zone. And they are also found in the drainage systems such as the Taumo and Umayan Rivers. At the headwaters of them, the peridotite has been recognized actually or its existence expected. But there are no anomalies in the drainages, e.g. the Langilang, the Pipisan and the Simong Rivers, which branches do not reach the peridotite zone. Ni contents in the peridotite zone are always very high with

800-1,500ppm and extend to the down stream. For example, in the Taumo River more than 400ppm of Ni content has been carried as far as 20km from the peridotite zone. In the small creeks west of Halapitan Municipality, there are other Ni anomalies which are also caused by serpentinized peridotite dykes.

A somewhat concentrated Cu anomaly is located in the pyroxenite zone of the Tigua River. The contents are from 150 to 200ppm here. The anomalous zone on − 100-mesh fraction is wider than on coarse-grained fraction. The pyroxenite is intruded by gabbro. Silicification and epidotization are common and pyrite veinlets are partly observed. Therefore, this area should be further surveyed in detail. Although pyroxenite is an ultrabasic rock as well as peridotite, Ni anomalies have not been recognized. Along the Langilang River, there is another Cu anomalous zone where the contents show 90 ~ 100ppm, but it looks very difficult to survey this dangerous area.

A Zn anomaly of − 100-mesh fraction is located in the Taumo River. But it is considered unimportant for reasons that the mean contents are about 100ppm and are not accompanied by Cu.

In the Tertiary area, some Zn anomalous zones are obtained in the Madgao and the adjacent rivers. These samples were collected at crossing points of logging roads and creeks. Considering the fact that these are not intense anomalies of Zn along the Magimon and the Kapalong Rivers in the same rock formation, those anomalies may have been caused by artificial contamination.

In other places, Cu and Zn show the normal contents. In general, Ni contents are relatively high compared with the Eastern Tertiary Area. They are owing to the many fragments of peridotite in Tertiary congglomerate or sandstone beds.

From the geochemical facts described above, the promising area is limitted to the western wing of the Pantaron Mountain Range, that is, in Bukidnon Province. This area consists of Cretaceous rocks, and the detailed geochemical survey is desirable for Cu and Ni ore deposits.

The bank sediments were also collected as check samples.

The correlation between the stream and the bank sediments is not clear because of a few samples, but it might be said that both sediments contain about the same amounts of metals, and that the contents in soil show higher values about 1.5 ~ 2 times those in stream sediment.

PART III CONCLUSIONS AND FUTURE PROBLEMS

Conclusions and Future Problems

Conclusions reached from the synthetic studies based on the geological and the geochemical surveys along the main routes are as follows:

1. Judging from the geological structures and geochemically anomalous zone of copper, zinc and nickel, the areas for further detailed survey are selected about 3,000 km^2 in all, that is, about 1,600 km^2 in the Eastern Area and about 1,400 km^2 covering an area within Bukindnon Province and an area west of the Davao River in the Western Area. Both of them consist of the Cretaceous rocks.

2. In spite of various inconveniences, especially topographical one, geological structure as well as the extent of mineralization of said area was clarified.

3. On the geochemical stream sediment survey, the determinations of copper, zinc and nickel have proved effective for selecting the promising area.

4. Some areas where metals concentrate anomalously have been found. However, it does not always indicate the existence of the ore deposits. The detailed survey is needed to make clear the geological structure of this area.

5. Generally speaking, the methods of airborne survey are useful for making clear the underground geological structure. But in this area they are not effective to distinguish the dioritic rocks from Cretaceous andesite or basalt, or to find out the mineralized zone. Therefore, the best way seems to use the surface geophysical method as well as the detailed geological and the geochemical surveys for defining the most promising area. Thereafter drilling should be carried out.

6. As for the diorites which generally have a close relation with the porphyry copper deposits, these causal relations to the Philippines Fault-zone and these intruding age are left unknown, because outcrops are limited in a very narrow region. To know these facts, it is necessary to carry out more extensive geological survey on this project area.

7. As a whole, the Philippine Fault-zone, in this report, is considered the subsiding area since its genetic time although this is not confirmed. There are some possibilities, however, that some parts within this Fault-zone are rather an uplifting area, because, according to the Philippine geological map at a scale of 1 : 1,000,000, the Tertiary rocks can be recognized in the neighboring area. It is quite possible that the Philippine Fault movement has a close relation with the mechanism of diorite intrusion. Therefore, it is desirable to make clear the basement structure of this area in the future.

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APPENDICES

Table 1. Fossils

General explanation

(A) So-called Cretaceous System

Only one fragment of Porifera is in the sample A - 14 but its geological age is not clear.

(B) Kapalong Formation

The samples from this formation contain many fossils (smaller foraminifera and larger f.). The presence of foraminiferas, such as, Globorotalia tosaensis, Pulleniatia obliqueloculata obliqueloculata and Sphaeroidinella dehiscenes (s. l.) suggest that the geological age of this formation is from Upper Pliocene to Pleistocene.

As a whole, the sedimental environment is considered to be somewhat deep sea.

(C) Bislig Formation

The four samples from this formation contain many smaller foraminiferas, but the geological age is not clear because of lacking index fossil.

The foraminiferas, consisting of all benthonic, suggest this formation was formed in an open but shallow marine environment.

(D) Agtuucan Formation

The sample No. EB-8, taken as a representative of this formation tentatively regardless of that there are still unclear points, indicates this formation was formed in lower Miocene age.

The sedimentary environment was also shallow sea.

(Porifera)

Sample No: A-14

Locality : Simong River
Formation : Cretaceous
Rock : Shale
Species :
Porifera
Geological age : not clear

(Foraminifera)

Sample No: B-5

Locality : Maguimon River
Formation : Kapalong F.
Rock : Siltstone
Species : Smaller f.

(Benthonic)	(Planktonic)
Sigmoilina sp.	Globigerina bulloides (s. l.)
Stilostomella sp.	Globigerina decoraperta
Bolivinita guadrilatera	Globigerina spp.
Bolivina robusta	Globigerinoides ruber (s. l.)
Bolivina sp.	Globigerinoides elongalus
Uvigerina peregrina dirupta	Globigerinoides obliquus
Bulimina aculeata	Globigerinoides quadrilobatus quadrilobatus
Elphidium sp.	Globigerinoides quadrilobatus sacculifer
Planulina wuellerstorfi	Globigerinoides quadrilobatus trilobus
Cibicides spp.	Sphaeroidinella dehiscens (s. l.)
Oridorsalis umbonatus	Globorotaria acostaensis (s. l.)
Cassidulina subglobosa	Globorotaria inflata ?
Cassidulina carinata	Globorotaria tosaensis
	Globorotaria cultrata (s. l.)
	Globigerinita glutinata
	Pulleniatina obliqueloculata obliqueloculata •

Geological age : Upper Pliocene ~ Pleistocene

Sample No: B-6

Locality : Maguimon River
Formation : Kapalong F.
Rock : Siltstone
Species : Smaller f.

(Benthonic)

- Textularia sp.
- Fissurina sp.
- Lenticulina sp.
- Uvigerina peregrina dirupta
- Bolivinita guadrilatera
- Sphaeroidina bulloides
- Astrononion spp.
- Cibicides spp.
- Cassidulina carinata
- Cassidulina spp.
- Gyroidina spp.

(Planktonic)

- Globigerina bulloides (s. l.)
- Globigerina decoraperta
- Globigerina spp.
- Globorotalia cultrata (s. l.)
- Globorotalia acostaensis (s. l.)
- Globorotalia tosaensis
- Globorotalia tumida tumida
- Globigerinoides ruber (s. l.)
- Globigerinoides obliguus
- Globigerinoides quadrilobatus quadrilobatus
- Globigerinoides quadrilobatus sacculifer
- Globigerinoides quadrilobatus trilobus
- Hastigerina siphonifera
- Globigerinita glutinata
- Pulleniatina obliqueloculata obliqueloculata

Geological age : Upper Pliocene ~ Pleistocene

Sample No: B-10

Locality : Maguimon River
Formation : Kapalong F.
Rock : Siltstone
Species : Smaller f.

(Benthonic)
Stilostomella sp.
Cassidulina spp.
Cibicides spp.

(Planktonic)
Globigerina bulloides (s. l.)
Globigerina decoraperta
Globigerina spp.
Globigerinoides ruber (s. l.)
Globigerinoides bollii
Globigerinoides obliquus
Globigerinoides quadrilobatus trilobus
Globorotalia acostaensis (s. l.)
Globorotalia cultrata (s. l.)
Globorotalia tumida plesiotumida ?
Pulleniatina sp.

Geological age : Pliocene

Sample No: C-1

Locality : Taumo River
Formation : Kapalong F.
Rock : Sandstone
Species : Smaller f.
Quinqueloculina spp.
Elphidium spp.
Ammonia ? spp.
Amphistegina sp.
Geological age : not clear

Sample No: D-8

Locality : Kapalong River
Formation : Kapalong F.
Rock : Mudstone
Species : Smaller f.
Calcarina spp.
Anomalina sp.
Elphidium sp.
Pyrgo sp.
Geological age : not clear

Sample No: D-9

Locality : Kapalong River
Formation : Kapalong F.
Rock : Mudstone
Species : Smaller f.

(Benthonic)	(Planktonic)
Amphistegina sp.	Globigerina spp.
Gypsina ? sp.	Globigerinoides obliquus
Cibicides spp.	Globigerinoides quadrilobatus trilobus
Elphidium spp.	Globorotalia sp.
Anomalina sp.	
Cassidulina sp.	

Geological age : Pleistocene ?

Sample No: D-10

Locality : Kapalong River
Formation : Kapalong F.
Rock : Limestone
Species : Smaller f.

(Benthonic)	(Planktonic)
Stilostomella sp.	Globigerinoides ruber (s. l.)
Bolivinita quadrilatera	Globigerinoides elongatus
Pleurostomella sp.	Globigerinoides quadrilobatus quadrilobatus
Angulogerina sp.	Globigerinoides quadrilobatus trilobus
Oridorsalis umbonatus	Globigerinita glutinata
Cibicides sp.	Globigerina bulloides (s. l.)
Astrononion sp.	Globoquadrina altispira altispira
Pullenia bulloides	Globoquadrina venezuelana
Melonis sp.	Globorotalia cultrata (s. l.)
Hoeglundina sp.	Globorotalia cf. crassaformis
	Globorotalia acostaensis (s. l.)
	Sphaeroidinella dehiscens (s. l.)
	Pulleniatina obliqueloculata obliqueloculata

Geological age : Upper Pliocene

Sample No: D-11

Locality : Kapalong River
Formation : Kapalong F.
Rock : Mudstone
Species : Smaller f.

(Benthonic)
- Stilostomella spp.
- Uvigerina sp.
- Sphaeroidina bulloides
- Bolivinita quadrilatera
- Bolivina robusta
- Bolivina sp.
- Lenticulina sp.
- Planulina wuellerstorfi
- Cibicides sp.
- Astrononion sp.
- Gavelinopsis
- Oridorsalis umbonatus
- Cassidulina carinata
- Cassidulina delicata
- Cassidulina sp.
- Pararotalia globosa

(Planktonic)
- Globigerina bulloides (s. l.)
- Globigerina decoraperta
- Globigerina spp.
- Globorotalia acostaensis
- Globorotalia cultrata (s. l.)
- Globorotalia crassaformis (s. l.)
- Globigerinoides ruber (s. l.)
- Globigerinita glutinata
- Pulleniatina obliqueloculata obliqueloculata

Geological age : Upper Pliocene ~ Pleistocene

Sample No: D-12

Locality : Kapalong River
Formation : Kapalong F.
Rock : Limestone
Species : Smaller f.

(Benthonic)
- Bulimina cf. inflata
- Bolivina robusta
- Pullenia bulloides
- Sphaeroidina bulloides
- Cassidulina sp.
- Astrononion sp.
- Cibicides pseudoungerianus
- Cibicides sp

(Planktonic)
- Globigerina bulloides (s. l.)
- Globigerina spp.
- Globorotalia acostaensis (s. l.)
- Globorotalia tumida tumida
- Globorotalia cultrata (s. l.)
- Orbulina universa
- Pulleniatina obliqueloculata obliqueloculata
- Globoquadrina venezuelana
- Globigerinita glutinata
- Globigerinoides quadrilobatus quadrilobatus
- Globigerinoides quadrilobatus trilobus
- Globigerinoides ruber (s. l.)
- Globigerinoides elongatus
- Globigerinoides obliquus

Geological age : Upper Pliocene ~ Pleistocene

Sample No: E-2

Locality : Maguimon River
Formation : Kapalong F.
Rock : Siltstone
Species : Smaller f.

(Benthonic)	(Planktonic)
Articulina sp.	Globorotalia tumida tumida
Quinqueloculia spp.	Globorotalia cultrata (s. l.)
Stilostomella sp.	Globorotalia acostaensis (s. l.)
Loxostomoides bradyi	Globigerina bulloides (s. l.)
Bolivina sp.	Globigerina decoraperta
Cassidulina sp.	Globigerina quinqueloba
Cibicides sp.	Globigerina spp.
Uvigerina sp.	Globigerinoides ruber (s. l.)
Bulimina sp.	Globigerinoides elongatus
Globobulimina sp.	Globigerinoides obliquus
Pullenia bulloides	Globigerinoides quadrilobatus quadrilobatus
Grabratella sp.	Globigerinita glutinata
	Pulleniatina obliqueloculata obliqueloculata

Geological age : Upper Pliocene ~ Pleistocene

Sample No: G-16

Locality : Bislig River
Formation : Bislig F.
Rock : Limestone
Species : Smaller f.
Cibicides spp.
Operculina ? sp.
Geological age : not clear

Sample No: H-4

Locality : San Jose
Formation : Bislig F.
Rock : Taffaceous sandstone
Species : Smaller f.
Ouinqueloculina spp.
Nonion spp.
Elphidium spp.
Ammonia spp.
Geological age : not clear

Sample No: H-22F

Locality : San Jose
Formation : Bislig F.
Rock : Sandstone
Species : Smaller f.
Quiqueloculina spp.
Nonion spp.
Elphidium spp.
Ammonia spp.
Spirillina sp.
Geological age : not clear

Sample No: H-112

Locality : Cateel River
Formation : Bislıg F.
Rock : Mudstone
Species : Smaller f.
Operculina sp.
Massilina sp.
Elphidium spp.
Nonion spp.
Ammonia cf. beccarii
Pseudorotalia sp.
Valvulineria sp.
Geological age : not clear

Sample No: EB-8

Locality : Mambalilli
Formation : Agtuucan F.?
Rock : Limestone
Species : Larger f.
Lepidocyclina (Nephrolepidina sp.)
Miogypsina sp.
Cycloclypeus sp.
Geological age : Lower Miocene

Table 2. Microscopic observations

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
A - 1	Pipisan Creek	Cretaceous	Andesitic tuff	Greenish-gray, fine grained rock with white spots or white veinlets.	Subangular fragments of pilotaxitic andesite, mud, plagioclase and augite. Plagioclase is replaced by zeolite and calcite. Analcite or wairakite is found in calcite stringers. Laumontite occurs also in veins.	
A - 2	ditto	ditto	Andesitic fine tuff	Reddish, soft rock with white veinlets.	Very fine grained, well sorted. Fine fragments are composed of much hornblende, quartz, plagioclase, volcanic ash and a little clino-pyroxene. Laumontite veins are abundant.	See PL.1 A
A - 4	ditto	ditto	Andesitic tuff	Dark-gray rock with tiny rock fragments.	Essential rock fragments, namely, amygdaloidal glassy andesite, porphyritic augite andesite and pilotaxitic andesite occur in a matrix of less clearly defined glassy fragments. Secondary minerals are carbonate (some appear to be organic origin) and laumontite.	See PL.1 B
A - 6	ditto	ditto	Tuffaceous sandstone	Soft, fine grained, gray rock	The principal clastic grains are subrounded quartz, plagioclase and augite. Small grains of epidote (partly altered to chlorite) are present. Secondary calcite and laumontite veins fill the fissure.	
A - 10	Simong R.	ditto	Andesitic tuff	Dark-green rock with clear striation.	Fragments of porphyrytic augite andesite, organic carbonate, plagioclase and augite are welded by yellow to green colored clay minerals. Dark-yellowish clay mineral has high birefringence (probably saponite) and pale green one is montmorilonite or chlorite. Plagioclase is partly altered to ceradonite. Analcite and wairakite fill small pools in dark yellowish clay.	
A - 12	ditto	ditto	Acidic tuff	Yellowish-brown, compact rock showing weak welding.	Crystals of plagioclase, augite, biotite, quartz and lithic fragments (pumice) are in a matrix of pale brown volcanic glass. Secondary sericite occur in network all over the rock.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
A - 13	Simong R.	Cretaceous	Andesitic tuff	Grayish, badly sorted rock with dark-green patches	Rock components are similar to A-12. Fragments of ophitic andesite to basalt, pilotaxitic augite andesite and pumice and chips of biotite, plagioclase, augite and epidote occur in a matrix of glassy material. Sericite and clay mineral are also recognized.	
A - 16	ditto	ditto	Glassy andesite	Pale-green, compact rock. Many white colored veinlets.	Small chips of plagioclase and pyroxene are scattered in a matrix of glass and microlite. Laumontite veinlets accompanying calcite are observed commonly.	
A - 18	Naunum R.	Intrusives	Hornblende gabbro	Coarse grained, dark-green rock showing graphic texture.	Principal minerals are abundant hornblende and plagioclase and show graphic texture. Anhedral clinopyroxene, sphene and quartz are accessories. Secondary minerals are sericite and epidote.	
A - 19A	ditto	ditto	Dolerite	Gray, compact rock with sulphide impregnation	Lath-shaped altered plagioclase and ophitic pyroxene (almost altered to chlorite) are the principal minerals. Opaque minerals are ilmenite and sulphide.	See PL.6 A
A - 19B	ditto	Cretaceous	Sandstone	Yellowish-green rock with many rock fragments.	Subangular grains of quartz are welded by very small grained quartz, epidote and interstitial clay. Secondary prismatic epidote (some are granular) and quartz occur abundantly (probably by hydrothermal alteration). Many ilmenite and leucoxene are accessories.	See X-ray chart 1
A - 21	Bonacao R.	Intrusives	Sheared peridotite	Sheared, dark-green, soft rock.	Fragments of pyroxene and olivine (both altered thoroughly to chlorite, epidote and calcite) show weak schistosity. Quartz and zeolite veinlets are present.	See X-ray chart 2
A - 22	ditto	Cretaceous	Siliceous shale	Dark-green, glassy, hard rock.	Whole groundmass consists of a cryptocrystalline aggregate of felsic minerals. Phenocryst is absent. There are some sericite and pyrite along fissures.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
A - 24	Paradise	Intrusives	Serpentinized peridotite (Lherzolite)	Dark-green, hard rock with white veinlets. Pale brownish, filmy metallic minerals occur along fissures.	Orthopyroxene and olivine are nearly completely serpentinized and show mesh-structure. Clinopyroxene, brown spinel and much chromite are present.	See PL.3 C
A - 25	Pulangi R.	Cretaceous	Andesitic crystal tuff	Pale purplish-gray rock with essential boulders. Prismatic black minerals are scattered.	Cryslalline texture seems to be volcanic rock, but there are many fragments of hornblende and plagioclase. Hornblende is yellowish brown and shows weak pleochroism. Euhedral plagioclase has albite twinning. Other components are augite and accessory magnetite. Quartz: absent.	
a - 1	Locawan R.	ditto	Andesitic lapilli tuff	Subangular rock fragments are cemented by greenish tuff. Soft rock.	Fragments of andesite, chips of plagioclase, pyroxene and epidote are in a glassy matrix of carbonate, chlorite, clay with accessory magnetite.	See X-ray chart 3
a - 2	ditto	ditto	Augite bearing hornblende andesite	Dark-green rock with pyrite impregnation.	Phenocrysts of prismatic large hornblende and sodic plagioclase are abundant. It shows porphyritic texture. Mafic minerals are replaced thoroughly by epidote, chlorite and sericite. Opaque minerals are magnetite.	
a - 3	ditto	Intrusives	Hornblende bearing pyroxenite	Dark-green, holocrystalline rock. Medium grained minerals show weak trend of parallel arrangement.	Small grains (0.2 mm in size) of euhedral clinopyroxene are welded by brown, anhedral hornblende and magnetite. The texture is mosaic rather than granular. A large clinopyroxene (7 mm in size) encloses small grains of brown hornblende poikilitically.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
a - 4	Locawan R.	Cretaceous	Hornblende andesite	Whitish-gray, compact rock with green prismatic mineral.	Phenocrysts of abundant hornblende (altered to uralite) and plagioclase are in a matrix of foliated plagioclase. It shows holocrystalline texture. Secondary minerals are uralite.	
AJ - 1	Silae	ditto	Porphyritic pyroxene andesite	Dark-green, compact rock. Sub-rounded green minerals are scattered in a glassy material.	Large phenocrysts of plagioclase and clinopyroxene are in a matrix of plagioclase laths enclosed in glass. Some plagioclase are altered to chlorite and calcite. Clinopyroxene are mostly augite and show weak pleochroism.	
AJ - 3	ditto	ditto	Basalt	Dark-green, fine grained rock with white spots.	Phenocrysts of plagioclase and clinopyroxene occur in a matrix which is full of plagioclase lath and pyroxene. Brownish-green clay mineral, chlorite and zeolite are observed.	
B - 3	Maguimon R.	Kapalong F.	Mudstone (Pebble of conglomerate)	Coarse grained, dark-gray, muddy rock with white veinlets and spots.	Fragments of mudstone, andesite, plagioclase, hornblende and chlorite are welded by pelitic material. Calcite replaces some plagioclase. Analcite and laumontite veins. are recognizable.	
B - 11	ditto	ditto	Calcareous tuff	Rock fragments (1 mm - 5 mm in diameter) are cemented by soft yellowish tuff.	Subangular rock fragments of mudstone, volcanic rock (chiefly andesite) and shells of foraminifera and chips of plagioclase, augite and hornblende are cemented by secondary calcite.	
B - 17	Libuganon R.	Kapalong F.	Dolerite	Gray, compact rock.	Subhedral crystals of plagioclase are embedded with augite, partly altered to chlorite. Plagioclase are almost dusted with a fine grained clay mineral (Kaoline?). Accessory is much magnetite.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
C - 4	Taumo R.	Cretaceous	Propylitic tuff	Dark, greenish-gray rock with spangles of whitish and black spots. White veinlets.	Crystals of plagioclase, clinopyroxene, magnetite, hornblende and rarely biotite. Plagioclase is altered to albite, white mica and zeolite. Hornblende pleochroic from brownish green to pale, light, greenish brown. Biotite is usually bended and pleochroic from pale, greenish brown to pale, light brown. Lithic (andesite composed of plagioclase, magnetite and clinopyroxene) fragments are abundant. Chlorite substitutes some ferromagnesian minerals. Accessory, apatite.	
C - 6	ditto	ditto	ditto	Dark, greenish-gray rock with whitish and black spots.	Crystals of plagioclase, clinopyroxene, brownish green hornblende and magnetite. Plagioclase is altered to albite and zeolite. Calcite occurs interstitially or as alteration product. Some calcite retain organic structure. Chlorite, as pseudomorphs after ferromagnesian minerals. Various lithic fragments: present.	
C - 12	ditto	Intrusives	Garnet pyroxenite	Greenish rock with pinkish crystal.	Diopside and garnet: abundant. Enstatite: in small amount. Garnet: usually surrounded by kelyphite composed of tremolite, plagioclase, serpentine, augite and rarely spinel.	See PL.4 A
C - 14	ditto	ditto	Serpentinized peridotite (Lherzolite)	Dark-green rock with pale and lustrous, dark green crystals.	Olivine: altered to serpentine along the fractures of crystals. Clinopyroxene, orthopyroxene and chromian spinel are found. A small amounts of magnetite and brown hornblende are present.	
C - 16	ditto	Cretaceous	Impure dolomite	Pale, greenish-gray, compact rock with black patches.	Very fine granules of dolomite are crowded. Irregular and skeletal magnetite, sporadically. Magnetite is partially altered to limonite. Calcite occurs as veinlets and isolated crystals. Interstitial talc or white mica abundant.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
C - 18	Taumo R.	Intrusives	Monzonite	Very heterogeneous rock, composed of white part with brown spots, purplish-brown and grayish-green part with white spots, and dark-green schistose part.	Potash feldspar (orthoclase) and plagioclase are essential. Magnetite (almost altered), brownish green hornblende, biotite and aggregates of fibrous white mica occur interstitially. Small prisms of apatite are present.	
C - 21	Davao R.	Cretaceous	Siltstone	Very compact rock composed of alteration of bluish-green and light gray bands and often with light yellowish-green patches.	Irregular fine grains (0.01 - 0.1 mm in size) of feldspar, quartz, magnetite, clinopyroxene and (probably) hornblende are scattered in brownish green matrix. Rounded grains might have originated from radiolaria.	
C - 24	Locawon R.	ditto	Propylitic lapilli tuff	Dark, grayish-green rock with whitish spots.	Plagioclase, clinopyroxene, magnetite and lithic fragments are abundant. Calcite occurs interstitially in shell form. Chlorite is interstitial and often substitute plagioclase partially.	
C - 28	Tigua R.	ditto	Hornblende-bearing biotite-clinopyroxene andesite	Dark, greenish-gray rock with black spangles.	Phenocrysts are plagioclase, clinopyroxene, biotite, magnetite and rare hornblende. Ground mass is consisted of laths of plagioclase and clinopyroxene and magnetite granules with accessory apatite.	
C - 31	ditto	Intrusives	Biotite hornblende clinopyroxene gabbro	Dark, greenish-gray rock with black spangles, white and light green veinlets.	Mosaic texture built up of plagioclase, clinopyroxene, brownish-green hornblende and magnetite. Biotite: rather interstitial. Accessory apatite is found as isolated grains and inclusion in clinopyroxene, hornblende and biotite.	See PL.4 B

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
C - 36	Tigua R.	Intrusives	Biotite hornblende clinopyroxenite	Dark green rock composed of light greenish-gray and dark green crystals.	Clinopyroxene and magnetite: abundant. Brown hornblende and biotite, subordinate. Calcite and light yellowish-green prisms of epidote and acicular green hornblende form veinlets. Secondary chlorite: present.	
C - 37	ditto	ditto	Biotite clinopyroxene porphyrite	Dark green and light greenish-white crystals scattered in whitish matrix.	Phenocrysts of plagioclase, clinopyroxene, magnetite and biotite: abundant. Alkali feldspar: interstitial. Apatite, accessory. Calcite and white mica occur as alteration products along the fractures of plagioclase.	
C - 38	ditto	ditto	Biotite clinopyroxene gabbro	Greenish gray rock.	Plagioclase, clinopyroxene and magnetite are main constituents. Biotite, rather interstitial. Apatite, accessory. White mica occurs along the fractures of plagioclase and interstitially.	
C - 46	Kalaguloy	Cretaceous	Clinopyroxene andesite	Light brownish-gray rock with white and dark green spots.	Phenocrysts: plagioclase, clinopyroxene and magnetite. Groundmass consists of plagioclase laths and irregular grains of clinopyroxene and magnetite. Irregular cavities are composed of zeolite or hornblende. Apatite, accessory.	
C - 48	Kawayan R.	ditto	Propylitic tuff	Dark greenish-gray rock.	Crystals of plagioclase, clinopyroxene and lithic fragments: abundant. Magnetite and epidote are rarely seen. Accessory apatite. Chlorite, calcite and zeolite: secondary.	
D - 2	Kapalong R.	ditto	ditto	Dark gray, compact rock.	Abundant irregular grains (0.002 - 0.2 mm in size) of plagioclase, clinopyroxene, brownish green hornblende and magnetite are scattered in devitrified glass. Plagioclase are replaced by calcite and zeolite. Secondary chlorite and biotite are found.	
D - 4A	Umayan R.	ditto	ditto	Light greenish-gray rock with white and light yellowish-green spots.	Crystals of plagioclase, clinopyroxene, green hornblende and magnetite and various lithic fragments are main constituents. Plagioclase is altered to zeolite. Calcite and chlorite occur as alteration products.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
D - 4B	Umayan R.	Cretaceous	Propylitic tuff	Dark greenish-gray rock with white spots and veinlets.	Crystals of plagioclase, clinopyroxene, magnetite and various lithic fragments are abundant. Greenish brown hornblende: subordinate. Plagioclase is altered to zeolite. Chlorite completely replaces some ferro-magnesian minerals and occurs interstitially. Glass is devitrified.	
D - 5	Simong R.	ditto	Chert	Reddish-brown, compact rock with white vein-lets.	Colorless spherules (usually 0.05 - 0.15 mm in dia-meter) are scattered in reddish-brown matrix. Ratio of spherule to matrix varies significantly. Spherules may represent original radiolaria and now are con-structed by minute, irregular-formed quartz.	
E - 4	Pulangi R.	ditto	Andesitic tuff	Gray, medium grained rock.	Fragments of porphyritic andesite, glassy andesite, quartz, plagioclase, augite, hornblende and magnetite are in a matrix of fine glassy microlite, chrysolite, hydromica and magnetite. Weakly altered.	
E - 7	ditto	ditto	ditto	Dark gray, com-pact rock.	Fragments of porphyritic andesite, aphyric rock, glassy andesite, twinned plagioclase, clinopyroxene, magnetite and hornblende occur in a pale greenish matrix of chlorite. Quartz and calcite veinlets: abundant.	
E - 10	ditto	ditto	ditto	ditto	Fragments of aphyric rock, plagioclase, clinopyroxene, magnetite and mollusca occur in a matrix of chlorite. Chlorite surrounds all the fragments.	
E - 15	ditto	ditto	ditto	ditto	Fragments of aphyric rock, aphyric microdioritic rock, plagioclase, clinopyroxene and magnetite are in a matrix of glass (altered to chlorite). Secondary min-erals are chlorite and opal.	
E - 17	Halapitan	Intrusives	Clinopyroxene peridotite	Dark-gray, holo-crystalline rock.	Partly serpentinized olivine and clinopyroxene make up most of this rock. Accessories are spinel, enclosed in olivine and pyroxene, biotite and ore mineral.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
E - 20	Naunum R.	Intrusives	Serpentinized peridotite	Grayish-black to green compact rock with flat slippy surface.	Holocrystalline rock. Pyroxene and olivine are completely serpentinized and show mesh structure. There is a little chromite.	
E - 21	Tugop R.	Cretaceous	Andesitic tuff	Bedded rock with white veinlets.	Fragments of aphyric andesite with plagioclase laths, porphyritic andesite, pumice, basaltic holocrystalline rock, serpentinite and chips of plagioclase, clinopyroxene hornblende and biotite are cemented by chlorite and carbonate minerals.	
E - 22	ditto	Intrusives	Garnet bearing diallage pyroxenite	Dark-gray rock with garnet spots.	It consists of clinopyroxene, foliated diallage and serpentine altered from mafic minerals. Many carbonate veinlets.	
E - 24	Pulangi R.	Cretaceous	Andesitic crystalline tuff	Gray, porphyritic rock with much hornblende.	Crushed crystals of twinned and zoned plagioclase, hornblende are in a matrix of plagioclase laths, pyroxene and ore mineral. It contains some fragments of holocrystalline andesite. Zeolite veinlets present.	
E - 26	ditto	Intrusives	Gabbroic pegmatite	Pegmatitic rock which large crystals of mafic and felsic mineral.	Altered large crystal of plagioclase (20 mm in size) and clinopyroxene are main constituents. Tremolite and quartz veinlets are observed.	
e - 3	Halapitan	Cretaceous	Augite andesite	Dark-gray rock with white and brown phenocrysts.	Phenocrysts are composed of twinned and zoned plagioclase, augite and carbonate minerals and show porphyritic texture. Groundmass: plagioclase laths, granular augite, chlorite, ore mineral and brownish glass.	See PL.1 C
e - 4	ditto	ditto	ditto	Dark-brown compact rock.	It has porphyritic texture. Phenocrysts of plagioclase, augite and ore mineral are in a groundmass of plagioclase laths, granular pyroxene and brownish glass. Microcrystal tremolite veinlets are present.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
e - 9	Bubasawan R.	Intrusives	Olivine bearing clinopyroxene-gabbro	Dark-gray, holocrystalline rock	Basic subhedral plagioclase, clinopyroxene (showing exsolution texture), olivine partially altered to serpentine, and a small amount of tremolite and ore mineral make up this rock.	
F - 19	Yan R.	Bislig F.	Pyroxene-hornblende-andesite	Gray compact rock.	Phenocrysts of plagioclase, clinopyroxene and hornblende (altered to clay minerals) are porphyritically in a groundmass of microlite, opaque mineral and glass. Secondary minerals are clay minerals, laumontite, calcite, quartz and sericite.	
F - 29	Maganding R.	Intrusives	Quartz-diorite	Holocrystalline rock with weak foliation.	The major constituents are augite (altered to uralite), anhedral quartz and altered plagioclase. Epidote, chlorite, quartz and sericite occur secondarily.	See PL.4 C
F - 30	ditto	ditto	Quartz bearing dolerite	Dark greenish-gray, compact rock.	Large euhedral pyroxene and plagioclase show ophitic to gabbroic texture. Intersertal and anhedral quartz is present. Secondary minerals are uralite, calcite, epidote, chlorite and quartz.	
F - 32	ditto	ditto	Quartz-diorite	Greenish-gray rock with weak foliation.	Strongly altered so that original texture and constituents are obscure. Alteration minerals are epidote, calcite, chlorite and quartz.	
F - 36	Boadan	Cretaceous	Coarse tuff	Gray, limy, compact rock.	Strongly carbonized clastic rock. Relic minerals appear to be plagioclase and mafic mineral. No fossil.	
F - 38	Bantacan	ditto	Pyroxene-bearing hornblende-andesite	Greenish rock with dark-green mafics.	Texture is similar to F-19 but phenocrysts are smaller. Alteration minerals are prehnite, epidote and chlorite.	
G - 13	Taon R.	ditto	Clinopyroxene-basalt	Gray volcanic rock. Porphyritic texture is not clear.	This is holocrystalline rock including plagioclase and clinopyroxene phenocrysts. Plagioclase shows glomeroporphyritic texture and albite or carlsbad twin is common. Groundmass is consisted of plagioclase laths, clinopyroxene, magnetite and carbonate and shows intergranular texture.	See PL.2 A

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
G - 26	Taon R.	Intrusives	Dolerite	Gray, fine grained, holocrystalline rock with a little mafic mineral.	Phenocrysts of plagioclase and augite are in a groundmass of twinned plagioclase laths, augite, magnetite and hydromica. Texture is porphyritic. Groundmass: intergranular.	
G - 30	ditto	Cretaceous	Augite andesite	Gray, porphyritic and compact rock with flow structure.	Phenocrysts of twinned and zoned plagioclase and augite are in a matrix of brownish glass, plagioclase laths, clinopyroxene and magnetite.	
G - 32	ditto	ditto	ditto	Yellowish-gray, porphyritic and compact rock with plagioclase and mafics.	Phenocrysts are twinned and zoned plagioclase (partly altered to hydromica) and augite. Groundmass consists of plagioclase laths, augite and magnetite, and shows intergranular to intersertal texture. Secondary minerals are chlorite and hydromica.	
G - 35	ditto	ditto	ditto	Dark-gray, compact rock	Phenocrysts of twinned and zoned plagioclase, pale pinkish augite and magnetite are in a matrix of intergranular plagioclase, granular augite and magnetite. Texture is porphyritic. Secondary chlorite fills the druse of matrix.	
G - 36	ditto	ditto	Altered acidic volcanic rock?	Yellowish-brown and gray striped soft rock.	This rock consists of coarse grained holocrystalline and fine grained groundmass. The former is glomeroporphyritic twinned plagioclase. The latter is an aggregate of glass, plagioclase, quartz and ore minerals. Secondary minerals composed of hydromica, sericite and chlorite occur around the rim of druses and crystals.	
G - 41	Bislig R.	Bislig F.	Altered andesite (pebble in conglomerate)	Gray porphyritic rock.	Phenocrysts of twinned plagioclase, altered pyroxene, magnetite and a little rutil are in a matrix of plagioclase laths, granular quartz and magnetite.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
G - 44	Bislig R.	Bislig F.	Basaltic andesite	Dark-gray, compact rock.	Porphyritic rock. Phenocryst consists of twinned plagioclase and pyroxene (partly altered to chlorite). Groundmass shows basaltic texture and consists of plagioclase laths, granular augite, magnetite and glass. Chlorite from mafic minerals is observed commonly.	
G - 109	Cateel R.	Cretaceous	ditto	Dark-gray, porphyritic rock.	Texture and components are similar to G-44. Phenocrysts of plagioclase and augite are in a matrix of plagioclase, augite, magnetite and glass.	
G - 115	ditto	ditto	Andesitic tuff breccia	Gray, compact rock with lithic fragments.	Fragments of andesite and chips of plagioclase, augite, hornblende and magnetite are welded by secondary chlorite. There are porphyritic and aphyric and trachytic textures in andesite fragments.	See PL.2 C
G - 123	ditto	ditto	Augite andesite	Dark-gray, compact rock.	Phenocrysts of plagioclase, twinned augite and magnetite are in a matrix of plagioclase laths, pyroxene and magnetite. Plagioclase phenocryst shows carlsbad or albite twin and zonal structure. Texture of this rock is porphyritic.	
G - 133	San Miguel	ditto	Altered andesite	Very dark-gray, compact rock.	This rock has autobrecciated block texture. The blocks are 0.5 mm - 6 mm in size and have different colors. Phenocrysts of twinned plagioclase, pyroxene (completely altered to carbonate) and magnetite are in a matrix of brownish glass, plagioclase laths, pyroxene and magnetite.	
G - 140	ditto	ditto	Altered pyroxene andesite	Dark-gray, compact rock with porphyritic texture.	Phenocrysts of plagioclase (single and glomeroporphyritic), chloritized pyroxene and magnetite are in a matrix of plagioclase laths, orbicular quartz, chlorite, hematite and titanite. Texture is porphyritic and micro-poikilitic.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
G - 153	Cook Creek	Intrusives	Diorite porphyry	Gray, holocrystalline rock.	Large phenocrysts of subhedral twinned plagioclase, hornblende (altered to chlorite, secondary biotite, magnetite and pyroxene) and small phenocrysts of quartz, plagioclase, potassium feldspar showing perthite texture, magnetite, apatite and biotite show porphyritic texture.	
G - 156	ditto	ditto	Granodiorite porphyry	Gray, holocrystalline rock.	Main constituents and texture are similar to G-153. Quartz and potash feldspar show graphic texture.	
G - 178	Panusugon R.	Cretaceous	Altered tuff	Gray, strongly altered rock.	Alteration is very strong so that original texture is disappeared. Fragments of plagioclase (altered to clay mineral or sericite) and mafic minerals (altered to pyrite and clay mineral) are in a compact matrix of micro-grained secondary quartz.	
G - 179	ditto	ditto	Augite andesite	Dark-gray, porphyritic rock.	Phenocrysts of twinned and zoned plagioclase, augite altered to hydromica or carbonate minerals are in a groundmass of plagioclase laths, micrograined ore and pyroxene.	
G - 187	ditto	ditto	Altered tuff	Gray, compact rock with pyrite impregnation.	Strongly altered. Sericite, quartz, chlorite and pyrite are altered-minerals. Original texture is not clear.	
G - 193	ditto	ditto	Altered andesite	Gray, porphyritic rock.	This rock shows porphyritic texture. Phenocrysts of plagioclase, altered to clay or carbonate minerals, rutile and pyrite are in a matrix of micrograined quartz.	
G - 207	Panusugon R.	ditto	Basaltic andesite	Dark-gray, porphyritic rock.	Phenocrysts are composed of twinned and zoned plagioclase and chloritized augite, and shows porphyritic texture. Groundmass is plagioclase laths, microgranular pyroxene, magnetite and brownish glass.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
G - 236	Mambalili	Cretaceous	Hornblende andesite	Gray, porphyritic rock.	Phenocrysts of twinned and zoned plagioclase, hornblende and magnetite are in a matrix of cubic to granular plagioclase, pyroxene, magnetite and quartz. Hornblende shows pleochroism (green to greenish-brown) and opacite forms rim on it.	
G - 241	ditto	ditto	Altered tuff breccia	Dark-greenish rock with lithic fragments.	Fragments of porphyritic andesite are cemented by carbonate and clay minerals. Andesite is composed of plagioclase phenocryst (completely replaced by carbonate) and fine sericite.	
H - 1	San Jose	Bislig F.	Tuffaceous sandstone	Soft, coarse grained rock with white spots.	Subangular to subrounded grains (0.3 mm in size) are welded by clay. A little fragment of plagioclase is recognizable but quartz grain is absent. Owing to strong alteration, it is quite difficult to decide the original minerals.	
H - 56A	Liboy Creek	ditto	Pyroxene andesite	Gray, compact rock with white colored mineral.	Phenocrysts of plagioclase and mafic minerals in a pale-green matrix with many tiny magnetite. Plagioclase is altered to albite and mafic minerals to calcite or chlorite thoroughly.	
H - 56B	ditto	ditto	Trachyte	Greenish-gray, homogeneous, compact rock.	A little phenocryst of sanidine is sprinkled in a trachytic matrix of sanidine laths. Very fine grained pyroxene, brownish-green clay and calcite enclose these laths. A large amount of magnetite is present.	
H - 62	ditto	Agtuucan F.	Pyroxene andesite	Dark gray, compact rock.	Phenocrysts of euhedral plagioclase and pyroxene are in a matrix of pale-brownish glass. Plagioclase is altered to albite and calcite in part, and pyroxene to calcite perfectly. There are some calcite and laumontite veins.	
H - 85	Cateel R.	ditto	Fossiliferous limestone	Yellowish-white, soft rock with gray streak.	Numerous fragments of smaller foraminifera, a little of plagioclase, pyroxene, and brown hornblende are welded by coarse calcite grains.	See PL.3 B

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
H - 115	Cateel R.	Bislig F.	Taffaceous mudstone	Grayish, well-consolidated rock. Clear grain gradation is visible.	Lithic fragments (perlite, andesite and mud) and crystals of augite, hornblende, plagioclase and quartz are in a matrix of calcite aggregate.	
H - 135	ditto	Agtuucan F.	Porphyritic augite andesite	Black, compact, hard rock with yellowish-brown, amorphous spots.	Phenocrysts of twinned plagioclase (andesine to labradorite) and augite in a holocrystalline matrix of small plagioclase laths and augite. Plagioclase has euhedral form and is quite fresh, but augite and matrix are partly altered to yellowish-brown clay minerals.	
H - 136	ditto	ditto	Red chert	Reddish-brown, hard rock. White veinlets cross this rock.	Aggregate of fine grained irregular quartz. Quartz and laumontite veinlets are present.	
H - 200	Bahayon R.	Cretaceous	Amygdaloidal pyroxene andesite	Purplish, glassy rock. There is many small gas cavities.	Phenocrysts are abundant large plagioclase and a few augite. Matrix is consisted of dark-brown glass and plagioclass laths. Many amygdals which are filled with laumontite occur in this section.	See PL.3 A
H - 207	ditto	ditto	Augite andesite	Dark-gray, compact rock.	Phenocrysts of plagioclase (andesine) and augite are in a holocrystalline matrix of plagioclase laths and clay minerals. Twinned and zoned plagioclase are abundant and these size vary from 2 mm to 0.3 mm long. Hematite fills cleavages of crystal. Petrographically similar to H-135.	
H - 521	San Jose	Bislig F.	Andesite	Dark-gray, compact rock with brownish streaks.	Crystals of plagioclase, partially altered to calcite, are in a pilotaxitic matrix of plagioclase laths with chlorite patches and magnetite. Aggregates of magnetite and hematite occur in veinlets.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
I - 5	Lingig R.	Bislig F.	Basalt	Dark-gray, compact rock.	It shows porphyritic texture. Phenocrysts are composed of twinned plagioclase (partially altered to chlorite and carbonate) and chloritized pyroxene. Groundmass is plagioclase laths, granular pyroxene and magnetite. Quartz and laumontite veinlets are observed.	
I - 7	ditto	ditto	ditto	Dark-gray rock.	Phenocrysts of twinned and zoned plagioclase and pyroxene altered to hydromica are in a matrix of plagioclase laths, pyroxene, magnetite and brown glass. Texture is basaltic.	
I - 10	ditto	ditto	Augite andesite	Dark-gray, compact, aphyric rock	Phenocrysts of twinned plagioclase and augite are in a groundmass of plagioclase laths, augite, magnetite, chlorite and quartz. Texture is porphyritic.	
I - 14	ditto	ditto	ditto	Dark-gray, glassy rock with large plagioclase prisms.	Phenocrysts are composed of twinned plagioclase and a little pyroxene. Plagioclase crystal is very large (max. 15 mm in size) and its component is labradorite. Groundmass is plagioclase laths, augite, magnetite, chlorite and brownish glass. Calcite, chlorite and quartz veinlets are also seen.	
I - 16	Simulaw R.	Cretaceous	ditto	Dark-gray, compact rock.	Plagioclase, clinopyroxene and magnetite are its phenocrysts. Plagioclase shows carlsbad or albite twinning and zonal structure. Groundmass is plagioclase laths, magnetite, pyroxene and rutile. Mafic minerals are partially chloritized.	
I - 17	ditto	ditto	Altered pyroxene andesite	Gray, porphyritic rock with pyrite impregnation.	Phenocrysts of plagioclase altered to carbonate or sericite and pyroxene altered to carbonate are in a matrix of secondary quartz and a little plagioclase laths.	
I - 18	ditto	ditto	Andesitic tuff	Pale-green, altered rock with pyrite impregnation.	Fragments of altered plagioclase, mafic minerals and pyrite are welded by fine grained secondary quartz, chlorite, carbonate and sericite.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
I - 21	Simulaw R.	Cretaceous	Augite basalt	Dark-gray, compact rock.	It shows porphyritic texture. Microphenocrysts of twinned plagioclase, chloritized augite and magnetite in a matrix of plagioclase laths, augite, magnetite, chlorite and brownish glass.	
I - 22	ditto	ditto	ditto	ditto	It shows porphyritic and basaltic textures. Quite similar to I-21.	
I - 23	Bohayan R.	ditto	Vesicular andesite	Dark-gray, vesicular rock.	Phenocrysts of twinned plagioclase partially altered to carbonate are in a groundmass of plagioclase laths, augite and brownish glass. Chlorite, zeolite and quartz fill some amygdaloidal cavities.	
I - 29	Simulow R.	ditto	Augite basalt	Dark-gray, compact rock.	It shows porphyritic and intergranular textures. Microphenocrysts of twinned plagioclase and magnetite are in a matrix of plagioclase laths, granular augite and magnetite.	
I - 31	ditto	ditto	Altered andesite	Dark-gray, porphyritic rock.	Phenocrysts are consisted of twinned and zoned plagioclase, secondary hydromica and ore mineral. Irregular secondary quartz, plagioclase laths, hydromica and ore mineral make up a matrix.	
I - 34	ditto	ditto	Tuff breccia	Reddish-brown tuff with greenish fragments.	Fragments of dacite pumice, porphyritic and aphyric andesite, plagioclase and augite are cemented by secondary quartz, chlorite, hematite and plagioclase laths. Pumice is composed of plagioclase, quartz and carbonates and shows clear flow texture.	
I - 36	ditto	ditto	Augite andesite	Gray, porphyritic rock.	This rock shows porphyritic texture. Phenocrysts of twinned and zoned plagioclase, mafic minerals (almost altered to hydromica or chlorite) magnetite and rutile are in a groundmass of plagioclase, pyroxene, hydromica or chlorite and magnetite.	
I - 40	ditto	ditto	Olivine augite basalt	Dark-gray, porphyritic rock.	Phenocrysts are consisted of twinned and zoned plagioclase, augite, olivine perfectly altered to chlorite and magnetite. Groundmass: plagioclase laths, granular clinopyroxene, magnetite, chlorite and brownish glass, and shows basaltic texture.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
I - 43	Simulaw R.	Cretaceous	Augite andesite	Gray, porphyritic rock.	Phenocrysts of twinned and zoned plagioclase, augite, mafic minerals altered to chlorite or sericite and magnetite are in a matrix of plagioclase and magnetite. Quartz and tremolite veinlets run in this rock.	
I - 58	Wago R.	ditto	ditto	Dark-gray, porphyritic rock showing flow structure.	Phenocrysts of twinned and zoned plagioclase, augite and magnetite are in a matrix of plagioclase laths, granular pyroxene and magnetite. Texture is porpyritic.	
I - 61	Mamunga R.	ditto	ditto	Dark-gray, porphyritic rock.	Phenocrysts are similar to I-58. Plagioclase laths of groundmass are surrounded by rims of alkali feldspar. Epidote is also observed.	See PL.2 B
I - 63	ditto	ditto	Hornblende dacite	Gray, porphyritic rock.	Phenocrysts of twinned and zoned plagioclase, hornblende altered to black minerals, granular quartz, augite, magnetite are in a matrix of plagioclase laths, quartz and magnetite. Secondary carbonate minerals are abundant.	
I - 64	ditto	ditto	Hornblende andesite tuff	Gray fragments are in a reddish-brown matrix.	Fragments of volcanic rock with phenocrysts of plagioclase, hornblende and magnetite are cemented by volcanic ash or tiny chips of plagioclase, hornblende and magnetite.	
I - 65	ditto	ditto	Hornblende andesite	Dark, porphyritic rock.	Phenocrysts of twinned and zoned plagioclase, hornblende, magnetite and apatite are in a matrix of plagioclase laths, secondary quartz and chlorite. Texture is porphyritic.	
I - 69	ditto	ditto	Hornblende augite andesite	Gray, porphyritic rock.	Phenocrysts are consisted of twinned and zoned plagioclase, augite, hornblende and magnetite. There is a quartz crystal affected magmatic corrosion. Groundmass: granular quartz showing mosaic texture, plagioclase laths and microgranular chlorite.	

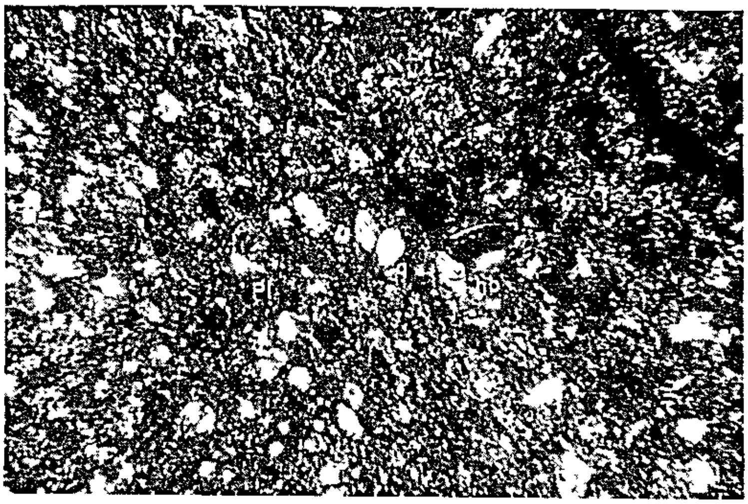
Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
I - 70	Mamunga R.	Cretaceous	Augite andesite	Dark-gray rock.	Phenocrysts of twinned and zoned plagioclase, pyroxene altered to black minerals and magnetite are in a glassy matrix. Some pyroxene and magnetite are enclosed in plagioclase.	
I - 74A	ditto	ditto	Altered hornblende andesite	Dark-greenish, porphyritic rock.	This rock shows porphyritic texture. Phenocrysts are twinned plagioclase almost altered to secondary quartz and carbonate, and hornblende. Hornblende is euhedral form but altered to epidote, chlorite, magnetite and carbonate completely. Groundmass is consisted of granular quartz, chlorite, epidote and ore mineral.	
I - 79	ditto	ditto	ditto	ditto	Plagioclase altered to carbonate, sericite and quartz, and mafic mineral altered to opaque mineral or carbonate and chlorite are the phenocrysts of this rock. Mafic mineral is surrounded by opacite margin. Matrix: secondary quartz, plagioclase, chlorite, carbonate and ore mineral.	
I - 81	ditto	ditto	Augite basalt	Dark-gray, compact rock.	This is holocrystalline and shows intergranular texture. Phenocrysts of twinned plagioclase and augite are in a groundmass of plagioclase laths, augite, magnetite, and chlorite. Twinned plagioclase veinlets occur partly.	
I - 82	ditto	ditto	Pyroxene-andesitic tuff breccia	Gray rock with rock fragments.	Fragments are porphyritic andesite which has phenocrysts of plagioclase and pyroxene. Cementing materials are chlorite and glass. There are chips of plagioclase, augite and calcite.	
I - 85	Ngan R.	ditto	Tuff breccia	Gray aggregate of volcanic rock fragments.	Fragments are consisted of holocrystalline, volcanic rock and pyrite. Holocrystalline rock is made up of quartz, plagioclase, chlorite and pyrite. Volcanic rock is aphyric and contains plagioclase laths, chlorite and granular opacite. Chlorite is cementing material.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
I - 87	Ngan R.	Cretaceous	Augite andesite	Dark-gray, porphyritic rock.	Phenocrysts of plagioclase, augite and magnetite are in a matrix of plagioclase laths, pyroxene, magnetite, rutile and chlorite. Plagioclase shows carlsbad or albite twinning and its zonal texture is remarkable. Chlorite and carbonate are the alteration products.	
I - 88	ditto	ditto	ditto	ditto	Quite similar to I-87.	
I - 91	ditto	ditto	Crystalline tuff	Gray rock with white veinlets.	Fragments of plagioclase showing twin, hornblende altered to chlorite and magnetite are in a matrix of plagioclase laths, chlorite and ore mineral. Some of rock fragments show trachytic texture or flow structure.	
I - 93	ditto	ditto	Altered andesite	Dark-green, porphyritic rock.	Phenocrysts of twinned and zoned plagioclase, mafic minerals altered to chlorite or hydromica and pyrite are in a matrix of plagioclase laths and chlorite. Generally chloritization is very strong. Zircon is accessory.	
EB - 4	Mambalili	Intrusives	Hornblende quartz diorite	Dark-green, medium grained rock.	Plagioclase, quartz and hornblende are the principal constituents of this rock. Plagioclase, showing carlsbad or albite twinnings and zonal structure, are surrounded by rims of alkali feldspar. Hornblende is partly altered to epidote, chlorite and carbonate. Quartz is fairly abundant, interstitial to the plagioclase. Magnetite is also visible.	
EB - 5	ditto	ditto	Quartz diorite porphyry	Gray, porphyritic rock.	Main constituents are twinned plagioclase altered to chlorite, quartz, and altered hornblende. Groundmass consists of granular to irregular quartz, plagioclase laths, chlorite and ore mineral. The texture is porphyritic.	
EB - 6	ditto	Cretaceous	Hornblende dacite	Gray, porphyritic rock.	Phenocrysts of twinned and zoned plagioclase, quartz (with rounded, corroded edges), augite and magnetite are in a matrix of granular quartz, plagioclase laths and magnetite. Matrix shows mosaic texture.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
EB - 7	Mambalili	Intrusives	Hornblende quartz diorite	Gray, medium grained, holocrystalline rock.	Twinned and zoned plagioclase, quartz interstitial to plagioclase, hornblende altered to chlorite and secondary biotite and ore mineral are the major minerals. Alkali feldspar rims on the plagioclase. There are some potash feldspar showing perthite texture and ilmenite.	See PL.5 A
EB - 8	ditto	Agtuucan F.	Fossiliferous limestone	Yellowish-gray rock with gray streak.	Fragments of fossils are welded together by coarse calcite grains. Tiny chips of hornblende are also present.	
EB - 9	Manat	Intrusives	Biotite quartz diorite	Light gray, medium grained.	Anhedral quartz, twinned plagioclase completely altered to sericite and biotite are the main constituents. Biotite (flexured cleavage) is altered to chlorite and hydromica.	See PL.5 B
EB - 10	Agusan R.	ditto	Granodiorite porphyry	Porphyritic rock with compact xenolith.	Plagioclase (showing twinning and altered to carbonate and sericite), mafic minerals (replaced by carbonate and epidote) and magnetite are the phenocrysts. Groundmass is plagioclase, quartz, chlorite and epidote and shows micrographic or myrmekite structure. Xenolith consists of fine grained plagioclase laths, chlorite and magnetite.	
EB - 11	ditto	ditto	Hornblende quartz diorite	Light gray, holocrystalline rock with fine grained xenolith.	Euhedral to subhedral plagioclase, quartz interstitial to plagioclase, and hornblende. Plagioclase shows carlsbad or albite twinning and zonal structure. Alkali feldspar rims on the plagioclase. There is a little ilmenite. Plagioclase laths, hornblende and ore mineral make up a xenolith.	
(Polished Section)						
A - 19	Naunum R.	Intrusives	Dolerite		Numerous acicular hematite is scattered in epidotized dolerite. Its arrangement is rather radical than irregular.	

Sample No.	Location	Formation	Rock	Macroscopic features	Microscopic observations	Remarks
E - 17	Halapitan	Intrusives	Peridotite		This ore is made up of troilite, pentlandite and chalcopyrite. Both troilite and pentlandite are massive in form and exsolution lamellae of pentlandite (10 - 30μ) are commonly observed in troilite. Chalcopyrite occurs massive in form and some veinlets penetrate troilite. Quartz has filled fractures in ore minerals. By fluorescent X-ray analysis, cobalt is detected.	See PL.6 B, X-ray chart 6, 7
G - 158 G - 178 G - 187	Cook Creek Panusugan R. ditto	Cretaceous	Altered tuff		Pyrite impregnation. Pyrite shows irregular thread-like to globular or colloform-like form. Chalcopyrite is absent.	
G - 163	Cook Creek	Intrusives	Quartz diorite		Irregular thread-like pyrite is impregnated. A small amount of fine grained chalcopyrite (maximum 0.1 mm) and abundant magnetite are also observed. But the latter looks an accessory mineral of diorite.	See PL.6 C

PL.1



A: Andesitic fine tuff
(Sample No. A-2)

Fine fragments composed of plagioclase(pl), quartz(q) and hornblende(hb) are in a matrix of volcanic ash.

X–nicols.

x 50

B: Andesitic tuff
(Sample No. A-4)

Andesitic rock fragments (r) and chips of augite(au) occur in a matrix of less clearly defined glassy fragments.

Ore mineral(o) is magnetite.

X–nicols.

(X=50)

x 50

C: Augite-andesite
(Sample No. e-3)

Phenocrysts of twinned plagioclase(pl) and augite(au) are in a pilotaxitic groundmass.

X–nicols.

x 50

PL.2

A: **Clinopyroxene-basalt**
(Sample No. G-13)
Phenocrysts of plagioclase(pl) and clinopyroxene(cp) in a holocrystalline matrix showing dolerite texture.
X–nicols.

x 50

B: **Augite-andesite**
(Sample No. I-61)
Phenocrysts of twinned and zoned plagioclase(pl), augite(au) are in a matrix of plagioclase laths, pyroxene and magnetite.
X–nicols.

x 50

C: **Andesitic tuff-breccia**
(Sample No. G-115)
Fragments of porphyritic or aphyric andesite(r), and chips of plagioclase(pl) are welded by secondary chlorite.
Plane light.

x 50

PL. 3

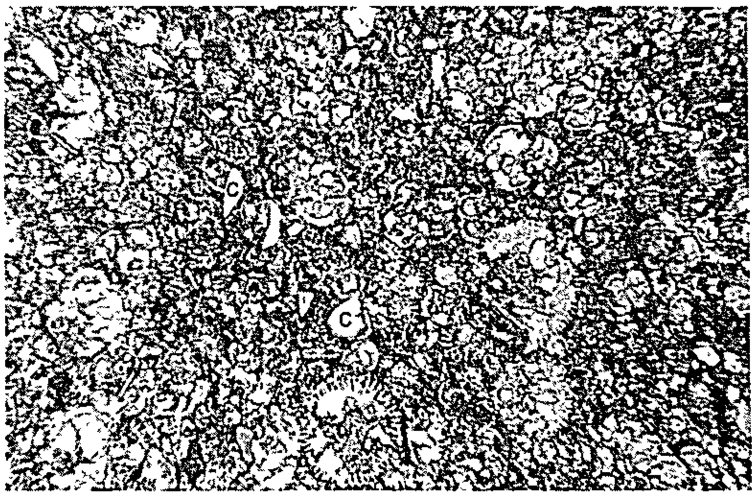
A: Amygdaloidal pyroxene-andesite (Sample No. H-200)

Phenocrysts of plagioclase(pl) and augite(au) are in a glassy matrix.

Many amygdals(am) occur in this section.

X–nicols.

x 50

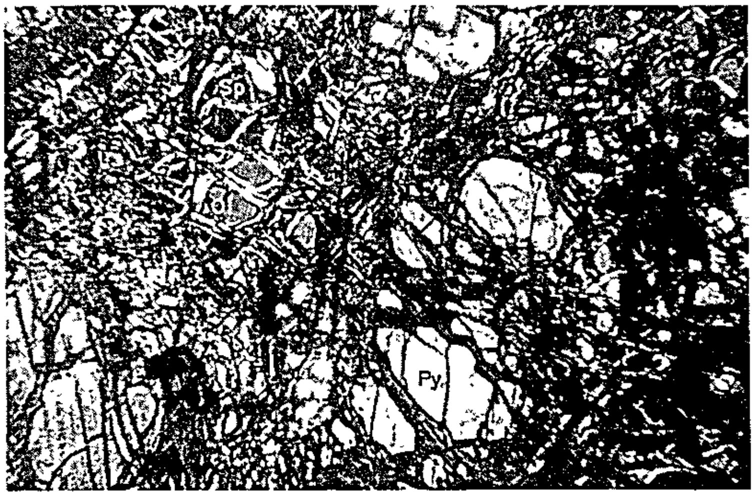


B: Fossiliferous limestone (Sample No. H-85)

Numerous fragments of smaller foraminifera and chips(c) of plagioclase, pyroxene and hornblende.

Plane light.

x 50



C: Serpentinized peridotite (Sample No. A-24)

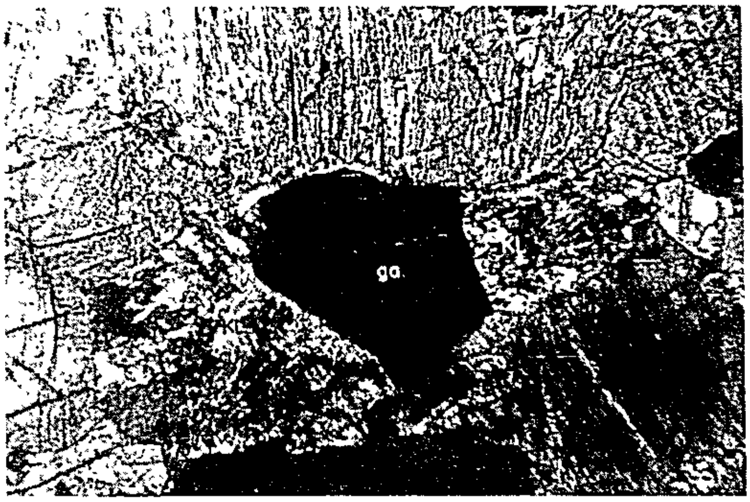
Orthopyroxene(py) and olivine (ol) are nearly completely serpentinized(sp).

Mesh-structure is remarkable.

X–nicols.

x 50

PL. 4



A: Garnet-pyroxenite
(Sample No. C-12)

Diopside (di), garnet (ga) and kelyphite (kl).

Kelyphite is composed of tremolite, plagioclase, serpentine and augite.

X–nicols

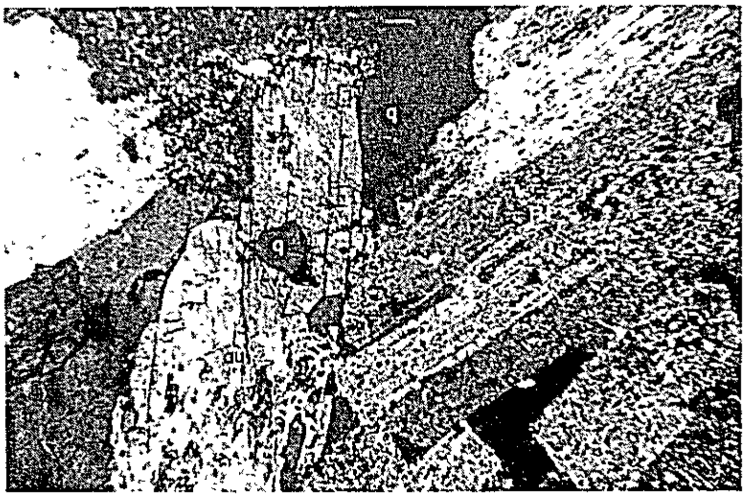
x 50

B: Gabbro
(Sample No. C-31)

Plagioclase(pl), clinopyroxene (py), hornblende(hb) and biotite (bi), showing mosaic texture.

X–nicols

x 50



C: Quartz-diorite
(Sample No. F-29)

Augite(au), altered to uralite, anhedral quartz(q) and altered plagioclase(pl) are the major constituents.

X–nicols

x 50

PL.5

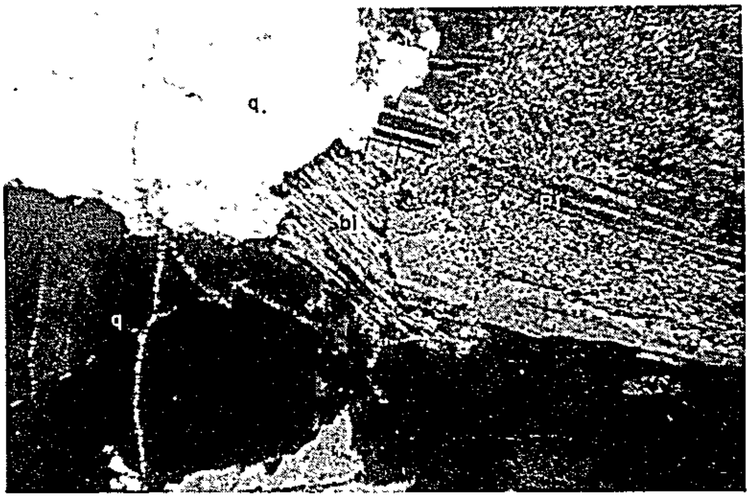
A: **Quartz-diorite**
(Sample No. EB-7)

Twinned and zoned plagioclase (pl), quartz(q) interstitial to plagioclase and hornblende(hb).

Note potash feldspar rims(pf) on the plagioclase.

X–nicols.

x 50



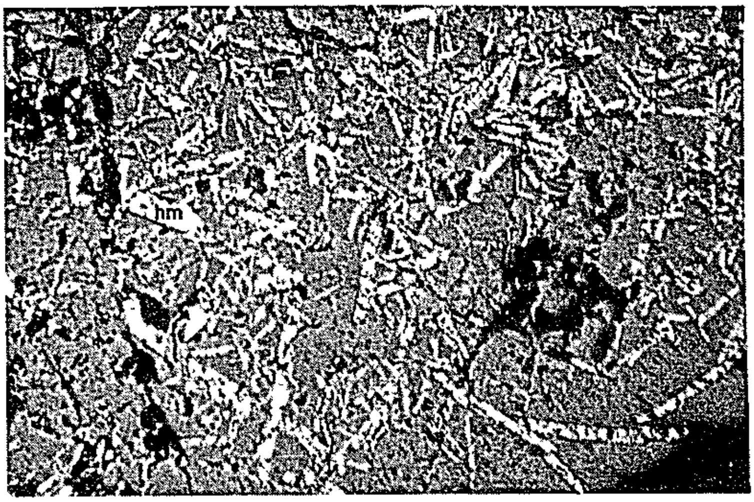
B: **Quartz-diorite**
(Sample No. EB-9)

Quartz(q), altered plagioclase (pl) and biotite(bi) are the main constituents.

X–nicols.

x 50

PL. 6



A: Hematite in dolerite
(Sample No. A-19A)

Numerous acicular hematite (hm) crystals lie scattered likely, forming radial mass in each small partition.

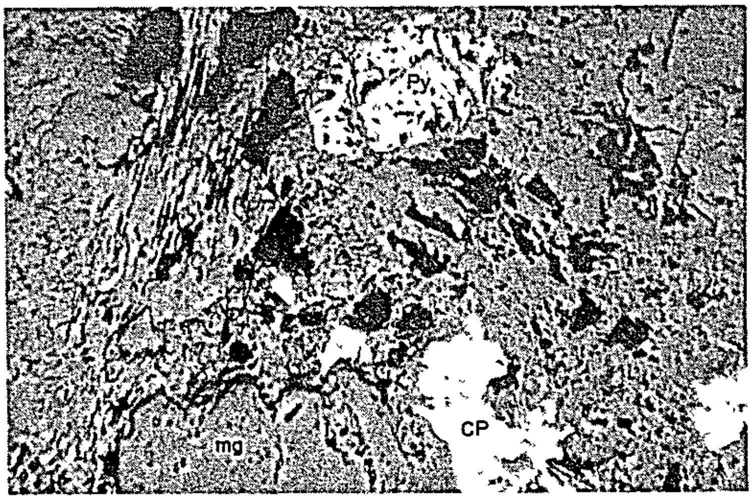
x 50

B: Ni-ore
(Sample No. E-17)

Chalcopyrite(cp), pentlandite (pe) and troilite(tr).

Note exsolution lamellae of pentlandite in troilite (right side).

x 50



C: Impregnated chalcopyrite (cp) and pyrite (py) in quartz diorite
(Sample No. G-163)

Magnetite(mg) is fairly abundant in this field but is probably an accessory mineral of diorite.

x 50

Table 3. Chemical analysis of rock samples

Sample No.	Location	Country rock	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Mo %	Ni %	S %	Remarks
A - 19A	Ba. Bonacao	Dolerite			0.02			0.00	0.00	21.34	Pyrite stringer (malachite stained), width: 0.05 m See Microscopic observations PL.6A
A - 19B	Ba. Bonacao	Sandstone			0.01			0.00	0.00	0.53	Impregnated zone, width: 10 m
C - 30	Tigua River	Pyroxenite			0.03			0.01	0.11	3.06	Pyrite vein, width· 0.20 m
C - 32	Tigua River	Gabbro			0.05			0.02	0.06	9.57	Pyrite stringer, width: 0.03 m
C - 33	Tigua River	Pyroxenite			0.02			0.01	0.06	0.24	Pyrite impregnation, width: 0.70 m
C - 34	Tigua River	Pyroxenite			0.05			0.02	0.10	2.19	Pyrite impregnation, width· 0.40 m
E - 17	Halapitan	Peridotite			0.07		0.00		0.28		Float. See microscopic observations PL.6B, X-ray chart 6 and 7
F - 31	Maganding	Andesite	1.5	11.5	0.06	0.04	0.01			2.31	Argillized zone, width: 5 m.
G - 158	Cook Creek	Hornfels			0.01		0.01		0.00		Contact zone of granodiorite. See microscopic observations.
G - 163	Cook Creek	Quartz diorite			0.00		0.04		0.00		Pyrite impregnation. See microscopic observations PL.6C.
G - 187	Panusugon River	Altered tuff			0.02		0.01		0.00		Pyrite impregnation. See microscopic observations.
G - 190	Panusugon River	Altered tuff			0.00		0.00		0.00		Weakly argillized.
I - 18	Simulaw River	Andesitic tuff			0.01		0.00		0.00		Pyrite impregnation.
I - 72	Mamunga River	Altered andesite			0.00		0.00		0.00		Pyrite impregnation.
I - 75	Mamunga River	Silicified andesite			0.01		0.00		0.01		Pyrite impregnation, width: 20 m
I - 85	Ngan River	Andesitic tuff-breccia			0.02		0.01		0.00		Pyrite impregnation.
I - 90A	Ngan River	Andesitic tuff-breccia			0.00		0.00		0.00		Pyrite impregnation.

Remarks: Blank means unenforcement.

TABLE 4 X-ray analysis

A) Mineral composition by X-ray diffractive analysis

Chart No.	Sample No.	Location	Formation	Rock	Qz	Pl	Hb	Chl	Cal	Cor	Ep	Tr	Pe	Remarks
1	A-19B	Ba. Bonacao	Cretaceous	Sandstone	+++						+			Mineralized
2	A-21	Bonacao R.	Intrusives	Peridotite	++	++		+						Sheared and silicified
3	a-1	Locawon R.	Cretaceous	Andesitic lapilli tuff	+	++		+						
4	C-40	Tigua R.	Intrusives	Pyroxenite		++	+?	++		+?				
5	C-41	ditto	ditto	ditto	+	+		++	+++					
6	E-17	Halapitan	ditto	Peridotite								+++	++	Ore (float)

Remarks

Qz : Quartz Pl : Plagioclase Hb : Hornblende Chl : Chlorite Cal : Calcite Cor : Cordierite
Ep : Epidote Tr : Troilite Pe : Pentlandite

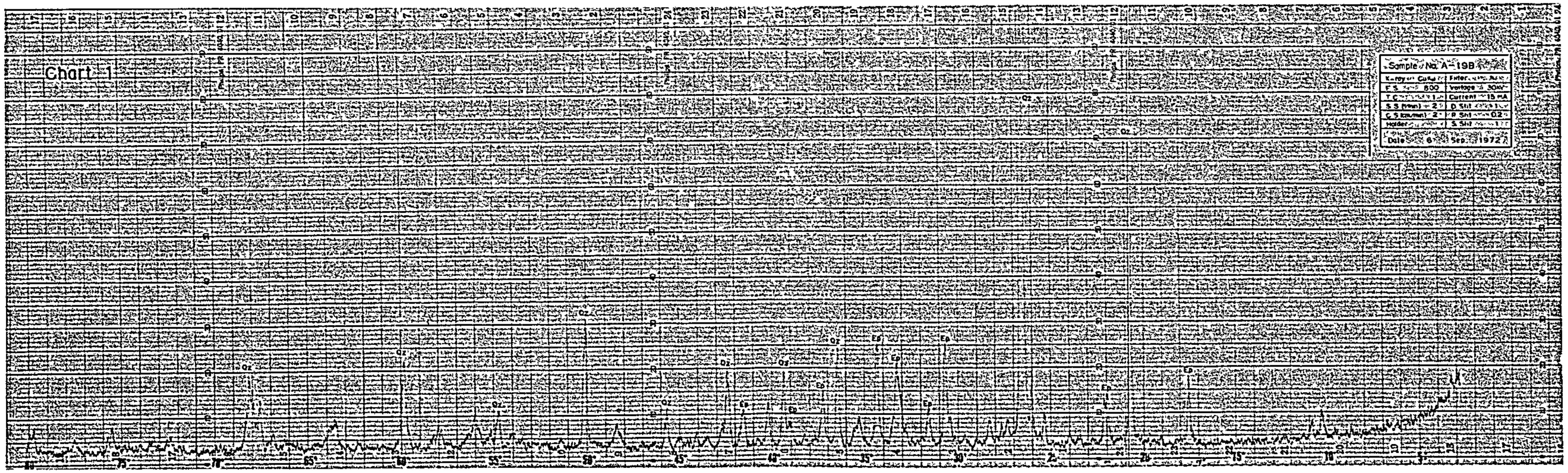
B) Metalic element by X-ray fluorescent analysis

Chart No.	Sample No.	Location	Formation	Rock	Cu	Zn	Fe	Co	Ni	Mn	Remarks
7	E-19	Halapitan	Intrusives	Ore in peridotite	+++	+	+++	++	+++	+	

Remarks

+++ : abundant ++ : common + : a little ? : uncertain

Chart 1.



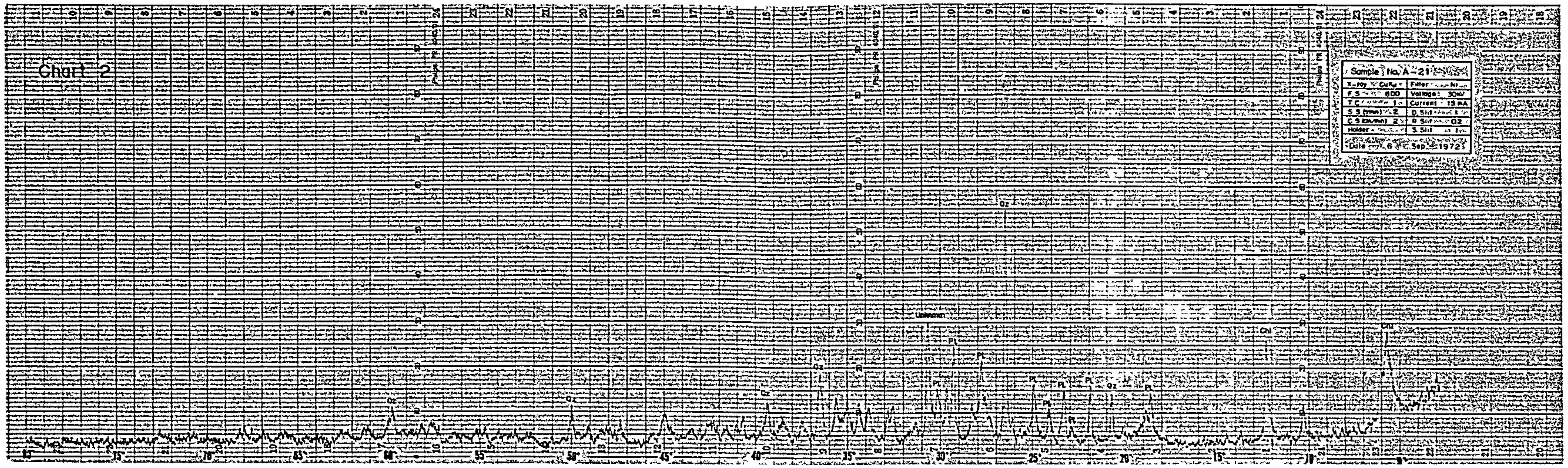


Chart 2
Sample No. A-21

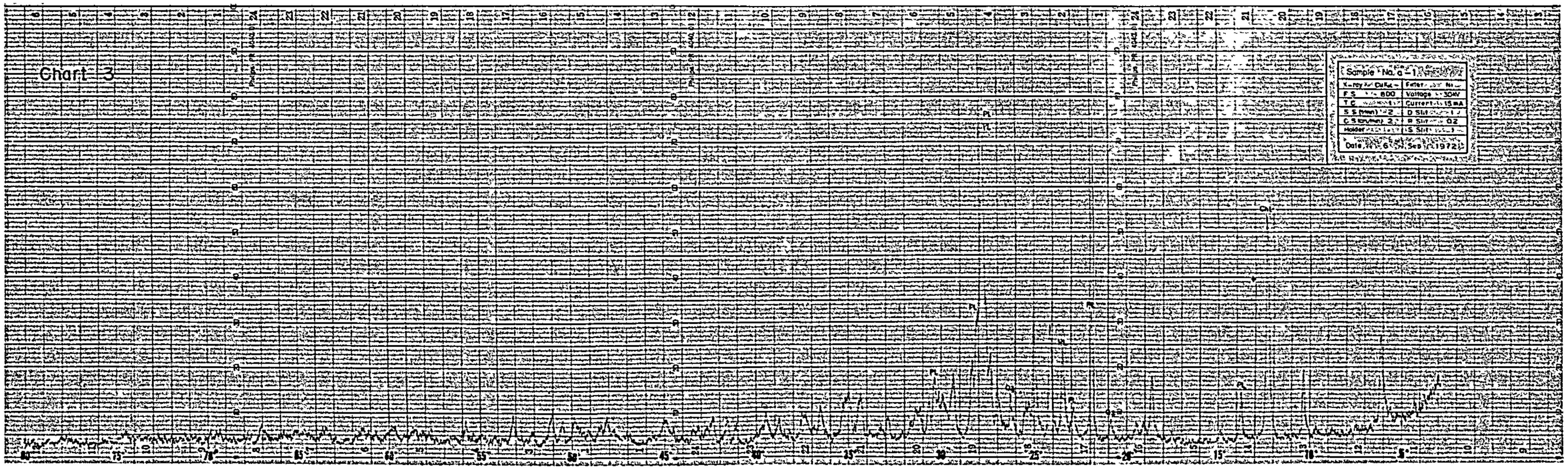


Chart 3

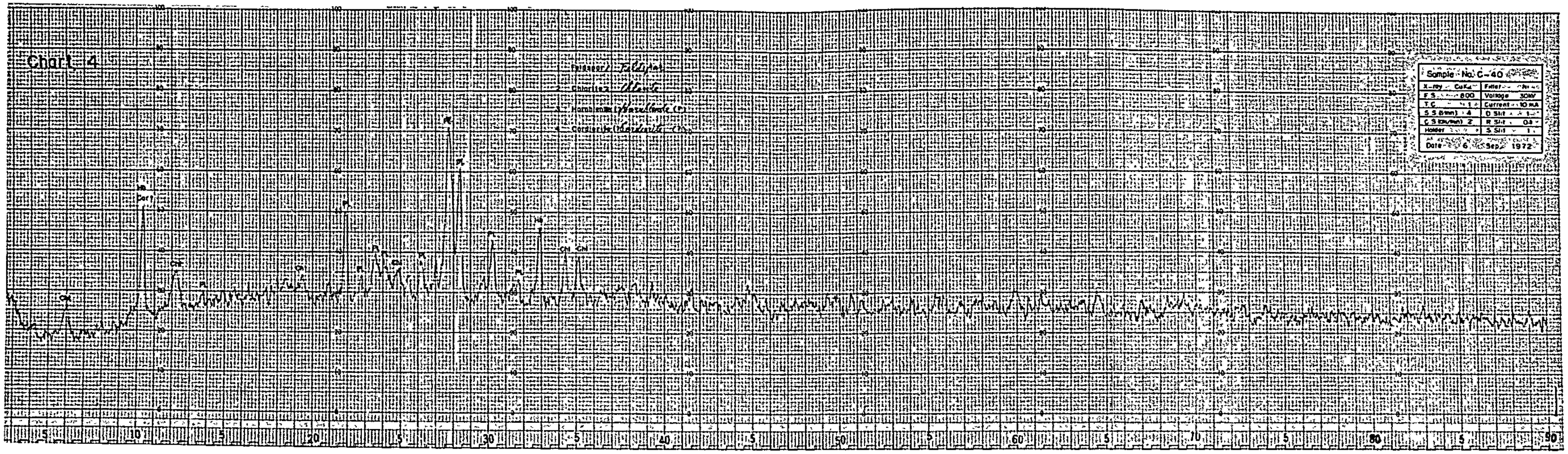


Chart 4
Sample No. C-40
X-ray CuKα
Filter Ni
F S 800
Voltage 30KV
T C 1
Current 10 mA
S S (mm) 4
D Slit 1
C S (cm/min) 2
R Slit 0.4
Holder
S Slit 1
Date 6 Sep 1972
5
10
5
20
5
30
5
40
5
50
5
60
5
70
5
80
5
90

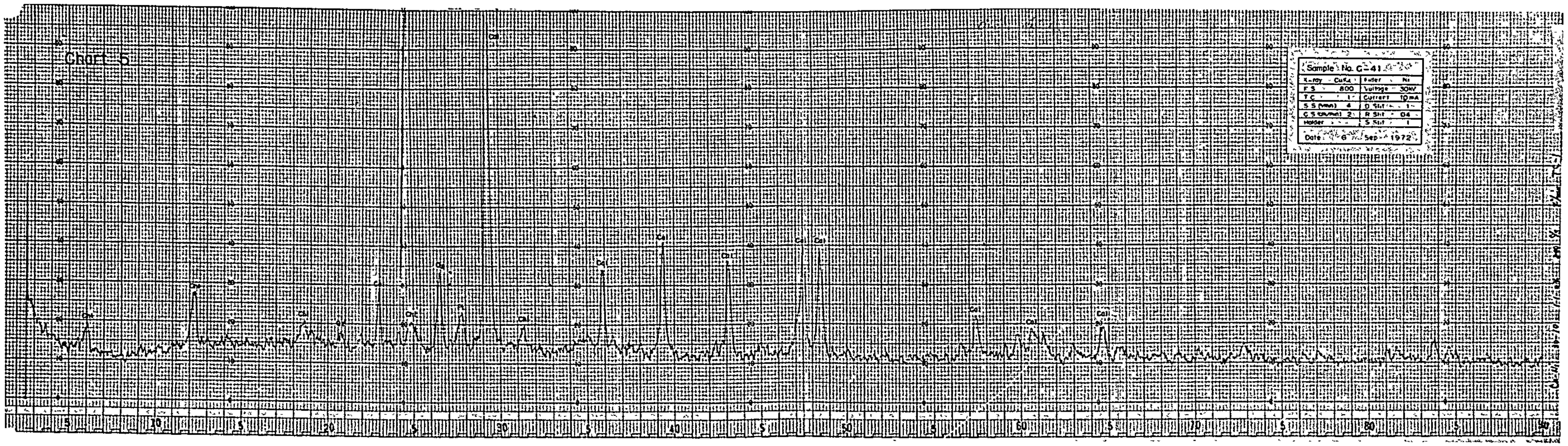


Chart 5
Sample No. C-41
X-ray CuKα
Filter Ni
F S 800
Voltage 30KV
T C 1
Current 10 mA
S S (mm) 4
D Slit 1
C S (cm/min) 2
R Slit 0.4
Holder
S Slit 1
Date 6 Sep 1972
5
10
5
20
5
30
5
40
5
50
5
60
5
70
5
80
5
90

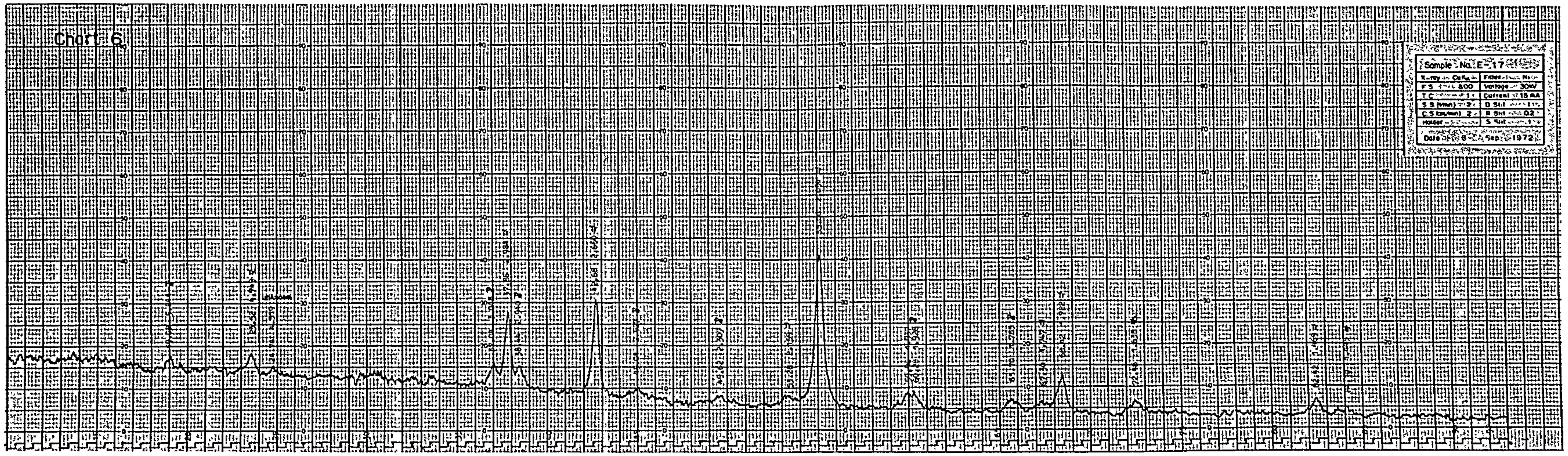


Chart 6
Sample No. E-17
F.S. 800
Voltage 30kV
T.C. 1
Current 15 mA
S.S. (Min) 2
C.S. (cm/min) 2
R Slit 0.2
Date 6 Sep. 1972

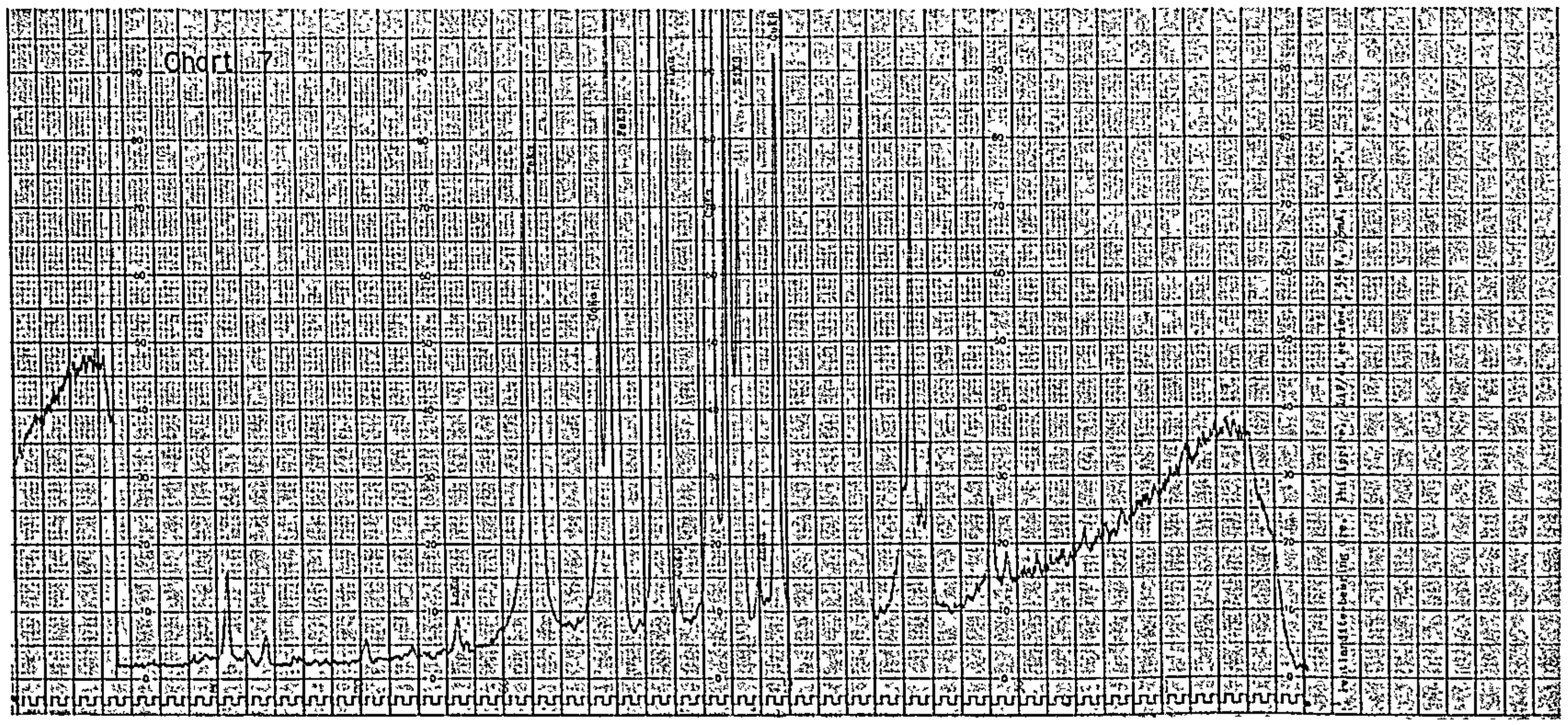


Chart 7

Table 5. Qualitative emission spectrochemical analysis of stream sediments

Remarks
Photographical intensity
5: very strong 4: strong
3: medium 2: weak
1: very weak 0: none

(A) Data on −80 ~ +100 mesh fraction

Sample No.		Cu	Zn	Pb	Mo	Ni	Co	Ti	Sn	Cr	Ag
1	A - 2	3	0	0	0	3	3	3	0	1	0
2	13	3	0	0	0	3	3	3	0	0	0
3	23	3	0	0	0	3	3	3	0	1	0
4	34	3	1	0	0	2	3	3	0	1	0
5	44	3	0	0	0	2	2	2	0	0	0
6	56	3	1	0	0	2	3	2	0	0	0
7	65	3	0	0	0	2	3	2	0	0	0
8	90	3	0	0	0	3	3	2	0	2	0
9	103	3	0	0	0	2	3	3	0	1	0
10	123	3	0	0	0	3	3	3	0	3	0
11	134	3	1	0	0	4	3	2	0	4	0
12	145	3	0	0	0	4	3	3	0	3	0
13	172	3	0	0	0	2	2	3	0	0	0
14	184	3	1	0	0	4	3	3	0	4	0
15	a - 5	3	0	0	0	2	3	3	0	0	0
16	9	3	3	0	0	2	2	3	0	0	0
17	10	3	3	0	0	2	3	3	0	0	0
18	18	3	0	0	0	0	1	3	0	0	0
19	24	3	1	0	0	2	2	3	0	2	0
20	Aj - 6	3	0	0	0	3	1	3	0	2	0
21	12	3	0	0	0	3	3	3	0	4	0
22	17	3	0	0	0	4	3	2	0	4	0
23	B - 1	3	0	0	0	2	1	3	0	1	0
24	3	3	0	0	0	3	2	3	0	0	0
25	5	3	0	0	0	2	2	3	0	0	0
26	32	3	0	0	0	3	2	2	0	3	0
27	44	3	0	0	0	2	2	3	0	3	0
28	55	4	0	0	0	3	2	3	0	3	0
29	77	3	1	0	0	3	3	2	0	3	0
30	122	3	0	0	0	3	2	3	0	1	0
31	132	3	0	0	0	2	2	2	0	0	0
32	135	3	1	0	0	3	3	2	0	1	0
33	139	3	0	0	0	2	2	3	0	0	0
34	140	4	0	0	0	4	3	2	0	1	0
35	161	4	2	1	0	4	3	3	0	2	0
36	180	3	0	0	0	3	2	2	0	1	0
37	196	4	0	0	0	3	2	3	0	2	0
38	202	3	0	0	0	2	1	3	0	0	0
39	251	3	0	0	0	3	2	3	0	2	0
40	256	3	0	0	0	3	2	4	0	3	0
41	C - 1	3	0	0	0	3	4	2	0	3	0
42	9	3	1	0	0	4	4	2	0	4	0
43	20	3	1	1	0	4	4	3	0	4	0
44	30	3	0	0	0	3	3	2	0	3	0
45	40	3	0	2	0	4	4	2	0	3	0
46	49	2	0	0	0	2	2	3	0	3	0
47	60	3	1	1	0	4	4	3	0	4	0
48	70	3	1	2	0	4	4	3	0	3	0
49	80	3	0	0	0	3	3	3	0	3	0
50	90	3	0	2	0	4	4	2	0	3	0
51	100	3	0	0	0	1	1	3	0	0	0
52	110	2	1	0	0	4	4	3	0	5	0
53	120	3	1	0	0	4	4	3	0	4	0
54	130	2	0	0	0	3	3	3	0	4	0
55	140	3	0	0	0	4	4	3	0	4	0
56	150	3	1	0	0	3	4	3	0	4	0
57	C - 160	2	0	0	0	3	2	2	0	3	0
58	170	3	2	0	0	2	4	3	0	2	0
59	180	3	0	0	0	2	2	2	0	1	0
60	190	3	1	0	0	2	2	3	0	2	0
61	200	2	1	0	0	2	2	3	0	0	0
62	210	3	1	0	0	2	3	3	0	2	0
63	220	3	4	0	0	2	3	3	0	0	0
64	230	3	0	0	0	1	2	3	0	0	0
65	240	3	3	0	0	2	2	3	0	0	0
66	250	3	1	1	0	0	2	3	0	0	0
67	260	3	3	0	0	1	2	3	0	0	0
68	270	4	1	1	0	3	3	2	0	3	0
69	280	3	0	0	0	3	2	3	0	2	0
70	290	3	2	0	0	3	3	3	0	3	0
71	300	3	0	0	0	4	4	2	0	3	0
72	310	3	0	0	0	4	4	2	0	3	0
73	320	3	0	2	0	4	3	2	0	3	0
74	C' - 1	2	0	0	0	4	3	2	0	4	0
75	10	3	0	0	0	3	3	3	0	3	0
76	20	3	1	0	0	2	3	3	0	2	0
77	30	3	2	0	0	2	3	3	0	2	0
78	40	3	2	1	0	3	4	3	0	3	0
79	50	3	0	0	0	3	2	2	0	2	0
80	60	3	1	0	0	1	2	3	0	1	0
81	70	3	0	0	0	3	3	1	0	2	0
82	80	3	0	0	0	3	3	2	0	2	0
83	90	3	1	0	0	4	3	3	0	3	0
84	100	3	1	0	0	4	4	3	0	4	0
85	D - 1	3	2	0	0	4	3	3	0	3	0
86	10	3	0	0	0	2	2	3	0	1	0
87	20	3	1	0	0	4	3	2	0	3	0
88	30	3	2	1	0	4	3	3	0	1	0
89	40	2	1	0	0	3	2	2	0	2	0
90	50	3	0	0	0	4	3	3	0	3	0

No.	Sample No.	Cu	Zn	Pb	Mo	Ni	Co	Ti	Sn	Cr	Ag
91	59	3	0	0	0	3	2	3	0	2	0
92	70	3	0	0	0	4	3	3	0	2	0
93	80	3	3	0	0	3	3	3	0	2	0
94	90	3	1	0	0	2	3	2	0	0	0
95	100	3	1	0	0	2	3	3	0	1	0
96	D - 110	3	1	0	0	2		3	0	2	0
97	119	3	0	0	0	2	3	2	0	0	0
98	130	3	0	0	0	2	3	3	0	0	0
99	140	3	0	0	0	2	3	2	0	0	0
100	149	3	0	0	0	2	3	3	0	0	0
101	160	3	0	0	0	2	2	2	0	0	0
102	170	3	0	0	0	2	3	3	0	0	0
103	180	3	0	0	0	2	2	2	0	0	0
104	189	3	0	0	0	2	2	2	0	0	0
105	E - 6	3	1	0	0	2	3	3	0	0	0
106	11	3	0	0	0	2	2	3	0	1	0
107	12	3	0	0	0	2	2	1	0	0	0
108	24	3	0	0	0	2	2	3	0	0	0
109	43	4	1	1	0	3	2	3	0	3	0
110	48	3	0	0	0	1	2	3	0	0	0
111	66	3	1	1	0	1	2	3	0	1	0
112	97	3	0	0	0	1	1	2	0	0	0
113	120	3	0	0	0	1	2	3	0	0	0
114	123	3	0	0	0	2	2	4	0	0	0
115	129	3	1	1	0	3	2	3	0	3	0
116	132	3	3	0	0	3	2	4	0	3	0
117	138	3	0	0	0	2	1	3	0	3	0
118	154	3	0	0	0	4	4	3	0	4	0
119	175	3	1	0	0	4	4	3	0	4	0
120	178	3	0	0	0	4	3	3	0	3	0
121	190	3	0	0	0	4	4	2	0	3	0
122	194	3	0	0	0	3	3	3	0	3	0
123	196	3	1	1	0	3	4	4	0	3	0
124	205	3	0	0	0	3	2	3	0	3	0
125	212	3	0	0	0	1	2	3	0	1	0
126	e - 14	3	0	0	0	4	3	3	0	4	0
127	33	3	0	0	0	3	3	3	0	3	0
128	52	3	0	0	0	3	3	3	0	3	0
129	53	3	0	0	0	3	3	2	0	1	0
130	55	3	0	0	0	3	3	3	0	4	0
131	F - 1	3	3	0	0	2	3	3	0	0	0
132	10	3	1	0	0	2	2	3	0	0	0
133	21	3	4	0	0	2	3	4	0	0	0
134	31	3	1	0	0	1	2	3	0	0	0
135	40	3	0	0	0	1	2	3	0	0	0
136	49	3	4	0	0	2	3	4	0	3	0
137	50	3	3	0	0	2	3	3	0	1	0
138	55	3	4	0	0	1	3	4	0	0	0
139	60	3	4	0	0	2	4	4	0	0	0
140	65	3	1	0	0	1	3	3	0	0	0
141	70	3	3	0	0	2	2	3	0	0	0
142	80	3	3	0	0	2	2	3	0	2	0
143	88	3	4	0	0	2	3	4	0	0	0
144	100	3	2	0	0	0	1	3	0	0	0
145	108	3	2	0	0	2	3	3	0	0	0

No.	Sample No.	Cu	Zn	Pb	Mo	Ni	Co	Ti	Sn	Cr	Ag
146	120	3	2	0	0	2	3	3	0	0	0
147	124	3	1	0	0	2	2	3	0	0	0
148	130	3	2	0	0	2	3	3	0	0	0
149	140	3	2	0	0	2	2	3	0	0	0
150	150	3	3	0	0	2	3	4	0	2	0
151	160	3	1	0	0	2	3	2	0	0	0
152	170	3	0	0	0	2	3	2	0	0	0
153	173	3	1	0	0	1	2	1	0	0	0
154	180	3	0	0	0	2	3	2	0	0	0
155	190	3	1	0	0	1	3	2	0	0	0
156	200	3	2	0	0	1	1	2	0	0	0
157	209	3	3	0	0	2	3	4	0	0	0
158	220	3	0	0	0	2	2	2	0	0	0
159		3	0	0	0	2	2	2	0	0	0
160	241	3	0	0	0	1	1	2	0	0	0
161	255	3	1	0	0	1	1	3	0	1	0
162	261	3	1	0	0	1	3	2	0	0	0
163	264	3	1	0	0	1	3	2	0	0	0
164	270	2	0	0	0	1	0	2	0	0	0
165	280	2	0	0	0	2	2	3	0	0	0
166	284	3	0	0	0	1	1	3	0	0	0
167	290	3	0	0	0	1	2	3	0	0	0
168	300	3	0	0	0	0	1	3	0	0	0
169	310	3	0	0	0	1	3	3	0	0	0
170	320	2	0	0	0	1	2	2	0	0	0
171	330	2	0	0	0	1	1	2	0	0	0
172	340	3	0	0	0	1	3	3	0	0	0
173	346	3	0	0	0	0	1	3	0	0	0
174	F - 350	3	0	0	0	1	2	2	0	0	0
175	352	3	1	0	0	1	3	3	0	0	0
176	360	3	1	0	0	1	3	2	0	0	0
177	370	3	0	0	0	1	2	2	0	0	0
178	378	3	0	0	0	1	2	3	0	0	0
179	390	2	0	0	0	0	0	2	0	0	0
180	400	3	1	0	0	1	3	3	0	0	0
181	406	3	0	0	0	1	2	2	0	0	0
182	G - 18	3	0	0	0	1	2	4	0	0	0
183	29	3	1	0	0	2	3	4	0	0	0
184	31	3	2	0	0	2	3	3	0	0	0
185	34	3	1	0	0	2	3	4	1	2	0
186	76	3	3	0	0	0	2	4	0	0	0
187	82	3	0	0	0	0	2	3	0	0	0
188	110	3	2	0	0	1	2	3	0	0	0
189	115	3	0	0	0	0	2	3	0	0	0
190	126	3	1	0	0	1	2	3	0	0	0
191	136	3	0	0	0	0	2	3	0	0	0
192	153	3	0	0	0	0	2	4	0	0	0
193	154	3	2	0	0	2	1	3	0	0	0
194	164	3	2	0	0	1	2	4	0	0	0
195	170	3	0	0	0	0	0	5	0	0	0
196	173	3	0	0	0	0	1	5	0	0	0
197	175	3	0	1	0	0	1	5	0	0	0
198	179	3	3	0	0	1	1	3	0	1	0
199	188	3	2	0	0	1	3	3	0	0	0
200	195	3	1	0	0	0	1	3	0	0	0

Sample No.		Cu	Zn	Pb	Mo	Ni	Co	Ti	Sn	Cr	Ag
201	197	3	0	0	0	1	2	3	0	0	0
202	201	3	0	0	0	0	1	4	0	0	0
203	225	3	1	0	0	2	1	3	0	0	0
204	232	3	0	0	0	0	2	3	0	0	0
205	233	3	1	0	0	1	2	3	0	0	0
206	g - 8	3	3	0	0	0	1	3	0	0	0
207	45	3	3	1	0	0	3	4	0	0	0
208	47	3	4	1	0	2	3	4	0	1	0
209	H - 1	3	0	0	0	0	1	0	3	0	0
210	8	3	3	0	0	1	2	0	4	3	0
211	25	3	0	0	0	1	2	0	3	0	0
212	33	3	2	0	0	1	2	0	3	1	0
213	41	3	0	0	0	1	2	3	0	1	0
214	49	3	1	0	0	0	1	3	0	0	0
215	57	3	3	0	0	1	3	4	0	0	0
216	66	3	3	0	0	1	2	3	0	0	0
217	74	3	4	0	0	1	2	4	0	1	0
218	75	3	0	0	0	2	2	3	0	0	0
219	81	3	0	0	0	0	0	3	0	0	0
220	91	3	2	0	0	1	2	3	0	0	0
221	99	3	3	0	0	1	1	3	0	0	0
222	107	3	3	0	0	1	2	4	0	0	0
223	115	3	0	0	0	0	1	3	0	0	0
224	124	3	0	0	0	0	0	3	0	0	0
225	131	3	3	0	0	1	1	3	0	0	0
226	138	3	0	0	0	0	1	3	0	0	0
227	147	3	2	1	0	1	3	3	0	0	0
228	155	3	0	0	0	0	2	3	0	0	0
229	164	3	0	0	0	0	0	3	0	0	0
230	172	3	3	1	0	1	2	3	0	0	0
231	180	3	3	0	0	1	1	3	0	0	0
232	188	3	2	0	0	1	2	3	0	0	0
233	196	3	3	0	0	1	2	3	0	0	0
234	204	3	0	0	0	0	1	3	0	0	0
235	213	3	3	0	0	1	2	3	0	0	0
236	220	3	1	0	0	1	2	3	0	0	0
237	228	3	1	0	0	1	3	3	0	0	0
238	238	3	0	0	0	0	1	3	0	0	0
239	245	3	0	0	0	0	1	3	0	0	0
240	252	3	0	0	0	1	2	3	0	0	0

Sample No.		Cu	Zn	Pb	Mo	Ni	Co	Ti	Sn	Cr	Ag
241	260	3	0	0	0	1	1	2	0	0	0
242	h - 1	3	1	0	0	1	1	4	0	0	0
243	9	3	0	0	0	0	1	3	0	0	0
244	17	3	0	0	0	0	1	3	0	0	0
245	25	3	3	0	0	1	2	4	0	0	0
246	33	3	1	0	0	1	1	4	0	3	0
247	61	3	1	0	0	1	2	3	0	0	0
248	68	3	1	0	0	1	1	3	0	0	0
249	76	3	0	0	0	1	1	3	0	0	0
250	84	3	2	0	0	1	2	3	0	0	0
251	91	3	1	0	0	1	1	3	0	0	0
252	100	3	3	0	0	1	2	3	0	0	0
253	108	3	0	0	0	1	1	3	0	0	0
254	116	3	0	0	0	0	0	3	0	0	0
255	125	3	3	0	3	1	1	4	0	0	0
256	I - 3	3	2	0	0	0	2	3	0	0	0
257	11	3	3	0	0	0	2	3	0	0	0
258	14	3	1	0	0	2	2	3	0	0	0
259	21	3	3	0	0	1	2	3	0	0	0
260	37	3	1	0	0	1	3	3	0	0	0
261	71	3	1	0	0	1	2	3	0	0	0
262	105	3	1	0	0	0	2	3	0	0	0
263	108	3	0	0	0	0	1	3	0	0	0
264	126	3	2	0	0	0	2	3	0	0	0
265	136	3	0	0	0	1	2	3	0	0	0
266	158	3	1	0	0	0	3	3	0	0	0
267	169	3	0	0	0	0	2	3	0	0	0
268	179	3	0	0	0	0	2	3	0	0	0
269	184	3	1	0	0	0	2	3	0	0	0
270	188	3	1	0	0	0	1	3	0	0	0
271	189	3	1	0	0	0	2	3	0	0	0
272	204	3	0	0	0	0	1	3	0	0	0
273	206	3	0	0	0	0	2	3	0	0	0
274	207	3	0	0	0	0	2	3	0	0	0
275	217	3	1	0	0	0	2	3	0	0	0
276	218	3	4	1	0	2	3	3	0	1	0
277	222	3	4	1	0	2	3	4	0	0	0
278	223	3	2	0	0	0	2	3	0	0	0
279	225	3	2	0	0	2	3	3	0	1	0

(B) Data on −100 − +200mesh fraction

Sample No.		Cu	Zn	Pb	Mo	Ni	Co	Ti	Sn	Cr	Ag
280	A - 2	3	1	0	0	3	3	3	0	1	0
281	13	3	1	0	0	3	3	3	0	1	0
282	23	3	1	0	0	2	3	3	0	1	0
283	34	3	1	0	0	2	3	3	0	0	0
284	44	3	0	0	0	1	2	3	0	0	0
285	56	3	1	0	0	2	3	2	0	0	0
286	65	3	0	0	0	2	3	2	0	0	0
287	90	3	0	0	0	3	3	2	0	3	0
288	103	3	0	0	0	2	2	3	0	0	0
289	123	3	0	0	0	3	2	3	0	2	0
290	134	3	1	0	0	4	3	2	0	3	0

Sample No.		Cu	Zn	Pb	Mo	Ni	Co	Ti	Sn	Cr	Ag
291	A - 145	3	0	0	0	4	3	3	0	4	0
292	172	3	1	0	0	3	3	3	0	3	0
293	184	3	0	0	0	4	3	3	0	4	0
294	a - 5	3	0	0	0	0	1	3	0	0	0
295	9	3	3	0	0	2	2	3	0	0	0
296	10	3	3	0	0	2	2	3	0	0	0
297	18	3	3	0	0	2	2	3	0	2	0
298	24	3	1	0	0	3	1	3	0	2	0
299	Aj - 6	3	0	0	0	2	1	3	0	3	0
300	12	3	0	0	0	3	3	3	0	4	0

Sample No.		Cu	Zn	Pb	Mo	Ni	Co	Ti	Sn	Cr	Ag
301	17	3	0	0	0	4	3	2	0	4	0
302	B - 1	3	0	0	0	2	1	3	0	1	0
303	3	3	0	0	0	3	2	3	0	1	0
304	5	3	0	0	0	2	2	3	0	1	0
305	32	3	0	0	0	2	2	3	0	2	0
306	44	4	0	0	0	3	2	3	0	3	0
307	55	3	0	0	0	2	1	2	0	0	0
308	77	3	1	0	0	2	3	3	0	3	0
309	122	3	0	0	0	1	1	3	0	3	0
310	132	3	2	0	0	2	3	3	0	1	0
311	135	3	2	0	0	3	3	3	0	1	0
312	139	3	0	0	0	2	2	3	0	0	0
313	140	4	2	0	0	4	3	3	0	1	0
314	161	3	0	0	0	2	2	3	0	1	0
315	180	3	0	0	0	3	2	3	0	2	0
316	196	4	0	1	0	3	2	3	0	2	0
317	202	3	0	0	0	2	2	3	0	0	0
318	251	3	0	0	0	3	2	3	0	3	0
319	256	3	0	0	0	2	2	3	0	1	0
320	C - 1	3	0	0	0	3	4	2	0	3	0
321	9	3	1	1	0	4	4	2	0	4	0
322	20	3	0	0	0	3	3	3	0	3	0
323	30	3	0	1	0	3	4	3	0	3	0
324	40	3	3	2	0	4	4	3	0	3	0
325	49	3	0	0	0	3	3	2	0	4	0
326	60	3	2	2	0	4	4	3	0	4	0
327	70	3	0	0	0	2	2	3	0	1	0
328	80	3	0	0	0	3	4	3	0	3	0
329	90	4	2	2	0	4	4	3	0	3	0
330	100	3	0	0	0	1	1	3	0	0	0
331	110	2	1	0	0	4	4	3	0	5	0
332	120	2	0	0	0	3	3	3	0	4	0
333	130	3	0	0	0	4	4	3	0	4	0
334	140	3	2	0	0	4	4	3	0	4	0
335	150	3	0	0	0	3	3	2	0	3	0
336	160	3	0	0	0	4	4	3	0	3	0
337	170	3	0	0	0	2	2	2	0	0	0
338	180	3	1	0	0	2	2	3	0	2	0
339	190	3	3	0	0	2	3	3	0	2	0
340	200	2	0	0	0	2	2	3	0	2	0
341	210	3	1	1	0	3	3	3	0	3	0
342	220	3	3	0	0	1	2	3	0	0	0
343	230	3	2	0	0	1	2	3	0	0	0
344	240	3	3	0	0	2	3	3	0	0	0
345	250	3	1	0	0	0	2	3	0	0	0
346	260	3	3	2	0	1	2	3	0	0	0
347	270	3	0	0	0	3	2	2	0	1	0
348	280	3	1	0	0	3	2	3	0	3	0
349	290	3	3	0	0	4	3	3	0	3	0
350	300	3	0	0	0	4	4	2	0	3	0
351	310	3	0	0	0	4	4	2	0	3	0
352	320	3	0	0	0	3	3	3	0	1	0
353	C' 1	2	0	0	0	4	4	3	0	4	0
354	10	3	3	0	0	3	3	3	0	3	0
355	20	3	1	0	0	2	3	3	0	3	0

Sample No.		Cu	Zn	Pb	Mo	Ni	Co	Ti	Sn	Cr	Ag
356	30	3	2	1	0	2	3	3	0	3	0
357	40	3	0	0	0	3	3	2	0	2	0
358	50	3	1	0	0	3	2	3	0	3	0
359	60	3	3	0	0	1	3	3	0	1	0
360	70	2	0	0	0	3	3	1	0	2	0
361	80	2	0	1	0	3	3	2	0	3	0
362	C' - 90	3	0	0	0	4	4	3	0	3	0
363	100	3	2	0	0	4	4	3	0	4	0
364	D - 1	3	2	0	0	4	3	3	0	3	0
365	10	3	0	0	0	2	2	3	0	1	0
366	20	3	1	0	0	4	3	3	0	4	0
367	30	2	1	0	0	2	2	3	0	1	0
368	40	3	0	0	0	4	3	3	0	3	0
369	50	3	1	0	0	4	3	3	0	3	0
370	59	3	0	0	0	3	2	3	0	2	0
371	70	3	0	0	0	4	3	3	0	3	0
372	80	3	1	0	0	2	3	2	0	0	0
373	90	3	3	0	0	2	3	3	0	1	0
374	100	3	3	1	0	3	3	3	0	1	0
375	110	3	2	0	0	2	3	3	0	2	0
376	119	3	0	0	0	2	3	3	0	0	0
377	130	3	0	0	0	2	3	3	0	1	0
378	140	3	0	0	0	2	3	3	0	0	0
379	149	3	0	0	0	2	3	2	0	0	0
380	160	3	0	0	0	2	2	3	0	0	0
381	170	3	0	0	0	2	3	3	0	0	0
382	180	3	1	0	0	2	3	3	0	2	0
383	189	3	1	0	0	2	3	3	0	0	0
384	E - 6	3	1	0	0	2	2	4	0	2	0
385	11	4	2	1	0	2	2	4	0	1	0
386	12	3	0	0	0	2	2	3	0	0	0
387	24	3	1	0	0	2	3	3	0	2	0
388	43	3	1	0	0	1	2	3	0	0	0
389	48	3	0	1	0	2	3	3	0	0	0
390	66	3	3	0	0	2	2	3	0	1	0
391	97	3	0	0	0	1	2	3	0	0	0
392	120	3	0	0	0	1	2	3	0	0	0
393	123	2	0	0	0	0	0	4	0	0	0
394	129	3	1	0	0	3	3	4	0	3	0
395	132	3	3	1	0	3	2	3	0	3	0
396	138	3	2	0	0	2	1	3	0	3	0
397	154	3	0	0	0	4	4	3	0	4	0
398	175	3	0	0	0	4	3	3	0	3	0
399	178	3	1	0	0	4	4	3	0	3	0
400	190	3	0	0	0	4	4	2	0	3	0
401	194	3	0	0	0	3	3	3	0	3	0
402	196	3	1	0	0	3	4	4	0	3	0
403	205	3	0	0	0	2	2	3	0	2	0
404	212	3	0	0	0	2	3	3	0	2	0
405	e - 14	4	0	0	0	4	2	3	0	4	0
406	33	3	0	0	0	3	3	3	0	3	0
407	52	3	0	0	0	3	3	3	0	3	0
408	53	3	0	0	0	3	3	3	0	3	0
409	55	3	2	0	0	2	3	3	0	3	0
410	F - 1	3	3	0	0	1	2	3	0	0	0

Sample No.	Cu	Zn	Pb	Mo	Ni	Co	Ti	Sn	Cr	Ag
411 F - 10	3	2	0	0	2	2	3	0	0	0
412 21	3	4	0	0	2	3	4	0	0	0
413 31	3	3	0	0	1	2	3	0	0	0
414 40	3	1	0	0	1	2	4	0	0	0
415 49	3	4	0	0	2	3	4	0	3	0
416 50	3	3	0	0	2	3	4	0	1	0
417 55	3	4	0	0	2	3	4	0	0	0
418 60	3	4	0	0	2	4	4	0	0	0
419 65	3	1	0	0	0	2	3	0	0	0
420 70	3	4	0	0	2	3	3	0	3	0
421 80	3	4	1	0	2	3	4	0	3	0
422 88	3	4		0	3	4	3	0	0	0
423 100	3	1	0	0	0	1	3	0	0	0
424 108	3	2	0	0	2	3	3	0	0	0
425 120	3	2	0	0	2	3	3	0	0	0
426 124	3	3	0	0	1	2	3	0	0	0
427 130	3	3	0	0	2	2	4	0	2	0
428 140	3	2	0	0	2	2	3	0	0	0
429 150	3	3	0	0	2	3	4	0	0	0
430 160	3	1	0	0	2	3	2	0	0	0
431 170	3	2	0	0	2	2	2	0	0	0
432 173	3	1	0	0	1	1	2	0	1	0
433 180	3	3	0	0	2	3	3	0	1	0
434 190	3	2	0	0	1	1	2	0	0	0
435 200	3	4	0	0	2	3	3	0	0	0
436 209	3	3	0	0	2	3	4	0	1	0
437 220	3	0	0	0	2	2	2	0	0	0
438 230	3	0	0	0	2	3	2	0	0	0
439 241	3	0	0	0	2	1	2	0	0	0
440 255	3	1	0	0	0	1	3	0	0	0
441 261	3	0	0	0	1	3	2	0	0	0
442 264	3	3	0	0	1	3	3	0	1	0
443 270	2	0	0	0	1	0	2	0	0	0
444 280	3	2	0	0	2	3	2	0	0	0
445 284	3	0	0	0	1	1	2	0	0	0
446 290	3	0	0	0	2	3	2	0	0	0
447 300	3	0	0	0	0	1	2	0	0	0
448 310	3	0	0	0	1	3	3	0	0	0
449 320	3	0	0	0	1	2	2	0	0	0
450 330	3	0	0	0	2	3	3	0	0	0
451 340	3	0	0	0	1	2	2	0	0	0
452 346	3	1	0	0	2	3	3	0	0	0
453 350	3	0	0	0	1	2	2	0	0	0
454 352	3	1	0	0	2	2	3	0	0	0
455 360	3	1	0	0	1	3	3	0	0	0
456 370	3	0	0	0	1	2	2	0	0	0
457 378	3	0	0	0	0	2	3	0	0	0
458 390	3	1	0	0	0	2	3	0	0	0
459 400	3	1	0	0	2	2	3	0	0	0
460 406	3	0	0	0	1	2	2	0	0	0
461 G - 18	3	0	0	0	1	2	4	0	0	0
462 29	3	1	0	0	2	3	4	0	0	0
463 31	3	2	0	0	3	3	4	0	3	0
464 34	3	1	0	0	2	3	4	0	2	0
465 76	3	3	0	0	0	2	4	0	0	0
466 82	3	0	0	0	1	2	3	0	0	0
467 110	3	2	0	0	0	2	3	0	0	0
468 115	3	0	0	0	0	2	3	0	0	0
469 126	3	1	0	0	1	2	3	0	0	0
470 136	3	1	0	0	0	2	3	0	0	0
471 153	3	1	0	0	2	2	4	0	0	0
472 154	3	2	0	0	1	3	4	0	0	0
473 164	3	1	0	0	0	2	4	0	0	0
474 170	3	0	0	0	1	1	5	0	1	0
475 173	3	2	0	0	1	2	5	0	0	0
476 175	3	0	0	0	1	1	4	0	1	0
477 179	3	4	0	0	1	3	4	0	1	0
478 188	3	1	0	0	1	2	3	0	0	0
479 G - 195	3	1	0	0	0	1	3	0	0	0
480 197	3	1	0	0	0	3	3	0	0	0
481 201	3	0	0	0	1	1	4	0	0	0
482 225	3	1	1	0	1	1	3	0	0	0
483 232	3	1	0	0	0	2	3	0	0	0
484 238	3	1	0	0	1	2	3	0	0	0
485 g - 8	3	1	0	0	0	1	3	0	0	0
486 45	3	3	1	0	0	2	4	0	0	0
487 47	3	4	1	0	2	3	4	0	1	0
488 H 1	3	1	0	0	1	2	4	0	0	0
489 8	3	1	0	0	1	2	4	0	2	0
490 25	3	0	0	0	1	1	3	0	0	0
491 33	3	2	0	0	1	2	4	0	1	0
492 41	3	0	0	0	1	2	3	0	1	0
493 49	3	3	0	0	1	2	3	0	0	0
494 57	3	3	0	0	0	4	3	0	0	0
495 66	3	2	0	0	0	2	3	0	0	0
496 74	3	4	0	0	1	2	4	0	0	0
497 75	3	0	0	0	2	2	3	0	0	0
498 81	3	2	0	0	1	2	3	0	0	0
499 91	3	3	0	0	1	1	3	0	0	0
500 99	3	0	0	0	0	0	3	0	1	0
501 107	3	2	0	0	1	2	4	0	0	0
502 115	3	0	0	0	0	1	2	0	0	0
503 124	3	0	0	0	1	2	3	0	0	0
504 131	3	3	0	0	1	1	3	0	1	0
505 138	3	0	0	0	0	1	3	0	0	0
506 147	3	2	0	0	1	3	3	0	0	0
507 155	3	2	0	0	0	1	3	0	0	0
508 164	3	3	1	0	1	2	3	0	0	0
509 172	3	3	0	0	1	2	3	0	0	0
510 180	3	3	0	0	0	0	3	0	0	0
511 188	3	3	0	0	1	2	3	0	0	0
512 196	3	0	0	0	1	2	3	0	0	0
513 204	3	2	1	0	1	2	3	0	1	0
514 213	3	3	0	0	1	2	3	0	0	0
515 220	3	0	0	0	0	1	3	0	0	0
516 228	3	1	0	0	0	3	3	0	0	0
517 238	3	0	0	0	0	1	3	0	0	0
518 245	3	1	0	0	1	2	3	0	0	0
519 252	3	0	0	0	0	1	2	0	0	0
520 260	3	0	0	0	0	1	3	0	0	0

Sample No.		Cu	Zn	Pb	Mo	Ni	Co	Ti	Sn	Cr	Ag
521	h - 1	3	2	0	0	1	2	4	0	0	0
522	9	3	2	0	0	0	1	3	0	0	0
523	17	3	4	1	0	1	2	4	0	1	0
524	25	3	2	0	0	1	1	4	0	0	0
525	33	3	0	0	0	2	1	3	0	3	0
526	61	3	2	0	0	1	2	3	0	0	0
527	68	3	1	0	0	0	0	3	0	0	0
528	76	3	1	0	0	1	2	3	0	0	0
529	84	3	2	0	0	0	1	3	0	0	0
530	91	3	0	0	0	0	1	3	0	0	0
531	100	3	3	0	0	0	2	3	0	0	0
532	108	3	0	0	0	1	1	3	0	0	0
533	116	3	3	0	0	2	1	4	0	0	0
534	125	3	3	0	0	1	1	4	0	0	0
535	I - 3	3	3	0	0	0	2	3	0	0	0
536	11	3	4	0	0	2	2	4	0	0	0
537	14	3	0	0	0	1	2	3	0	0	0
538	21	3	3	0	0	1	2	4	0	0	0
539	37	3	0	0	0	1	3	3	0	0	0
540	71	3	3	0	0	1	2	3	0	0	0
541	105	3	0	0	0	0	1	3	0	0	0
542	108	3	0	0	0	0	2	3	0	0	0
543	126	3	2	0	0	0	1	3	0	0	0
544	136	3	1	0	0	0	2	3	0	0	0
545	158	3	1	0	0	1	3	3	0	0	0
546	169	3	0	0	0	0	1	3	0	0	0
547	179	3	4	0	0	0	1	4	0	0	0
548	184	3	2	0	0	0	2	3	0	0	0
549	188	3	1	0	0	0	1	3	0	0	0
550	189	3	0	0	0	0	2	3	0	0	0
551	204	3	0	0	0	0	1	3	0	0	0
552	206	3	0	0	0	0	2	3	0	0	0
553	207	3	0	0	0	0	2	3	0	0	0
554	217	3	1	0	0	0	2	3	0	0	0
555	218	3	4	1	0	2	3	3	0	1	0
556	222	3	1	0	0	0	2	3	0	0	0
557	223	3	3	1	0	2	3	3	0	0	0
558	225	3	3	1	0	2	3	4	0	1	0

Table 6. Metal content of geochemical Samples

(A) Stream sediment (−80 ~ +100−mesh fraction)

(ppm)

Cons. No	Sample No.	Cu	Zn	Ni	Cons. No	Sample No.	Cu	Zn	Ni	Cons. No	Sample No.	Cu	Zn	Ni
1	A - 1	25	38	20	51	A - 52	48	77	28	101	A - 102	62	51	19
2	2	57	43	42	52	53	50	53	41	102	103	57	32	24
3	3	31	38	20	53	54	41	65	37	103	104	49	25	39
4	4	88	51	40	54	55	49	58	41	104	105	54	51	6
5	5	72	41	37	55	56	50	62	22	105	106	67	40	13
6	6	41	54	35	56	57	41	51	40	106	107	49	54	9
7	7	57	51	24	57	58	46	56	39	107	108	59	25	12
8	8	34	39	111	58	59	56	63	28	108	109	62	20	14
9	9	49	43	36	59	60	42	66	39	109	110	57	32	12
10	10	62	43	16	60	61	59	62	22	110	113	61	35	21
11	11	44	43	75	61	62	50	51	39	111	114	69	59	13
12	12	52	53	35	62	63	40	75	22	112	115	49	34	210
13	13	64	51	37	63	64	41	44	38	113	116	10	11	374
14	14	51	50	30	64	65	49	43	16	114	117	65	31	192
15	15	60	60	39	65	66	39	96	38	115	118	45	37	196
16	16	63	44	30	66	67	61	66	22	116	119	50	37	197
17	17	62	45	68	67	68	41	48	42	117	120	17	17	362
18	18	75	44	35	68	69	43	51	33	118	121	40	46	254
19	19	52	52	60	69	70	47	68	22	119	122	9	21	970
20	20	55	54	30	70	71	59	54	21	120	123	24	25	303
21	21	67	64	24	71	72	37	186	36	121	124	9	21	985
22	22	72	72	24	72	73	48	77	18	122	125	23	45	365
23	23	75	65	21	73	74	38	87	20	123	126	27	29	367
24	24	68	71	25	74	75	45	108	18	124	127	34	43	396
25	25	73	64	24	75	76	44	85	29	125	128	26	35	382
26	26	63	53	19	76	77	50	59	37	126	129	9	21	913
27	27	39	29	26	77	78	41	131	20	127	130	11	25	1,280
28	28	61	32	20	78	79	45	107	36	128	131	28	38	438
29	29	48	95	28	79	80	44	123	20	129	132	35	30	786
30	30	68	40	17	80	81	51	94	16	130	133	25	39	481
31	31	62	43	30	81	82	43	95	39	131	134	33	35	244
32	32	57	61	31	82	83	44	55	29	132	135	28	44	65
33	33	78	38	23	83	84	44	54	20	133	135a	23	50	65
34	34	95	40	23	84	85	50	55	36	134	136	22	81	94
35	35	55	65	30	85	86	40	52	18	135	137	28	43	367
36	36	70	49	30	86	87	44	82	22	136	138	20	47	382
37	37	74	51	30	87	88	45	61	33	137	139	28	65	197
38	38	64	37	43	88	89	55	88	23	138	140	42	45	442
39	39	46	61	25	89	90	35	67	117	139	141	36	54	242
40	40	62	56	21	90	91	44	91	25	140	142	29	58	182
41	41	46	105	21	91	92	42	71	20	141	143	12	43	427
42	42	54	54	29	92	93	41	107	22	142	144	25	57	340
43	43	78	62	34	93	94	43	115	23	143	145	27	39	144
44	44	49	29	18	94	95	60	60	18	144	146	37	15	303
45	45	57	74	19	95	96	59	29	26	145	147	31	21	319
46	46	42	54	20	96	97	47	34	18	146	148	31	37	236
47	47	70	41	16	97	98	52	20	30	147	149	25	15	186
48	48	63	52	17	98	99	67	32	24	148	150	22	14	375
49	49	46	66	36	99	100	58	73	30	149	151	33	26	180
50	51	41	46	36	100	101	45	57	18	150	152	32	25	264

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
151	A - 153	24	21	107
152	154	39	16	231
153	155	35	29	242
154	156	31	39	245
155	157	34	31	40
156	158	31	26	75
157	159	19	54	35
158	161	29	52	242
159	162	27	37	204
160	163	27	33	107
161	164	32	26	77
162	165	24	27	33
163	166	27	29	249
164	167	33	36	44
165	148	36	49	49
166	169	42	45	68
167	170	37	38	40
168	171	28	60	41
169	172	23	59	35
170	173	26	58	43
171	174	14	38	20
172	175	31	43	40
173	176	38	40	23
174	177	75	59	68
175	178	38	38	52
176	179	69	57	33
177	180	53	49	174
178	182	33	39	848
179	183	53	47	335
180	184	32	44	437
181	185	40	32	450
182	186	33	58	1263
183	187	23	37	
184	188	13	28	850
185	189	16	32	675
186	190	23	41	405
187	191	31	92	208
188	a - 1	33	59	27
189	2	34	74	25
190	3	32	82	25
191	4	80	20	15
192	5	39	10	11
19	6	22	18	30
194	7	57	15	16
195	8	50	19	14
196	9	39	15	20
197	10	58	17	15
198	11	40	19	19
199	12	46	21	21
200	13	51	9	16
201	14	49	14	14
202	15	63	10	20
203	16	44	13	20
204	17	32	22	21
205	18	26	14	14

Cons. No.	Sample No.	Cu	Zn	Ni
206	a - 19	17	39	15
207	20	17	51	20
208	21	25	111	25
209	22	26	51	55
210	23	24	98	21
211	24	32	60	28
212	25	42	44	25
213	26	37	51	29
214	27	47	50	21
215	28	35	51	29
216	29	34	48	30
217	30	46	51	30
218	31	32	35	25
219	32	53	47	26
220	33	58	35	435
221	34	50	25	356
222	35	26	31	444
223	36	38	38	345
224	AJ - 1	33	46	53
225	2	39	47	50
226	3	37	46	49
227	4	44	46	48
228	5	43	46	54
229	6	43	46	51
230	7	40	46	53
231	8	39	43	54
232	9	43	50	57
233	10	43	88	41
234	11	37	37	52
235	12	39	31	56
236	13	26	12	13
237	14	31	11	386
238	15	37	20	363
239	16	36	50	203
240	17	39	31	781
241	18	36	37	326
242	B - 1	54	64	76
243	3	81	69	111
244	3	108	64	99
245	4	66	63	98
246	5	43	52	78
247	6	49	55	79
248	7	49	51	80
249	8	66	54	46
250	9	35	52	66
251	10	38	51	73
252	14	37	56	65
253	15	64	60	99
254	17	49	57	88
255	18	43	58	74
256	19	48	55	79
257	22	40	44	69
258	25	59	60	91
259	28	53	53	88
260	30	66	63	95

Cons. No.	Sample No.	Cu	Zn	Ni
261	B - 32	66	63	95
262	34	59	58	99
263	35	60	64	99
264	36	55	60	90
265	37	114	99	171
266	39	53	55	83
267	41	45	51	71
268	42	66	62	150
269	43	38	49	63
270	45	51	59	78
271	46	30	64	51
272	47	49	60	91
273	48	60	61	87
274	49	49	52	70
275	50	39	53	61
276	52	49	62	68
277	53	52	60	70
278	54	39	62	120
279	55	53	52	71
280	56	51	62	67
281	58	54	54	82
282	59	54	60	70
283	60	51	64	98
284	62	59	55	81
285	64	64	62	79
286	65	53	54	68
287	67	58	51	63
288	68	53	53	92
289	69	53	52	95
290	70	60	74	128
291	71	54	72	180
292	73	67	76	107
293	74	138	107	154
294	75	85	84	98
295	76	159	115	126
296	77	72	80	83
297	78	151	114	111
298	79	75	66	68
299	80	81	78	103
300	81	94	74	77
301	82	149	112	86
302	83	132	11	94
303	84	86	98	97
304	85	49	75	73
305	86	87	87	81
306	87	83	83	86
307	88	53	60	77
308	89	74	68	51
309	90	60	68	74
310	91	65	62	94
311	92	53	61	72
312	93	64	78	94
313	94	48	62	100
314	95	73	77	98
315	96	69	73	94

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
316	B - 97	60	68	86
317	99	75	72	103
318	100	94	81	47
319	101	71	91	133
320	103	60	58	114
321	104	69	73	143
322	105	55	84	94
323	106	70	67	137
324	107	95	90	184
325	108	72	68	145
326	109	92	76	171
327	110	98	75	163
328	111	64	72	131
329	112	64	79	120
330	113	84	76	171
331	114	91	71	175
332	115	65	71	124
333	116	79	67	171
334	117	74	72	158
335	118	86	66	193
336	119	70	68	145
337	120	71	71	152
338	121	57	55	120
339	122	73	64	141
340	123	71	71	146
341	124	64	67	145
342	125	64	69	93
343	126	67	62	146
344	127	80	67	180
345	128	62	61	148
346	129	79	64	165
347	130	103	61	138
348	131	86	65	101
349	132	69	61	173
350	133	60	70	131
351	134	70	67	135
352	135	75	70	177
353	136	75	69	152
354	137	73	69	186
355	138	60	63	152
356	139	67	64	169
357	140	46	60	123
358	141	52	83	51
359	142	53	53	158
360	143	56	72	182
361	144	83	66	131
362	145	75	65	57
363	146	82	73	72
364	147	90	74	70
365	148	79	67	152
366	149	84	72	72
367	150	79	68	59
368	151	57	61	59
369	152	69	68	59
370	153	79	73	89

Cons. No.	Sample No.	Cu	Zn	Ni
371	B - 154	90	79	87
372	155	76	73	79
373	156	74	69	76
374	157	54	56	65
375	158	85	71	68
376	159	64	63	68
377	160	61	69	72
378	161	34	55	51
379	162	76	73	68
380	163	77	71	104
381	164	56	69	55
382	166	55	61	110
383	168	41	48	68
384	169	56	64	85
385	170	52	61	123
386	171	71	69	68
387	172	72	69	63
388	173	65	69	93
389	174	71	71	101
390	175	78	68	68
391	176	78	98	92
392	177	79	76	80
393	178	72	75	76
394	179	93	77	101
395	180	68	71	64
396	181	69	109	88
397	182	42	114	64
398	183	80	110	84
399	184	63	68	92
400	185	38	55	64
401	186	57	72	100
402	187	63	67	120
403	188	63	89	127
404	189	50	54	36
405	190	47	69	37
406	191	71	62	44
407	192	47	57	35
408	193	91	78	54
409	195	74	74	51
410	C - 1	52	85	560
411	2	42	61	456
412	3	57	45	604
413	4	29	45	524
414	5	45	45	540
415	6	50	60	552
416	7	28	37	380
417	8	21	34	328
418	9	18	29	344
419	12	41	44	500
420	13	45	51	572
421	14	27	39	552
422	15	33	48	320
423	16	38	39	444
424	17	49	63	100
425	18	51	45	536

Cons. No.	Sample No.	Cu	Zn	Ni
426	C - 19	51	44	564
427	20	60	52	380
428	21	39	42	832
429	22	49	39	644
430	23	70	76	24
431	24	64	63	76
432	25	40	40	536
433	26	88	70	44
434	27	47	35	536
435	28	57	65	208
436	29	42	39	500
437	30	44	46	488
438	31	51	69	108
439	32	36	42	440
440	33	42	52	456
441	34	33	39	424
442	35	41	38	500
443	36	58	106	448
444	17	34	37	436
445	28	64	64	16
446	39	32	92	432
447	40	51	45	528
448	41	55	46	492
449	42	55	43	536
450	43	72	48	20
451	44	52	49	512
452	45	37	38	472
453	46	51	64	8
454	47	39	48	480
455	48	53	46	512
456	49	38	37	480
457	50	53	46	516
458	51	65	65	212
459	52	3	43	500
460	53	53	43	648
461	54	55	52	396
462	55	45	40	600
463	56	51	55	46
464	57	40	43	520
465	58	45	41	572
466	59	38	65	18
467	60	40	40	464
468	61	48	50	20
469	62	49	53	10
470	63	67	47	150
471	64	67	47	420
472	65	45	42	552
473	66	48	47	584
474	67	45	38	596
475	68	62	45	636
476	69	36	44	460
477	70	76	60	242
478	71	60	57	134
479	72	50	47	384
480	73	51	45	320

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
481	C - 74	38	39	548
482	75	63	67	180
483	76	55	49	600
484	77	33	51	460
485	78	47	96	596
486	79	52	96	596
487	80	43	82	996
488	81	52	92	492
489	82	38	86	520
490	83	50	94	488
491	84	50	100	504
492	85	35	96	464
493	86	58	100	212
494	87	40	84	516
495	88	53	100	432
496	89		94	532
497	90	56	102	456
498	91	55	100	492
499	92	54	114	15
500	93	61	102	528
501	94	54	98	484
502	95	62	108	20
503	96	44	96	624
504	97	51	100	552
505	98	87	128	14
506	99	53	108	440
507	100	70	94	4
508	101	67	138	21
509	102	41	96	500
510	103	71	62	110
511	105	56	72	390
512	108	35	58	358
513	109	33	65	945
514	110	14	64	1,580
515	111	37	59	1,020
516	112	35	53	980
517	113	41	54	851
518	114	45	58	1,040
519	115	33	63	930
520	116	33	50	945
521	117	13	37	1,400
522	118	20	40	1,270
523	119	16	46	1,220
524	120	15	43	1,280
525	121	18	34	1,180
526	122	14	33	1,100
527	123	27	35	1,350
528	124	16	38	1,130
529	125	13	45	1,240
530	126	13	32	1,100
531	127	17	44	1,180
532	128	13	35	1,330
533	129	16	37	1,080
534	130	23	46	1,000
535	131	21	38	1,020
536	C - 132	28	48	970
537	134	59	72	520
538	135	35	53	590
539	136	45	51	570
540	137	37	51	680
541	138	38	55	140
542	139	28	48	770
543	140	35	55	750
544	141	15	42	1,450
545	142	25	48	480
546	143	12	38	1,550
547	144	24	44	1,130
548	145	35	63	340
549	146	32	44	840
550	147	50	47	550
551	148	53	68	370
552	149	50	42	610
553	150	54	44	370
554	151	45	42	600
555	152	40	57	430
556	153	47	47	570
557	154	42	44	570
558	155	40	51	200
559	156	40	44	570
560	157	38	55	540
561	158	36	50	457
562	159	35	38	442
563	160	57	55	423
564	161	40	42	450
565	162	43	59	569
566	163	41	59	459
567	164	32	61	11
568	165	44	61	32
569	166	39	61	24
570	167	32	80	16
571	168	37	75	27
572	169	43	61	20
573	170	43	70	24
574	171	54	75	38
575	172	56	77	28
576	173	54	95	25
577	174	48	57	14
578	175	54	65	28
579	176	36	59	2
580	177	58	78	28
581	178	56	85	27
582	179	70	90	42
583	180	47	71	27
584	181	43	78	24
585	182	37	36	308
586	183	54	58	384
587	184	20	68	22
588	185	41	57	38
589	186	40	56	35
590	187	42	61	35
591	C - 188	34	56	24
592	189	44	52	43
593	190	35	49	30
594	191	43	74	9
595	192	42	55	35
596	193	42	40	11
597	194	36	58	24
598	195	46	57	22
599	196	40	53	32
600	197	37	36	263
601	198	36	34	250
602	199	31	66	54
603	200	31	63	61
604	201	24	57	39
605	202	31	72	60
606	203	28	60	53
607	204	27	65	22
608	205	21	63	24
609	206	27	57	53
610	207	25	73	42
611	208	22	66	33
612	209	28	62	56
613	210	35	68	69
614	211	24	68	40
615	212	26	56	36
616	213	34	66	135
617	214	23	38	250
618	215	23	57	126
619	216	32	61	200
620	217	46	63	144
621	218	60	36	50
622	219	46	35	8
623	220	46	33	10
624	221	90	41	18
625	222	40	33	22
626	223	66	38	14
627	224	73	36	12
628	225	27	47	32
629	226	46	36	6
630	227	60	30	12
631	228	37	36	10
632	229	37	73	18
633	230	94	33	10
634	231	50	38	16
635	232	58	23	1
636	233	51	21	2
637	234	48	40	6
638	235	54	38	6
639	236	88	24	3
640	237	46	34	4
641	238	90	21	3
642	239	100	30	5
643	240	90	27	2
644	241	105	21	2
645	242	112	21	1

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
646	C - 243	139	23	2
647	244	194	18	2
648	245	108	17	2
649	246	84	24	2
650	247	63	21	18
651	248	68	25	2
652	249	100	27	2
653	250	134	28	2
654	251	90	24	2
655	252	99	21	2
656	253	54	17	2
657	254	102	29	2
658	255	60	31	2
659	256	74	22	4
660	257	133	15	6
661	258	64	22	5
662	259	98	27	11
663	260	70	38	7
664	261	77	21	9
665	262	83	27	3
666	263	118	31	11
667	264	78	29	7
668	265	97	24	9
669	266	135	24	5
670	267	39	42	23
671	268	129	26	45
672	269	39	47	25
673	270	69	68	57
674	271	35	42	25
675	272	49	57	107
676	273	31	57	32
677	274	46	56	44
678	275	25	51	30
679	276	27	58	32
680	277	42	54	38
681	278	38	69	28
682	279	27	53	27
683	280	45	64	79
684	281	27	51	20
685	282	51	74	116
686	283	34	46	14
687	284	13	49	7
688	285	32	67	16
689	286	35	62	18
690	287	26	63	8
691	288	21	46	21
692	289	32	52	18
693	290	21	39	17
69	291	91	71	31
695	292	34	32	13
696	293	21	52	9
697	294	23	75	725
698	295	30	44	660
699	296	32	52	740
700	297	32	37	535

Cons. No.	Sample No.	Cu	Zn	Ni
701	C' - 298	31	47	437
702	299	31	40	535
703	300	34	43	740
704	301	28	40	395
705	302	15	32	1,548
706	303	40	42	472
707	304	38	40	444
708	305	30	37	358
709	306	37	41	410
710	307	14	33	1,620
711	308	38	40	405
712	309	22	36	1,630
713	310	34	38	434
714	311	31	39	1,365
715	312	35	38	405
716	313	34	51	460
717	314	46	51	460
718	315	17	50	1,434
719	316	36	45	360
720	317	22	24	434
721	318	39	47	355
722	319	11	21	636
723	320	47	56	350
724	321	27	53	805
725	322	31	46	928
726	323	42	64	1,490
727	324	36	57	1,490
728	325	5	26	875
729	C' - 1	10	23	1,750
730	2	10	21	1,718
731	3	10	27	1,755
732	4	14	26	1,518
733	5	10	21	1,750
734	6	9	22	1,800
735	7	32	55	25
736	8	32	10	26
737	9	42	91	22
738	10	31	17	26
739	11	30	65	25
740	12	25	32	56
741	13	30	58	25
742	14	36	63	40
743	15	36	63	28
744	16	19	40	50
745	17	31	53	26
746	18	61	56	407
747	19	45	48	360
748	20	42	49	278
749	21	30	55	166
750	22	28	29	233
751	23	48	41	330
752	24	59	50	419
753	25	51	45	516
754	26	44	42	315
755	27	32	28	219

Cons. No.	Sample No.	Cu	Zn	Ni
756	C' - 28	29	44	133
757	29	38	50	168
758	30	26	73	33
759	31	39	50	165
760	32	46	59	192
761	33	44	62	172
762	34	44	56	172
763	35	40	64	76
764	36	44	63	176
765	37	46	58	132
766	38	46	61	196
767	39	44	67	192
768	40	44	60	172
769	41	47	58	246
770	42	54	53	192
771	43	38	68	84
772	44	57	63	222
773	45	42	69	134
774	46	60	67	186
775	47	79	64	64
776	48	50	62	218
777	49	40	54	132
778	50	49	55	306
779	51	59	64	182
780	52	59	57	306
781	53	47	35	262
782	54	83	20	12
783	55	77	39	9
784	56	49	40	16
785	57	52	39	16
786	58	40	33	8
787	59	57	23	4
788	60	58	45	15
789	61	74	50	22
790	62	55	33	11
791	63	31	12	3
792	64	69	20	4
793	65	56	66	20
794	66	50	53	18
795	67	38	36	12
796	68	42	43	570
797	70	40	45	535
798	71	46	43	425
799	71	46	43	425
800	72	31	32	770
801	73	37	34	285
802	74	47	40	340
803	75	51	44	395
804	76	57	55	285
805	77	45	35	285
806	78	50	39	680
807	79	47	39	285
808	80	40	34	305
809	81	56	45	260
810	82	43	37	275

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
811	C' - 83	48	42	300
812	84	57	49	265
813	85	53	54	310
814	86	43	43	650
815	87	26	38	260
816	88	44	48	650
817	89	29	50	590
818	90	33	47	610
819	91	40	42	590
820	92	17	25	370
821	93	47	42	530
822	94	33	39	530
823	95	38	47	510
824	96	39	45	490
825	97	39	41	490
826	98	34	45	530
827	99	24	45	530
828	100	33	59	790
829	D - 1	39	52	150
830	2	24	44	110
831	3	26	41	115
832	4	52	44	15
833	5	84	62	140
834	6	48	48	150
835	7	27	68	140
836	8	86	60	75
837	9	75	60	44
838	10	61	39	85
839	11	82	49	17
840	12	75	45	55
841	13	56	64	150
842	14	55	48	125
843	15	51	54	250
844	16	71	40	14
845	17	46	52	185
846	18	75	60	305
847	19	47	57	205
848	20	47	55	225
849	21	48	59	300
850	22	53	58	195
851	23	44	47	235
852	24	32	40	80
853	25	41	54	215
854	26	59	65	205
855	27	45	55	230
856	28	42	38	220
857	29	49	53	280
858	30	52	67	145
859	31	39	49	190
860	32	41	47	240
861	D - 33	62	66	70
862	34	25	58	130
863	35	40	48	245
864	36	53	52	270
865	37	23	53	205
866	38	37	49	205
867	39	36	47	220
868	40	28	38	290
869	41	42	54	215
870	42	36	40	160
871	43	28	58	110
872	44	48	54	220
873	45	40	43	185
874	46	32	45	160
875	48	37	69	125
876	48	37	69	125
877	49	37	80	135
878	50	49	60	185
879	51	46	56	170
880	52	58	62	245
881	53	70	59	305
882	54	52	51	215
883	55	35	84	110
884	56	60	60	250
885	57	40	85	110
886	58	61	60	255
887	59	55	56	240
888	60	75	67	270
889	61	51	60	210
890	62	55	54	230
891	63	60	62	240
892	64	58	61	225
893	65	63	65	250
894	66	93	73	45
895	67	48	63	250
896	68	43	66	235
897	69	54	64	195
898	70	49	53	165
899	71	44	56	425
900	73	62	66	70
901	74	62	54	150
902	76	49	48	100
903	77	4	56	85
904	78	52	46	120
905	79	57	47	90
906	80	49	62	35
907	81	43	58	135
908	8	55	60	35
909	83	43	41	185
910	84	53	60	168
911	85	44	48	197
912	86	130	59	22
913	87	42	41	215
914	88	42	61	140
915	89	44	54	282
916	D - 90	37	79	22
917	91	36	40	340
918	92	25	18	320
919	93	24	46	75
920	94	42	40	98
921	95	44	44	68
922	96	42	40	72
923	97	37	56	152
924	98	42	39	75
925	99	73	44	87
926	100	49	50	55
927	101	64	44	68
928	102	59	52	68
929	103	53	51	65
930	104	58	51	65
931	105	58	54	75
932	106	59	44	65
933	107	39	80	35
934	108	54	58	75
935	109	53	64	63
936	110	66	44	33
937	111	43	48	40
938	112	56	43	65
939	113	47	54	52
940	114	60	38	55
941	116	40	38	18
942	117	68	59	27
943	118	50	40	10
944	119	66	57	32
945	120	75	50	32
946	121	41	27	18
947	122	60	43	25
948	123	75	52	27
949	124	68	42	25
950	125	70	44	27
951	126	66	40	25
952	127	76	51	27
953	128	21	80	10
954	129	86	55	23
955	130	56	56	23
956	131	73	45	27
957	132	68	49	30
958	133	80	55	27
959	134	71	42	10
960	135	72	43	10
961	136	67	58	12
962	137	64	55	27
963	138	80	57	30
964	139	40	54	15
965	140	66	33	18
966	141	72	53	22
967	142	71	52	26
968	143	83	58	33
969	144	61	57	31
970	145	94	63	31

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
971	D - 146	65	55	25
972	147	52	59	48
973	148	101	67	45
974	149	58	50	222
975	150	69	67	24
976	151	71	55	28
977	152	40	60	16
978	153	71	56	27
979	154	60	52	22
980	155	81	58	32
981	156	59	53	18
982	157	78	58	31
983	158	71	57	28
984	159	73	59	30
985	160	71	59	30
986	161	65	47	24
987	162	52	51	23
988	163	72	58	28
989	164	88	59	34
990	165	61	53	31
991	166	59	51	23
992	167	70	48	24
993	168	58	57	39
994	169	67	58	44
995	170	70	50	48
996	171	66	67	322
997	172	72	56	53
998	173	89	62	97
999	174	61	61	341
1000	175	44	56	68
1001	177	67	63	278
1002	178	62	62	221
1003	179	61	42	24
1004	180	51	47	38
1005	181	67	55	37
1006	182	61	48	38
1007	184	56	56	43
1008	185	88	58	48
1009	186	65	52	23
1010	187	70	59	47
1011	188	77	58	26
1012	189	54	64	26
1013	190	77	57	30
1014	193	74	57	54
1015	194	83	60	60
1016	E - 2	23	51	132
1017	3	75	68	120
1018	4	53	68	56
1019	5	94	79	56
1020	6	63	67	61
1021	7	69	62	35
1022	8	78	64	32
1023	9	60	63	35
1024	10	40	88	40
1025	11	76	69	36

Cons. No.	Sample No.	Cu	Zn	Ni
1026	E - 12	62	71	60
1027	13	53	57	300
1028	14	48	102	76
1029	15	68	62	71
1030	16	40	47	50
1031	17	50	59	58
1032	18	92	79	70
1033	19	55	58	60
1034	20	185	72	60
1035	21	80	70	60
1036	22	71	91	35
1037	23	63	65	68
1038	24	78	93	72
1039	25	84	102	78
1040	26	94	109	71
1041	27	43	78	54
1042	28	37	49	96
1043	29	36	82	60
1044	30	86	71	64
1045	31	98	83	64
1046	32	69	68	41
1047	33	93	92	65
1048	34	79	83	61
1049	35	84	96	69
1050	36	20	71	33
1051	37	98	71	61
1052	38	30	78	102
1053	39	84	75	59
1054	40	93	99	61
1055	41	73	96	60
1056	42	85	83	45
1057	43	84	106	57
1058	44	66	98	61
1059	45	205	138	57
1060	46	67	69	78
1061	47	81	65	60
1062	48	97	94	62
1063	49	82	95	90
1064	50	85	93	41
1065	51	82	109	87
1066	52	75	87	41
1067	53	71	91	41
1068	55	93	116	82
1069	57	81	59	34
1070	58	85	94	49
1071	59	64	86	62
1072	60	69	79	37
1073	61	91	90	39
1074	62	57	75	34
1075	63	60	51	29
1076	64	88	96	52
1077	65	84	82	75
1078	66	53	95	38
1079	67	73	60	33
1080	68	53	87	35

Cons. No.	Sample No.	Cu	Zn	Ni
1081	E - 70	79	78	33
1082	71	72	81	35
1083	72	99	73	50
1084	73	66	89	37
1085	74	77	72	58
1086	75	76	96	42
1087	76	71	91	63
1088	77	84	74	43
1089	78	77	83	33
1090	79	81	110	79
1091	80	78	65	38
1092	81	62	89	38
1093	82	82	67	38
1094	83	64	89	40
1095	84	81	102	67
1096	85	75	62	34
1097	86	91	83	42
1098	87	73	61	33
1099	88	89	79	43
1100	89	81	73	38
1101	90	82	66	35
1102	91	82	74	40
1103	92	71	61	33
1104	93	78	73	39
1105	94	82	64	34
1106	95	82	65	35
1107	96	79	67	38
1108	97	72	67	34
1109	98	85	66	46
1110	99	82	85	68
1111	100	73	74	37
1112	101	76	92	65
1113	102	95	72	43
1114	103	74	65	32
1115	104	93	81	39
1116	105	66	73	34
1117	106	81	81	38
1118	107	59	72	51
1119	108	76	68	34
1120	109	68	71	24
1121	110	87	95	66
1122	111	85	67	57
1123	112	86	90	35
1124	117	89	85	36
1125	118	89	83	50
1126	119	77	85	42
1127	120	85	88	36
1128	121	79	77	37
1129	122	98	84	42
1130	123	211	141	87
1131	124	22	51	463
1132	125	41	49	308
1133	126	24	58	201
1134	128	35	43	364
1135	129	44	74	154

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
1136	E - 130	37	47	350
1137	131	15	67	66
1138	132	33	43	270
1139	134	31	56	238
1140	135	37	54	298
1111	136	45	55	314
1142	137	24	44	326
1143	138	22	70	165
1144	139	28	63	240
1145	140	59	64	437
1146	141	35	56	629
1147	142	17	69	116
1148	143	30	47	265
1149	144	33	73	146
1150	145	43	56	347
1151	146	56	68	407
1152	147	39	61	190
1153	148	54	66	408
1154	149	41	56	278
1155	150	39	56	316
1156	151	45	59	366
1157	152	22	60	153
1158	153	33	59	290
1159	154	32	53	812
1160	155	30	61	265
1161	156	33	63	824
1162	157	33	53	765
1163	158	30	45	811
1164	159	37	55	397
1165	160	25	62	266
1166	161	30	73	265
1167	162	31	64	293
1168	163	37	56	329
1169	164	36	66	1,526
1170	165	33	57	262
1171	166	36	64	345
1172	167	53	62	475
1173	168	40	67	584
1174	169	26	54	350
1175	170	28	53	761
1176	171	30	53	827
1177	172	45	76	668
1178	173	43	61	662
1179	174	35	58	657
1180	175	41	58	743
1181	176	15q	39	984
1182	177	46	56	824
1183	178	45	73	744
1184	179	38	86	352
1185	180	41	64	888
1186	181	42	56	574
1187	182	33	65	281
1188	183	33	71	283
1189	184	35	60	281
1190	185	30	56	290

Cons. No.	Sample No.	Cu	Zn	Ni
1191	E - 186	29	75	457
1192	187	22	70	447
1193	188	41	85	294
1194	189	48	61	261
1195	190	53	87	447
1196	191	46	50	498
1197	192	28	48	369
1198	193	31	53	470
1199	194	40	46	652
1200	195	30	67	446
1201	196	41	74	129
1202	197	38	59	76
1203	198	33	60	101
1204	199	35	59	154
	200	37	73	183
1206	201	50	59	189
1207	202	51	79	124
1208	203	40	66	543
1209	204	47	80	515
1210	205	44	76	89
1211	206	44	95	76
1212	207	47	79	180
1213	208	59	89	115
1214	209	49	90	154
1215	212	51	86	51
1216	213	331	47	34
1217	214	35	71	26
1218	215	24	60	22
1219	216	47	94	116
1220	e - 1	39	55	486
1221	2	41	55	365
1222	3	71	76	616
1223	4	36	47	601
1224	5	41	55	369
1225	6	39	47	506
1226	7	35	56	139
1227	8	35	43	622
1228	9	31	40	455
1229	10	30	44	474
1230	11	35	54	522
1231	12	47	62	721
1232	13	31	48	360
1233	14	35	46	470
1234	15	51	54	552
1235	16	53	75	789
1236	17	34	56	397
1237	18	45	57	444
1238	19	41	59	456
1239	20	43	56	661
1240	21	44	64	712
1241	22	39	42	48
1242	23	94	72	77
1243	25	60	58	71
1244	26	47	57	69
1245	27	81	65	112

Cons. No.	Sample No.	Cu	Zn	Ni
1246	e - 28	76	78	139
1247	29	76	63	87
1248	30	65	58	98
1249	31	86	70	130
1250	32	79	64	312
1251	33	99	82	369
1252	35	39	66	823
1253	36	57	76	1,409
1254	38	82	70	1,260
1255	39	51	68	213
1256	40	52	73	236
1257	42	72	78	355
1258	46	43	61	154
1259	47	49	76	173
1260	48	51	65	126
1261	49	58	80	223
1262	50	58	62	248
1263	51	56	83	217
1264	52	43	56	154
1265	53	47	56	165
1266	54	57	61	230
1267	55	39	56	119
1268	56	45	73	102
1269	57	67	99	121
1270	58	35	52	132
1271	59	55	71	95
1272	60	47	65	199
1273	61	51	52	72
1274	62	59	81	113
1275	63	48	68	87
1276	64	43	66	192
1277	65	52	79	130
1278	66	61	62	130
1279	F - 1	62	140	7
1280	2	86	112	12
1281	3	56	104	5
1282	4	51	136	7
1283	5	54	71	4
1284	6	43	149	4
1285	7	56	103	5
1286	8	46	149	6
1287	9	31	111	4
1288	10	62	93	7
1289	11	46	71	7
1290	12	68	100	5
1291	13	51	133	5
1292	14	47	156	6
1293	15	28	128	3
1294	16	48	88	5
1295	17	31	109	4
1296	18	28	108	5
1297	19	48	120	7
1298	20	6	45	5
1299	21	34	138	17
1300	22	18	82	15

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
1301	F - 23	51	60	21
1302	24	104	148	17
1303	25	89	111	17
1304	26	29	89	11
1305	27	72	80	8
1306	28	14	102	8
1307	29	31	118	13
1308	30	57	98	14
1309	31	47	115	16
1310	32	71	107	20
1311	34	54	116	24
1312	35	57	79	26
1313	36	61	76	25
1314	37	11	149	28
1315	38	38	72	16
1316	39	56	127	31
1317	40	36	90	19
1318	41	10	92	16
1319	42	4	96	13
1320	43	7	77	11
1321	44	2	17	9
1322	45	2	19	8
1323	46	20	71	15
1324	47	4	92	12
1325	48	9	82	12
1326	49	21	91	10
1327	50	16	85	16
1328	51	25	71	11
1329	52	25	58	9
1330	53	35	66	13
1331	54	35	76	13
1332	55	29	80	17
1333	56	33	64	12
1334	57	28	77	14
1335	58	41	68	14
1336	59	34	114	20
1337	60	31	125	20
1338	61	26	93	13
1339	62	49	69	13
1340	63	52	147	25
1341	64	47	102	18
1342	65	43	107	19
1343	66	17	111	20
1344	67	15	117	23
1345	68	15	90	15
1346	69	17	109	20
1347	70	17	117	15
1348	71	18	118	21
1349	72	17	107	19
1350	73	16	108	17
1351	74	21	117	16
1352	75	16	129	22
1353	76	18	111	12
1354	77	22	108	18
1355	78	40	110	17
1356	F - 79	12	106	20
1357	80	26	125	21
1358	81	19	103	19
1359	82	23	124	21
2360	83	15	122	22
1361	84	42	115	21
1362	85	19	96	14
1363	86	32	66	6
1364	87	122	62	17
1365	88	77	263	23
1366	89	66	145	13
1367	90	44	150	14
1368	91	66	93	25
1369	92	29	96	16
1370	93	33	103	18
1371	94	25	113	18
1372	95	21	96	15
1373	96	18	78	6
1374	97	19	72	25
1375	99	27	87	26
1376	100	30	97	25
1377	101	130	182	24
1378	104	50	91	21
1379	105	155	12	25
1380	106	184	160	23
1381	107	216	113	26
1382	108	146	140	28
1383	109	95	96	16
1384	110	163	200	24
1385	111	156	214	22
1386	112	183	136	17
1387	113	101	144	19
1388	114	97	118	20
1389	116	105	146	24
1390	117	136	234	27
1391	118	110	176	22
1392	119	108	172	22
1393	120	137	131	15
1394	121	106	130	16
1395	122	82	93	113
1396	123	81	66	14
1397	124	89	141	25
1398	125	70	129	22
1399	126	121	129	22
1400	127	100	88	24
1401	128	82	87	22
1402	129	124	101	28
1403	130	106	158	25
1404	131	158	111	20
1405	132	96	98	22
1406	133	94	124	20
1407	134	119	129	24
1408	135	131	184	25
1409	136	138	133	21
1410	137	70	129	18
1411	F - 138	103	78	29
1412	139	106	157	21
1413	140	145	114	24
1414	141	94	183	99
1415	142	67	121	20
1416	143	19	123	18
1417	144	66	141	18
1418	145	62	77	19
1419	146	46	33	27
1420	147	47	33	24
1421	148	41	32	27
1422	149	56	62	24
1423	150	57	71	25
1424	151	55	67	20
1425	152	43	60	11
1426	153	36	45	11
1427	154	45	89	20
1428	155	60	56	12
1429	156	107	101	28
1430	157	71	56	19
1431	158	66	56	18
1432	159	87	79	21
1433	160	95	76	24
1434	161	75	70	17
1435	162	27	37	9
1436	163	55	47	21
1437	164	67	64	23
1438	165	28	50	16
1439	166	51	72	35
1440	167	55	54	19
1441	168	70	52	16
1442	169	58	45	22
1443	170	45	42	15
1444	171	51	42	15
1445	172	47	38	15
1446	173	43	38	18
1447	174	83	52	22
1448	175	70	55	24
1449	176	64	41	15
1450	177	82	60	22
1451	178	66	60	22
1452	179	86	59	23
1453	180	85	61	23
1454	181	74	61	23
1455	182	65	54	20
1456	183	48	36	13
1457	184	58	51	24
1458	185	95	58	22
1459	186	32	52	11
1460	187	53	47	10
1461	188	38	59	15
1462	189	44	70	18
1463	190	37	76	17
1464	191	37	46	16
1465	192	41	48	12

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
1466	F - 193	66	67	24
1467	194	101	74	26
1468	195	37	85	20
1469	196	77	76	18
1470	197	72	57	26
1471	198	112	80	24
1472	199	86	63	23
1473	200	37	71	18
1474	201	88	70	28
1475	202	50	55	17
1476	203	56	54	23
1477	204	51	57	16
1478	205	61	63	24
1479	206	59	62	24
1480	207	92	61	19
1481	208	150	79	24
1482	209	88	79	23
1483	210	74	83	21
1484	211	87	79	18
1485	212	65	74	20
1486	213	84	82	25
1487	214	80	80	25
1488	215	93	81	30
1489	216	102	92	20
1490	217	105	76	21
1491	218	73	68	27
1492	219	93	94	37
1493	220	89	57	23
1494	221	65	49	15
1495	222	30	31	11
1496	223	33	35	13
1497	224	54	45	14
1498	225	43	44	14
1499	226	42	44	17
1500	227	36	47	17
1501	228	51	37	15
1502	229	39	50	16
1503	230	56	52	16
1504	231	56	47	16
1505	241	56	37	47
1506	242	48	40	20
1507	243	84	53	25
1508	244	60	46	14
1509	245	63	44	18
1510	246	76	53	24
1511	248	43	46	19
1512	249	74	44	16
1513	250	82	56	18
1514	251	72	39	21
1515	252	55	52	19
1516	253	51	40	13
1517	254	89	61	21
1518	255	24	60	17
1519	256	76	94	14
1520	257	14	37	18
1521	F - 258	48	42	16
1522	259	47	48	15
1523	260	61	48	16
1524	261	62	49	16
1525	262	44	39	16
1526	263	53	54	16
1527	264	45	39	17
1528	265	51	41	17
1529	266	67	50	20
1530	272	23	47	9
1531	273	22	43	12
1532	274	28	36	9
1533	275	26	45	10
1534	276	35	60	11
1535	277	35	43	10
1536	278	28	42	17
1537	279	57	76	12
1538	280	30	31	8
1539	281	40	42	8
1540	282	36	44	6
1541	283	42	48	16
1542	284	46	58	11
1543	285	31	39	10
1544	286	67	56	15
1545	287	42	54	11
1546	288	44	45	9
1547	289	47	58	11
1548	290	54	47	14
1549	291	95	19	11
1550	292	107	32	7
1551	293	136	54	8
1552	294	149	69	15
1553	295	147	28	7
1554	296	145	31	8
1555	297	133	33	7
1556	298	143	32	8
1557	299	150	32	9
1558	300	143	31	11
1559	301	145	37	8
1560	302	148	35	9
1561	303	144	40	10
1562	304	134	47	9
1563	305	143	39	7
1564	306	114	30	8
1565	307	132	39	13
1566	308	134	36	12
1567	309	135	63	12
1568	310	134	54	11
1569	311	130	50	12
1570	312	130	58	10
1571	313	72	31	9
1572	314	85	66	9
1573	315	115	63	13
1574	316	102	46	11
1575	317	39	88	22
1576	F- 321	33	79	19
1577	322	70	86	21
1578	323	77	84	19
1579	324	62	99	22
1580	325	70	76	18
1581	326	71	75	24
1582	327	69	73	21
1583	328	78	74	23
1584	330	49	150	21
1585	331	57	73	18
1586	332	80	87	21
1587	333	51	70	13
1588	334	107	109	24
1589	335	52	76	20
1590	336	54	73	19
1591	337	62	80	20
1592	338	55	70	18
1593	339	55	91	18
1594	340	49	76	20
1595	341	67	80	22
1596	342	65	91	21
1597	343	57	94	20
1598	344	48	89	19
1599	345	73	63	25
1600	346	94	71	22
1601	347	88	66	20
1602	348	80	77	19
1603	349	88	76	20
1604	350	64	62	26
1605	351	77	78	18
1606	352	30	34	10
1607	353	81	68	20
1608	354	52	86	21
1609	355	3	56	17
1610	356	70	62	21
1611	357	87	81	21
1612	358	72	68	23
1613	359	74	71	24
1614	360	71	77	24
1615	361	48	64	18
1616	362	80	63	15
1617	363	99	73	17
1618	364	111	78	17
1619	365	128	95	19
1620	366	116	79	16
1621	367	122	94	17
1622	368	100	76	16
1623	369	143	96	19
1624	370	134	85	17
1625	371	118	76	16
1626	372	141	113	18
1627	373	125	94	18
1628	374	114	79	17
1629	375	54	72	18
1630	376	125	95	17

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
1631	F - 377	124	72	17
1632	378	109	66	16
1633	379	122	77	17
1634	380	137	78	18
1635	381	101	65	15
1636	382	59	56	11
1637	383	74	69	13
1638	384	56	58	12
1639	385	84	58	12
1640	386	100	76	15
1641	387	95	67	14
1642	388	73	56	13
1643	389	82	62	13
1644	390	14	30	5
1645	391	184	106	16
1646	392	168	94	16
1647	393	172	96	16
1648	394	158	88	17
1649	395	70	67	18
1650	396	96	79	20
1651	397	77	68	18
1652	398	97	84	21
1653	399	92	77	20
1654	400	90	74	19
1655	401	16	53	24
1656	402	99	93	19
1657	403	39	66	18
1658	404	61	94	23
1659	405	45	67	19
1660	406	65	75	20
1661	G - 2	26	143	17
1662	3	143	139	22
1663	4	161	108	30
1664	5	115	95	26
1665	6	83	170	12
1666	7	31	136	17
1667	8	37	126	17
1668	9	54	118	17
1669	10	57	131	23
1670	11	350	87	24
1671	12	90	152	33
1672	13	125	125	31
1673	14	143	195	35
1674	15	71	101	26
1675	16	53	136	26
1676	17	68	116	26
1677	18	35	88	21
1678	19	33	85	27
1679	20	38	140	20
1680	21	38	152	21
1681	22	19	155	19
1682	23	30	157	27
1683	24	200	179	44
1684	25	33	200	27
1685	26	157	145	39
1686	G - 27	220	170	53
1687	28	182	161	51
1688	29	212	184	66
1689	30	199	201	76
1690	31	153	199	59
1691	32	252	312	80
1692	33	187	198	65
1963	34	186	185	62
1964	35	191	205	62
1965	36	180	182	53
1966	37	127	166	44
1967	38	96	141	35
1968	39	56	141	30
1969	40	82	318	40
1700	41	90	116	27
1701	43	103	142	42
1702	44	69	170	35
1703	45	96	123	33
1704	46	115	151	35
1705	47	118	125	37
1706	48	156	146	40
1707	49	209	144	44
1708	50	238	171	45
1709	51	162	109	35
1710	52	117	91	27
1711	71	94	73	19
1712	72	63	99	27
1713	73	80	114	28
1714	74	61	133	31
1715	75	92	115	27
1716	76	47	155	25
1717	77	69	93	27
1718	78	76	81	27
1719	79	47	44	23
1720	80	88	90	27
1721	81	72	129	35
1722	82	80	90	27
1723	83	61	99	27
1724	84	74	98	27
1725	85	79	95	28
1726	86	85	97	27
1727	87	92	76	27
1728	88	71	77	33
1729	89	63	77	30
1730	90	60	81	29
1731	91	49	78	27
1732	92	61	97	31
1733	93	59	99	32
1734	94	60	58	31
1735	95	66	102	34
1736	96	66	57	31
1737	97	65	97	30
1738	98	59	107	30
1739	99	58	73	30
1740	100	50	74	26
1741	G - 101	42	116	23
1742	102	50	84	39
1743	103	62	128	30
1744	104	71	82	32
1745	105	61	110	31
1746	106	65	102	29
1747	107	61	82	29
1748	108	64	75	28
1749	109	60	111	28
1750	110	45	95	21
1751	111	80	96	37
1752	112	55	104	26
1753	113	43	97	24
1754	114	50	69	25
1755	115	85	77	27
1756	116	59	97	32
1757	117	68	95	32
1758	118	52	73	33
1759	119	59	79	26
1760	120	68	79	29
1761	121	72	91	26
1762	122	67	101	25
1763	123	73	92	25
1764	124	77	94	25
1765	125	91	77	24
1766	126	53	79	22
1767	127	65	138	30
1768	128	69	95	24
1769	129	54	109	25
1770	130	61	95	24
1771	131	61	122	20
1772	132	65	95	18
1773	133	68	102	20
1774	134	58	89	17
1775	135	65	147	21
1776	136	59	84	19
1777	137	63	82	18
1778	138	57	81	18
1779	139	53	122	18
1780	140	53	98	16
1781	141	57	88	17
1782	142	65	144	18
1783	143	63	81	18
1784	144	38	69	17
1785	145	76	91	20
1786	146	101	99	20
1787	147	57	128	18
1788	148	61	92	18
1789	149	106	78	25
1790	150	49	48	19
1791	151	57	69	23
1792	152	36	50	18
1793	153	26	27	15
1794	154	45	58	19
1795	155	45	59	19

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
1796	G - 156	50	57	18
1797	157	49	53	18
1798	158	35	49	19
1799	159	38	58	24
1800	160	47	59	20
1801	161	72	75	26
1802	162	48	53	19
1803	163	40	53	19
1804	164	71	58	19
1805	165	42	49	19
1806	166	60	60	23
1807	167	46	50	23
1808	168	38	56	18
1809	169	43	57	22
1810	170	41	61	19
1811	171	22	48	19
1812	172	19	41	16
1813	173	25	47	15
1814	174	40	65	20
1815	175	39	51	17
1816	176	38	84	23
1817	177	34	47	17
1818	178	51	91	35
1819	179	50	162	33
1820	180	53	140	31
1821	181	101	68	28
1822	182	67	119	33
1823	183	67	64	25
1824	184	46	131	29
1825	185	64	130	32
1826	186	61	111	30
1827	187	53	30	16
1828	188	66	96	17
1829	189	39	120	16
1830	190	78	104	17
1831	191	50	134	16
1832	192	65	100	17
1833	193	58	98	18
1834	194	57	94	19
1835	195	68	185	18
1836	196	58	83	20
1837	197	57	93	21
1838	198	70	133	17
1839	199	50	120	21
1840	200	50	100	20
1841	201	47	76	13
1842	202	47	111	18
1843	203	58	152	21
1844	204	35	110	15
1845	205	44	98	19
1846	206	19	137	13
1847	207	47	154	21
1848	208	45	93	16
1849	209	19	152	13
1850	210	47	153	16

Cons. No.	Sample No.	Cu	Zn	Ni
1851	G - 211	58	129	20
1852	212	21	113	12
1853	213	17	126	12
1854	214	54	104	19
1855	215	49	89	18
1856	216	32	109	14
1857	217	31	136	16
1858	2p8	48	121	18
1859	219	50	138	18
1860	220	62	105	17
1861	221	97	120	20
1862	222	61	244	28
1863	223	52	121	18
1864	224	66	114	18
1865	225	72	116	18
1866	226	67	148	221
1867	227	73	306	41
1868	228	57	106	16
1869	229	58	95	17
1870	230	44	123	16
1871	231	63	102	18
1872	232	17	83	12
1873	233	35	50	14
1874	234	12	69	10
1875	235	32	106	14
1876	236	30	59	10
1877	237	47	72	12
1878	238	31	68	12
1879	239	35	63	12
1880	240	32	67	12
1881	241	46	69	11
1882	242	46	62	13
1883	243	39	60	11
1884	244	46	57	12
1885	245	27	51	10
1886	246	31	66	12
1887	247	27	57	13
1888	248	31	96	14
1889	249	24	57	13
1890	250	24	55	14
1891	251	35	62	12
1892	g - 5	104	86	22
1893	6	82	100	13
1894	8	39	172	13
1895	20	39	109	12
1896	23	39	169	13
1897	26	169	131	33
1898	29	104	118	30
1899	31	81	322	52
1900	32	134	117	24
1901	33	164	111	29
1902	34	158	186	28
1903	39	39	138	19
1904	40	89	99	25
1905	41	27	111	16

Cons. No.	Sample No.	Cu	Zn	Ni
1906	g - 45	133	181	15
1907	47	49	156	19
1908	48	58	99	23
1909	49	182	131	41
1910	50	62	300	22
1911	51	196	105	32
1912	H - 1	35	88	15
1913	2	35	67	12
1914	3	28	88	10
1915	4	43	65	13
1916	5	35	95	14
1917	6	29	140	15
1918	7	32	114	11
1919	8	31	123	14
1920	9	43	75	9
1921	10	47	56	10
1922	11	22	222	20
1923	12	38	104	15
1924	13	55	87	11
1925	14	22	163	17
1926	15	28	75	8
1927	16	30	113	15
1928	17	20	213	19
1929	18	18	88	8
1930	19	42	77	12
1931	20	34	120	16
1932	21	34	166	16
1933	22	31	125	17
1934	23	29	73	70
1935	24	36	92	17
1936	25	27	80	8
1937	26	49	54	31
1938	27	56	69	21
1939	28	26	43	20
1940	29	44	61	26
1941	30	28	41	13
1942	31	68	52	10
1943	32	38	27	12
1944	33	46	75	9
1945	34	55	85	8
1946	35	28	38	12
1947	36	53	76	8
1948	37	53	79	9
1949	38	74	74	8
1950	39	51	67	10
1951	40	74	79	9
1952	41	51	80	15
1953	42	27	69	9
1954	43	20	86	8
1955	45	82	87	11
1956	47	20	33	9
1957	48	34	83	5
1958	49	23	123	8
1959	50	26	141	19
1960	51	27	31	7

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
1961	H - 52	26	30	7
1962	53	28	20	7
1963	54	26	30	7
1964	55	26	30	7
1965	56	25	41	7
1966	57	23	41	7
1967	58	25	33	7
1968	59	30	35	11
1969	60	30	48	6
1970	62	25	88	7
1971	63	35	102	10
1972	66	20	71	14
1973	67	20	73	15
1974	68	23	80	7
1975	69	32	84	7
1976	70	27	91	9
1977	71	19	194	14
1978	72	21	159	13
1979	73	23	50	8
1980	74	25	206	9
1981	75	27	90	1
1982	76	48	63	10
1983	77	48	119	11
1984	77	20	65	7
1985	78	57	75	8
1986	79	46	219	17
1987	80	42	86	12
1988	81	55	95	13
1989	82	45	87	15
1990	83	52	87	13
1991	84	60	52	8
1992	85	47	126	16
1993	86	42	233	20
1994	87	52	110	17
1995	88	49	195	20
1996	89	57	52	6
1997	90	37	124	13
1998	91	45	170	18
1999	92	35	176	11
2000	93	52	78	10
2001	94	46	55	10
2002	95	55	62	8
2003	96	56	103	11
2004	97	28	41	10
2005	98	27	48	19
2006	99	55	135	16
2007	100	47	139	22
2008	101	55	132	14
2009	102	54	250	22
2010	103	62	70	10
2011	104	48	181	16
2012	105	36	162	19
2013	106	49	131	14
2014	107	55	212	17
2015	108	48	118	14

Cons. No.	Sample No.	Cu	Zn	Ni
2016	H - 109	62	122	10
2017	110	50	550	30
2018	111	46	206	19
2019	112	48	99	12
2020	113	49	233	19
2021	114	49	223	20
2022	115	54	73	12
2023	116	48	89	11
2024	117	27	252	29
2025	118	51	257	8
2026	119	59	126	17
2027	120	29	54	11
2028	121	51	102	11
2029	122	52	121	12
2030	123	51	113	11
2031	124	65	65	9
2032	125	57	98	12
2033	126	67	156	21
2034	127	64	187	18
2035	128	57	97	14
2036	129	51	102	16
2037	130	55	121	14
2038	131	46	392	32
2039	132	52	125	12
2040	133	63	101	12
2041	134	64	66	10
2042	135	66	120	10
2043	136	65	131	13
2044	137	54	62	12
2045	138	62	75	11
2046	139	67	219	18
2047	140	51	66	12
2048	141	75	119	12
2049	142	66	78	12
2050	143	55	74	12
2051	144	108	196	12
2052	145	189	698	36
2053	146	94	164	12
2054	147	99	172	13
2055	148	100	184	13
2056	149	76	79	6
2057	150	78	91	8
2058	151	77	81	7
2059	152	72	80	6
2060	154	87	192	9
2061	155	88	132	8
2062	155	88	132	8
2063	156	68	64	5
2064	157	73	75	6
2065	159	108	469	17
2066	160	76	142	8
2067	161	91	195	10
2068	162	78	126	7
2069	163	83	191	9
2070	164	83	121	8

Cons. No.	Sample No.	Cu	Zn	Ni
2071	H - 165	91	260	12
2072	166	76	95	7
2073	167	107	588	15
2074	168	119	593	19
2075	169	60	94	7
20				
2076	170	82	187	10
2077	171	69	125	8
2078	172	60	101	8
2079	173	79	203	8
2080	174	70	101	7
2081	175	88	168	9
2082	176	91	77	7
2083	177	88	138	10
2084	178	102	223	13
2085	179	119	320	20
2086	180	96	241	13
2087	181	80	72	8
2088	182	108	348	17
2089	183	88	221	12
2090	184	134	166	12
2091	185	108	194	11
2092	186	56	120	15
2093	187	68	136	13
2094	188	60	82	11
2095	189	63	83	12
2096	190	61	88	9
2097	191	56	60	8
2098	193	112	103	5
2099	194	127	96	7
2100	195	168	198	7
2101	196	141	114	10
2102	197	137	113	13
2103	198	164	185	14
2104	199	137	104	12
2105	200	121	66	8
2106	201	121	95	9
2107	202	110	64	7
2108	203	114	90	13
2109	204	113	71	14
2110	205	125	87	9
2111	206	132	71	12
2112	207	121	78	12
2113	208	116	77	13
2114	209	115	65	11
2115	210	124	74	12
2116	211	112	66	72
2117	212	72	103	10
2118	213	96	179	13
2119	214	96	164	13
2120	215	103	195	13
2121	216	137	458	19
2122	217	73	75	7
2123	218	70	58	7
2124	219	72	66	8
2125	220	71	112	8

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
2126	H - 221	102	208	12
2127	222	85	117	9
2128	223	71	46	7
2129	224	76	42	8
2130	225	124	60	16
2131	226	75	135	7
2132	227	77	66	9
2133	228	76	34	10
2134	229	80	36	9
2135	230	69	34	8
2136	231	130	111	20
2137	232	144	115	18
2138	233	162	421	26
2139	234	60	86	8
2140	235	94	84	7
2141	236	62	75	13
2142	237	60	99	10
2143	238	50	99	9
2144	239	58	88	7
2145	240	71	76	9
2146	241	62	107	13
2147	242	83	133	13
2148	243	85	136	14
2149	244	87	246	26
2150	245	83	133	14
2151	246	87	111	12
2152	247	93	94	7
2153	248	88	142	14
2154	249	82	123	13
2155	250	94	106	11
2156	251	74	76	7
2157	252	59	72	10
2158	253	56	85	10
2159	254	56	64	8
2160	255	35	57	11
2161	256	19	35	8
2162	257	54	89	6
2163	258	37	75	12
2164	259	68	62	7
2165	260	91	113	13
2166	h - 1	33	24	7
2167	2	27	33	8
2168	3	33	53	11
2169	4	33	50	7
2170	5	32	43	9
2171	6	23	37	12
2172	7	20	120	22
2173	8	19	74	16
2174	9	22	84	14
2175	10	44	61	14
2176	11	55	33	9
2177	12	57	17	7
2178	13	22	97	17
2179	14	18	58	16
2180	15	25	69	12

Cons. No.	Sample No.	Cu	Zn	Ni
2181	h - 16	19	59	11
2182	17	25	35	14
2183	18	23	64	13
2184	19	19	52	16
2185	20	20	90	17
2186	21	23	82	14
2187	22	22	65	14
2188	23	19	105	17
2189	24	23	87	16
2190	25	25	72	12
2191	26	29	74	12
2192	27	16	184.	15
2193	28	25	81	11
2194	29	23	61	15
2195	30	33	100	25
2196	31	66	68	38
2197	32	61	88	37
2198	33	44	86	35
2199	34	58	44	36
2200	35	55	87	31
2201	36	50	70	33
2202	37	57	53	37
2203	61	90	91	9
2204	62	130	141	14
2205	63	113	280	12
2206	64	113	306	12
2207	65	45	253	15
2208	66	128	309	15
2209	67	47	195	12
2210	68	102	209	12
2211	69	109	207	12
2212	70	89	200	12
2213	71	89	156	9
2214	72	87	39	7
2215	73	87	59	9
2216	74	105	66	8
2217	75	100	62	20
2218	76	88	55	9
2219	77	106	63	8
2220	78	125	98	11
2221	79	110	111	8
2222	80	77	69	9
2223	81	101	157	113
2224	82	102	83	9
2225	83	56	63	7
2226	84	93	122	10
2227	85	88	68	18
2228	86	75	98	7
2229	87	88	130	9
2230	88	73	106	7
2231	89	95	69	8
2232	90	92	141	10
2233	91	97	89	8
2234	92	73	88	8
2235	93	98	105	9

Cons. No.	Sample No.	Cu	Zn	Ni
2236	h - 94	128	122	8
2237	95	105	112	9
2238	96	118	140	12
2239	97	88	141	9
2240	98	98	170	10
2241	99	96	77	8
2242	100	124	132	12
2243	101	91	194	10
2244	102	112	142	9
2245	103	89	161	14
2246	104	53	20	8
2247	105	83	63	13
2248	106	75	64	10
2249	107	75	99	14
2250	108	69	73	10
2251	109	66	100	13
2252	110	59	38	15
2253	111	61	63	11
2254	112	61	36	11
2255	113	51	37	8
2256	114	57	110	15
2257	115	43	53	11
2258	116	64	56	9
2259	117	54	73	10
2260	118	65	45	8
2261	119	46	24	10
2262	120	58	72	12
2263	121	42	50	10
2264	122	48	55	8
2265	123	69	59	10
2266	124	76	98	9
2267	125	339	120	8
2268	126	61	116	8
2269	127	48	75	12
2270	128	74	83	7
2271	I - 1	100	115	18
2272	2	152	98	17
2273	3	60	99	17
2274	4	104	96	15
2275	5	54	112	17
2276	6	73	70	16
2277	7	81	66	18
2278	8	75	69	16
2279	9	61	102	17
2280	10	58	76	30
2281	11	59	118	16
2282	12	73	102	17
2283	13	43	124	14
2284	14	87	88	16
2285	15	108	102	24
2286	16	85	97	17
2287	17	89	90	21
2288	18	85	90	17
2289	19	71	92	22
2290	20	35	102	13

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
2291	I - 21	60	85	16
2292	22	83	90	21
2293	23	87	84	19
2294	24	67	80	21
2295	25	72	85	18
2296	26	101	94	21
2297	27	107	97	21
2298	28	91	81	19
2299	29	74	75	17
2300	330	106	64	18
2301	31	79	70	15
2302	32	277	87	18
2303	33	97	64	17
2304	34	52	79	15
2305	35	56	60	12
2306	36	78	153	19
2307	37	103	69	16
2308	38	107	88	14
2309	39	89	62	17
2310	40	60	48	14
2311	41	66	55	14
2312	42	47	52	13
2313	43	60	69	16
2314	44	62	66	19
2315	45	91	91	15
2316	46	109	87	18
2317	47	76	93	21
2318	48	100	62	16
2319	49	70	85	15
2320	50	96	78	16
2321	51	95	85	17
2322	52	114	91	16
2323	53	83	69	14
2324	54	82	56	16
2325	55	166	77	19
2326	56	96	76	17
2327	57	207	90	17
2328	58	98	72	15
2329	59	91	108	16
2330	60	95	82	12
2331	61	95	69	16
2332	62	68	97	15
2333	63	81	87	18
2334	64	74	104	17
2335	65	76	71	17
2336	66	55	108	16
2337	67	90	55	16
2338	68	75	52	16
2339	69	73	68	17
2340	70	101	58	16
2341	71	90	72	20
2342	72	97	65	22
2343	73	58	71	18
2344	74	79	63	14
2345	75	71	74	16

Cons. No.	Sample No.	Cu	Zn	Ni
2346	I - 76	59	100	17
2347	77	81	62	23
2348	78	66	76	16
2349	79	66	74	16
2350	80	60	93	14
2351	81	72	86	16
2352	82	79	82	14
2353	83	86	69	23
2354	84	82	99	17
2355	85	71	65	17
2356	86	82	82	17
2357	87	45	73	17
2358	88	89	72	19
2359	89	82	73	19
2360	90	93	67	20
2361	91	78	84	16
2362	92	99	110	17
2363	93	75	103	19
2364	94	109	74	19
2365	95	92	82	18
2366	96	94	81	17
2367	97	149	91	19
2368	98	87	77	20
2369	99	89	93	17
2370	100	73	64	14
2371	101	91	73	18
2372	102	86	84	19
2373	103	171	72	18
2374	104	71	93	22
2375	105	97	99	19
2376	106	85	66	16
2377	107	79	64	17
2378	108	73	71	15
2379	109	75	77	16
2380	110	101	116	16
2381	111	72	94	17
2382	112	97	93	22
2383	113	89	77	18
2384	114	70	76	14
2385	115	75	71	14
2386	116	84	66	15
2387	117	69	86	15
2388	118	89	86	18
2389	119	87	56	15
2390	120	69	72	15
2391	121	71	65	15
2392	126	43	77	15
2393	127	53	78	15
2394	128	52	47	13
2395	129	54	76	16
2396	130	55	58	13
2397	131	66	94	16
2398	132	58	89	17
2399	133	51	56	14
2400	134	60	81	17

Cons. No.	Sample No.	Cu	Zn	Ni
2401	I - 135	77	86	18
2402	136	74	74	21
2403	137	54	61	16
2404	138	51	53	14
2405	139	56	95	17
2				
2406	140	60	69	16
2407	141	67	109	24
2408	142	58	59	14
2409	143	61	78	15
2410	144	138	91	15
2411	145	182	85	19
2412	146	104	71	16
2413	147	189	85	17
2414	148	104	73	19
2415	149	73	67	18
2416	150	83	73	20
2417	151	101	89	21
2418	152	75	74	17
2419	153	56	103	18
2420	154	66	71	18
2421	155	75	67	16
2422	156	75	72	18
2423	157	83	50	26
2424	158	87	91	16
2425	159	84	79	18
2426	170	73	70	18
2427	161	108	73	19
2428	162	49	83	14
2429	173	39	90	13
2430	164	36	79	12
2431	175	40	78	14
2432	166	47	63	13
2433	167	47	88	15
2434	168	47	72	12
2435	169	38	48	12
2436	170	38	72	12
2437	171	40	65	10
2438	172	48	61	14
2439	173	51	103	16
2440	174	52	79	12
2441	175	34	85	12
2442	176	54	77	14
2443	177	52	91	14
2444	178	51	60	13
2445	179	47	134	14
2446	180	57	82	15
2447	181	51	77	15
2448	182	51	58	14
2449	183	48	127	13
2450	184	59	92	14
2451	185	55	97	17
2452	186	55	96	14
2453	187	43	86	12
2454	188	37	91	13
2455	189	38	68	12

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
2456	I - 190	37	55	11
2457	191	37	59	12
2458	192	44	66	13
2459	193	38	68	17
2460	194	48	57	12
2461	195	48	117	12
2462	196	49	82	14
2463	197	60	65	16
2464	198	33	66	10
2465	199	66	72	20
2466	200	35	78	15
2467	201	57	88	15
2468	202	84	70	17
2469	203	73	66	17
2470	204	74	65	20
2471	205	75	66	19
2472	206	87	73	20
2473	207	77	69	21
2474	208	73	63	21
2475	209	81	85	18

Cons. No.	Sample No.	Cu	Zn	Ni
2476	210	87	65	22
2477	211	95	100	17
2478	212	89	95	14
2479	213	85	82	14
2480	214	84	73	16
2481	215	68	89	16
2482	216	77	83	15
2483	217	83	78	15
2484	218	72	117	13
2485	219	81	85	15
2486	220	73	136	14
2487	221	61	73	15
2488	222	75	75	16
2489	223	65	100	13
2490	224	70		14
2491	225	75	81	15
2492	226	60	99	15
2493	BED - 1	73	73	50
2494	2	45	19	50
2495	4	103	49	33

Cons. No.	Sample No.	Cu	Zn	Ni
2496	BED - 5	59	28	57
2497	6	34	48	105
2498	7	90	47	19
2499	8	47	43	78
2500	10	111	57	22
2501	O - 1	53	89	50
2502	2	48	142	36
2503	3	55	47	42
2504	4	47	30	36
2505	5	52	37	38
2506	6	49	123	49
2507	7	37	53	31
2508	8	44	85	35
2509	9	46	63	40
2510	10	51	121	37

(B) Stream sediment (−100 ~ + 200 − mesh fraction)

Cons. No.	Sample No.	Cu	Zn	Ni
2511	A - 1	44	76	33
2512	2	53	44	36
2513	3	36	43	21
2514	4	41	20	18
2515	5	54	39	36
2516	6	47	63	37
2517	7	55	56	24
2518	8	39	37	105
2519	9	51	51	35
2520	10	70	62	15
2521	11	46	41	79
2522	12	69	38	40
2523	13	65	61	42
2524	14	48	66	30
2525	15	61	57	38
2526	16	64	45	30
2527	17	64	51	65
2528	18	75	54	35
2529	19	37	48	53
2530	20	60	43	26
2531	21	66	76	25
2532	22	80	71	25
2533	23	77	78	29
2534	24	74	82	30
2535	25	63	58	28
2536	26	60	47	19
2537	27	57	44	33
2538	28	61	75	26
2539	29	51	95	28
2540	30	14	42	19

Cons. No.	Sample No.	Cu	Zn	Ni
2541	A - 31	58	59	32
2542	32	59	72	30
2543	33	73	44	25
2544	34	94	54	24
2545	35	63	38	31
2546	36	69	43	30
2547	37	66	55	29
2548	38	66	30	43
2549	39	49	68	26
2550	40	61	49	20
2551	41	41	124	25
2552	42	53	67	30
2553	43	80	44	30
2554	44	46	44	18
2555	45	57	85	20
2556	46	46	82	20
2557	47	60	22	16
2558	48	60	52	16
2559	50	47	63	37
2560	51	41	90	33
2561	52	48	60	30
2562	53	53	55	36
2563	54	45	95	39
2564	55	49	63	39
2565	56	56	83	24
2566	57	49	75	40
2567	58	48	51	37
2568	59	56	75	24
2569	60	51	63	39
2570	61	61	105	22

Cons. No.	Sample No.	Cu	Zn	Ni
2571	A - 62	52	61	36
2572	63	45	92	24
2573	64	44	70	37
2574	65	52	57	15
2575	66	42	92	37
2576	67	56	66	22
2577	68	49	55	41
2578	69	54	75	37
2579	70	52	68	22
2580	71	59	63	21
2581	72	44	223	37
2582	73	47	109	23
2583	74	44	139	28
2584	75	53	121	20
2585	76	50	71	28
2586	77	50	74	40
2587	78	48	119	19
2588	79	52	98	40
2589	80	50	84	23
2590	81	53	79	18
2591	82	52	99	38
2592	83	52	68	35
2593	84	50	67	23
2594	85	54	68	39
2595	86	45	58	22
2596	87	447	77	20
2597	88	49	71	36
2598	89	58	83	22
2599	90	44	74	107
2600	91	50	61	25

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
2601	A - 92	48	68	22
2602	93	46	98	23
2603	94	44	102	24
2604	95	67	68	19
2605	96	63	32	27
2606	97	47	33	18
2607	98	60	25	33
2608	99	65	32	24
2609	100	65	43	28
2610	101	41	67	18
2611	102	52	48	16
2612	103	54	39	25
2613	104	50	45	43
2614	105	52	48	7
2615	106	83	48	13
2616	107	78	46	14
2617	108	58	51	11
2618	109	74	25	18
2619	110	57	48	11
2620	113	64	59	26
2621	114	72	30	15
2622	115	49	32	215
2623	116	10	13	440
2624	117	60	29	146
2625	118	20	15	481
2626	119	19	11	463
2627	120	17	16	321
2628	121	42	61	223
2629	122	8	34	1,327
2630	123	33	40	301
2631	124	8	21	1,089
2632	125	28	31	365
2633	126	29	30	357
2634	127	33	48	382
2635	128	31	40	393
2636	129	8	22	960
2637	130	11	25	1,275
2638	131	32	40	446
2639	132	40	46	833
2640	133	28	42	483
2641	134	35	43	255
2642	135	26	60	65
2643	135a	26	58	72
2644	136	24	94	92
2645	137	27	52	394
2646	138	20	54	409
2647	139	28	93	186
2648	140	38	38	423
2649	141	32	61	223
2650	142	28	90	192
2651	143	14	43	479
2652	144	28	55	340
2653	145	33	38	194
2654	146	35	16	259
2655	147	35	19	277

Cons. No.	Sample No.	Cu	Zn	Ni
2656	A - 148	31	24	248
2657	149	25	12	361
2658	150	23	11	380
2659	151	35	20	199
2660	152	35	39	268
2661	153	26	21	122
2662	154	37	27	244
2663	155	36	35	232
2664	156	34	30	257
2665	157	31	24	36
2666	158	27	28	65
2667	159	22	69	40
2668	161	31	51	231
2669	162	32	95	165
2670	163	26	35	92
2671	164	30	34	72
2672	165	26	31	30
2673	166	30	34	212
2674	167	29	66	37
2675	168	36	40	49
2676	169	43	31	71
2677	170	43	48	48
2678	171	32	58	48
2679	172	29	30	40
2680	173	11	53	18
2681	174	28	30	40
2682	175	31	43	40
2683	176	36	41	23
2684	177	68	47	50
2685	178	40	33	48
2686	179	75	50	33
2687	180	57	55	145
2688	182	36	45	765
2689	183	52	49	323
2690	184	38	54	398
2691	185	46	36	405
2692	186	34	54	1,170
2693	187	28	46	878
2694	188	15	30	940
2695	189	19	34	775
2696	190	27	41	439
2697	191	30	70	225
2698	a - 1	32	66	25
2699	2	36	91	29
2700	3	35	144	28
2701	4	69	21	14
2702	5	77	33	18
2703	6	33	26	25
2704	7	70	16	14
2705	8	58	24	14
2706	9	53	18	23
2707	10	56	38	22
2708	11	52	19	19
2709	12	54	22	20
2710	13	50	14	18

Cons. No.	Sample No.	Cu	Zn	Ni
2711	a - 14	46	14	16
2712	15	67	13	21
2713	16	45	13	15
2714	17	31	15	18
2715	18	38	21	18
2716	19	19	52	17
2717	20	19	128	25
2718	21	27	164	29
2719	22	26	61	58
2720	23	29	168	27
2721	24	30	78	27
2722	25	42	40	23
2723	26	33	49	25
2724	27	47	48	15
2725	28	32	48	27
2726	29	31	52	28
2727	30	40	48	25
2728	31	45	37	23
2729	32	47	41	26
2730	33	57	34	435
2731	34	49	25	283
2732	35	34	40	415
2733	36	37	68	270
2734	AJ - 1	35	47	53
2735	2	35	48	45
2736	3	39	48	49
2737	4	43	48	48
2738	5	43	47	55
2739	6	42	44	54
2740	7	40	45	50
2741	8	39	46	51
2742	9	41	48	54
2743	10	40	103	36
2744	11	39	45	52
2745	12	41	30	59
2746	13	27	14	14
2747	14	34	33	383
2748	15	38	27	377
2749	16	40	53	208
2750	17	44	38	420
2751	18	38	44	322
2752	B - 1	77	111	72
2753	2	72	70	17
2754	3	77	73	92
2755	4	61	66	89
2756	5	44	59	74
2757	6	60	72	92
2758	7	77	79	98
2759	8	70	72	44
2760	9	59	65	92
2761	10	43	76	74
2762	14	49	80	74
2763	15	58	66	92
2764	17	49	63	74
2765	18	61	71	92

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
2766	B - 19	52	71	84
2767	22	43	73	74
2768	25	61	75	91
2769	28	61	70	91
2770	30	39	84	63
2771	32	72	75	87
2772	34	57	70	87
2773	35	56	65	85
2774	36	57	69	92
2775	37	75	87	165
2776	39	60	73	82
2777	41	43	70	69
2778	42	60	68	139
2779	43	39	73	61
2780	45	50	77	65
2781	46	36	86	55
2782	47	46	69	75
2783	48	61	73	83
2784	49	46	74	70
2785	50	44	85	63
2786	52	51	72	74
2787	53	61	74	84
2788	54	42	76	114
2789	55	50	72	72
2790	56	54	73	68
2791	58	54	63	74
2792	59	57	70	74
2793	60	54	84	123
2794	62	57	67	77
2795	64	56	64	74
2796	65	50	66	69
2797	67	57	65	74
2798	68	54	67	112
2799	69	54	88	116
2800	70	49	12	135
2801	71	49	68	164
2802	73	62	81	116
2803	74	73	79	145
2804	75	77	83	103
2805	76	59	71	114
2806	77	52	75	75
2807	78	73	79	117
2808	79	105	70	61
2809	80	97	73	106
2810	81	86	73	72
2811	82	75	70	72
2812	83	144	99	80
2813	84	73	66	63
2814	85	66	62	63
2815	86	84	67	66
2816	87	63	67	71
2817	88	54	90	79
2818	89	59	65	49
2819	90	55	83	80
2820	91	54	71	81

Cons. No.	Sample No.	Cu	Zn	Ni
2821	B - 92	47	83	72
2822	93	62	88	79
2823	94	45	69	109
2824	95	60	88	90
2825	96	59	79	93
2826	97	55	83	83
2827	99	59	75	97
2828	100	74	93	50
2829	101	51	89	110
2830	103	56	79	109
2831	104	62	74	130
2832	105	54	92	100
2833	106	55	61	118
2834	107	52	59	108
2835	108	58	74	126
2836	109	75	71	145
2837	110	58	63	135
2838	111	56	70	111
2839	112	62	73	126
2840	113	66	70	135
2841	114	79	69	152
2842	115	57	69	115
2843	116	76	78	155
2844	117	68	73	153
2845	118	69	60	146
2846	119	60	67	128
2847	120	59	63	135
2848	121	60	68	126
2849	122	72	66	128
2850	123	62	59	141
2851	124	51	59	124
2852	125	55	74	115
2853	126	66	64	141
2854	127	71	61	168
2855	128	53	71	117
2856	129	66	66	138
2857	130	56	60	123
2858	131	77	65	114
2859	132	55	58	141
2860	133	65	84	137
2861	134	52	68	131
2862	135	62	62	150
2863	136	57	66	123
2864	137	58	84	148
2865	138	47	78	123
2866	139	140	64	150
2867	140	55	68	132
2868	141	61	106	66
2869	142	56	66	148
2870	143	52	84	159
2871	144	73	61	150
2872	145	74	72	53
2873	146	71	75	62
2874	147	77	73	61
2875	148	67	66	123

Cons. No.	Sample No.	Cu	Zn	Ni
2876	B - 149	73	66	53
2877	150	87	76	63
2878	151	61	69	77
2879	152	66	67	57
2880	153	81	72	81
2881	154	70	69	60
2882	155	55	64	53
2883	156	66	71	53
2884	157	55	71	54
2885	158	69	62	52
2886	159	69	69	55
2887	160	64	74	71
2888	161	36	92	53
2889	162	72	74	64
2890	163	62	69	83
2891	164	47	78	45
2892	166	60	66	106
2893	168	35	77	52
2894	169	53	67	55
2895	170	50	70	115
2896	171	73	76	70
2897	172	64	71	63
2898	173	75	79	97
2899	174	75	72	88
2900	175	76	70	65
2901	176	73	77	87
2902	177	42	77	70
2903	178	77	75	83
2904	179	99	84	117
2905	180	82	75	70
2906	181	72	70	70
2907	182	38	81	54
2908	183	60	63	70
2909	184	53	65	79
2910	185	58	76	68
2911	186	49	67	79
2912	187	60	70	109
2913	188	58	62	116
2914	189	56	73	49
2915	190	53	76	44
2916	191	68	75	50
2917	192	64	76	47
2918	193	80	72	52
2919	195	74	66	52
2920	C - 1	57	66	456
2921	2	46	56	456
2922	3	51	45	456
2923	4	36	54	524
2924	5	28	29	292
2925	6	47	61	444
2926	7	34	50	356
2927	8	29	41	340
2928	9	29	41	320
2929	12	45	44	440
2930	13	45	50	448

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
2931	C - 14	36	61	320
2932	15	27	48	304
2933	16	44	42	444
2934	17	53	60	100
2935	18	42	45	464
2936	19	49	46	496
2937	20	62	61	352
2938	21	32	45	396
2939	22	53	48	500
2940	23	63	72	24
2941	24	58	63	64
2942	25	45	47	456
2943	26	79	74	28
2944	27	47	44	496
2945	28	54	61	168
2946	29	41	44	416
2947	30	53	48	472
2948	31	50	63	104
2949	32	43	49	404
2950	33	37	53	376
2951	34	48	54	380
2952	35	42	50	448
2953	36	58	108	476
2954	37	51	56	440
2955	38	68	65	20
2956	39	37	45	404
2957	40	41	40	424
2958	41	62	44	492
2959	42	59	42	460
2960	43	65	62	32
2961	44	56	54	456
2962	45	51	49	400
2963	46	58	65	8
2964	47	46	49	464
2965	48	53	67	456
2966	49	46	46	400
2967	50	62	54	488
2968	51	68	64	228
2969	52	54	46	464
2970	53	47	39	448
2971	54	56	49	420
2972	55	47	41	548
2973	56	48	55	40
2974	57	51	46	552
2975	58	51	45	508
2976	59	50	66	20
2977	60	46	45	488
2978	61	64	63	12
2979	62	63	57	10
2980	63	65	49	132
2981	64	45	63	436
2982	65	54	47	536
2983	66	50	48	524
2984	67	52	56	552
2985	68	60	46	556

Cons. No.	Sample No.	Cu	Zn	Ni
2986	C - 69	45	52	488
2987	70	76	61	142
2988	71	65	65	180
2989	72	60	51	328
2990	73	56	51	262
2991	74	43	57	452
2992	75	62	60	206
2993	76	50	48	548
2994	77	51	49	516
2995	78	51	104	488
2996	79	50	94	532
2997	80	40	92	918
2998	81	59	102	452
2999	82	53	100	416
3000	83	53	96	484
3001	84	51	108	428
3002	85	34	126	396
3003	86	56	108	189
3004	87	51	96	472
3005	88	49	100	456
3006	89	20	102	452
3007	90	61	104	424
3008	91	52	96	428
3009	92	58	116	10
3010	93	56	99	192
3011	94	54	106	524
3012	95	71	126	29
3013	96	46	100	428
3014	97	47	102	524
3015	98	86	136	12
3016	99	51	108	404
3017	100	77	118	10
3018	101	69	140	21
3019	102	46	102	440
3020	103	72	64	95
3021	105	59	67	310
3022	108	39	65	320
3023	109	35	59	851
3024	110	13	46	1,680
3025	111	36	50	890
3026	112	40	52	945
3027	113	47	54	700
3028	114	41	65	945
3029	115	33	59	755
3030	116	37	56	903
3031	117	13	34	1,378
3032	118	20	45	1,180
3033	119	15	44	1,170
3034	120	18	43	1,300
3035	121	18	34	1,240
3036	122	18	31	1,170
3037	123	28	40	1,330
3038	124	15	40	1,110
3039	125	17	40	1,200
3040	126	30	41	1,060

Cons. No.	Sample No.	Cu	Zn	Ni
3041	C - 127	11	36	1,180
3042	128	14	35	1,390
3043	129	17	39	1,030
3044	130	26	46	1,010
3045	131	16	38	1,000
3046	132	29	48	1,000
3047	134	59	66	480
3048	135	44	59	660
3049	136	40	59	570
3050	137	15	360	1,550
3051	138	38	55	640
3052	139	25	51	750
3053	140	37	57	700
3054	141	13	40	1,450
3055	142	30	48	550
3056	143	50	57	590
3057	144	23	46	1,160
3058	145	30	68	340
3059	146	31	44	770
3060	147	50	42	520
3061	148	50	66	340
3062	149	50	47	610
3063	150	54	42	610
3064	151	44	38	520
3065	152	44	61	550
3066	153	44	42	570
3067	154	50	48	570
3068	155	50	59	250
3069	156	44	47	600
3070	157	40	56	504
3071	158	41	51	477
3072	159	43	40	493
3073	160	57	56	440
3074	161	42	41	488
3075	162	45	62	500
3076	163	44	62	495
3077	164	35	67	14
3078	165	39	58	22
3079	166	39	60	13
3080	167	41	79	20
3081	168	36	77	28
3082	169	43	67	24
3083	170	42	69	36
3084	171	57	69	32
3085	172	60	77	27
3086	173	53	94	13
3087	174	49	59	13
3088	175	57	65	25
3089	176	30	47	4
3090	177	60	79	27
3091	178	54	84	27
3092	179	62	85	27
3093	180	54	66	28
3094	181	40	66	16
3095	182	37	43	286

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
3096	C - 183	49	56	363
3097	184	34	82	54
3098	185	39	66	38
3099	186	38	52	35
3100	187	39	63	32
3101	188	33	57	22
3102	189	36	46	31
3103	190	35	55	20
3104	191	40	74	8
3105	192	40	60	32
3106	193	29	26	7
3107	194	38	65	22
3108	195	46	60	22
3109	196	40	59	31
3110	197	42	41	282
3111	198	34	36	225
3112	199	41	67	78
3113	200	35	64	69
3114	201	35	73	67
3115	202	37	73	73
3116	203	34	74	65
3117	204	31	73	22
3118	205	24	75	35
3119	206	27	63	52
3120	207	25	75	49
3121	208	26	71	41
3122	209	28	71	53
3123	210	32	68	60
3124	211	24	68	34
3125	212	28	63	34
3126	213	28	73	116
3127	214	28	57	198
3128	215	36	57	200
3129	216	32	63	210
3130	217	37	57	130
3131	218	63	51	50
3132	219	39	38	8
3133	220	37	43	16
3134	221	103	47	22
3135	222	52	44	14
3136	223	86	47	26
3137	224	101	47	8
3138	225	28	51	23
3139	226	56	44	12
3140	227	114	48	16
3141	228	34	42	8
3142	229	41	79	20
3143	230	124	49	16
3144	231	49	52	16
3145	232	79	34	6
3146	233	54	25	2
3147	234	58	47	9
3148	235	56	40	6
3149	236	120	30	2
3150	237	60	54	6

Cons. No.	Sample No.	Cu	Zn	Ni
3151	C - 238	142	28	6
3152	239	102	32	6
3153	240	125	33	2
3154	241	120	24	2
3155	242	146	30	5
3156	243	137	25	2
3157	244	232	23	3
3158	245	195	23	2
3159	246	104	33	3
3160	247	75	27	3
3161	248	69	26	2
3162	249	102	30	5
3163	250	155	37	6
3164	251	108	30	2
3165	252	108	26	2
3166	253	75	21	2
3167	254	126	31	2
3168	255	69	37	2
3169	256	110	27	3
3170	257	189	20	7
3171	258	70	25	7
3172	259	141	37	13
3173	260	91	49	11
3174	261	80	27	10
3175	262	130	50	7
3176	263	187	33	11
3177	264	102	34	6
3178	265	91	28	8
3179	266	144	26	7
3180	267	46	51	22
3181	268	134	28	44
3182	269	42	53	24
3183	270	70	66	51
3184	271	40	49	23
3185	272	54	65	122
3186	273	33	67	39
3187	274	42	60	54
3188	275	28	64	34
3189	276	30	67	35
3190	277	44	69	38
3191	278	39	73	32
3192	279	30	65	30
3193	280	33	55	75
3194	281	25	64	27
3195	282	44	80	98
3196	283	26	66	15
3197	284	16	65	9
3198	285	40	103	13
3199	286	34	77	20
3200	287	23	78	9
3201	288	24	68	34
3202	289	36	72	21
3203	290	22	49	19
3204	291	92	69	72
3205	292	41	70	26

Cons. No.	Sample No.	Cu	Zn	Ni
3206	C - 293	28	78	13
3207	294	42	46	592
3208	295	37	40	526
3209	296	33	37	568
3210	297	37	41	444
3211	298	28	49	358
3212	299	40	47	490
3213	300	40	44	628
3214	301	30	37	345
3215	302	18	28	1,372
3216	303	40	43	377
3217	304	38	39	377
3218	305	37	43	377
3219	306	40	46	375
3220	307	13	30	1,518
3221	308	31	34	330
3222	309	20	30	1,035
3223	310	38	42	395
3224	311	30	33	1,238
3225	312	37	40	355
3226	313	29	42	335
3227	314	43	46	390
3228	315	16	45	1,365
3229	316	36	40	350
3230	317	29	31	470
3231	318	41	51	312
3232	319	18	18	630
3233	320	26	44	242
3234	321	25	53	715
3235	322	31	55	890
3236	323	35	57	1,268
3237	324	33	58	1,320
3238	325	3	27	740
3239	1	9	19	1,675
3240	2	11	23	1,800
3241	3	10	21	1,830
3242	4	11	21	1,312
3243	5	10	20	1,725
3244	6	10	19	1,722
3245	7	35	76	34
3246	8	37	14	37
3247	9	42	85	22
3248	10	33	71	30
3249	11	33	71	27
3250	12	33	45	74
3251	13	38	70	26
3252	14	42	70	46
3253	15	36	62	26
3254	16	24	53	60
3255	17	37	67	29
3256	18	45	46	285
3257	19	35	36	234
3258	20	42	43	278
3259	21	25	39	129
3260	22	36	36	260

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
3261	C - 23	39	30	295
3262	24	45	43	310
3263	25	39	44	275
3264	26	55	36	328
3265	27	29	31	205
3266	28	30	51	117
3267	29	37	50	153
3268	30	27	53	34
3269	31	34	44	143
3270	32	38	59	158
3271	33	50	67	162
3272	34	38	58	128
3273	35	34	64	68
3274	36	42	62	162
3275	37	38	56	112
3276	38	46	64	172
3277	39	42	60	152
3278	40	46	58	148
3279	41	47	55	208
3280	42	46	56	162
3281	43	42	70	84
3282	44	53	65	212
3283	45	42	65	116
3284	46	64	68	162
3285	47	79	72	56
3286	48	47	61	210
3287	49	42	60	138
3288	50	53	62	302
3289	51	50	56	142
3290	52	53	58	290
3291	53	46	51	224
3292	54	119	26	9
3293	55	79	44	8
3294	56	47	40	9
3295	57	69	48	14
3296	58	44	36	11
3297	59	47	31	4
3298	60	53	45	11
3299	61	82	50	18
3300	62	72	39	11
3301	63	28	15	4
3302	64	72	24	5
3303	65	66	62	19
3304	66	72	52	13
3305	67	50	48	12
3306	68	40	41	460
3307	69	46	47	445
3308	70	39	44	405
3309	71	48	43	340
3310	72	35	38	640
3311	73	40	41	240
3312	74	48	42	265
3313	75	54	49	295
3314	76	56	50	250
3315	77	47	38	215

Cons. No.	Sample No.	Cu	Zn	Ni
3316	C - 78	40	38	620
3317	79	47	40	225
3318	80	41	39	275
3319	81	56	44	240
3320	82	48	44	240
3321	83	50	47	245
3322	84	56	48	235
3323	85	49	49	270
3324	86	44	42	460
3325	87	23	39	135
3326	88	38	45	500
3327	89	32	59	
3328	90	35	52	470
3329	91	41	39	395
3330	92	17	26	1,280
3331	93	43	42	360
3332	94	38	47	470
3333	95	45	47	360
3334	96	37	37	330
3335	97	44	46	350
3336	98	42	48	440
3337	99	37	46	520
3338	100	24	50	580
3339	D - 4	54	66	21
3340'	7	37	78	140
3341	9	57	53	33
3342	11	67	42	14
3343	13	53	64	145
3344	16	47	33	8
3345	17	53	58	160
3346	19	51	65	170
3347	21	42	57	165
3348	24	42	55	90
3349	27	42	59	175
3350	30	45	65	95
3351	34	30	67	105
3352	37	36	71	135
3353	40	48	56	250
3354	44	49	63	195
3355	48	60	82	155
3356	50	58	76	185
3357	55	41	77	95
3358	61	52	61	180
3359	66	95	80	40
3360	69	49	68	205
3361	71	52	69	520
3362	73	59	68	60
3363	77	44	45	70
3364	78	52	51	85
3365	79	57	50	70
3366	80	58	66	35
3367	81	46	80	85
3368	82	47	56	25
3369	83	44	52	110
3370	84	56	68	125

Cons. No.	Sample No.	Cu	Zn	Ni
3371	D - 85	44	59	143
3372	86	92	63	13
3373	87	42	48	168
3374	88	44	76	140
3375	89	51	51	187
3376	90	64	100	22
3377	91	42	50	300
3378	92	39	45	430
3379	93	35	64	100
3380	94	55	51	75
3381	95	30	41	55
3382	96	41	40	55
3383	97	43	68	142
3384	98	37	39	40
3385	99	62	44	75
3386	101	59	53	68
3387	104	45	73	40
3388	105	54	58	60
3389	106	54	51	65
3390	107	48	86	45
3391	108	48	63	55
3392	109	48	61	70
3393	110	55	49	33
3394	111	39	59	36
3395	112	53	50	60
3396	113	54	47	65
3397	114	35	38	36
3398	116	40	48	10
3399	117	65	53	32
3400	118	55	50	25
3401	119	66	55	30
3402	120	68	27	25
3403	121	40	58	17
3404	122	63	52	32
3405	123	62	50	18
3406	124	63	46	27
3407	125	63	43	23
3408	126	60	55	23
3409	127	64	46	23
3410	128	31	106	13
3411	129	79	47	27
3412	130	63	53	23
3413	131	76	48	25
3414	132	62	57	27
3415	133	75	57	32
3416	134	90	66	18
3417	135	69	55	15
3418	136	64	63	10
3419	137	61	53	23
3420	138	66	54	25
3421	139	44	59	16
3422	140	54	34	15
3423	141	68	54	19
3424	142	66	56	26
3425	143	71	56	31

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
3426	D - 144	61	66	22
3427	145	94	67	30
3428	146	59	60	21
3429	147	52	58	48
3430	148	95	68	45
3431	149	53	49	21
3432	150	52	33	21
3433	151	71	60	28
3434	152	40	63	17
3435	153	73	68	28
3436	154	68	55	26
3437	155	71	57	31
3438	156	59	61	26
3439	157	73	58	30
3440	158	63	67	29
3441	159	71	62	32
3442	160	67	64	27
3443	161	55	52	22
3444	162	54	65	24
3445	163	73	68	27
3446	164	89	70	34
3447	165	52	54	27
3448	166	54	55	28
3449	167	61	51	28
3450	168	55	64	37
3451	169	65	57	47
3452	170	58	56	62
3453	171	65	68	327
3454	172	70	57	54
3455	173	80	57	205
3456	174	64	71	339
3457	175	47	62	80
3458	177	65	72	271
3459	178	55	63	279
3460	179	67	57	24
3461	180	55	54	35
3462	181	52	48	31
3463	182	56	51	40
3464	184	59	55	38
3465	185	83	71	42
3466				
3466	186	63	50	23
3467	187	69	62	46
3468	188	68	60	23
3469	189	46	66	20
3470	190	68	53	26
3471	193	62	60	42
3472	194	80	64	62
3473	E - 2	30	60	154
3474	3	45	86	124
3475	4	49	79	45
3476	5	76	67	44
3477	6	67	70	55
3478	7	72	77	32
3479	8	69	54	22
3480	9	65	68	44

Cons. No.	Sample No.	Cu	Zn	Ni
3481	E - 10	41	51	35
3482	11	68	74	31
3483	12	65	74	59
3484	13	40	47	326
3485	14	60	75	70
3486	15	59	57	53
3487	16	55	87	57
3488	17	53	78	67
3489	18	72	64	52
3490	19	52	66	39
3491	20	72	70	48
3492	21	80	69	52
3493	22	57	66	28
3494	23	61	68	44
3495	24	61	63	45
3496	25	65	64	44
3497	26	77	71	48
3498	27	49	70	51
3499	28	49	63	93
3500	29	49	73	52
3501	30	72	62	50
3502	31	87	73	44
3503	32	66	78	50
3504	33	84	71	48
3505	34	73	72	48
3506	35	73	67	47
3507	36	41	72	48
3508	37	97	72	50
3509	38	31	71	86
3510	39	90	73	48
3511	40	77	71	42
3512	41	73	64	67
3513	42	81	68	31
3514	43	82	77	56
3515	44	49	71	50
3516	45	81	62	32
3517	46	63	75	62
3518	47	72	59	39
3519	48	72	66	41
3520	49	28	69	58
3521	50	69	63	29
3522	51	89	88	67
3523	52	67	70	34
3524	53	70	71	27
3525	55	96	101	70
3526	57	89	69	31
3527	58	89	81	39
3528	59	77	76	48
3529	60	78	66	34
3530	61	85	67	34
3531	62	84	78	39
3532	63	67	76	39
3533	64	58	60	30
3534	65	66	63	58
3535	66	33	55	21

Cons. No.	Sample No.	Cu	Zn	Ni
3536	E - 67	73	67	29
3537	68	40	46	19
3538	70	77	77	31
3539	71	46	46	19
3540	72	77	68	39
3541	73	61	55	24
3542	74	85	71	39
3543	75	58	61	29
3544	76	83	81	48
3545	77	69	64	29
3446	78	74	51	19
3447	79	76	84	60
3448	80	81	67	30
3449	81	61	60	29
3450	82	74	58	33
3551	83	54	61	24
3552	84	80	85	49
3553	85	71	67	31
3554	86	88	68	34
3555	87	67	68	35
3556	88	83	70	36
3557	89	83	70	35
3558	90	75	70	33
3559	91	87	66	35
3560	92	68	72	34
3561	93	79	59	31
3562	94	76	72	35
3563	95	91	78	37
3564	96	79	80	37
3565	97	91	83	37
3566	98	79	70	39
3567	99	83	79	62
3568	100	71	68	35
3569	101	72	77	45
3570	102	83	71	36
3571	103	67	65	27
3572	104	87	64	36
3573	105	66	74	28
3574	106	80	80	38
3575	107	71	83	45
3576	108	63	80	31
3577	109	72	79	28
3578	110	77	80	44
3579	111	75	75	44
3580	112	93	87	36
3581	117	103	88	35
3582	118	83	80	37
3583	119	63	73	36
3584	120	90	76	35
3585	121	83	74	35
3586	122	87	67	35
3587	123	79	54	29
3588	124	36	57	427
3589	125	32	59	259
3590	126	36	48	258

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
3591	E - 128	36	54	379
3592	129	53	83	170
3593	130	37	46	349
3594	131	24	81	85
3595	132	38	48	264
3596	134	32	64	256
3597	135	55	62	412
3598	136	46	61	304
3599	137	36	55	407
3600	138	40	64	220
3601	139	57	62	439
3602	140	26	72	198
3603	141	40	78	445
3604	142	28	50	259
3605	143	41	65	306
3606	144	41	69	151
3607	145	42	58	304
3608	146	47	49	374
3609	147	42	65	202
3610	148	46	55	338
3611	149	46	64	217
3612	150	47	61	275
3613	151	86	100	311
3614	152	36	61	177
3615	153	35	53	247
3616	154	38	43	826
3617	155	36	58	291
3618	156	38	43	758
3619	157	28	37	711
3620	158	27	32	628
3621	159	29	46	288
3622	160	26	54	218
3623	161	33	53	269
3624	162	31	56	259
3625	163	35	63	319
3626	164	57	67	368
3627	165	30	67	225
3628	166	30	58	281
3629	167	42	60	417
3630	168	36	53	475
3631	169	33	60	374
3632	170	34	49	705
3633	171	38	55	696
3634	172	34	43	781
3635	173	54	61	643
3636	174	56	62	667
3637	175	49	54	618
3638	176	14	31	949
3639	177	54	57	682
3640	178	51	61	692
3641	179	31	69	339
3642	180	34	46	634
3643	181	34	56	533
3644	182	34	52	266
3645	183	38	59	303

Cons. No.	Sample No.	Cu	Zn	Ni
3646	E - 184	34	56	284
3647	185	39	66	327
3648	186	37	60	507
3649	187	77	112	573
3650	188	45	59	273
3651	189	50	668	318
3652	190	44	59	336
3653	191	51	66	474
3654	192	25	52	281
3655	193	37	65	411
3656	194	38	53	540
3657	195	207	181	452
3658	196	45	77	159
3659	197	49	75	89
3660	198	37	16	106
3661	199	56	76	167
3662	200	41	82	179
3663	201	45	79	254
3664	202	41	85	98
3665	203	52	75	573
3666	204	41	75	425
3667	205	48	87	90
3668	206	42	77	100
3669	207	43	63	158
3670	208	55	71	92
3671	209	45	82	121
3672	212	51	77	50
3673	213	52	64	41
3674	214	39	74	26
3675	215	29	84	37
3676	216	35	80	78
3677	e - 1	41	63	430
3678	2	35	58	308
3679	3	86	87	586
3680	4	39	56	573
3681	5	42	65	319
3682	6	33	54	371
3683	7	39	57	159
3684	8	37	51	564
3685	9	64	77	475
3686	10	34	53	559
3687	11	31	75	360
3688	12	37	65	497
3689	13	33	74	303
3690	14	30	51	299
3691	15	56	66	443
3692	16	28	58	325
3693	17	30	74	285
3694	18	35	62	314
3695	19	34	51	307
3696	20	33	63	394
3697	21	56	64	337
3698	22	39	42	48
3699	23	94	72	77
3700	25	60	58	71

Cons. No.	Sample No.	Cu	Zn	Ni
3701	e - 26	47	57	69
3702	27	81	65	112
3703	28	76	78	139
3704	29	76	63	87
3705	30	65	58	98
3706	31	86	70	130
3707	32	102	75	292
3708	33	93	86	290
3709	35	96	93	924
3710	36	52	73	944
3711	38	70	63	702
3712	39	53	73	221
3713	40	67	88	267
3714	42	105	93	322
3715	46	47	72	170
3716	47	54	72	175
3717	48	56	71	141
3718	49	43	76	159
3719	50	94	89	326
3720	51	43	70	169
3721	52	56	71	184
3722	53	49	70	188
3723	54	60	66	292
3724	55	32	67	117
3725	56	55	84	120
3726	57	115	130	145
3727	58	54	76	219
3728	59	55	77	99
3729	60	33	75	246
3730	61	56	61	84
3731	62	53	72	94
3732	63	42	69	78
3733	64	44	75	209
3734	65	59	86	125
3735	66	48	70	190
3736	F - 1	80	151	5
3737	2	93	106	10
3738	3	68	115	5
3739	4	51	184	7
3740	5	68	103	6
3741	6	51	174	5
3742	7	51	128	5
3743	8	56	146	6
3744	9	41	104	4
3745	10	59	111	7
3746	11	62	97	5
3747	12	71	100	7
3748	13	46	166	6
3749	14	43	113	6
3450	15	28	151	4
3551	16	56	92	5
3552	17	28	130	5
3553	18	43	123	5
3554	19	28	156	7
3555	20	4	32	1

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
3756	F - 21	50	175	20
3757	22	15	74	13
3758	23	66	71	19
3759	24	96	110	18
3760	25	48	86	20
3761	26	24	91	12
3762	27	76	111	8
3763	28	13	117	9
3764	29	31	101	11
3765	30	57	123	14
3766	31	48	135	16
3767	32	85	112	19
3768	34	22	136	18
3769	35	60	86	39
3770	36	52	85	21
3771	37	9	143	26
3772	38	49	88	27
3773	39	22	135	34
3774	40	34	90	17
3775	41	7	88	11
3776	52	32	84	16
3777	53	36	76	11
3778	54	37	79	16
3779	55	29	90	15
3780	56	30	77	12
3781	57	31	74	15
3782	58	41	75	15
3783	59	36	117	21
3784	60	31	137	24
3785	61	24	102	16
3786	62	53	100	20
3787	63	49	163	13
3788	64	50	105	17
3789	65	41	136	22
3790	81	20	126	20
3791	83	17	119	23
3792	86	29	41	5
3793	87	130	75	29
3794	88	81	233	18
3795	89	65	173	20
3796	90	38	207	11
3797	91	43	147	33
3798	92	30	131	17
3799	93	33	135	20
3800	94	17	105	15
3801	95	17	102	12
3802	96	19	69	4
3803	97	17	70	27
3804	99	22	3	26
3805	100	27	89	24
3806	101	122	174	22
3807	104	42	99	20
3808	118	117	205	25
3809	120	178	174	19
3810	121	80	92	11

Cons. No.	Sample No.	Cu	Zn	Ni
3811	F - 123	95	88	14
3812	124	97	152	20
3813	125	87	173	28
3814	126	124	142	24
3815	127	118	117	28
3816	128	89	123	22
3817	129	121	127	29
3818	130	104	172	26
3819	131	156	106	20
3820	132	99	111	23
3821	133	108	146	22
3822	134	122	189	25
3823	135	159	229	31
3824	136	152	118	18
3825	137	13	148	92
3826	138	189	103	31
3827	139	118	138	23
3828	140	173	143	24
3829	141	74	161	21
3830	142	70	136	21
3				
3831	143	71	137	19
3832	144	82	178	20
3833	145	64	96	21
3834	146	30	33	28
3835	147	41	58	30
3836	148	28	39	22
3837	149	43	70	24
3838	150	31	81	26
3839	151	44	91	20
3840	152	39	79	15
3841	153	54	56	16
3842	154	52	121	21
3843	155	63	86	22
3844	156	102	107	29
3845	157	53	52	19
3846	158	49	66	24
3847	159	27	80	21
3848	160	86	86	19
3849	161	69	77	18
3850	162	26	46	13
3851	163	48	62	27
3852	164	48	75	30
3853	165	73	93	23
3854	166	38	74	24
3855	167	37	61	20
3856	168	62	56	16
3857	169	43	43	23
3858	170	40	41	14
3859	171	54	50	18
3860	172	40	37	16
3861	173	27	30	18
3862	174	72	49	25
3863	175	50	52	23
3864	176	60	49	16
3865	177	82	63	23

Cons. No.	Sample No.	Cu	Zn	Ni
3866	F - 178	52	67	23
3867	179	84	76	26
3868	180	86	68	27
3869	181	60	64	22
3870	182	50	57	21
3871	183	45	43	18
3872	184	59	50	24
3873	185	73	60	23
3874	186	45	61	11
3875	187	53	58	16
3876	188	28	79	17
3877	189	35	75	17
3878	190	40	86	17
3879	191	40	18	15
3880	192	38	76	16
3881	193	68	79	26
3882	194	99	78	28
3883	195	26	80	18
3884	196	75	88	17
3885	197	57	69	31
3886	198	105	86	21
3387	199	65	82	26
3888	200	37	83	25
3889	201	60	79	31
3890	202	43	72	25
3891	203	51	54	24
3892	204	41	79	24
2893	205	67	77	29
2894	206	52	65	24
2895	207	88	69	25
2896	208	133	79	22
3897	209	92	99	24
3898	210	76	94	21
3899	211	98	106	20
3900	212	57	97	27
3901	213	46	48	15
3902	214	85	95	32
3903	215	93	93	30
3904	216	96	100	21
3905	217	105	85	27
3906	218	68	70	24
3907	219	99	111	36
3908	220	78	65	22
3909	221	58	62	19
3910	222	40	45	14
3911	223	36	49	14
3912	224	41	52	20
3913	225	38	65	18
3914	226	42	47	15
3915	22	33	58	17
3916	228	44	44	13
3917	229	37	72	21
3918	230	59	59	17
3919	231	48	51	15
3920	241	53	42	18

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
3921	F - 242	51	44	17
3922	243	54	45	23
3923	244	69	69	17
3924	345	66	57	20
3925	246	65	51	23
926	248	56	54	21
927	249	72	47	16
3928	250	80	57	16
3929	251	63	46	20
3930	252	57	52	19
3931	253	47	53	18
3932	254	61	55	20
3933	255	32	54	16
3934	256	94	152	18
3935	257	50	42	18
3936	258	46	53	17
3937	259	52	72	18
3938	260	55	55	17
3939	261	58	48	18
3940	262	40	51	17
3941	263	34	62	16
3942	264	38	62	18
3943	265	47	52	19
3944	266	55	50	18
3945	272	23	62	12
3946	273	27	57	15
3947	274	29	43	10
3948	275	30	62	15
3949	276	36	58	12
3950	277	32	52	11
3951	278	34	50	13
3952	279	64	82	22
3953	280	33	42	10
3954	281	36	45	12
3955	282	37	53	62
3956	283	47	61	15
3957	284	49	78	14
3958	285	33	50	13
3959	286	72	78	18
3960	287	37	63	11
3961	288	44	49	13
3962	289	41	60	9
3963	290	52	14	14
3964	291	103	14	14
3965	292	153	48	8
3966	293	139	75	9
3967	294	145	37	8
3968	295	139	33	9
3969	296	149	36	10
3970	297	141	39	9
3971	298	151	66	10
3972	299	149	38	15
3973	300	154	38	14
3974	301	156	43	10
3975	302	163	40	9
3976	F - 303	136	42	10
3977	304	147	45	11
3978	305	138	43	9
3979	306	103	30	8
3980	307	130	42	9
3981	308	142	42	10
3982	309	157	78	13
3983	310	128	56	12
3984	311	136	59	13
3985	312	137	63	11
3986	313	77	35	9
3987	314	86	66	10
3988	315	111	69	12
3989	316	80	37	10
3990	317	42	80	21
3991	321	35	74	17
3992	322	67	77	18
3993	323	76	78	18
3994	324	64	98	21
3995	325	76	76	18
3996	326	70	76	25
3997	327	48	46	15
3998	328	54	61	20
3999	330	61	135	20
4000	331	72	78	17
4001	332	87	87	20
4002	333	42	68	14
4003	334	94	101	21
4004	335	55	70	31
4005	336	64	78	23
4006	337	58	77	19
4007	338	60	72	17
4008	339	62	77	24
4009	340	57	77	20
4010	341	50	75	18
4011	342	53	89	18
4012	343	48	96	22
4013	344	56	87	19
4014	345	82	71	20
4015	346	76	67	20
4017	347	80	70	36
4017	348	83	73	18
4018	349	70	74	18
4019	350	81	65	19
4020	351	74	78	18
4021	352	71	73	16
4022	353	114	105	23
4023	354	55	83	20
4024	355	22	35	34
4025	356	65	65	21
4026	357	66	89	21
4027	358	76	70	24
4028	359	68	92	23
4029	360	65	72	20
4030	361	45	77	19
4031	F - 362	84	73	16
4032	363	110	86	17
4033	364	114	77	17
4034	365	108	93	16
4035	366	121	86	17
4036	367	115	97	16
4037	368	116	84	17
4038	369	132	99	18
4039	370	122	80	16
4040	371	136	89	17
4041	372	126	111	17
4042	373	114	97	17
4043	374	114	87	18
4044	375	55	76	19
4045	376	122	102	17
4046	377	13	86	19
4047	378	132	86	18
4048	379	136	29	17
4049	380	137	82	17
4059	381	102	66	13
4051	382	94	64	14
4052	383	65	69	14
4053	384	49	58	15
4054	385	73	55	11
4055	386	87	72	14
4056	387	100	64	13
4057	388	78	60	12
4058	389	90	68	14
4059	390	33	49	7
4060	391	170	93	16
4061	392	160	85	14
4062	393	160	24	14
4063	394	149	86	16
4064	395	72	71	19
4065	396	93	80	21
4066	397	72	66	17
4067	398	78	73	17
4068	399	00	67	18
4069	400	85	70	18
4070	401	18	49	23
4071	402	95	86	17
4072	403	36	65	17
4073	404	52	94	20
4074	405	55	67	18
4075	406	88	77	17
4076	G - 2	69	206	28
4077	3	159	214	30
4078	4	203	174	33
4079	5	141	112	30
4080	6	140	345	29
4081	7	63	169	28
4082	8	64	153	25
4083	9	63	165	24
4084	10	70	134	24
4085	11	637	146	42

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
4086	G - 12	135	190	44
4087	13	139	110	28
4088	14	173	198	39
4089	15	95	102	23
4090	16	64	123	18
4091	17	80	105	23
4092	18	48	90	19
4093	19	42	82	20
4094	20	68	130	22
4095	21	72	113	21
4096	22	28	146	15
4097	23	54	146	19
4098	24	28	173	21
4099	25	219	188	39
4100	26	227	190	40
4101	27	254	183	46
4102	28	208	188	50
4103	29	228	197	57
4104	30	200	198	63
4105	31	196	212	56
4106	32	191	200	55
4107	33	167	173	46
4108	34	193	180	48
4109	35	196	186	49
4110	36	214	188	48
4111	37	185	154	38
4112	38	123	148	28
4113	39	66	134	21
4114	40	60	132	18
4115	41	131	117	28
4116	43	96	87	21
4117	44	61	134	21
4118	45	116	109	23
4119	46	125	129	27
4120	47	116	109	25
4121	48	153	117	27
4122	49	193	128	28
4123	50	210	121	28
4124	51	179	113	24
4125	52	148	98	23
4126	71	118	82	19
4127	72	75	88	19
4128	73	72	85	18
4129	74	67	123	20
4130	75	74	102	18
4131	76	48	127	17
4132	77	87	74	18
4133	78	92	100	19
4134	79	48	40	16
4135	80	90	88	19
4136	81	94	107	19
4137	82	81	93	18
4138	83	62	113	16
4139	84	77	100	17
4140	85	73	104	18

Cons. No.	Sample No.	Cu	Zn	Ni
4141	G - 86	80	117	19
4142	87	81	73	15
4143	88	91	95	18
4144	89	79	107	18
4145	90	78	133	21
4146	91	72	141	16
4147	92	66	116	17
4148	93	74	126	17
4149	94	78	70	18
4150	95	80	123	18
4151	96	87	84	17
4152	97	61	106	15
4153	98	60	97	17
4154	99	66	74	17
4155	100	68	91	19
4156	101	70	146	18
4157	102	60	89	22
4158	103	50	135	13
4159	104	45	57	17
4160	105	61	106	15
4161	106	64	98	16
4162	107	75	108	18
4163	108	77	99	14
4164	109	77	122	15
4165	110	77	161	15
4166	111	77	90	15
4167	112	66	138	16
4168	113	59	128	16
4169	114	64	131	19
4170	115	91	91	15
4171	116	59	91	18
4172	117	74	113	17
4173	118	58	103	23
4174	119	61	104	14
4175	120	62	98	18
4176	121	77	111	15
4177	122	84	123	15
4178	123	97	105	14
4179	124	82	96	16
4180	125	114	91	13
4181	126	75	113	14
4182	127	78	102	13
4183	128	73	87	13
4184	129	62	114	13
4185	130	81	101	14
4186	131	80	102	13
4187	132	100	113	14
4188	133	87	113	12
4189	134	94	149	13
4190	135	90	112	12
4191	136	82	98	12
4192	137	106	125	14
4193	138	67	96	13
4194	139	91	153	13
4195	140	96	166	14

Cons. No.	Sample No.	Cu	Zn	Ni
4196	G - 141	85	131	13
4197	142	75	159	13
4198	143	79	100	11
4199	144	69	95	13
4200	145	75	116	11
4201	146	98	95	11
4202	147	94	130	13
4203	148	79	125	13
4204	149	110	76	13
4205	150	62	75	14
4206	151	90	95	16
4207	152	67	79	13
4208	153	63	46	10
4209	154	409	157	12
4210	155	65	75	14
4211	156	71	60	14
4212	157	63	62	12
4213	158	51	62	12
4214	159	68	89	17
4215	160	71	81	14
4216	161	81	72	16
4217	162	71	72	14
4218	163	55	69	15
4219	164	71	74	14
4220	165	63	74	13
4221	166	75	74	19
4222	167	55	60	15
4223	168	59	71	11
4224	169	55	71	11
4225	170	59	70	12
4226	171	30	64	11
4227	172	39	52	11
4228	173	47	75	12
4229	174	70	92	12
4230	175	66	79	12
4231	176	66	87	13
4232	177	51	70	11
4233	178	65	90	18
4234	179	67	138	19
4235	180	51	113	16
4236	181	103	71	17
4237	182	55	104	16
4238	183	61	59	13
4239	184	42	87	13
4240	185	62	93	16
4241	186	47	70	13
4242	187	40	28	7
4243	188	42	72	13
4244	189	43	115	15
4245	190	59	89	14
4246	191	48	104	14
4247	192	46	77	12
4248	193	48	95	20
4249	194	40	81	16
4250	195	69	146	15

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
4251	G - 196	53	82	19
4252	197	51	91	18
4253	198	67	120	18
4254	199	47	108	19
4255	200	36	98	18
4256	201	60	77	15
4257	202	40	99	18
4258	203	45	125	17
4259	204	40	128	16
4260	205	39	92	16
4261	206	22	111	11
4262	207	48	127	22
4263	208	37	91	17
4264	209	26	113	14
4265	210	51	145	18
4266	211	58	152	21
4267	212	27	96	16
4268	213	26	89	13
4269	214	51	102	19
4270	215	40	67	15
4271	216	15	90	15
4272	217	18	141	18
4273	218	19	116	19
4274	219	17	134	17
4275	220	19	107	19
4276	221	58	103	17
4277	222	42	139	20
4278	223	51	125	15
4279	224	41	73	13
4280	225	55	95	14
4281	226	41	72	13
4282	227	67	139	26
4283	228	45	116	16
4284	229	53	115	14
4285	230	55	115	15
4286	231	55	92	13
4287	232	22	87	9
4288	233	37	65	11
4289	234	11	61	7
4290	235	35	103	11
4291	236	30	98	10
4292	237	41	80	9
4293	238	28	65	10
4294	239	33	76	10
4295	240	41	80	10
4296	241	38	74	10
4297	242	33	57	8
4298	243	44	79	10
4299	244	44	71	9
4300	245	25	63	10
4301	246	28	64	11
4302	247	24	54	11
4303	248	26	101	13
4304	249	27	62	12
4305	250	28	59	12

Cons. No.	Sample No.	Cu	Zn	Ni
4306	G - 251	44	88	11
4307	g - 5	118	97	23
4308	6	96	110	19
4309	8	85	113	14
4310	20	34	81	12
4311	23	33	157	12
4312	26	181	131	33
4313	29	126	130	30
4314	31	108	221	45
4315	32	150	134	24
4316	33	169	118	25
4317	34	173	181	25
4318	39	41	125	16
4319	40	104	94	21
4320	41	30	132	17
4321	45	95	159	15
4322	47	49	109	16
4323	48	58	103	20
4324	49	153	112	38
4325	50	71	183	18
4326	51	201	103	23
4327	H - 1	38	102	14
4328	2	39	85	15
4329	3	31	83	11
4330	4	43	68	14
4331	5	40	112	15
4332	6	36	108	15
4333	7	25	171	15
4334	8	36	151	18
4335	9	43	74	10
4336	10	46	60	10
4337	11	27	224	20
4338	12	40	95	15
4339	13	43	91	14
4340	14	30	224	19
4341	15	34	105	11
4342	16	31	123	15
4343	17	28	223	21
4344	18	20	135	11
4345	19	40	107	13
4346	20	35	156	21
4347	21	34	203	21
4348	22	38	151	11.0
4349	23	30	72	7
4350	24	40	113	17
4351	25	31	80	8
4352	26	49	56	31
4353	27	58	91	26
4354	28	44	85	26
4355	29	26	30	13
4356	30	61	32	10
4357	31	57	33	13
4358	32	25	26	15
4359	33	42	115	13
4360	34	56	58	8

Cons. No.	Sample No.	Cu	Zn	Ni
4361	H - 35	29	45	11
4362	36	46	39	9
4363	37	54	86	9
4364	38	74	69	7
4365	39	49	53	8
4366	40	69	82	10
4367	41	48	79	8
4368	42	32	74	10
4369	43	22	83	9
4370	45	76	131	14
4371	47	17	31	9
4372	48	29	88	6
4373	49	33	128	14
4374	50	30	155	9
4375	51	27	42	8
4376	52	26	28	8
4377	53	28	44	7
4378	54	25	31	8
4379	55	25	53	7
4380	56	25	39	7
4381	57	26	57	7
4382	58	29	41	7
4383	59	25	60	9
4384	60	29	50	7
4385	62	24	64	7
4386	63	38	86	9
4387	66	25	94	14
4388	67	22	80	17
4389	68	23	77	7
4390	69	33	84	6
4391	70	26	94	11
4392	71	21	173	19
4393	72	22	200	15
4394	73	25	84	11
4395	74	29	151	7
4396	75	28'	109	7
4397	76	52	83	11
4398	77	52	116	7
4399	77'	29	153	13
4400	78	60	91	8
4401	79	49	172	18
4402	80	43	86	11
4403	81	55	138	15
4404	82	50	86	13
4405	83	53	103	15
4406	84	46	101	12
4407	85	52	159	16
4408	86	45	262	21
4409	87	43	129	11
4410	88	48	213	16
4411	89	64	60	7
4412	90	45	121	10
4413	91	47	196	18
4414	92	29	72	10
4415	93	52	98	13

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
4416	H - 94	46	81	12
4417	95	55	55	8
4418	96	57	118	13
4419	97	27	83	13
4420	98	33	68	13
4421	99	52	190	23
4422	100	42	179	20
4423	101	64	173	16
4424	102	54	398	24
4425	103	54	86	9
4426	104	52	247	28
4427	105	41	100	14
4428	106	52	128	14
4429	107	59	145	14
4430	108	49	171	16
4431	109	62	137	9
4432	110	54	233	25
4433	111	53	269	25
4434	112	49	154	15
4435	113	53	242	21
4436	114	53	172	19
4437	115	48	67	11
4438	116	53	95	12
4439	117	30	251	27
4440	118	51	82	11
4441	119	58	185	19
4442	120	33	61	11
4443	121	56	104	11
4444	122	48	180	14
4445	123	54	115	12
4446	124	60	78	9
4447	125	50	92	13
4448	126	56	196	21
4449	127	50	225	23
4450	128	51	110	14
4451	129	55	107	15
4452	130	51	129	14
4453	131	46	237	26
4454	132	68	121	11
4455	133	68	94	11
4456	134	57	75	8
4457	135	68	101	12
4458	136	73	114	13
4459	137	55	56	12
4460	138	73	89	9
4461	139	71	178	13
4462	140	58	84	14
4463	141	71	119	12
4464	142	70	88	12
4465	143	59	74	13
4466	144	115	204	13
4467	145	152	461	21
4468	136	98	158	12
4469	147	91	204	14
4470	148	107	175	13
4471	H - 149	74	112	6
4472	150	78	109	7
4473	151	84	111	8
4474	152	79	100	6
4475	153	87	153	8
4476	154	88	154	8
4477	155	114	235	
4478	156	76	91	6
4479	157	76	97	6
4480	159	76	197	8
4481	160	83	174	9
4482	161	84	151	6
4483	162	74	123	6
4484	163	89	220	9
4485	164	97	265	12
4486	165	90	146	9
4487	166	74	98	6
4488	167	74	146	9
4489	168	127	567	17
4490	169	69	96	8
4491	170	100	263	12
4492	171	69	135	8
4493	172	118	416	15
4494	173	75	195	9
4495	174	103	196	10
4496	175	98	181	10
4497	176	89	72	13
4498	177	103	182	11
4499	178	96	164	9
4500	179	161	668	27
4501	180	113	396	17
4502	181	87	96	7
4503	183	116	308	15
4504	183	91	153	9
4505	184	143	207	12
4506	185	100	165	9
4507	186	57	122	15
4508	187	77	148	14
4509	188	61	106	14
4510	189	62	84	13
4511	190	59	85	11
4512	191	62	79	9
4513	193	165	178	7
4514	194	182	193	13
4515	195	197	213	8
4516	196	192	184	9
4517	197	156	131	15
4518	198	176	215	15
4519	199	149	121	10
4520	200	116	60	8
4521	201	138	118	8
4522	202	120	68	7
4523	203	139	82	11
4524	204	137	115	11
4525	205	133	103	7
4526	H - 206	123	69	12
4527	207	122	90	8
4528	208	122	79	10
4529	209	126	74	12
4530	210	130	83	9
4531	211	122	74	11
4532	212	83	120	8
4533	213	118	195	12
4534	214	129	254	12
4535	215	130	211	18
4536	216	163	618	19
4537	217	81	79	8
4538	218	72	68	7
4539	219	85	75	12
4540	220	76	111	7
4541	221	80	103	10
4542	222	80	87	7
4543	223	74	56	7
4544	224	80	66	7
4545	225	143	174	15
4546	226	92	62	10
4547	227	80	18	10
4548	228	96	69	8
4549	229	84	60	8
4550	230	67	32	8
4551	231	121	91	13
4552	232	137	105	14
4553	233	172	487	26
4554	234	58	69	10
4555	235	94	101	14
4556	236	70	88	8
4557	237	67	120	10
4558	238	67	101	20
4559	239	69	109	8
4560	240	72	86	12
4561	241	69	125	13
4562	242	93	140	13
4563	243	87	127	13
4564	244	83	184	17
4565	245	84	100	11
4566	246	89	148	13
4567	247	91	56	7
4568	248	91	141	12
4569	249	93	114	10
4570	250	88	106	11
4571	251	79	100	11
4572	252	70	74	12
4573	253	54	112	12
4574	254	61	141	11
4575	255	48	49	12
4576	256	24	38	8
4577	257	54	99	6
4578	258	44	78	12
4579	259	65	75	9
4580	260	105	129	13

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
4581	h - 1	32	37	10
4582	2	30	47	9
4583	3	26	71	15
4584	4	32	74	11
4585	5	33	77	10
4586	6	28	72	16
4587	7	23	176	22
4588	8	22	56	21
4589	9	24	118	18
4590	10	21	73	18
4591	11	55	61	10
4592	12	59	64	7
4593	13	25	87	22
4594	14	24	41	22
4595	15	24	98	16
4596	16	26	68	16
4597	17	24	46	19
4598	18	26	60	16
4599	19	22	47	19
4600	20	22	58	17
4601	21	25	45	17
4602	22	24	91	17
4603	23	18	138	28
4604	24	22	114	22
4605	25	26	137	17
4606	26	29	89	12
4607	27	18	193	28
4608	28	26	153	13
4609	29	24	87	15
4610	30	34	57	25
4611	31	61	64	38
4612	32	61	90	36
4613	33	50	82	36
4614	34	61	93	35
4615	35	53	69	35
4616	36	54	94	32
4617	37	56	75	37
4618	61	86	98	9
4619	62	139	295	14
4620	63	137	307	15
4621	64	124	306	15
4622	65	45	221	12
4623	66	156	306	14
4624	67	41	175	8
4625	68	115	278	12
4626	69	93	155	9
4627	70	102	245	12
4628	71	93	162	11
4629	72	83	50	6
4630	73	100	48	8
4631	74	108	43	10
4632	75	103	86	9
4633	76	91	67	9
4634	77	95	52	7
4635	78	83	82	6

Cons. No.	Sample No.	Cu	Zn	Ni
4636	h - 79	119	75	9
4637	80	87	122	9
4638	81	130	231	12
4639	82	75	72	8
4640	83	81	102	9
4641	84	138	138	12
4642	85	68	87	12
4643	86	71	74	7
4644	87	70	110	9
4645	88	85	74	8
4646	89	91	116	9
4647	90	121	164	7
4648	91	103	143	9
4649	92	65	104	7
4650	93	94	123	9
4651	94	136	120	10
4652	95	109	118	9
4653	96	129	144	6
4654	97	80	104	8
4655	98	112	192	10
4656	99	90	99	8
4657	100	140	146	12
4658	101	94	152	10
4659	102	125	172	9
4660	103	83	116	14
4661	104	52	37	8
4662	105	84	131	11
4663	106	81	95	11
4664	107	68	75	10
4665	108	77	67	13
4666	109	75	116	14
4667	110	61	29	14
4668	111	71	55	12
4669	112	65	66	12
4670	113	47	39	6
4671	114	56	112	14
4672	115	47	57	10
4673	116	61	79	11
4674	117	58	74	10
4675	118	63	55	7
4676	119	49	39	12
4677	120	39	83	7
4678	121	47	88	10
4679	122	59	46	10
4680	123	53	93	3
4681	124	46	193	7
4682	125	44	88	7
4683	126	63	89	7
4684	127	44	82	9
4685	128	72	57	8
4686	I - 1	119	115	17
4687	2	151	121	17
4688	3	104	100	15
4689	4	70	85	14
4690	5	82	120	16

Cons. No.	Sample No.	Cu	Zn	Ni
4691	I - 6	70	107	16
4692	7	67	63	14
4693	8	67	78	16
4694	9	67	123	15
4695	10	60	63	29
4696	11	89	152	17
4697	12	94	146	19
4698	13	75	165	16
4699	14	95	129	19
4700	15	120	103	23
4701	16	100	130	20
4702	17	101	97	18
4703	18	86	110	19
4704	19	80	95	22
4705	20	64	152	17
4706	21	85	123	18
4707	22	79	110	20
4708	23	90	101	20
4709	24	72	122	18
4710	25	78	130	18
4711	26	114	100	18
4712	27	133	100	17
4713	28	102	98	19
4714	29	82	89	16
4715	30	124	93	18
4716	31	90	95	17
4717	32	330	107	18
4718	33	131	90	18
4719	34	67	116	16
4720	35	91	85	15
4721	36	97	114	16
4722	37	114	76	15
4723	38	129	134	16
4724	39	121	81	18
4725	40	71	70	15
4726	41	68	77	15
4727	42	64	71	14
4728	43	74	101	16
4729	44	76	74	16
4730	45	118	112	17
4731	46	157	112	28
4732	47	75	107	19
4733	48	116	87	17
4734	49	75	149	15
4735	50	112	92	16
4736	51	104	111	16
4737	52	119	91	16
4738	53	112	123	16
4739	54	106	82	15
4740	55	175	105	19
4741	56	101	88	15
4742	57	236	104	18
4743	58	123	85	16
4744	59	103	117	17
4745	60	144	156	14

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
4746	I - 61	118	97	17
4747	62	90	137	14
4748	63	109	97	16
4749	64	103	135	18
4750	65	106	110	17
4751	66	77	107	13
4752	67	107	97	18
4753	68	98	82	16
4754	69	109	106	18
4755	70	161	89	16
4756	71	143	111	16
4757	72	99	92	17
4758	73	91	112	18
4759	74	100	92	17
4760	75	102	99	18
4761	76	88	140	16
4762	77	110	107	19
4763	78	94	106	17
4764	79	103	136	18
4765	80	126	154	17
4766	81	95	125	17
4767	82	96	112	16
4768	83	97	106	19
4769	84	106	140	19
4770	85	101	133	16
4771	86	96	104	16
4772	87	107	153	20
4773	88	108	113	19
4774	89	104	99	21
4775	90	107	90	17
4776	91	114	143	22
4777	92	107	144	17
4778	93	107	134	20
4779	94	130	103	16
4780	95	107	118	18
4781	96	122	98	16
4782	97	149	107	19
4783	98	113	120	19
4784	99	114	120	20
4785	100	92	105	17
4786	101	96	111	20
4787	102	117	110	21
4788	103	161	87	16
4789	104	103	153	18
4790	105	115	124	21
4791	106	109	101	16
4792	107	104	94	17
4793	108	99	112	16
4794	109	108	113	17
4795	110	119	140	17
4796	111	97	156	17
4797	112	130	121	16
4798	113	117	101	16
4799	114	96	122	16
4800	115	105	113	18
4801	I - 116	116	106	18
4802	117	134	160	18
4803	118	107	81	15
4804	119	112	91	18
4805	120	92	101	15
4806	121	97	102	16
4807	126	63	98	14
4808	127	56	90	15
4809	128	49	61	13
4810	129	61	87	15
4811	130	76	71	12
4812	131	69	96	15
4813	132	61	80	14
4814	133	54	60	14
4815	134	88	117	17
4816	135	93	111	16
4817	136	78	92	15
4818	137	79	98	17
4819	138	73	90	16
4820	139	88	106	17
4821	140	83	112	17
4822	141	72	92	21
4823	142	73	79	13
4824	143	73	30	15
4825	144	119	82	15
4826	145	227	120	18
4827	146	137	97	17
4828	147	223	98	16
4829	148	158	92	16
4830	149	96	83	17
4831	150	113	101	18
4832	151	123	108	19
4833	152	84	94	16
4834	153	85	98	15
4835	154	82	85	17
4836	155	82	85	15
4837	156	79	80	16
4838	157	77	52	21
4839	158	68	76	13
4840	159	94	88	15
4841	160	81	82	16
4842	161	137	88	19
4843	162	58	85	15
4844	163	47	89	11
4845	164	46	96	12
4846	165	58	88	12
4847	166	55	70	15
4848	167	56	97	12
4849	168	50	93	12
4850	169	55	87	11
4851	170	42	73	11
4852	171	42	74	11
4853	172	48	85	12
4854	173	57	104	12
4855	174	56	95	12
4856	I - 175	44	107	11
4857	176	53	87	15
4858	177	50	94	13
4859	178	63	76	14
4860	179	70	125	13
4861	180	60	114	12
4862	181	54	89	12
4863	182	45	66	12
4864	183	37	92	10
4865	184	52	87	13
4866	185	57	89	13
4867	186	67	99	14
4868	187	63	137	13
4869	188	67	134	14
4870	189	58	82	13
4871	190	52	88	13
4872	191	56	81	12
4873	192	51	81	15
4874	193	56	79	13
4875	194	59	78	14
4876	195	69	116	13
4877	196	52	86	15
4878	197	67	79	15
4879	198	41	98	12
4880	199	79	80	17
4881	200	41	86	14
4882	201	67	120	14
4883	202	83	84	18
4884	203	82	70	17
4885	204	77	70	18
4886	205	80	76	19
4887	206	82	69	18
4888	207	86	77	16
4889	208	77	66	19
4890	209	68	70	14
4891	210	77	59	20
4892	211	93	89	14
4893	212	88	91	15
4894	213	95	87	14
4895	214	115	97	16
4896	215	90	88	14
4897	216	89	105	15
4898	217	86	75	13
4899	218	82	166	14
4900	219	85	81	12
4901	220	82	156	14
4902	221	67	67	14
4903	222	76	79	14
4904	223	93	104	14
4905	224	86	143	14
4906	225	86	86	13
4907	226	73	116	16
4908	BED - 2	58	38	57
4909	7	89	62	24
4910	O - 1	58	80	44

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
4911	O - 4	61	48	38
4912	5	62	44	44
4913	6	56	99	49
4914	7	39	64	35
4915	8	33	50	29
4916	9	48	72	42
4917	10	34	82	28
4918	P - 101	35	82	84
4919	103	50	72	49
4920	104	59	168	38
4921	105	47	90	56
4922	107	22	109	49
4923	109	35	53	42
4924	301	24	177	84
4925	304	29	214	42
4926	306	51	48	73
4927	307	46	63	84
4928	308	87	113	35
4929	401	35	111	99
4930	402	47	145	116

Cons. No.	Sample No.	Cu	Zn	Ni
4931	P - 403	53	81	98
4932	404	82	96	31
4933	406	56	194	116
4934	407	77	417	28
4935	408	86	425	58
4936	409	85	163	22
4937	411	74	1,042	18
4938	412	92	257	20
4939	501	41	179	28
4940	504	40	90	42
4941	505	51	101	42
4942	506	41	89	47
4943	507	53	176	42
4944	509	57	69	42
4945	510	24	165	49
4946	511	54	232	29
4947	512	70	160	60
4948	513	66	417	27
4949	514	83	875	18
4950	516	62	188	45

Cons. No.	Sample No.	Cu	Zn	Ni
4951	P - 517A	46	97	45
4952	517B	46	83	56
4953	518	35	112	112
4954	802	1,099	40	14
4955	803	60	35	28
4956	804	97	126	11
4957	806	69	53	6
4958	810	53	53	7
4959	811	63	50	18
4960	812	66	96	21
4961	901	54	69	28
4962	1102	50	77	24
4963	1103	67	47	49
4964	1112	92	65	8
4965	1113	104	44	11
4966	1204	61	52	42

(C) Bank Sediment (−80-mesh fraction)

Cons. No.	Sample No.	Cu	Zn	Ni
4967	B - 2	57	57	76
4968	6	77	67	110
4969	7	75	63	101
4970	8	68	66	32
4971	9	63	59	99
4972	10	84	66	116
4973	13	73	64	78
4974	14	32	125	118
4975	15	75	62	122
4976	18	68	66	110
4977	19	58	98	76
4978	21	80	58	116
4979	22	65	58	109
4980	24	95	68	86
4981	25	59	53	50
4982	26	81	65	103
4983	27	64	62	100
4984	28	68	60	100
4985	29	52	68	167
4986	30	59	59	100
4987	32	73	59	118
4988	33	64	58	113
4989	34	60	57	98
4990	36	52	54	90
4991	37	51	53	726
4992	39	60	58	81
4993	40	64	58	95
4994	41	64	57	94
4995	43	62	56	93

Cons. No.	Sample No.	Cu	Zn	Ni
4996	B - 44	48	51	353
4997	45	74	60	102
4998	46	64	65	86
4999	48	82	68	100
5000	49	65	60	80
5001	51	43	43	497
5002	54	46	62	114
5003	55	65	62	72
5004	56	79	60	75
5005	57	80	60	77
5006	59	63	58	72
5007	61	66	59	73
5008	62	64	53	73
5009	63	74	67	74
5010	65	63	73	71
5011	66	63	61	71
5012	67	61	70	60
5013	98	104	77	58
5014	145	85	70	151
5015	146	88	67	88
5016	147	106	76	63
5017	149	144	100	80
5018	152	108	96	50
5019	153	111	82	68
5020	154	77	71	77
5021	155	103	78	60
5022	156	107	78	100
5023	158	81	67	122
5024	159	90	75	73
5025	162	83	81	105

Cons. No.	Sample No.	Cu	Zn	Ni
5026	B - 164	72	78	63
5027	165	80	73	100
5028	168	112	84	86
5029	171	86	62	64
5030	172	80	71	109
5031	174	76	76	92
5032	175	88	78	76
5033	176	118	67	44
5034	177	122	74	58
5035	178	97	65	66
5036	179	63	77	77
5037	180	116	70	57
5038	181	60	69	108
5039	183	99	75	64
5040	184	91	67	66
5041	185	53	61	69
5042	186	72	75	99
5043	187	73	72	115
5044	189	78	64	58
5045	190	65	72	63
5046	191	63	84	66
5047	192	80	63	52
5048	193	105	78	51
5049	194	80	84	37
5050	195	102	73	55
5051	D - 1	78	68	87
5052	2	22	29	20
5053	3	3	4	195
5054	192	79	160	51
5055	E - 6	61	60	61

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
5056	F - 247	107	78	22
5057	318	45	101	16
5058	319	54	87	67
5059	320	38	91	17
5060	329	71	91	22
5061	I - 1	72	60	22
5062	2	75	61	23
5063	3	77	95	17
5064	4	86	84	18
5065	5	184	75	16
5066	6	73	91	20
5067	7	50	78	18
5068	8	47	79	15
5069	9	90	77	29
5070	10	75	72	23
5071	11	95	76	22
5072	12	74	111	21
5073	13	111	79	23
5074	14	116	73	26
5075	15	107	89	25
5076	17	78	117	26
5077	18	59	101	23
5078	19	94	80	29
5079	20	80	118	24
5080	21	75	98	22
5081	22	79	107	27
5082	23	79	107	23
5083	24	56	83	62
5084	25	113	98	31
5085	26	39	54	16
5086	27	23	30	23
5087	28	62	68	23
5088	29	35	44	14
5089	30	86	94	20
5090	31	67	73	19
5091	32	145	66	20
5092	33	71	182	29
5093	34	72	65	27
5094	35	141	92	22
5095	36	139	88	25

Cons. No.	Sample No.	Cu	Zn	Ni
5096	I - 37	94	76	24
5097	38	106	80	26
5098	39	110	95	24
5099	40	57	60	15
50	41	41	63	15
5101	42	32	52	18
5102	43	70	81	20
5103	44	43	69	17
5104	45	129	85	22
5105	46	39	71	18
5106	47	59	66	20
5107	48	98	81	23
5108	49	47	63	17
5109	50	74	80	18
5110	51	35	70	18
5111	52	39	48	14
5112	53	98	78	19
5113	54	71	65	18
5114	55	110	76	21
5115	56	180	77	19
5116	57	188	83	22
5117	58	145	82	20
5118	59	122	84	24
5119	60	124	87	22
5120	66	155	89	23
5121	67	113	91	18
5122	68	124	90	19
5123	69	151	94	17
5124	70	132	82	21
5125	72	186	94	19
5126	73	91	90	21
5127	74	118	90	19
5128	77	81	103	21
5129	78	97	77	19
5130	79	70	90	20
5131	81	58	152	19
5132	83	132	85	22
5133	84	78	85	23
5134	86	70	88	19
5135	91	102	90	20

Cons. No.	Sample No.	Cu	Zn	Ni
5136	I - 92	97	82	26
5137	94	149	96	25
5138	97	98	84	43
5139	101	116	80	20
5140	102	116	90	19
5141	105	129	81	20
5142	106	124	83	19
5143	108	128	98	19
5144	109	79	90	23
5145	111	143	78	23
5146	113	97	99	18
5147	115	60	65	19
5148	117	33	76	14
5149	119	70	108	19
5150	121	76	65	19
5151	129	59	72	22
5152	130	63	63	19
5153	133	62	95	17
5154	134	79	95	19
5155	135	50	78	17
5156	136	87	95	26
5157	137	35	79	16
5158	138	50	65	16
5159	141	69	90	25
5160	142	70	56	14
5161	144	101	74	17
5162	150	140	79	20
5163	153	19	111	11
5164	156	74	72	18
5165	160	70	65	20
5166	163	66	52	18
5167	165	47	64	13
5168	167	60	61	13
5169	172	43	128	16
5170	201	91	87	27
5171	213	78	70	16
5172	219	70	87	20
5173	224	66	111	16

(D) Soil

Cons. No.	Sample No.	Cu	Zn	Ni
5174	A - 1	41	56	98
5175	48	77	67	22
5176	49	52	57	20
5177	50	61	46	21
5178	52	61	67	17
5179	63	59	59	22
5180	65	56	70	20

Cons. No.	Sample No.	Cu	Zn	Ni
5181	A - 69	78	66	22
5182	71	64	64	18
5183	75	56	65	21
5184	76	43	64	39
5185	78	56	63	39
5186	81	62	66	15
5187	84	51	59	20
5188	87	47	64	28
5189	93	45	63	25
5190	95	40	57	29

Cons. No.	Sample No.	Cu	Zn	Ni
5191	A - 97	48	60	27
5192	98	30	49	27
5193	102	62	65	30
5194	104	30	51	31
5195	105	61	60	16
5196	107	52	57	68
5197	109	38	47	10
5198	111	25	54	15
5199	112	45	60	86
5200	113	53	51	22

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
5201	A - 116	24	33	1,345
5202	119	43	49	226
5203	120	19	28	615
5204	122	13	32	1,377
5205	125	18	35	539
5206	128	8	25	1,194
5207	130	11	28	1,310
5208	160	25	34	36
5209	177	63	38	38
5210	181	36	33	103
5211	a - 7	155	27	17
5212	31	48	60	27
5213	32	50	65	24
5214	B - 5	67	65	99
5215	11	80	66	106
5216	12	69	62	106
5217	16	100	74	113
5218	17	77	63	97
5219	20	61	65	92
5220	31	74	67	93
5221	38	67	61	96
5222	167	118	80	95
5223	C - 10	59	42	1,016
5224	11	41	42	782
5225	17	69	67	231
5226	36	137	54	160
5227	38	63	71	47
5228	40	80	52	419
5229	43	110	65	379
5230	48	133	76	47
5231	51	109	84	117
5232	56	81	63	203
5233	97	150	106	138
5234	99	233	154	76
5235	104	77	66	1,181
5236	106	16	23	1,363
5237	107	29	38	1,506
5238	133	62	54	978
5239	D - 1	107	80	267
5240	2	65	66	202
5241	3	60	63	187
5242	4	76	69	253
5243	5	63	62	203
5244	6	80	70	195
5245	7	55	70	228
5246	D - 8	85	79	64
5247	9	64	52	34
5248	10	78	64	43
5249	11	87	80	76
5250	12	59	47	558
5251	13	76	53	27
5252	14	146	77	42
5253	15	39	31	12
5254	16	85	51	65
5255	17	113	98	127

Cons. No.	Sample No.	Cu	Zn	Ni
5256	D - 18	156	80	38
5257	176	83	64	29
5258	183	146	67	53
5259	191	83	77	51
5260	E - 1	78	58	364
5261	3	76	64	61
5262	4	70	60	55
5263	7	106	70	37
5264	8	103	80	68
5265	9	96	64	62
5266	10	95	70	73
5267	12	73	69	198
5268	13	73	72	71
5269	14	111	82	55
5270	15	66	73	325
5271	18	87	70	51
5272	19	76	62	67
5273	20	83	72	69
5274	21	91	63	30
5275	22	75	64	45
5276	23	84	66	67
5277	25	95	67	58
5278	26	118	79	60
5279	27	76	66	69
5280	28	78	65	64
5281	31A	95	70	49
5282	31B	83	72	143
5283	32	83	67	46
5284	33A	76	56	48
5285	33B	102	70	46
5286	35	85	68	43
5287	36	98	71	46
5288	37	81	96	56
5289	38	152	65	33
5290	39	109	66	45
5291	40	103	72	51
5292	41	80	63	60
5293	43	78	64	52
5294	45	94	69	57
5295	48	107	65	29
5296	50	114	81	50
5297	51	84	66	60
5298	52	124	78	59
5299	53	107	71	56
5300	54	79	57	34
5301	55	99	73	47
5302	56	103	79	24
5303	59	93	62	36
5304	63	89	76	34
5305	64	90	62	50
5306	65	130	68	39
5307	67A	75	60	39
5308	67B	80	50	36
5309	69	61	53	24
5310	70A	100	66	39

Cons. No.	Sample No.	Cu	Zn	Ni
5311	E - 70B	90	56	40
5312	72	82	56	57
5313	74	80	73	49
5314	76	89	70	82
5315	78	102	65	51
5316	79	114	68	36
5317	81	90	69	45
5318	82	77	66	28
5319	83	94	69	51
5320	84	92	67	37
5321	86	92	66	37
5322	88	102	70	42
5323	90A	94	73	55
5324	90B	79	55	30
5325	92A	100	54	46
5326	92B	98	64	36
5327	94	96	62	41
5328	96	81	64	36
5329	98	99	73	42
5330	99	74	60	43
5331	101	73	59	31
5332	102	86	63	28
5333	106	88	60	49
5334	110	115	55	24
5335	112	72	54	25
5336	115	87	56	35
5337	116	73	62	28
5338	118	88	72	44
5339	122	75	64	25
5340	123	98	67	33
5341	124	46	49	468
5342	126	42	56	629
5343	127	42	64	165
5344	128	58	47	433
5345	129	61	53	462
5346	131	97	75	181
5347	132	62	53	433
5348	133	75	59	398
5349	137	61	57	407
5350	139	61	53	432
5351	141	57	51	443
5352	143	73	56	472
5353	148	61	61	494
5354	149	56	53	314
5355	152	59	51	407
5356	153	52	56	395
5357	154	50	49	1,295
5358	158	54	38	1,083
5359	159	55	54	443
5360	161	39	45	377
5361	162	40	48	384
5362	164	38	46	534
5363	165	64	59	438
5364	166	36	40	558
5365	169	34	43	514

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
5366	E - 170	30	40	858
5367	171	31	38	858
5368	172	27	34	954
5369	176	42	47	171
5370	177	15	32	1,201
5371	178	50	48	575
5372	195	34	50	601
5373	196	40	59	120
5374	197	46	53	64
5375	198	42	57	76
5376	199	49	63	184
5377	202	35	61	106
5378	203	39	62	414
5379	206	41	57	90
5380	207	87	70	43
5381	e - 1	83	47	643
5382	2	68	64	511
5383	4	50	49	621
5384	5	45	48	621
5385	6	32	39	617
5386	7	57	50	631
5387	8	56	53	723
5388	10	38	55	534
5389	11	37	42	607
5390	13	38	41	566
5391	14	31	43	562
5392	16	43	44	642
5393	17	34	44	549
5394	18	52	54	472
5395	20	43	46	516
5396	21	57	51	113
5397	22	34	39	471
5398	23	69	53	69
5399	24	64	47	99
5400	25	73	61	126
5401	26	42	61	68
5402	27	61	64	81
5403	28	47	53	105
5404	29	99	55	83
5405	30	72	72	53
5406	31	65	64	68
5407	32	53	57	69
5408	33	76	62	52
5409	34A	59	67	875
5410	34B	24	57	596
5411	35	37	50	987
5412	36	46	66	488
5413	37	23	58	1,133
5414	38	109	62	61
5415	39	76	66	157
5416	40	65	75	199
5417	41	69	76	225
5418	42	73	71	176
5419	43	68	69	340
5420	44	76	66	597

Cons. No.	Sample No.	Cu	Zn	Ni
5421	e - 45	62	71	155
5422	46	47	58	174
5423	47	42	59	164
5424	48	54	63	252
5425	50	41	51	138
5426	52	42	62	147
5427	53	38	51	130
5428	54	52	60	195
5429	56	50	63	96
5430	59	56	64	104
5431	61	69	66	121
5432	63	50	65	69
5433	65	50	67	120
5434	F - 33	69	65	32
5435	98	32	28	9
5436	102	112	40	16
5437	103	132	63	17
5438	G - 1	36	83	13
5439	4	153	76	17
5440	5	126	75	16
5441	6	40	87	16
5442	7	26	42	10
5443	9	41	61	15
5444	10	46	77	16
5445	11	353	86	24
5446	12	74	101	21
5447	13	50	65	15
5448	14	115	103	22
5449	15	53	82	19
5450	16	54	84	16
5451	17	57	79	17
5452	18	35	86	13
5453	19	36	62	15
5454	20	48	46	13
5455	21	57	85	21
5456	22	47	82	13
5457	23	54	88	17
5458	25A	29	118	13
5459	25B	67	41	17
5460	26	104	84	64
5461	27	108	85	22
5462	29A	73	51	24
5463	29B	103	93	28
5464	39	60	48	14
5465	40	30	58	12
5466	41	50	73	16
5467	42	38	54	15
5468	43	92	51	17
5469	44	88	89	22
5470	45	75	82	19
5471	46	67	76	19
5472	47	101	100	25
5473	48	110	71	19
5474	49	40	58	10
5475	71	78	67	18

Cons. No.	Sample No.	Cu	Zn	Ni
5476	G - 72	55	149	22
5477	73	62	81	20
5478	77	17	16	19
5479	82	65	49	26
5480	93	52	52	20
5481	96	69	78	31
5482	102	74	66	19
5483	131	71	66	16
5484	132	65	109	12
5485	133	55	91	13
5486	134	41	62	9
5487	135	62	74	11
5488	136	55	70	12
5489	137	26	50	12
5490	138	64	65	10
5491	139	67	109	13
5492	140	71	82	110
5493	141	37	65	12
5494	142	121	72	12
5495	143	110	65	15
5496	144	51	80	12
5497	145	67	78	12
5498	146	59	68	10
5499	146	38	101	12
5500	148	48	76	11
5501	149	64	78	17
5502	150	51	54	13
5503	151	38	52	12
5504	152	46	51	11
5505	153	9	15	6
5506	154	41	52	12
5507	155	24	35	10
5508	156	43	49	13
5509	157	51	41	13
5510	158	41	128	19
5511	159	46	69	16
5512	160	41	67	14
5513	161	20	29	9
5514	162	47	52	12
5515	163	43	68	14
5516	164	37	67	14
5517	165	47	59	16
5518	166	52	49	12
5519	167	43	50	12
5520	168	40	53	12
5521	169	38	54	13
5522	170	33	58	14
5523	171	59	72	14
5524	172	20	26	8
5525	173	33	78	12
5526	174	37	61	11
5527	175	32	59	12
5528	176	47	64	12
5529	177	52	58	12
5530	178	47	60	18

(ppm)

Cons. No.	Sample No.	Cu	Zn	Ni
5531	G - 179	55	141	22
5532	180	42	62	16
5533	181	88	95	19
5534	182	64	66	14
5535	183	60	39	13
5536	184	80	73	15
5537	185	72	99	21
5538	186	78	120	18
5539	187	60	42	11
5540	188	64	75	17
5541	189	62	74	17
5542	190	82	79	15
5543	191	70	94	18
5544	193	76	76	15
5545	194	52	102	21
5546	195	49	90	14
5547	196	51	68	19
5548	197	50	83	18
5549	198	52	71	17
5550	199	52	77	18
5551	200	54	82	22
5552	201	59	76	16
5553	202	40	97	21
5554	203	54	111	17
5555	204	52	78	21
5556	205	52	82	17
5557	206	56	356	31
5558	207	58	128	23
5559	208	42	78	18
5560	209	52	331	28
5561	210	53	102	20
5562	211	67	105	18
5563	212	29	76	17
5564	213	40	201	24
5565	214	45	73	19
5566	215	42	193	25
5567	216	38	85	17
5568	217	58	330	30
5569	218	45	96	19
5570	219	32	69	16
5571	220	54	73	20
5572	221	36	239	18
5573	222	43	78	25
5574	223	52	64	19
5575	224	42	70	11
5576	225	28	73	14
5577	226	52	226	21
5578	227	65	109	25
5579	228	33	92	17
5580	229	58	102	20
5581	230	23	61	13
5582	231	50	145	16
5583	232	13	58	11
5584	233	29	94	16
5585	234	7	39	12

Cons. No.	Sample No.	Cu	Zn	Ni
5586	G - 235	29	60	12
5587	236	33	108	10
5588	237	40	203	17
5589	238	38	65	13
5590	239	29	115	14
5591	240	33	59	11
5592	241	29	165	15
5593	242	27	64	12
5594	244	21	48	16
5595	245	17	47	10
5596	246	18	57	15
5597	247	21	97	29
5598	248	21	71	16
5599	249	25	62	18
5600	250	21	52	17
5601	251	38	81	15
5602	g - 6	61	64	17
5603	8	54	105	17
5604	20	26	59	13
5605	23	33	82	13
5606	26	80	82	19
5607	29	213	112	22
5608	39	42	72	13
5609	40	72	64	17
5610	41	39	51	17
5611	45	33	135	14
5612	47	54	85	16
5613	48	104	84	24
5614	H - 1	81	34	10
5615	2	46	39	8
5616	3	58	39	17
5617	4	84	39	13
5618	5	91	46	13
5619	6	41	40	14
5620	8	71	39	18
5621	9	72	51	12
5622	11	90	43	12
5623	12	49	38	15
5624	13	58	31	16
5625	14	52	34	10
5626	16	92	25	10
5627	17	70	31	10
5628	19	45	31	8
5629	20	49	26	14
5630	22	57	30	19
5631	24	87	40	10
5632	26	68	34	19
5633	27	78	37	8
5634	28	68	47	12
5635	29	82	28	10
5636	30	72	37	10
5637	32	68	43	14
5638	34	82	30	10
5639	36	46	28	8
5640	37	60	33	14

Cons. No.	Sample No.	Cu	Zn	Ni
5641	H - 39	71	31	8
5642	41	50	31	10
5643	43	142	55	16
5644	44	80	38	8
5645	45	105	53	8
5646	46	50	33	16
5647	47	42	44	8
5648	48	73	52	8
5649	49	62	40	8
5650	50	50	42	10
5651	52	44	72	8
5652	54	36	42	11
5653	56	52	38	8
5654	58	33	33	11
5655	61	45	36	12
5656	66	51	32	11
5657	70	88	45	11
5658	72	44	42	10
5659	74	63	35	10
5660	76	74	44	13
5661	77	72	37	8
5662	81	79	65	11
5663	86	90	63	12
5664	114	80	68	15
5665	115	82	63	11
5666	119	65	65	11
5667	120	52	55	7
5668	122	95	67	11
5669	123	58	62	12
5670	124	103	68	8
5671	126	61	79	11
5672	128	64	88	10
5673	133	52	65	11
5674	134	50	67	14
5675	135	38	67	11
5676	140	79	73	7
5677	142	64	58	12
5678	245	64	80	10
5679	248	36	38	8
5680	249	78	69	9
5681	250	70	55	10
5682	259	108	39	9
5683	h - 3	37	24	11
5784	9	38	41	18
5785	13	37	48	9
5786	19	33	43	10
5687	25	59	43	8
5688	85	34	39	10

Table 7. List of rock samples

Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished section	X-ray analysis	Chemical analysis	Remarks
A - 1	Pipisan Creek	Cretaceous	Andesitic tuff		○				
2	ditto	ditto	Andesitic fine tuff		○				
4	ditto	Cretaceous	Andesitic tuff		○				
5	ditto	ditto	Tuffaceous sandstone						
6	ditto	ditto	Tuffaceous sandstone		○				
7	ditto	Intrusives	Serpentinized peridotite						
8	Simong River	Cretaceous	Black shale						
9	ditto	ditto	Andesitic tuff						
10	ditto	ditto	Andesitic tuff		○				
11	ditto	ditto	Andesitic lapilli tuff						
12	ditto	ditto	Acidic tuff		○				
13	ditto	ditto	Andesitic tuff		○				
14	ditto	ditto	Shale	○					
15	ditto	ditto	Coarse grained sandstone						
16	ditto	ditto	Glassy andesite		○				
18	Naunum R.	Intrusives	Hornblende gabbro		○				
19A	ditto	ditto	Dolerite		○	○		○	
19B	ditto	Cretaceous	Sandstone		○		○	○	
20	ditto	Saug F ?	Mudstone						No fossil
21	Banacao R.	Intrusives	Sheared peridotite		○		○		
22	ditto	Cretaceous	Siliceous shale		○				
23	Silae	ditto	Andesite						

○ ..... Items chosen as the subject of the study.
Presented forward the teslimony of every item except X-ray and chemical analyses

Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished section	X-ray analysis	Chemical analysis	Remarks
A - 24	Paradise	Intrusives	Serpentinized peridotite		O				
25	Pulangi R.	Cretaceous	Andesitic crystalline tuff		O				
a - 1	Locawan R.	Cretaceous	Andesitic lapilli tuff		O		O		
2	ditto	ditto	Augite bearing hornblende andesite		O				
3	ditto	Intrusives	Hornblende bearing pyroxenite		O				
4	ditto	Cretaceous	Hornblende andesite		O				
5	ditto	ditto	Sandstone						
AJ - 1	Silae	Cretaceous	Porphyritic pyroxene andesite		O				
3	ditto	ditto	Basalt		O				
B - 1	Maguimon R.	Kapalong F.	Siltstone						Pebble of conglomerate
3	ditto	ditto	Mudstone		O				
5	ditto	ditto	Siltstone	O					
6	ditto	ditto	ditto	O					
10	ditto	ditto	ditto	O					
11	ditto	ditto	Calcareous tuff		O				
17	Libuganon R.	Intrusives	Dolerite		O				

Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished section	X-ray analysis	Chemical analysis	Remarks
C - 27	Tigua R.	Cretaceous	Fine tuff						
28	ditto	ditto	Andesite		○				
29	ditto	Intrusives	Pyroxenite						
30	ditto	ditto	Gabbro					○	Mineralized
31	ditto	Intrusives	ditto		○				
32	ditto	ditto	ditto					○	Mineralized
33	ditto	ditto	Pyroxenite					○	ditto
34	ditto	ditto	ditto					○	ditto
35	ditto	ditto	ditto						
36	ditto	Intrusives	Biotite-hornblende clinopyroxenite		○				
37	ditto	ditto	Biotite-clinopyroxene porphyrite		○				
38	ditto	ditto	Biotite-clinopyroxene gabbro		○				
40	ditto	Cretaceous	Fine tuff				○		Mineralized
41	ditto	ditto	Tuff breccia				○		ditto
42	ditto	ditto	Propyrite						
43	Kalaguloy	ditto	Propyrite						
44	ditto	ditto	Tuff breccia						
45	ditto	ditto	Siltstone						
46	ditto	ditto	Clinopyroxene andesite		○				
47	Kawayan R.	ditto	Coarse tuff						
48	ditto	ditto	Propylitic tuff		○				
49	ditto	Intrusives	Peridotite						

Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished section	X-ray analysis	Chemical analysis	Remarks
C - 1	Taumo R.	Kapalong F.	Sandstone	O					
2	ditto	Cretaceous	Basalt						
3	ditto	ditto	Tuff						
4	ditto	ditto	Propylitic tuff		O				
6	ditto	ditto	Propylitic tuff		O				
7	ditto	ditto	Andesitic tuff						
8	ditto	ditto	Propyrite						
9	ditto	ditto	Tuff breccia						
10	ditto	ditto	Fine tuff						
11	ditto	Intrusives	Peridotite						
12	ditto	ditto	Garnet pyroxenite		O				
13	ditto	ditto	Peridotite						
14	ditto	ditto	Serpentinized peridotite		O				
16	ditto	Cretaceous ?	Impure dolomite		O				
17	ditto	ditto	Quartz vein ?						
18	ditto	Intrusives	Monzonite		O				
19	ditto	ditto	Peridotite						
20	Davao R.	Cretaceous	Propyrite						
21	ditto	ditto	Siltstone		O				
22	ditto	Intrusives	Propyrite						
23	Locawon R.	Cretaceous	Lapilli tuff						
24	ditto	ditto	Propylitic lapilli tuff		O				
25	Lanipao R.	Kapalong F.	Sandstone						
26	Matabe R.	ditto	Sandstone						

Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished section	X-ray analysis	Chemical analysis	Remarks
D - 1	Kapalong R.	Kapalong F.	Sandstone						
2	ditto	Cretaceous	Propylitic tuff		○				
3	ditto	ditto	Red shale						
4A	Umayan R.	ditto	Propylitic tuff		○				
4B	ditto	ditto	Propylitic tuff		○				
5	Simong R.	ditto	Chert		○				
6	ditto	ditto	Shale						
7	ditto	ditto	Sandstone						
8	Kapalong R.	Kapalong F.	Mudstone	○					
9	ditto	ditto	ditto	○					
10	ditto	ditto	Limestone	○					
11	ditto	ditto	Mudstone	○					
12	ditto	ditto	Limestone	○					
E - 1	Libuganon R.	ditto	Siltstone						No fossil
2	ditto	ditto	ditto	○					
4	Pulangi R.	Cretaceous	Andesitic tuff		○				
7	ditto	ditto	ditto		○				
10	ditto	ditto	ditto		○				
15	ditto	ditto	ditto		○				
17	Halapitan	Intrusives	Clinopyroxene peridotite		○	○	○	○	
20	Naunum R.	ditto	Serpentinized peridotite		○				
21	Tugop R.	Cretaceous	Andesitic tuff		○				

Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished section	X-ray analysis	Chemical analysis	Remarks
E -22	Tugop R.	Intrusives	Garnet bearing diallage pyroxenite		O				
24	Pulangi R.	Cretaceous	Andesitic crystalline tuff		O				
26	ditto	Intrusives	Gabbroic pegmatite		O				
e - 3	Halapitan	Cretaceous	Augite andesite		O				
4	ditto	ditto	Augite andesite		O				
9	ditto	Intrusives	Olivine-bearing clinopyroxene gabbro		O				
F - 1	Bunawan R.	Cretaceous	Andesite						
2	ditto	ditto	Altered rock ?						Float
3	ditto	ditto	Porphyritic andesite						
4	ditto	ditto	Andesite						
5	ditto	ditto	Andesite breccia						
6	ditto	ditto	Lapilli tuff						
7	Borboan R.	Agtuucan F.	Limestone						
8	Bunawan R.	Cretaceous	Brecciated andesite						
9	Borboan R.	Bislig F.	Tuffaceous siltstone						
12	ditto	Cretaceous	Porphyritic andesite						
14	Tangmoan R.	ditto	ditto						
15	ditto	ditto	Sandstone						
16	ditto	Bislig F.	Mudstone						
17	ditto	ditto	Andesite					O	

Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished section	X-ray analysis	Chemical analysis	Remarks
F - 18	Tangmoan R.	Bislig F.	Sandstone						
19	ditto	ditto	Pyroxene hornblende-andesite		○				
20	ditto	ditto	Siltstone						
21	ditto	ditto	Sandstone						
21'	Mahanob R.	Mahanob F.	Limestone						
22	ditto	ditto	Limestone						
23	Baganga R.	Baganga F.	Limestone						
24	ditto	ditto	Tuffaceous sandstone						
25	ditto	ditto	Tuffaceous sandstone						
26	Maganding R.	Quarternary	Dacite						
27	ditto	Intrusives	Quartz diorite						
28	ditto	ditto	Quartz diorite						
29	ditto	ditto	Quartz diorite		○				
30	ditto	ditto	Quartz-bearing dolerite		○				
31	ditto	ditto	Altered andesite					○	
32	ditto	ditto	Quartz diorite		○				
35	Boadan	Cretaceous	Andesite						
36	ditto	ditto	Coarse tuff		○				
37	ditto	ditto	Porphyrite						
38	Bantacan	ditto	Pyroxene-bearing hornblende andesite		○				

Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished section	X-ray analysis	Chemical analysis	Remarks
G -13	Taon R.	Cretaceous	Clinopyroxene basalt		○				
16	Bislig R.	Bisling F.	Limestone	○					
26	Taon R.	Intrusives	Dolerite		○				
30	ditto	ditto	Augite andesite		○				
32	ditto	Cretaceous	Augite andesite		○				
35	ditto	ditto	Augite andesite		○				
36	ditto	ditto	Altered acidic volcanic rock ?		○				
37	ditto	ditto	Black shale						
41	Bislig R:	Bislig F.	Altered andesite (Pebble in conglom-erate)		○				
44	ditto	ditto	Basaltic andesite		○				
76	Cateel R.	Bisling F.	Sandstone						
109	ditto	Cretaceous	Basaltic andesite		○				
115	ditto	ditto	Andesitic tuff breccia		○				
123	ditto	ditto	Augite andesite		○				
133	San Miguel	ditto	Altered andesite		○				
140	ditto	ditto	Altered pyroxene andesite		○				
153	Cook Cr.	Intrusives	Diorite Porphyry		○				
156	ditto	ditto	Granodiorite porphyry		○				
158	ditto	Cretaceous	Hornfels			○		○	
163	ditto	Intrusives	Quartz diorite			○		○	
178	Panusugan R.	Cretaceous	Altered tuff		○	○			

Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished section	X-ray analysis	Chemical analysis	Remarks
G -179	Panusugan R.	Cretaceous	Augite andesite		O				
187	ditto	ditto	Altered tuff		O	O		O	
190	ditto	ditto	ditto					O	
193	ditto	ditto	Altered andesite		O				
207	ditto	ditto	Basaltic andesite		O				
217	ditto	ditto	Sandstone						
236	Mambalilli	ditto	Hornblende andesite		O				
241	ditto	Cretaceous	Altered tuff breccia		O				
H - 1	San Jose	Bislig F.	Tuffaceous sandstone		O				
4	ditto	ditto	Siltstone	O					
13	ditto	ditto	Tuffaceous sandstone						
22	ditto	ditto	Sandstone	O					
30	ditto	Mangagoy F.	Limestone						
56A	Liboy Cr.	Bislig F.	Pyroxene andesite		O				No fossil
56B	ditto	ditto	Trachyte		O				
62	ditto	ditto	Pyroxene andesite		O				
85	Cateel R.	Agtuucan F.	Fossiliferous limestone		O				
112	ditto	Bislig F.	Limestone	O					
115	ditto	ditto	Tuffaceous mudstone		O				
135	ditto	Agtuucan F.	Porphyritic augite andesite		O				
136	ditto	ditto	Red chert		O				
200	Bahayan R.	Cretaceous	Amygdaloial pyroxene andesite		O				

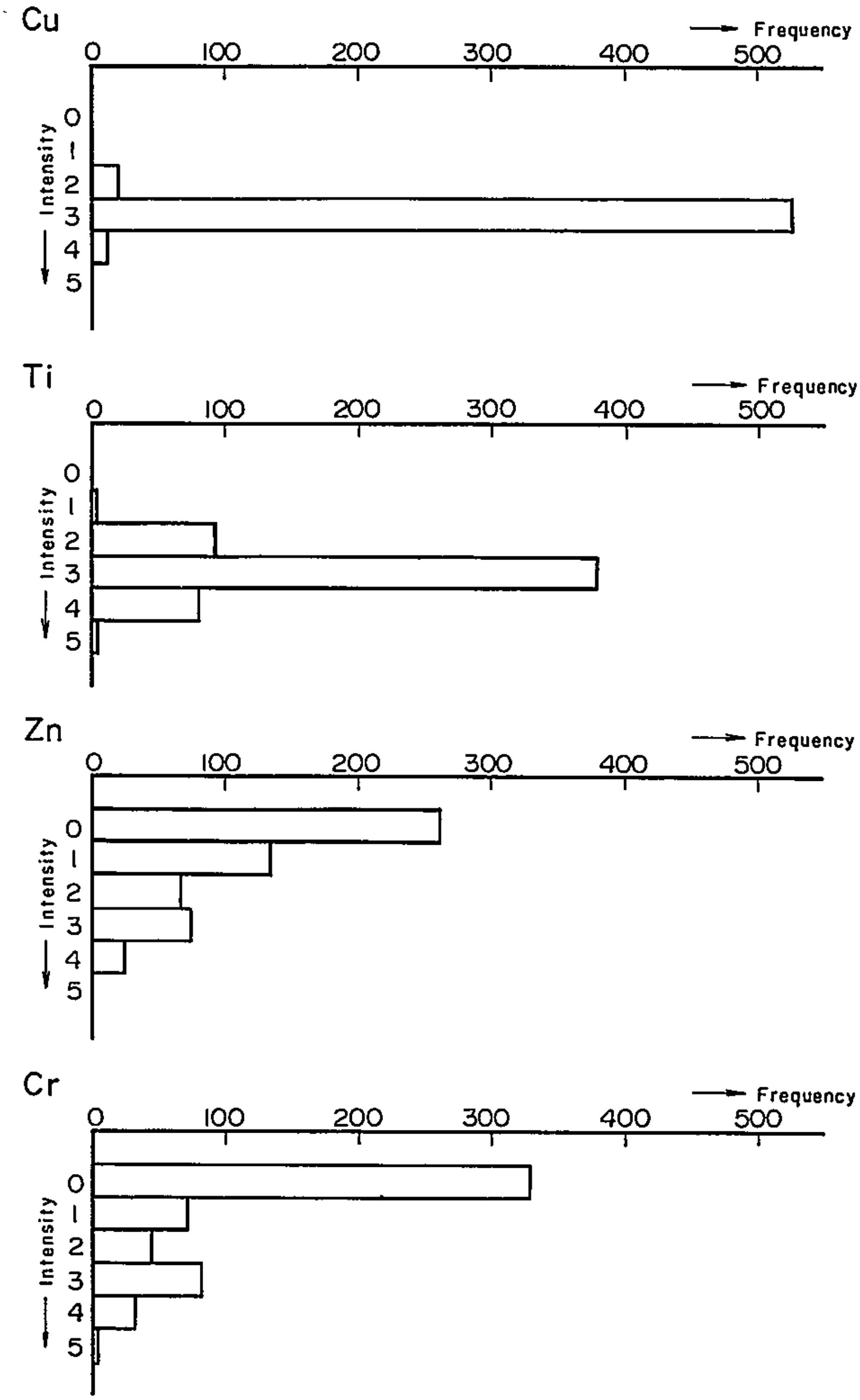
Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished Section	X-ray analysis	Chemical analysis	Remarks
H -207	Bahayan R.	Cretaceous	Augite andesite		○				
260	Pasian Cr.	Agtuucan F.	Limestone						
521	San Jose	Bislig F.	Andesite		○				
I - 3	Lingig R.	Bislig F.	Limestone						
4	ditto	ditto	Limestone						
5	ditto	ditto	Basalt		○				
7	ditto	ditto	Basalt		○				
10	ditto	Bislig F.	Augite andesite		○				
11	ditto	ditto	Altered lapilli tuff						
13	ditto	ditto	Limestone						
14	ditto	Cretaceous	Augite andesite		○				
15	ditto	ditto	Andesite						
16	Simulaw R.	ditto	Augite andesite		○				
17	ditto	ditto	Altered pyroxene andesite		○				
18	ditto	ditto	Andesitic tuff		○			○	
19	ditto	ditto	Andesitic lapilli tuff						
21	ditto	ditto	Augite basalt		○				
22	ditto	ditto	Augite basalt		○				
23	Bahayan R.	ditto	Vesicular andesite		○				
25	ditto	ditto	Porphyrite						
26	ditto	Intrusives	Basalt						
27	ditto	Cretaceous	Andesitic tuff						
28	Simulaw R.	Cretaceous	Basalt						

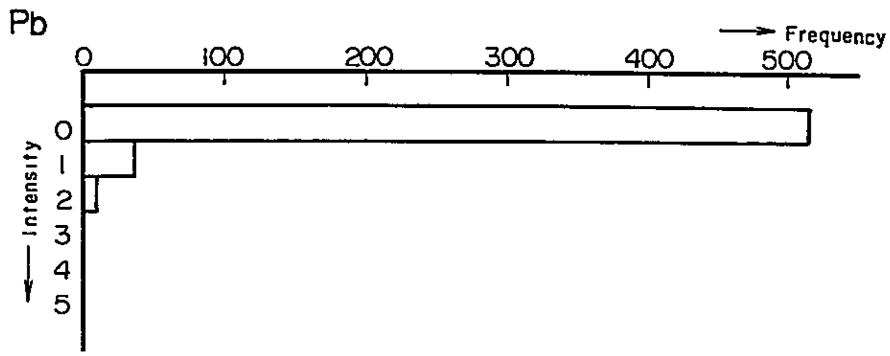
Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished section	X-ray analysis	Chemical analysis	Remarks
I - 29	Simulaw R.	Cretaceous	Augite basalt		O				
30	ditto	ditto	Lapilli tuff						
31	ditto	ditto	Altered andesite		O				
32	ditto	ditto	Basalt						
33	ditto	ditto	Basalt						
34	ditto	ditto	Tuff breccia		O				
35	ditto	ditto	Basalt						
36	ditto	ditto	Augite andesite		O				
38	ditto	ditto	Andesite						
39	ditto	ditto	Andesite						
40	ditto	ditto	Olivine augite basalt		O				
42	ditto	ditto	Basalt						
43	ditto	ditto	Augite andesite		O				
45	ditto	ditto	Limestone						Float
46	ditto	ditto	Andesite						Float
47	ditto	Agtuucan F.	Limestone						
49A	ditto	Bislig F.	Porphyritic andesite						Pebble of conglomerate
49B	ditto	ditto	Porphyritic andesite						ditto
51	ditto	Cretaceous	Basalt						Float
52	ditto	ditto	Basalt						
53A	ditto	ditto	Basalt						
53B	ditto	ditto	Basalt						
54	Wagas Cr.	ditto	Silicified andesite						
56	ditto	ditto	Basalt						

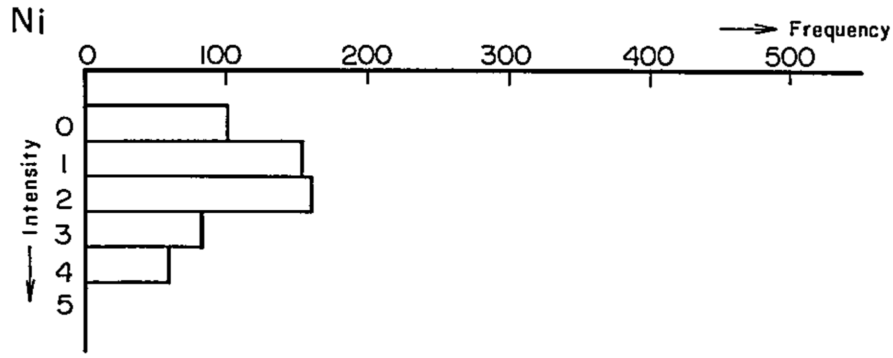
Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished section	X-ray analysis	Chemical analysis	Remarks
I - 57	Wagas Cr.	Cretaceous	Altered andesite						
58	ditto	ditto	Augite andesite		○				
61	Mamunga R.	ditto	Augite andesite		○				
62	ditto	ditto	Andesitic lapilli tuff						
63	ditto	ditto	Hornblende dacite		○				
64	ditto	ditto	Andesitic tuff breccia		○				
65	ditto	ditto	Hornblende andesite		○				
66	ditto	ditto	Andesitic lapilli tuff						
68	ditto	ditto	Porphyrite						
69	ditto	ditto	Hornblende augite andesite		○				
70	ditto	ditto	Augite andesite		○				
71	ditto	ditto	Andesitic tuff						
72	ditto	ditto	Mineralized rock ?					○	
74A	ditto	ditto	Altered hornblende andesite		○				
75	ditto	ditto	Silicified andesite					○	
77	ditto	ditto	Brecciated andesite						
77A	ditto	ditto	ditto						
78	ditto	ditto	Silicified andesite						
79	ditto	ditto	Altered hornblende andesite		○				
80	ditto	ditto	Tuff ?						
81	ditto	ditto	Augite basalt		○				
82	ditto	ditto	Pyroxene andesitic tuff breccia		○				

Sample No.	Location	Formation	Rock	Fossil	Thin section	Polished section	X-ray analysis	Chemical analysis	Remarks
I - 85	Ngan R.	Cretaceous	Tuff breccia		○				
86	ditto	ditto	Andesite						
87	ditto	ditto	Augite andesite		○				
88	ditto	ditto	Augite andesite		○				
89	ditto	ditto	Limestone						
90A	ditto	ditto	Hematitized tuff breccia					○	
90B	ditto	ditto	Brecciated andesite						
91	ditto	ditto	Crystalline tuff		○				
92	ditto	ditto	Limestone						
93	ditto	ditto	Altered andesite		○				
EB - 4	Mombalilli	Intrusives	Hornblende quartz diorite		○				
5	ditto	ditto	Quartz diorite porphyry		○				
6	ditto	Cretaceous	Hornblende dacite		○				
7	ditto	Intrusives	Hornblende quartz diorite		○				
8	ditto	Agtuucan F.	Fossiliferous limestone	○	○				
9	Manat	Intrusives	Biotite quartz diorite		○				
10	Agusan R.	ditto	Granodiorite porphyry		○				
11	ditto	ditto	Hornblende quartz diorite		○				

Fig. 1. Histogram of qualitative emission spectrochemical analysis




Pb
Frequency
0
100
200
300
400
500
Intensity
0
1
2
3
4
5


Ni
Frequency
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100
200
300
400
500
Intensity
0
1
2
3
4
5

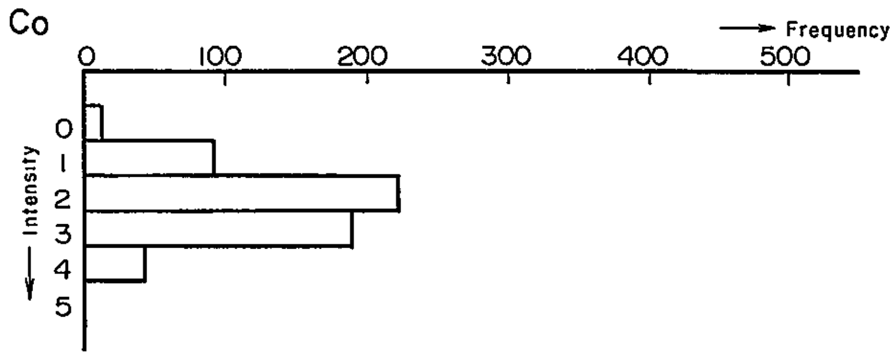
Co
Frequency
0
100
200
300
400
500
Intensity
0
1
2
3
4
5

Fig. 2. Cumulative frequency distribution of Cu, Zn and Ni

Fig. 2-1 (A) Cumulative frequency distribution of Cu Zn and Ni in the Eastern Cretaceous area

N = 780 (data on -80 ~ +100-mesh fraction)

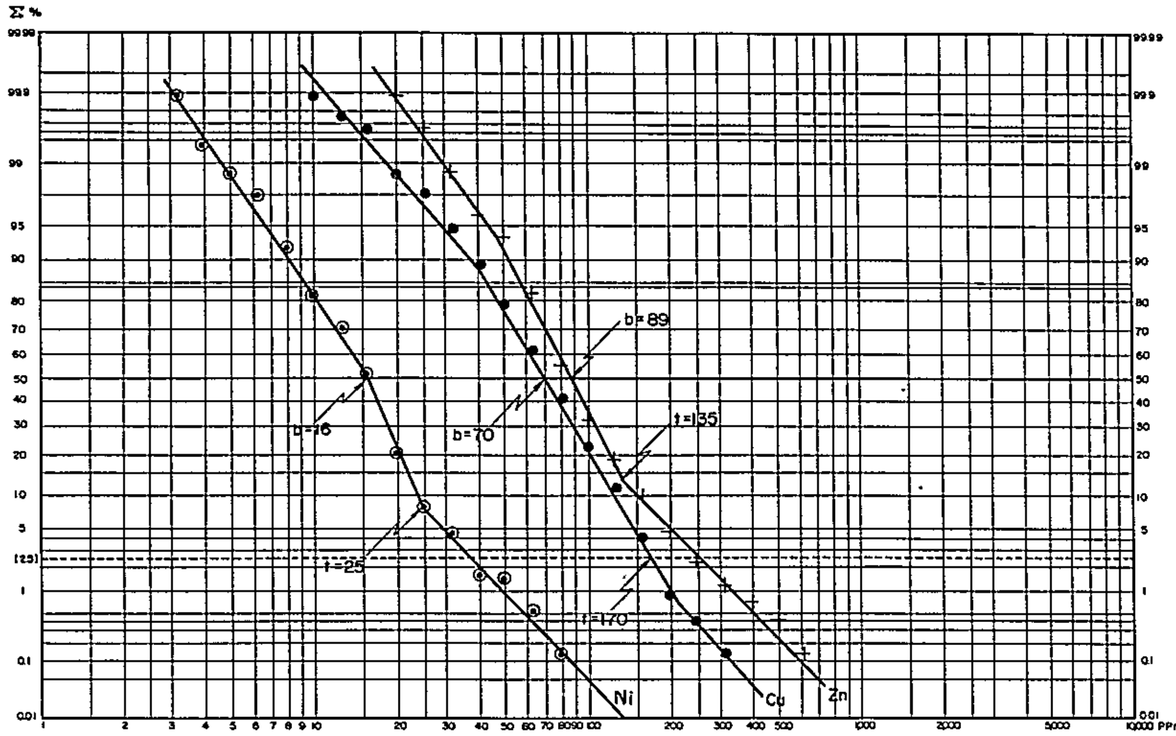

Fig. 2-1 (B) Cumulative frequency distribution of Cu Zn and Ni in the Eastern Cretaceous area

N = 757 (data on -100 ~ +200-mesh fraction)

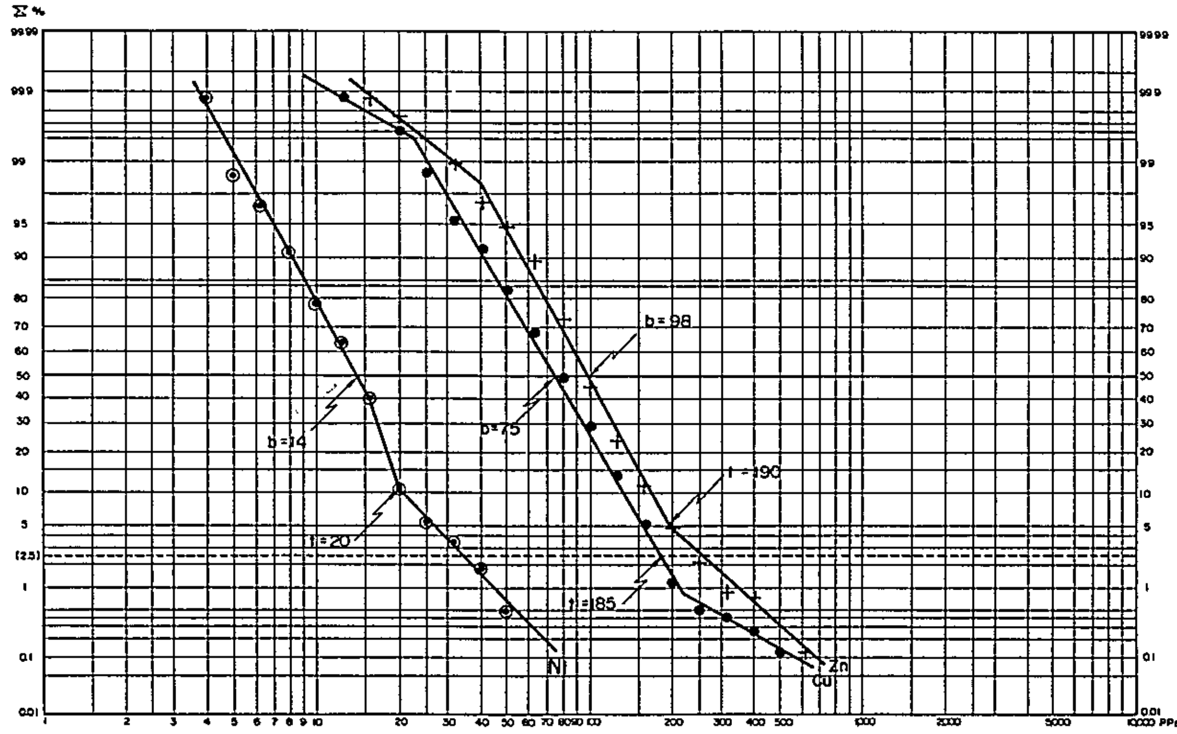

Fig. 2-2 (A) Cumulative frequency distribution of Cu Zn and Ni in the Eastern Tertiary area

N = 434 (data on -80 ~ +100-mesh fraction)

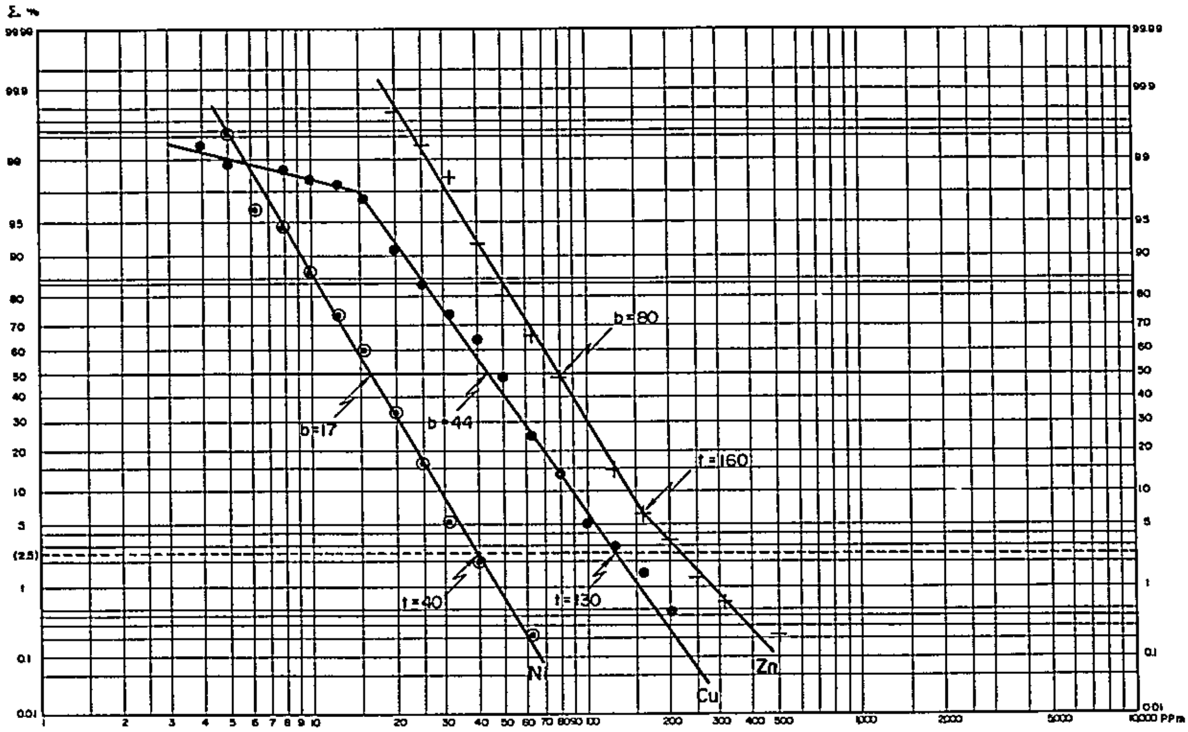

Fig. 2-2 (B) Cumulative frequency distribution of Cu Zn and Ni in the Eastern Tertiary area

N = 433 (data on -100 ~ +200-mesh fraction)

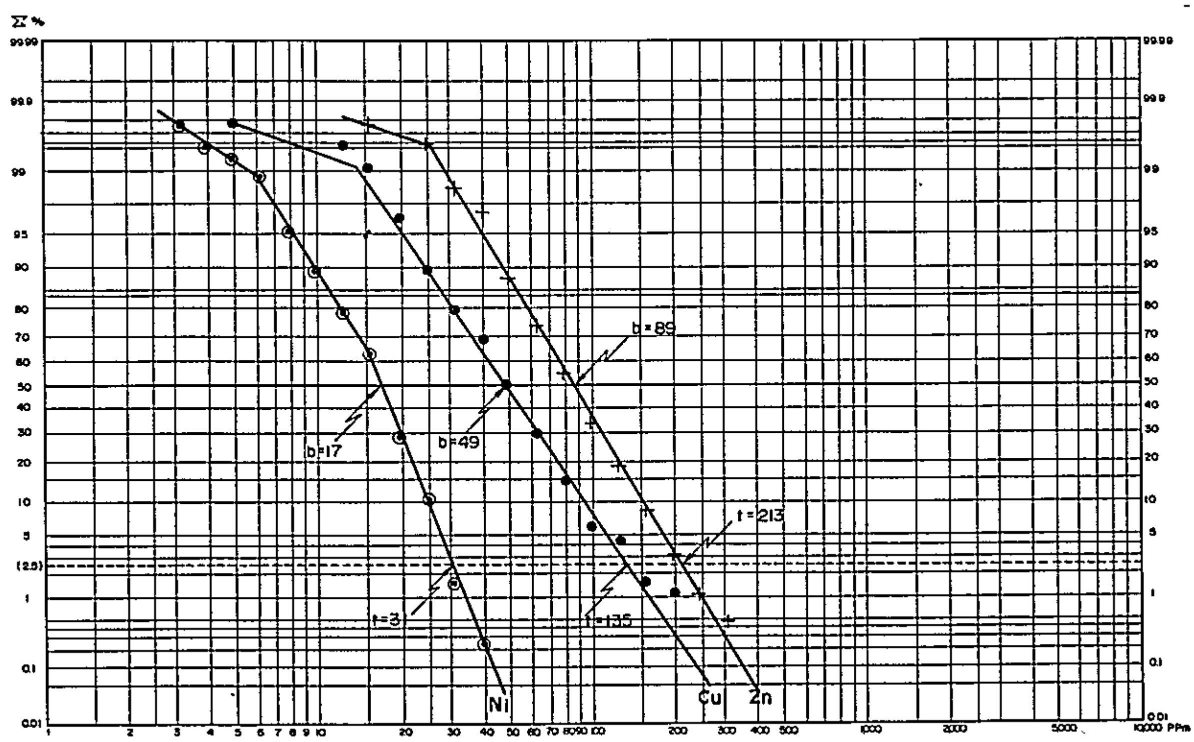

Fig. 2-3 (A) Cumulative frequency distribution of Cu Zn and Ni in the Western Cretaceous area

N = 804 (data on -80 ~ +100-mesh fraction)

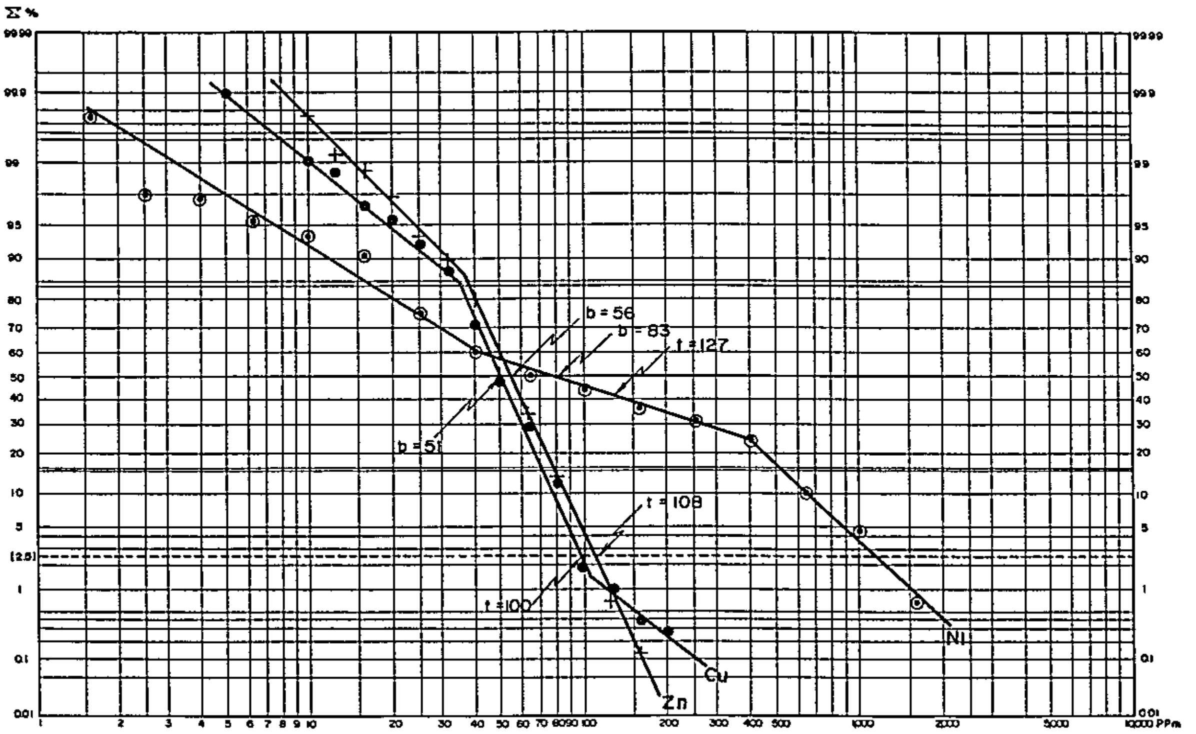

Fig. 2-3 (B) Cumulative frequency distribution of Cu Zn and Ni in the Western Cretaceous area

N = 803 (data on -100 ~ +200-mesh fraction)

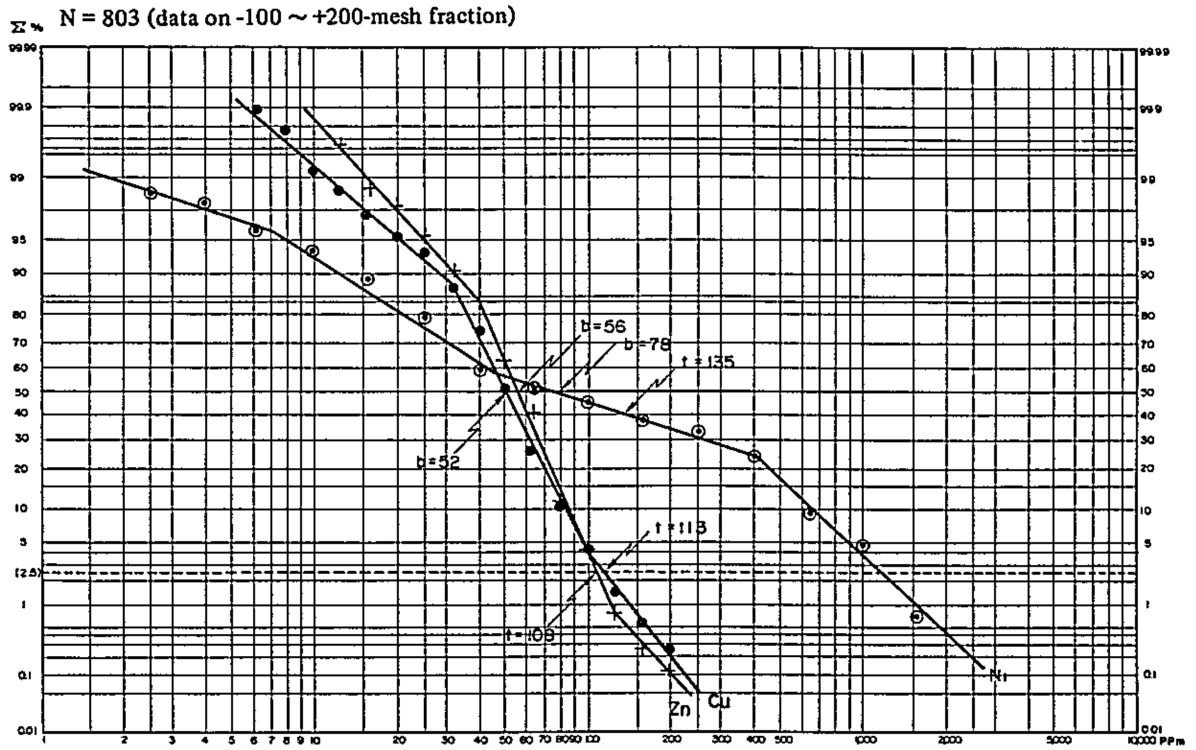

Fig. 2-4 (A) Cumulative frequency distribution of Cu Zn and Ni in the Western Tertiary area

N = 482 (data on -80 ~ +100-mesh fraction)

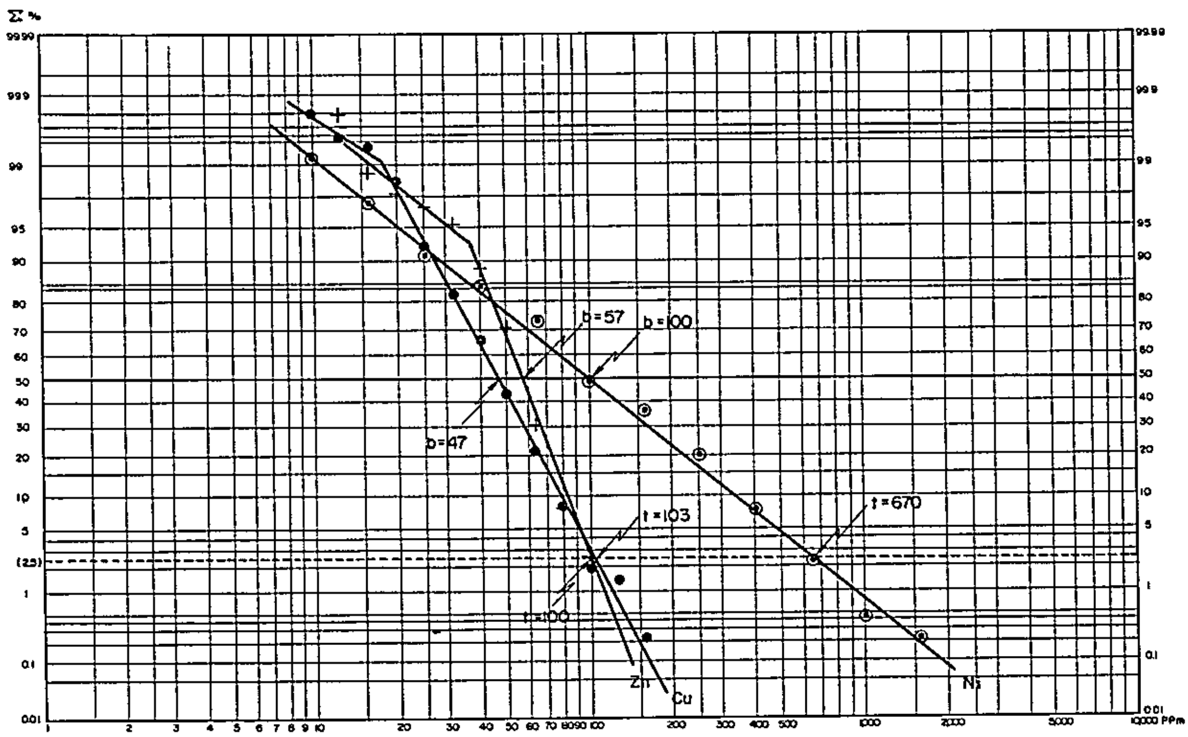

Fig. 2-4 (B) Cumulative frequency distribution of Cu Zn and Ni in the Western Tertiary area

N = 463 (data on -100 ~ +200-mesh fraction)