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GEOLOGIC REPORT NO. 27

Geology and Mineral Deposits of The Dolomi Area, Prince of Wales Island, Alaska

By

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Juneau, Alaska
June 1967

TABLE OF CONTENTS

ILLUSTRATIONS

TABLES

GEOLOGY AND MINERAL DEPOSITS OF THE DOLOMI AREA, PRINCE OF WALES ISLAND, ALASKA

by Gordon Herreid

ABSTRACT

The map area, of nine square miles, is 22 miles southwest of Ketchikan on the east coast of Prince of Wales Island. Numerous quartz-tetrahedrite veins, valuable mainly for gold and silver, were discovered in the area between 1898 and World War I. These deposits were explored by numerous shafts, adits, and pits, most of which are now overgrown or caved. Sporadic small scale mining has been done on at least two of the deposits between 1898 and World War II, but no production figures are available.

Most of the map area is underlain by schist-phyllite and marble of the Wales group of Silurian(?) age. Relatively unfoliated andesitic graywacke and slate with minor marble in the southwestern part of the area is of Devonian(?) age. The Wales group in the area is made up of marble and schist-phyllite units ranging from approximately 100 to 2,000 feet thick. Bedding of the Devonian(?) graywacke and slate is roughly parallel to the older Wales group, but the two are probably separated by a fault or unconformity.

The rocks of the Wales group show progressive metamorphism, ranging from low-grade phyllite to garnet schist in the southern part of the area. Elsewhere they are of greenschist facies except where upgraded to synkinematic garnet schist locally along schist marble contacts.

Widely scattered post-kinematic mafic dikes are the only igneous rocks in the area.

A dome at least three miles long is present in the Wales group rocks, centered on Paul Lake. This dome is cut by an east-west fault of small (?) displacement at the Valparaiso mine and by a major north-south fault system which extends through Dolomi Bay.

Post-metamorphic dolomitization of the marble has taken place in several areas of up to a few hundred feet in extent and locally along faults in the Dolomi Bay fault system. Banded quartzite (jasperoid) has formed by silicification of marble along some contacts and fault zones, and is locally gradational with dolomitized marble. The jasperoid is barren of sulfides, but is commonly cut by fissure quartz veins. The veins locally carry tetrahedrite and have values in gold, silver, and copper.

Seventy-nine stream sediment samples were taken throughout the area. These show a sparse scattering of moderate local copper, lead, zinc, geochemical anomalies along the fault zones which cut the Paul Lake dome.

The fault zones, with their associated dolomitization, silicification, and mineralized quartz veins, extend northward beyond the map area. The greater than average incidence of ore mineralization along these zones indicates the possibility of finding undiscovered deposits north of the map area.

INTRODUCTION

At present only a few uninhabited buildings in disrepair, some old workings, mostly caved or overgrown, and a few trails mark the considerable prospecting and exploration that took place between 1898 and 1948 in the Dolomi area. Short generalized descriptions of the geology and development work at the prospects have been published, but no adequate geologic map exists. Areas such as this, where enough promising prospects have been found to encourage considerable private effort, provide good opportunities for further discoveries based on the relationship of the mineral deposits to a detailed geological-geochemical map.

PRESENT INVESTIGATION

The field work for this report was done from May 20 to June 5, 1966. Traverses were made on foot overland and by small boat along the sea-shore and on Paul Lake. Considerable time was spent traversing the creeks and interstream areas between Paul Lake and salt water. Geochemical stream sediment samples were taken throughout the mapped area, mainly by Reger, who also did a considerable amount of geologic mapping north and south of Paul Lake.

PREVIOUS INVESTIGATIONS

The earliest geological work in the Dolomi area was that of Brooks (1902). He briefly described the geology of many prospects north of Dolomi and assigned the bedrock of the district to his Wales series (undifferentiated argillite, white limestone, and greenstone) of lower Paleozoic(?) age.

The Wright brothers visited the district at least once. They reported briefly on mining developments (1905, 1906, 1907, and 1908) and in 1908 published a major regional report which included a section on the geology and mining in the Dolomi district and a small scale geologic map.

In 1913 the district was visited by P. S. Smith who made a brief report on the gold prospects (1914). Chapin (1916) wrote a brief report on mining developments as a result of a visit to the district in 1915. In the monumental Bulletin 800, Geology and Mineral Deposits of Southeastern Alaska, Buddington and Chapin (1929) give a brief summary of the ore occurrences at Dolomi and show a map of the geology of the district in greater detail than previously. The most recent publication is a compilation of early reports and photogeology by Condon (1961). These reports indicate the structure of the rocks in only the most general fashion.

GEOGRAPHY

The map area covers nine square miles mostly north of Port Johnson on the southeastern coast of Prince of Wales Island, 22 miles southwest of Ketchikan. The area can be reached from Ketchikan by float plane or, in fair weather, by small boat. A good trail leads from Dolomi to Paul Lake. The old cabin at Dolomi is ruinous but usable, and one of the buildings at the Valparaiso mine on Paul Lake is habitable. There are no inhabitants in the area. The rain fall averages approximately 160 inches a year (Wahrhaftig, 1965) and supports a luxuriant growth of large spruce and moss. In most areas, brush does not seriously impede walking. Deer and black bear are present, but not abundant. No snow was present, even on the high hills, during the time field work was done.

Late Wisconsin glaciation of the area has resulted in over-steepened valley walls, lakes, and scoured-out lineaments which mark some of the faults. A karst topography has been developed in the marble areas, both on hillsides and in lowlands. Solution pits are up to 200 feet across and 50 feet deep, but generally only a few 10's of feet in diameter. Low-lying areas underlain by phyllite tend to be poorly drained muskeg with smaller timber than adjacent areas underlain by marble. In some areas this is clearly visible on the air photos. On better drained slopes, there is no clear-cut relation of topography and vegetation to bedrock type visible on the photos.

GEOLOGY

Principal features

The map area is mainly underlain by Silurian(?) marble and schist-phyllite (Wales group). The Wales group is present in an extensive area which rims the north and west sides of a large tract of younger (Devonian?) basic volcanic and clastic rocks (Condon, 1961, plate 1). These Devonian(?) rocks extend into the map area only along the south shore of Port Johnson, near its entrance. The argillaceous rocks of the Wales group rocks vary from phyllite to garnet schist, and the Devonian(?) graywackes and siltstones are slightly metamorphosed so that the Wales and the Devonian(?) rocks cannot be clearly differentiated on the basis of metamorphic grade. Both groups of rock probably predate the period of regional metamorphism.

The only intrusive rocks in the map area are post-metamorphic basic dikes which cut all rock types.

The Wales rocks have been deformed into an elongate structural dome at least three miles long in the Paul Lake area (figure 1). This dome is cut by at least three fault zones. The north-trending Dolomi Bay fault system is the most important of these. It is dominantly a wrench fault with a few hundred feet of strike-slip movement. This faulting controls minor dolomitization and abundant silicification of the marble and widespread emplacement of mineralized quartz veins.

Rock types

Early Paleozoic marble and schist (Wales group)

These rocks consist of alternating thick units of thin-banded light to light medium gray marble and chloritic schist. In the map area (figure 1) these rocks crop out at the head of Dolomi Bay, along Clarence Strait north of Port Johnson and around Paul Lake. Most of the mines and prospects are located in one of the marble horizons. These rocks were given the name Wales series by Brooks (1902, p. 41-42). His map shows the present map area as entirely underlain by this series. Buddington and Chapin (1929) and Condon (1961) show a more restricted Wales group which includes only the rocks north from the head of Dolomi Bay. An area five miles to the north and 25 miles to the west of Paul Lake is probably underlain by this group of rocks (Condon, 1961, plate 1). The detailed mapping of the present investigation indicates that the Wales group extends to the south shore of Port Johnson (see following).

Marble The marble is thin banded with alternating light to light gray and medium gray bands varying from 1/8 inch to 1 foot which parallel the bedding, the light bands predominating. Grain size is generally the same in both light and dark bands and ranges from 1/2 to 2 mm. Along the shore the dark bands stand in relief above the light gray bands. In most outcrops the bedding is planar.

In weathered exposures along the shore the dark bands tend to stand out as thin, dark brownish gray, hackly surfaced bands in a background of pitted very light gray marble. Both dark and light bands effervesce strongly with HCl. Some folding is evident but the micro-folding and boudining typical of the schists is lacking. Beds composed of thin light and dark marble bands range up to 1-2 feet thick. Scattered marble beds up to 10 feet thick (occasionally thicker) occur in the schist. The schists often have calcareous chloritic layers, but chloritic layers are rarely present in the marble, either in the isolated beds in schist or in the main horizons.

Under the microscope a typical specimen of marble is composed of twined calcite with (± 1 mm) grains set in a matrix of smaller (± 0.1 mm) grains.

Quartz veins are rare in the marble, as compared with the schist, in which they are common.

Metamorphism has resulted in rather uniform recrystallization of the marble throughout the map area. Locally, white banding parallels cross joints, and there is the appearance in some outcrops that the white bands are the result of recrystallization of original dark limestone along bedding planes. In most of the area, however, the banding has the appearance of an original feature of the rock.

No systematic differences in appearance of the marble were noted from one part of the area to another.

The thickness as indicated by the attitudes and outcrop pattern is variable, probably due in part to plastic flow during folding. The upper marble horizon appears to range from 1,300 feet thick at the head of Dolomi Bay to 200 feet on the northwest shore of Paul Lake. The lower marble horizon ranges from 200 feet on the south side of Paul Lake to 500 feet on the north side.

Schist-phyllite The Wales group is dominated by argillaceous sediments which have been metamorphosed to phyllite and schist. This is a chlorite-rich, often calcareous rock which gradationally increases in metamorphic grade from phyllite along the south shore of Port Johnson to schist further north. Widely scattered marble beds up to 10 or more feet thick are present.

Phyllite - On fresh surfaces this rock is grayish-green to dusky blue-green chlorite phyllite, fine-grained with lustrous chlorite sheen on the bumpy foliation surfaces, and no metamorphic segregation into layers. Faint discontinuous whitish calcite layers (1-2 mm) showing microfolds are present locally. On weathered surfaces along the shore, the calcite fold hinges are dissolved so as to give the rocks a pitted slag-like appearance. This is heightened by the thin black organic(?) layer which coats the rocks in many shore line exposures.

Thin banded light gray marble layers up to 10 feet thick are present in tne phyllite at about 1/2 of the field stations along Port Johnson. Quartzose phyllite is present in the cove on the south shore of Port Johnson through which the Dolomi Bay fault extends. This may be due to silicification along the fault. The pyritized zones near geochemical sample 6, figure 1 (described later) may also be related to faulting.

Under the microscope a typical-looking phyllite from the head of Port Johnson is made up of alternate layers of chlorite and calcite (4mm wide ±), both loaded with small detrital sand grains. These grains are mainly albite, for the most part untwined, but a few percent are quartz grains. The detrital grains float in a carbonate or chlorite matrix, mostly not touching one another, generally with no augen structures or flow banding. They are equant, subangular, range from 0.05 to 0.2 mm in diameter, and make up about 60% of the rock. Slight flow banding is locally visible in chlorite layers, particularly along wisps of carbonaceous material. The strongest band of carbonate in the specimen contains mainly quartz grains in contrast to the albite in adjacent chlorite bands. This rock apparently originated as a fine-grained muddy sandstone with greenstone source rocks contributing mainly albite, carbonate, and chlorite. It has undergone only very low-grade metamorphism, sufficient to recrystallize the chlorite and carbonate.

Schist - Northward from the south shore of Port Johnson the grain size of the phyllite gradually increases until the rock is more properly a chlorite schist, with megascopically visible mineral grains segregated into bands so that the foliation surfaces have a definitely micaceous appearance. Sparse quartz boudins up to a few inches long are present. This progressive increase in metamorphic grade is continued northward to the head of Dolomi Bay, where a band of garnet schist is present along the marble contact.

Schist at the east entrance to Dolomi Bay is a granular dusky yellow-green rock containing calcite-albite-quartz-chlorite-pyrite and is only rudely foliated due to the low chlorite content and lack of mica. This rock belongs to the lowest grade of the greenschist facies of regional metamorphism.

Further north in Dolomi Bay large garnets are present in the schist within a few hundred feet of the marble contact. Here garnet grade rocks have undergone perceptively more metamorphic differentiation into light and dark layers so that the overall rock is lighter colored and better banded than the lower grade schist and has easily visible mineral grains. The foliation layers are splendent with mica flakes and are lumpy, due to red garnets up to 1/2 inch across and locally prominent hornblende crystals. Megascopically visible S-shaped inclusion trains in a few of the garnet crystals indicate rotation during crystallization and in all cases the foliation swirls around the grains, indicating synkinematic growth during metamorphism. Also set in the schistose quartz-muscovite matrix of the rocks are dark greenish gray lenticular poikilitic chlorite patches containing nondirectional quartz and epidote grains. These appear to be moderately recrystallized relicts of the original phyllite. The small nondirectional, equant quartz inclusions (± 0.05 mm diameter) in these chlorite lenses and in hornblende crystals are in contrast with the somewhat coarser and more oriented trains of quartz grains in the garnet. Evidently both hornblende and garnet are replacements of poikilitic phyllite, and garnet was last to form.

The megascopic appearance of garnet schist is similar throughout the map area; a mottled light to dark green color, prominent light to dark greenish gray banding with bands (and foliation surfaces) deflected around garnets, and only sporadic presence of garnets. Large garnets of 1/4 inch or more may be encountered within a few feet of the outer edge of the garnet zone.

The metamorphic grade of the garnet schist is upper greenschist facies based on the assemblage of quartz, albite, chlorite, epidote, almandine garnet, and hornblende.

Schist horizon at Paul Lake (Sch-2) - This schist is similar to the schist along dolomi Bay, except that no marble beds were seen and black graphitic schist is present locally near the contact with the underlying marble.

Extent of Wales group It is evident from the present mapping that the marble-schist contact at the head of Dolomi Bay cannot be taken as the top of the Wales group as both Buddington and Chapin (1929, plate 1) and Condon (1961, plate 1) have shown it. There is little, if any, lithologic difference between the schist overlying this contact and the lower schist horizons around Paul Lake. They all appear to be conformable with the thick interbedded marble units, as indicated by parallel attitudes and the interbedding of thin marble beds with the schist.

Age of Wales group No new evidence for the age of the Wales group was found. The age is given as Devonian or older by Buddington and Chapin (1929) and "probably Silurian" by Brooks.

Metamorphism and alteration of the Wales group Subsequent to their deposition, these rocks underwent progressive regional metamorphism and at probably a much later date local metasomatism which dolomitized and silicified the rocks (mainly marble)along faults and contacts.

The progressive change from phyllite to low-grade greenschist to garnet schist has been described. This represents a substantial increase in temperature and intensity of pervasive deformation over a distance of 4,000 feet from the south shore of Port Johnson to the head of Dolomi Bay. Further north in the map area, the Wales group rocks are generally of lowest greenschist grade of metamorphism 1/ except where sporadic garnets mark higher grade zones along marble-schist contacts. These zones probably indicate higher temperatures which were a result of a concentration of shearing along the contacts. The presence of albite in these zones along with garnet and hornblende marks the rocks as upper greenschist facies. The lack of middle greenschist facies rocks (biotite zone) at the outer edge of the garnet zone may be due to a potassium content too low to form biotite.

1/ An exception is a specimen from near the outlet of the unnamed lake 1/2 mile north of James Lake. Here oligoclase is present in a quartz-muscovite-oligoclase-chlorite schist. A quartz muscovite schist at the northern limit of mapping on the coast has a similar composition, except that the feldspar is albite, as in the rest of the area.

Dolomite - Dolomitic marble is present locally in the upper part of the uppermost marble formation and about 1,000 feet southeast of the outlet of Paul Lake along a northerly-trending fault. On freshly broken surfaces, the dolomite looks much like marble. On weathered surfaces it is smoother than marble and tan or reddish. Marble weathers to a hackly surface, and is a very light gray. The lack of metamorphic upgrading of dolomite zones which are present within 200-300 feet of garnet zones indicates that dolomitization of marble took place after the rocks were regionally metamorphosed.

Jasperoid - banded quartzite (jasperoid) is present in many places around and east of Paul Lake. Typically it is a light gray rock composed of planar very light gray bands interbedded with medium gray bands, all from 1 to 10 mm thick. The darker bands have micaceous foliation surfaces. Near the intersection of John Creek with the creek that flows out of Paul Lake, banded jasperoid contains layers of breccia composed of angular banded quartzite clasts cemented by white quartz. West of James Lake an exposure on the rim of a sinkhole shows a gradation from banded marble to banded dolomite to banded quartzite over a distance of about six feet, with all bands similar in appearance. The rocks are folded, and quartz veins parallel to the axial planes of folds cut the quartzite. The surrounding area has karst topography and few bedrock exposures. It is evidently underlain mainly by marble with only local zones of quartzite.

Much banded quartzite is present along the marble-schist contact (M 2 - Sch 2) between James and Paul Lakes. At one exposure of planar marble in contact with quartzite beds just east of the left lateral cross fault shown in this area on the map, the contact is mainly parallel to the banding of both the quartzite and marble, but locally it extends along a joint approximately perpendicular to the bedding. The quartz is vuggy with crystal faces in the vugs.

These exposures of gradational contacts and contacts not parallel to bedding indicate a replacement origin for the quartzite. The cross-cutting quartz veins may represent fillings of shrinkage cracks in quartzite. The quartzite breccia could be a replacement of marble collapse breccia. An epigenetic replacement origin is also indicated on a larger scale by the localization of quartzite along faults and contacts. Siliceous rock of origin by replacement of carbonate rock is properly termed jasperoid (Lovering, 1962). Lovering believes silica has precipitated from cool hydrothermal solutions which concomitantly dissolved the marble. Jasperoid is common in mineralized districts, but is not restricted to them.

Devonian(?) andesitic graywacke and siltstone

This unit is only faintly foliated and is made up of andesitic graywacke and graywacke conglomerate interbedded with green andesitic siltstone. It was only seen along the southern entrance of Port Johnson, but has been mapped in Bulletin 800, plate 1, as underlying an extensive tract just south of the map area. Buddington and Chapin (Bulletin 800, plate 1) show these rocks as "DSV"-Middle Devonian sediments including graywacke, conglomerate, slate, limestone, and locally, chert with associated volcanics, including andesitic lava, breccia, and tuff.

The dominant rock type is andesitic graywacke. This rock is dusky bluish-green on freshly broken surfaces, commonly with scattered sand size grains visible in a fine-grained, slightly foliated groundmass. The graywacke is interbedded with medium bluish-green siltstone in some exposures. Elsewhere graywacke is interbedded with conglomeratic graywacke beds containing clasts of andesite up to one foot in diameter. Locally rhyolite and/or chert are present. The chloritic matrix has a slatey cleavage and a micaceous sheen on the foliation surface, but no stretching of rock fragments is visible. Graded graywacke and siltstone beds are fairly common in thicknesses ranging from an inch to more than 10 feet.

Marble clast conglomerate with a graywacke matrix and interbedded green siltstone is present in the unit on the small islands west of Inner Point.

Under the microscope, graywacke near Inner Point shows small clasts of andesite, rhyolite, chert, and albite in a nonfoliated fine-grained matrix of chlorite, carbonate, plagioclase laths, and crypto-felsic material. The rock represents a mixture of fine volcanic fragments and mud which has undergone low-grade metamorphism. Evidently a nearby source of volcanic material was present.

The exposed section from Inner Point south dips moderately to the south. The rocks are an alternation of graywacke beds up to 75 feet thick, interbedded on various scales with siltstone and conglomerate. In the vicinity of Inner Point, limy andesitic conglomerate beds grade upward to less limy, finer grained, graywacke, and to noncalcareous light greenish-gray siltstone over a width of 10 feet or less. Many of the beds tend to be similarly graded, from coarse at the base to fine at the top, indicating the section is right side up. If there are no fault complications, these exposures represent about 2,000 feet of section.

The prevalence of sand size or larger fragments, the comparative lack of marble, and the general lack of limy content, as shown by smooth weathered surfaces along the shore, differentiate these rocks from the phyllite, which lies to the west along the south shore of Port Johnson. The rapid alternation of fine and coarse-grained beds, and the grading of layers of siltstone as thin as 1-2 inches indicate a near shore marine environment of deposition.

The contact between the phyllite and the conglomerate is not exposed in the map area. The two rock types are roughly parallel in attitude. The lack of graywacke on the north side of Port Johnson indicates that the contact is most likely an unconformity or a fault.

The andesitic graywacke and siltstone of the map area has been correlated by previous workers (Buddington and Chapin, 1929) with the Middle Devonian. This can only be accepted as provisional due to the common occurrence of similar rocks of different age and the poor knowledge of the structure. No fossils have been found in these rocks in the map area and none are reported from the area immediately to the south.

Tertiary(?) dikes

All the dikes seen in the area were of mafic composition, mostly only a few feet in width. Dikes were seen at about one field station in 20 and range from fine-grained basalt to diabase with grains up to 2-3 mm long. Dips are invariably steep, 60° to 90°; and most dikes strike north-northeast. No dikes were seen in the mine openings or at prospects, but the Wrights mention dikes intruding ore deposits in the area. None of the dikes are large enough to show on the geologic map.

Under the microscope a sample taken from a medium gray, fine-grained dike located in the schist near the marble contact on Dolomi Bay is seen to be a porphyritic olivine basalt. The phenocrysts are serpentinized olivine (0.3 mm diameter) set in an intergranular matrix composed of randomly oriented plagioclase microlites, interstitial chlorite, and pyroxene, and scattered tiny magnetite(?) grains. A second sample, from a medium greenish-gray dike 35 feet wide located on the coast 400 feet northeast of geochemical sample 24, is seen to have a diabasic texture made up of saussuritized plagioclase laths (up to 2 1/2 mm long) with somewhat smaller interstitial grains of augite and chlorite. Magnetite grains (± 0.5 mm) make up about 10% of the rock.

These dikes have chill borders and sharp contacts with the surrounding phyllite, schist, and marble and were intruded after metamorphism was completed. They are tentatively correlated with Tertiary mafic dikes mapped elsewhere on Prince of Wales Island (Sainsbury, 1961).

Quaternary period

The topography has been strongly modified by glacial scouring which has locally steepened the slopes and etched out fault(?) lineaments. No glacial deposits were recognized in the area, but schist float in the low area of broken hills and sinkholes west of James Lake probably represents glacial erratics rather than bedrock float. Elsewhere float appears to mirror underlying bedrock.

Karst topography is well developed in much of the terrain underlain by marble. The marble-schist contact can be mapped in areas where outcrops are nearly lacking by the presence of small streams and subdued topography in schist areas versus lack of surface drainage and presence of sinkholes (up to 200 feet in diameter and 50 feet deep) in marble areas. The formation of caverns in marble along faults in mine working was noted in the old reports.

STRUCTURAL GEOLOGY

The structural features recognized in the district are major doming around Paul Lake, minor folds and crenulations, and faulting at Dolomi Bay and elsewhere which has controlled silicificationa dn replacement of mineralized quartz veins.

The Paul Lake dome is clearly indicated by the pattern of the schist and marble units and their outward dips. The tendency for west plunges of minor folds at the west end of the dome and east plunges at the east end (see figures 2 and 3) could be due to a single period of metamorphism and folding-doming or to two separate periods of deformation,with early formed folds and their minor structures draped over a later dome. The concentric outcrop pattern seems more indicative of a simple dome rather than domed folded beds. Detailed mapping of the marble and schist units over a wider area should indicate whether there has been one period of deformation or two.

The eastern end of the Paul Lake dome is cut by the Dolomi Bay fault system. This is a complex fault with both left lateral strike-slip movement (500 feet ±) and vertical movement (400 feet ±) which has uplifted a block of the underlying schist (Sch - 3) to the surface west of Amazon Lake (see section B-B, figure 1). The overall pattern of strike-slip movement with subsidery vertical movements seems clear, but many details of the blocks and their movements are unknown due to the poor exposures in the area.

The trace of the Valparaiso fault is visible on the air photos. Mapping along it was either not detailed enough to show offset of beds or there is very little offset.

Both the Dolomi Bay fault system and the Valparaiso fault have controlled the introduction of much silica, both along faults and in adjacent wall rock.

GEOCHEMISTRY

Geochemical stream sediment samples were taken throughout the map area to determine the reflection of mapped geologic features on the metal contents of the streams and in hopes of detecting undiscovered deposits. Samples were tested in the field using the cold extractable heavy metals method described by Hawkes (1963). Samples were later analyzed for total copper, lead, zinc, and molybdenum in the minus 80 mesh fraction by Rocky Mountain Geochemical Laboratories in Salt Lake City. Locations of the samples are shown on figure 1 and their values are listed in table 2.

Total copper, lead, and zinc contents of stream sediments have been summarized on frequency-concentration graphs (figure 10). The threshold values, above which samples are considered anomalous, have been determined from these graphs by inspection. These are copper, 70 ppm; lead, 30 ppm; and zinc, 200 ppm. No molybdenum anomalies were detected. Ten samples are moderately or fairly strongly anomalous in one or more of the metals, zinc, lead, and copper. All of these are located along either the Dolomi Bay fault, the Valparaiso fault, or the north-trending fault at the northwest corner of Paul Lake. All of these samples are from small drainages and probably represent only minor showings, but they bear out the results of early prospecting - that the mineralization is concentrated along the faults. Non-anomalous samples taken from the Josie(?) adit on Paul Lake (#69) and in the creek below the prospect at the outlet of John Lake (#46) suggest that direct geochemical prospecting for the small quartz vein deposits is not practical.

Several prospects and one sample anomalous in zinc and lead (#42) provide indications of mineralization in the karst area immediately west of James Lake. Unforturately the scarcity of streams in karst areas seriously restricts the usefulness of stream sediment sampling there. This difficulty would be present in many other lowland areas in the district underlain by marble. Float trains due to glacial smearing of outcropping ore deposits offers the possibility of fairly wide metal anomalies associated with the richer deposits. Such halos could show up as low anomalies in the occasional creeks that cross or border karst areas and could be further prospected by soil sampling.

MINERAL DEPOSITS

History of mining and exploration

Copper was first discovered at Kasaan Bay on Prince of Wales Island in the early 1870's, but little prospecting was done before the 1890's. In 1897 copper was found on Gravina Island and during the "Klondike excitement of 1897-98" a group of prospectors found their way to Port Johnson where they "learned of the discovery of gold in the vicinity through Paul Johnson, an Indian boy. The members of this party made many locations, and began some preliminary developments" (Brooks, 1902). John Bufvers (1967) states that the above mentioned Paul Johnson, in 1898 or 99 found gold-bearing quartz float on the north shore of Paul Lake when waiting with the canoe while his father hunted deer. The locality was at the Paul prospect. Charles Guzman purchased this location from Johnson and staked the nearby Valparaiso deposit. Charles Dunton, who also operated the Harris River mine at Hollis in the early days, operated the Valparaiso mine for a time. He built an arrastre, the remains of which stand near the Valparaiso adit (figure 4).

Brooks (1902) mentions that a town was present at Dolomi in 1901, and he shows 19 groups of claims around Paul, Amazon, and James Lakes, many with shafts and/or adits. Only a few new discoveries have been made since his visit.

The two most extensively developed deposits were the Golden Fleece and the Valparaiso. Both of these were connected by tram with Dolomi and had considerable exploration in the 1900's, and some later work (as late as 1945-50) at the Valparaiso. The Valparaiso mill and other buildings still stand, but in disrepair. Steel rails, fallen bridges, and pilings mark the Dolomi-Paul Lake tram. Little remains at the Golden Fleece but the old adit, the ruins of the mill on the shore of James Lake, and a connecting tram. The tram from James Lake to Dolomi is almost obliterated. At other prospects in the district, only the actual openings remain. The small settlement at Dolomi existed until at least 1920, but in 1966 there remained only a small cabin in a nearly ruinous condition, a few pilings, and the remnants of a small gasoline-powered railroad engine.

General features of mineral deposits

The ore deposits at Dolomi occur as quartz veins which are localized along or near faults, some of which are part of the major Dolomi Bay fault system. Ore minerals are sparsely disseminated in the veins, reportedly as plunging shoots. Ore minerals seen or reported are gold (free), tetrahedrite, galena, sphalerite, pyrite, and chalcopyrite. The quartz veins carry some calcite. In places, replacement of the marble country rock by silica has formed banded jasperoid (quartzite) and/or jasperoid breccia cemented by quartz. In some areas, mineralized quartz veins are in jasperoid, but elsewhere no mineralized veins or signs of mineralization were seen in jasperoid areas.

The locations of old properties are shown on sketch maps by Brooks (1902) and Wright and Wright (1908) (figure 6, this report). The U.S. Geological Survey writers give general descriptions of some of the properties based on examinations while work was in progress. This material plus brief informal reports of mainly historical interest by Alaska Territorial Department of Mines engineers J. C. Roehm (1939) and H. M. Fowler (1948), and Bufvers' historical sketch (mentioned under History of Mining) constitute the information on the deposits available to the writer.

Some of the old adits are open, but the shafts and trenches are mostly caved or filled and everything on the surface is overgrown with trees and moss. During the present investigation large scale sketch maps were made of one adit on the north side of Paul Lake and one pit (caved adit) on the east side of Amazon Lake. Information on the other deposits is from examination of mine dumps and the old reports.

Massive and disseminated pyrite-sericite zones almost barren of valuable metals are present along the south shore of Port Johnson. These deposits differ in origin from the fault controlled quartz vein deposits around Paul Lake. They are of no economic value in themselves, but may be representative of other ore-bearing pyritic deposits associated with the basic volcanics south of the map area.

Valparaiso mine

The Valparaiso mine appears to have been in fairly constant development or operation from 1898 to 1920. It was mined briefly by lessees in 1927 (T. Stevens) and in 1932 (Paul and Benolkin). In 1934-35, the property was put in shape but never operated. Again in 1945 a large sum of money was spent in readying the mine for operation, but again it was not put in production. As a result of these abortive efforts, there are several buildings and a good deal of equipment at the mine.

No production figures are available for ore shipped.

The best description of the Valparaiso mine is given by Wright and Wright (1908) based on visits in 1904 and perhaps later. The vein is several thousand feet long, four to 10 feet wide, has a N.55W. strike and 30-50° northeast dip, in general parallel to the marble wall rock, and contains moderate-grade ore with plunging highgrade shoots. "The central portion of the vein is made up of limestone breccia in a quartz matrix; and on both the foot and hanging wall sides, it is defined by veins of massive quartz. Slipping planes along which gouge is present were observed striking parallel of the vein. The ore minerals are tetrahedrite carrying free gold, chalcopyrite, and some pyrite. . .The ore shoot is confined to the foot wall and plunges 60° southeast. . . A considerable amount of this ore has been mined."

At the present time, a caved 10-15 foot square shaft inclined 45° north is located 150 feet north of the mill. A second more ruinous shaft is present 300-400 feet in N.80W. direction from the first shaft. Much of the ground between these shafts has subsided. Near the east end of this area, a stope has caved over an area of 20 x30 feet exposing the hanging wall of a fault face with N.85E. strike, 60° northwest dip, and horizontal slickensides. Two to three feet of rusty marble lies in the foot wall of the fault. Little quartz was seen. Banded marble is exposed 50 feet north of the fault. This fault makes a prominent west-northwest trending lineament on the air photo. On the ground the fault is marked by a distinct break in slope which to the west joins the fault mapped north of the Valparaiso adit (figure 4).

The adit about 600 feet west of the Valparaiso mill (figures 1 and 4) has been driven along a silicified zone at the schist-marble contact. Quartzite (jasperoid) exposed in the adit has banding and grain size similar to that of the adjacent marble and is apparently silicified marble. The quartzite is cut by fracture-filling quartz veins and locally is a breccia containing up to 75% vein quartz filling. A low north trending flat-topped ridge extends north above the adit to the poorly marked Valparaiso fault. The ridge marks the outcrop of the jasperoid zone. Silicification was evidently controlled by faulting along the schist-marble contact and was probably related in origin to the quartz vein that occupies the Valparaiso fault in some areas. No signs of sulfide mineralization were noted in and around the adit.

The veins on the Paul and Jessie claims, east of the Valparaiso, are approximately on strike with the Valparaiso vein. They are all probably along the same system of faults and may be the same vein. Exposures are few and no attempt was made to trace the vein - which was actually never seen in outcrop by the writer.

The veins exposed on the Paul and Jessie claims are similar to the Valparaiso vein and are reported to have fairly well-defined walls. The principal vein, which has been developed on both of the claims, strikes N.70°W. and dips 35° north east. It varies from three to eight feet in width and follows the general trend of the inclosing limestone. It is traversed by slip planes, showing the deformation of the vein has taken place since its deposition. Both in the vein and in the country rock, sulfide minerals are finely disseminated and occur in small masses throughout the vein. The minerals observed are free gold, pyrite, chalcopyrite, tetrahedrite, galena, and sphalerite, and at the surface malachite, azurite, and limonite are present (Wright and Wright, 1908).

Golden Fleece mine

The ruinous Golden Fleece mill on the northeast shore of James Lake is connected by a tramway to an adit about 900 feet to the north. No mineralized outcrops were seen during the present mapping.

"The Golden Fleece property, which represents one of the earliest locations in the region, lies on the north end of James Lake two miles from tide water. A five-stamp mill was erected on the property in 1901 and a tramway built from the lower end of the lake to the wharf at Dolomi. The mine developments which were actively advanced in 1901-02, consist of two long tunnels, each 200 feet in length, and from them slopes and winzes have been sunk on the ore body. Early in 1905, work on this property was suspended and since that time no attempt has been made to operate this mine.

The ore deposits are irregular lenses slightly cutting the bedding planes of the inclosing limestone and varying from a fraction of a foot to eight feet or more in width. The strike of these irregular deposits is northeasterly, the dip being 40° southeast. A peculiar and advantageous feature of this mine is the occurrence of several limestone caverns which in places follow the mineral deposit. Crosscutting both the limestone and the ore bodies are diabase dikes which are of more recent intrusion than the ore deposit. The ore consists of free gold with tetrahedrite and pyrite, the grade on a whole being moderate." (Wright and Wright, 1908).

According to Bufvers (1967), the lower tunnel was a crosscut connected by a raise to an upper adit 200 feet long. The vein dips 40° southwest (note the conflict with the Wright's attitude) and yielded a considerable tonnage of $12 ore during the 1920's. During the mid 30's the vein in the upper adit was mined through to the surface.

Two patented mining claims totaling 23.52 acres (U. S. M. S. 540 A & B) which apparently cover the deposit described above are scheduled for auction in 1967 by the State of Alaska.

Boston(?) prospects

A number of pits, adits, and inclined shafts along the east side of Amazon Lake mark the Boston(?) prospects. The southernmost occurrences (figure 7) are irregular quartz veins in schist bedrock west of the outlet of Amazon Lake. Further north an adit, three inclined shafts, and some pits (figure 8) mark a zone of quartz veining and jasperoid (quartzite) replacement of marble bedrock. These two groups of showings may be along a north-trending member of the Dolomi Bay fault system.

There is no clear reference to these claims in the U. S. Geological Survey bulletins and the name "Boston" is taken from the plat of patented claims.

Prospect east of Amazon Lake outlet

An area of old slumped-in trenches and one caved adit was seen immediately east of the lower end of Amazon Lake (figure 7). Bedrock is visible above the adit in a 15 x 20 foot caved area 20 feet deep, about 30 feet above the level of the lake.

The bedrock in the caved area is chlorite schist which contains an irregular zone at least 30 feet wide of silicification and veins which appear to strike N.60°E., and dip steeply. The central part of this zone contains an irregular quartz vein up to three feet wide which is locally brecciated, with white quartz fragments ± 1/2 inch in a fine-grained quartz matrix. Quartz replacement zones tend to follow the bedding planes of the schist and in places are vuggy and irregular.

Sulfides make up less than 1 percent of any sample of quartz, but cellular quartz indicates that leaching has occurred. Sulfides seen are tetrahedrite and pyrite. Downslope from the deposit, vein quartz and quartz breccia float are present along the lake and in the creek that flows out of the lake. Geochemical sample 46, taken in the creek about 120 feet below the deposit, shows only background amounts of copper, lead, zinc, and molybdenum.

Prospects east of central Amazon Lake

About 300 feet north-northeast of the lower end of Amazon Lake, an adit (figure 8) crosscuts a zone of white to medium gray banded jasperoid and vein quartz. This zone of silicified marble is at least 50 feet wide and extends northward from the schist contact for 400 feet or more, parallel to the strike of the banding. The adit dump contains only quartz with minor tetrahedrite and local malachite stain. A specimen of quartz-tetrahedrite ore from the dump (sample 8, table 1) contained 0.01 oz/ton gold. Two inclined shafts (figure 8) have been sunk in the vicinity of the adit. The southernmost shaft shows banded quartzite cut by crosscutting quartz veins which are coarsely crystalline and carry some tetrahedrite. Sample C, table 1, taken from the dump of this shaft, carries 0.10 oz/ton gold. The second shaft to the north-northeast is in similar rock.

A third steep inclined shaft in the same jasperoid-quartz vein zone is present about 200 feet north-northeast of the adit. Further north, infrequent exposures expose banded, partly silicified marble. Sinkholes are present to the east of the silicified zone, presumably in unsilicified marble. About 1,000 feet north of the adit, a bench cut 40 feet above the lake exposes a low-grade quartz-tetrahedrite vein two feet wide with quartz stringers extending into the marble wall rock. A 10-ton pile of the vein quartz is located below the cut. Another 200 feet further north a six-inch quartz vein crosscuts the bedding of the marble bedrock. This vein contains an estimated 10% tetrahedrite. It was the northernmost exposure of vein material seen east of Amazon Lake.

Prospects west of Amazon and James Lakes

A 45° inclined shaft is present about 700 feet west of Amazon Lake (near geochemical sample 45). The dump contains an estimated 100 tons of white vein quartz and dark gray micaceous silicified schist. An assay of a small grab sample of barren-looking vein quartz and inclosing schist (sample 45, table 1) shows 0.70 ounces of gold and low base metal values. Geochemical sample 45 was taken from a small creek between the shaft and Amazon Lake.

About 600 feet to the northeast a partially caved adit trending northwest has a 1,000(?) ton dump containing vein quartz and schist with crosscutting quartz veins. No sulfides were seen, but limonite-filled cavities up to one inch in diameter are present in the quartz.

Further north, the area from west of the head of Amazon Lake to west of the center of James Lake has a broken topography with occasional karst pits. Several shafts were found. These contain vein quartz on the dumps, some with jasperoid breccia cemented by quartz veins. No sign of sulfides was seen in this vein quartz. The impression gained from the scattered exposures was of complex structure, probably much faulting, and local silicification (formation of jasperoid) over a wide area.

West of the head of James Lake, a large apparently continuous quartz vein is present. Near geochemical sample 41, where an adit 35 feet long has been driven through it, the vein is about 40 feet wide (strike N.30W., dip about vertical) and is composed of a much fractured, white, remarkably barren-looking quartz with narrow stringers of pyrite near the contacts with quartzite wall rock. Low-grade disseminated pyrite with minor chalcopyrite is also present in limonite-stained quartzite wall rock exposed along the west side of the vein in the adit face and in a three-foot horse in the center of the vein. A chip sample taken along the first 10 feet of the adit (sample 41, table 1) contains only traces of gold and other metals. The same quartz vein is present for some distance south of the adit. North of the adit, it crops out on either side of the tributary creek at the northwest end of James Lake. A shaft 20 feet deep has been sunk on it a few hundred feet north of this creek. The vein must be more than 500 feet long, and perhaps 20 to 40 feet wide. Nowhere was any appreciable amount of sulfide other than pyrite seen in it, but there are few exposures.

Pyrite zones on south shore of Port Johnson

Limonite stained outcrops of pyrite-sericite altered phyllite (figure 9) are present along the south shore of Port Johnson near geochemical sample 6, 1/2 mile east-southeast of Moss Point. The highest grade zone seen was exposed on a small rochè moutonnèe (sheepback rock) on the beach west of the creek at this locality. The zone is pyrite-bearing over a width of 12 feet with wisps containing greater than 50% pyrite running through it. A chip sample across the zone (sample 6, table 1) contains 0.01 oz/ton gold and less than trace amounts of other metals. Geochemical samples 5 and 6 taken in the vicinity fail to indicate any metal anomalies.

These zones are probably similar in origin to several pyrite-free sericite-quartz replacement zones in the phyllite near geochemical sample 10, figure 1, near the west end of Port Johnson. These are very light yellow-green aphanitic zones with unreplaced micro-folded chlorite layers. The zones are up to 10 feet long and are gradational with the surrounding phyllite.

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Table 1. Assays from the Dolomi area

Map No.*	Field No.	Ounces per ton Au	Ag	Weight percent Cu	Pb	Zn	As	Ni	Remarks
A	6C-35-1	0.01	Nil	0.1 ± 0.03	N.D.	N.D.			6" malachite stained area in irregular quartz vein which is cut by basalt dike. Shore along Clarence Strait
A	6C-35-2A	0.01	Nil	N.D.	N.D.	N.D.		trace	Barren-looking quartz vein associated with basalt dike
B	6C-76	0.01	1.53	trace	N.D.	N.D.	trace		Quartz with minor malachite stain and tetrahedrite on adit dump, east side of Amazon Lake (figure 8)
C	6C-77	0.10	11.62	0.3 ± 0.05	trace	trace	trace		Banded jasperoid with crosscutting quartz veins containing low-grade tetrahedrite on shaft dump, east side of Amazon Lake (figure 8)
D	6C-203-2	0.22	trace	N.D.	N.D.	N.D.	N.D.		Small quartz veins in breccia zone. Valparaiso adit (figure 6)
D	6C-203-2	Nil	Nil	N.D.	N.D.	N.D.	N.D.		6" gray fault gouge. Valparaiso adit (figure 6)
6	6C-109	0.01	Nil	N.D.	N.D.	N.D.	N.D.		Chip sample across 12' pyrite-sericite zone, south shore Port Johnson (figure 9)
41	6C-85	trace	Nil	N.D.	N.D.	trace	trace		40' quartz vein. 10' chip sample across vein in 35' adit, west of James Lake, near north end
45	6C-197	0.70	0.68	N.D.	N.D.	N.D.			White vein quartz in micaceous silicified schist. Grab sample of quartz from dump of inclined shaft

Table 1. Continued

Map No.*	Field No.	Ounces per ton Au	Ag	Weight percent Cu	Pb	Zn	As	Ni	Remarks
49	6C-141	trace	Nil	N.D.	N.D.	trace			Barren-looking quartzite breccia on prospect dump near intersection of John Creek with creek draining Paul Lake
49	6C-147	0.02	0.04	N.D.	N.D.	N.D.	0.5 ± 0.1		Pulverized quartzite in fault zone at prospect along marble-schist contact about 200' west of intersection of John Creek and creek draining Paul Lake

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*Samples designated by geochemical sample site numbers wherever possible, otherwise by letter. All sample sites shown on figure 1. Some shown on appropriate large-scale maps included in this report.

Gold-silver by fire assay, Don Stein, Assayer, Division of Mines and Minerals.
Base elements by XRS, Namok Cho, analyst, Division of Mines and Minerals.

Table 2. Metal contents of stream sediment samples from the Dolomi map area.

Map No.	Sample No.	Concentration (ppm)* Cu	Zn	Pb	Mo	Field Test** (ml dz)	Stream Width	Float	Bedrock	Mineral-ization	Remarks
1	6L-45	10	65	15	4	4	3'	gwke.	andesitic gwke.	none	
2	6L-44	20	45	10	2	7	1'	chl.sch.,M, gwke.	chl.sch.,M,gwke.	none	
3	6L-41	-5	10	-5	2	2	1'	gwke.	andesitic gwke.	none	sediments from moss
4	6L-40	5	75	5	3	2	2'	gwke	andesitic gwke.	none	
5	6L-39	30	100	5	2	4	1'	chl.phyl.	chl.phyl.	none	30' above high tide
6	6L-38	50	100	5	4	2	3'	chl.phyl.	chl.phyl.	none	
7	6L-5	50	75	20	2	3	3'	chl.sch.,M		pyrite	creek 4" deep
8	6L-6	10	35	10	2	2	6'	chl.phyl.		none	creek 1' deep
9	6L-8	50	115	15	4	9	4'	chl.phyl		none	
10	6L-7	10	50	10	6	3	2'	chl.sch.,M, phyl.	chl.sch.	none	creek 6" deep
11	6L-9	5	30	5	2	7	4'	chl.phyl.	chl.phyl.	none	
12	6L-10	10	100	15	3	8	2'	chl.phyl,M	chl.phyl.,M	none	
13	6L-11	35	120	10	2	8	4'	chl.phyl.,M	chl.phyl.	none	
14	6L-12	30	125	10	2	3	3'	chl.sch.,dolo., M	chl.sch.,dolo., M	none	creek 6" deep
15	6L-13	30	115	10	2	2	3'	chl-mic-sch.,M	chl-mic-sch.,M	none	creek 6" deep
16	6L-14	50	95	5	2	3	2'	chl.sch.,M	chl.sch.,M	none	

Table 2. Continued

Map No.	Sample No.	Concentration (ppm)* Cu	Zn	Pb	Mo	Field Test** (ml dz)	Stream Width	Float	Bedrock	Mineral-ization	Remarks
17	6L-15	35	115	10	2	2	1'	chl.sch.,M	chl.sch.,M	none	
18	6L-16	35	120	10	4	2	3'	chl.sch.M	chl.sch.,M	none	
19	6L-17	30	110	5	1	2	1'	chl.sch.,M	chl.sch.,M		
20	6L-42	25	110	5	2						
21	6L-18	20	135	40	2	6	3'	M.	M.	none	
22	6L-37	10	75	45	3	4	2'	M.,chl.sch.	M,chl.sch.	none	
23	6L-43	70	210	5	3	3	1'	chl.sch.,M.	chl.sch.,M.	none	
24	6L-19	10	50	5	1	8	1'	chl.sch.,M.	chl.sch.,M.	none	
25	6L-1	10	70	20	7	2	4'	M		none	
26	6L-2	10	160	25	3	4	3'	dolo.,M		none	
27	6L-4	10	25	10	3	3	1'	chl-mica.sch.,M	chl-mica.sch. (not exp)	none	creek 2" deep
28	6L-3	20	110	15	2	2	6'	chl-mica.sch,M	chl-mica.sch.	none	
29	6C-123	5	55	10	3	-	20'	chl.sch.	none	minor v.q.	creek 6" deep
30	6C-125	5	20	10	2	1	1'	sch. vq.	sch.	much v.q.	creek 2" deep
31	6C-127	60	130	10	2	3	15'	sch., 5% vq.	sch.	v.q.	
32	6C-129	30	105	20	3	4	15'	mica sch.	mica sch.	none	
33	6C-130	20	95	10	2	3	15'	sch.	sch.	none	creek 1' deep

Table 2.. Continued

Map No.	Sample No.	Concentration (ppm)* Cu	Zn	Pb	Mo	Field Test** (ml dz)	Stream Width	Float	Bedrock	Mineral-ization	Remarks
34	6C-132	15	100	15	2	1	4'	sch.,5%v.q.	sch.	none	creek 1' deep
35	6C-134	30	125	10	1	2	3'	chl.sch.		none	creek 6" deep
36	6C-136	85	150	35	3	6	8'	M,chl.sch.	M	none	just above Golden Fleece adit in spring fed creek 1" deep.
37	6L-35	60	110	15	2	3	3'	chl.sch.,9% qtzite.,1%v.q.		1%v.q.	NE corner James L.
38	6L-34	20	80	5	2	2	4'	chl.sch.	chl.sch.(not exp)	1%v.q.	N end James L.
39	6L-33	60	125	5	2	2	4'	qtzite.,5%M., 5% sch.	qtzite(not exp)		NW corner James L.
40	6L-32	30	85	5	3	3	2'	andesite, 5% qtzite.,1%v.q.	v.q.,andesite dike (not exp)		NW side James L.
41	6L-31	10	70	10	3	3	1'	qtzite.,10%sch., 5% M	jasperoid(not exp)		W end James L.
42	6C-83	25	205	30	2	3	1/2'	qtzite.	jasperoid w/x/c.	q.v.	small spring near banded jasperoid crop
43	6L-30	50	110	45	2	3	4'	M, 15%sch., 5% v.q.			outlet James L.
44	6L-29	20	75	5	2	4	3'	M,4% sch.,2%v.q.			outlet to John L.
45	6C-197	10	30	25	2	2	3'	sch.	sch.		taken in small cr. below inclined shaft

Table 2. Continued

Map No.	Sample No.	Cu	Concentration (ppm)* Zn	Pb	Mo	Field Test** (ml dz)	Stream Width	Float	Bedrock	Mineral-ization	Remarks
46	6L-28	35	100	10	2		4'	mica sch.	mica sch.	tetrahed-rite q.v.	John Cr. below prospect (fig.6)
47	6L-27	30	90	10	2		1'	mica sch.,M		none	
48	(6L-26	5	70	5	2	3	8'	gar.amph.sch.20%, marble 80%		none	John Cr. 1' deep
	(6C-142	10	60	5	1	1	15'	sch.qtzite	sch.	none	John Cr. 6" deep
						(about same locality as 6L-26)					
49	6C-143	30	115	25	2	3	3'	chl.sch.,5% qtzite.	jasperoid along marble-sch.cct.	old shafts up cr.	Paul L. Cr. 6"deep
50	6L-60	20	50	5	1	3	2'	mica-chl.sch.	mica-chl.sch.		
51	6L-51	25	150	10	2	3	2'	mica-chl.sch.	chl.sch.		50' dn.stream fm. sch.-M cct.
52	6L-53	15	130	5	2	3	3'	M	M		
53	6L-50	10	50	5	3	3	1'	mica-chl-sch.	chl-sch.		
54	6L-49	40	70	5	1	2	3'	mica, 10% mica-qtzite.	qtzite.		50' dn.stream enters marble sink-hole
55	6L-48	20	100	10	2	3	2'	mica, 10% mica-qtzite.	chl.sch, qtzite		near sch.-M cct.
56	6L-47	40	90	10	3	5	2'	mica-M, 5% mica-sch.	mica-M		
57	6L-46	25	80	5	2	2	3'	chl.sch., 10% mica		1% v.q.	shore Paul L.

Table 2. Continued

Map No.	Sample No.	Concentration (ppm)* Cu	Zn	Pb	Mo	Field Test** (ml dz)	Stream Width	Float	Bedrock	Mineral-ization	Remarks
58	6L-55	30	100	10	3	3	1'	mica-chl.sch., 40% amph.	amph.		near fault
59	6L-56	50	80	10	3	2	1'	amph-mica.sch., 20% amph.	amph.		
60	6L-57	45	90	5	1	4	1'	mica-sch., 25% amph.			
61	6L-58	45	135	10	2	3	8'	mica-sch., 25% amph., 1% M	amph.		
62	6L-64	50	125	10	3	2	2'	mica-chl.-sch. mica-sch 10%	mica-sch.		
63	6L-63	45	160	10	2	2	1'	mica-chl-sch., 1% M	sch		
64	6L-95	<u>90</u>	175	15	1	3	2'	gar.sch. 20%, mica-chl-sch20%, amph.			
65	6L-102	<u>80</u>	<u>420</u>	20	4	3	2'	chl.sch 99%, M 1%	chl.sch.	none	
66	6L-106	35	<u>290</u>	20	1	4	1'	chl.sch. 60% mica.sch. 40%	sch.	none	
67	6L-61	50	90	10	5	5	2'	mica-chl.sch. 10% M	mica-chl.sch.	none	small creek just W of powerhouse, Val. mine.
68	6L-62	60	80	5	5	6	10'	mica-chl.sch., 10% M	mica-chl.sch.	none	large creek
69	6L-23	30	80	10	2	2	3'	mica.sch., M	mica.sch., M	none	small creek draining old adit

Table 2. Continued

Map No.	Sample No.	Cu	Concentration(ppm)* Zn	Pb	Mo	Field Test** (ml dz)	Stream Width	Float	Bedrock	Mineral-ization	Remarks
70	6L-24	60	65	5	1	2	1'	M		none	creek 2" deep
71	6L-22	50	300	35	3	4	2'	mica sch., M	mica sch., M	none	creek 6" deep
72	6L-21	20	115	15	1	6	2'	M	M	none	creek 4" deep
73	6L-25	10	90	5	2	3	2'	M	M	none	creek in sinkhole
74	6L-20	15	70	5	2	5	3'	M		none	creek 1" deep
75	6L-59	25	95	10	3	1	1'	chl.sch., 50% M	M	none	
76	6L-54	20	65	5	2	2	2'	mica chl.sch., 40% M	mica chl.sch.	none	M-sch. contact
77	6L-52	40	120	10	2	5	3'	M, 30% chl.sch.	chl.sch., M	none	large creek

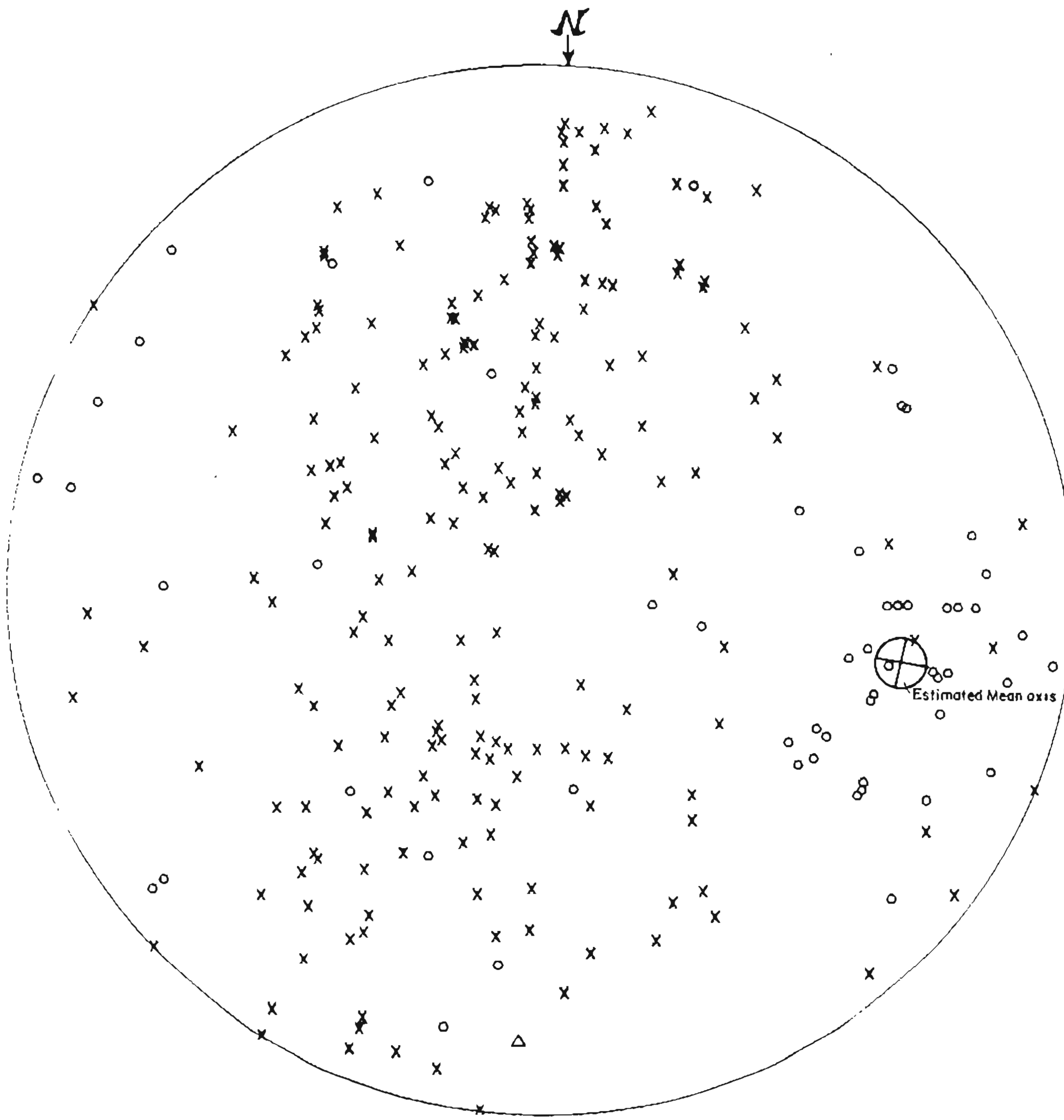
* Total metal contents analyzed by Rocky Mountain Geochemical Laboratories, Salt Lake City, Utah, using atomic absorption and colorimetric methods. Reported in parts per million.

** Milliliters dithizone, cold extractable heavy metals test (Hawkes, 1963).

Cu - copper; Zn - zinc; Pb - lead; Mo - molybdenum;

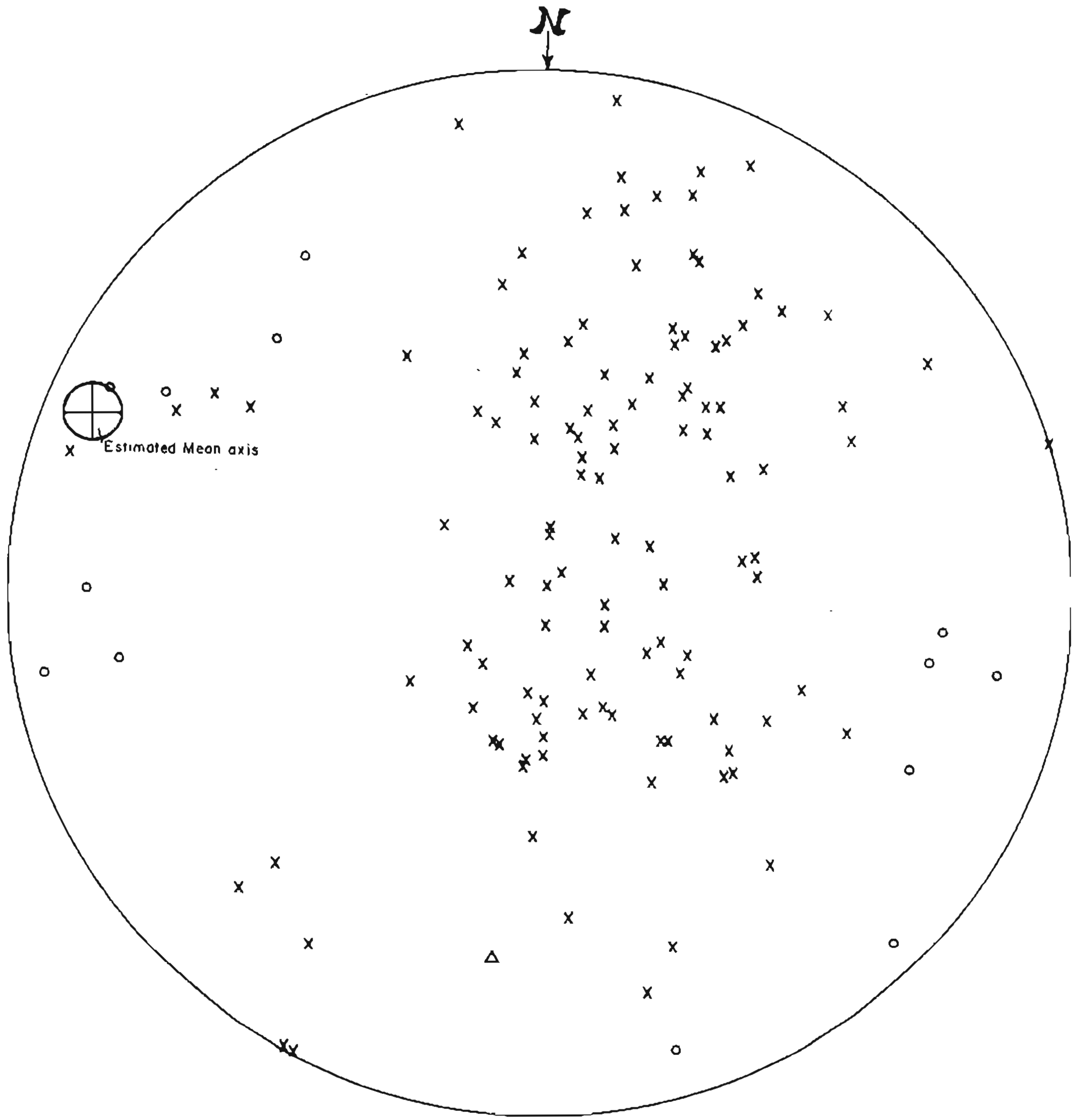
chl - chlorite; sch - schist; mic - mica; M - marble; dolo - dolomite; amph - amphibolite; v.q. - vein quartz;

qtzite - quartzite; cct. - contact; gwke - graywacke; phyl - phyllite; gar - garnet



O *Lineation or minor fold axis*
X *Pole of bedding or foliation plane*

Figure 2. Lower hemisphere, equal area projection of all measured attitudes in the Dolomi map area, east of the Paul Lake narrows



O Lineation of minor fold axis
X Pole of bedding or foliation plane

Figure 3. Lower hemisphere, equal area projection of all measured attitudes in the Dolomi map area, west of the Paul Lake narrows

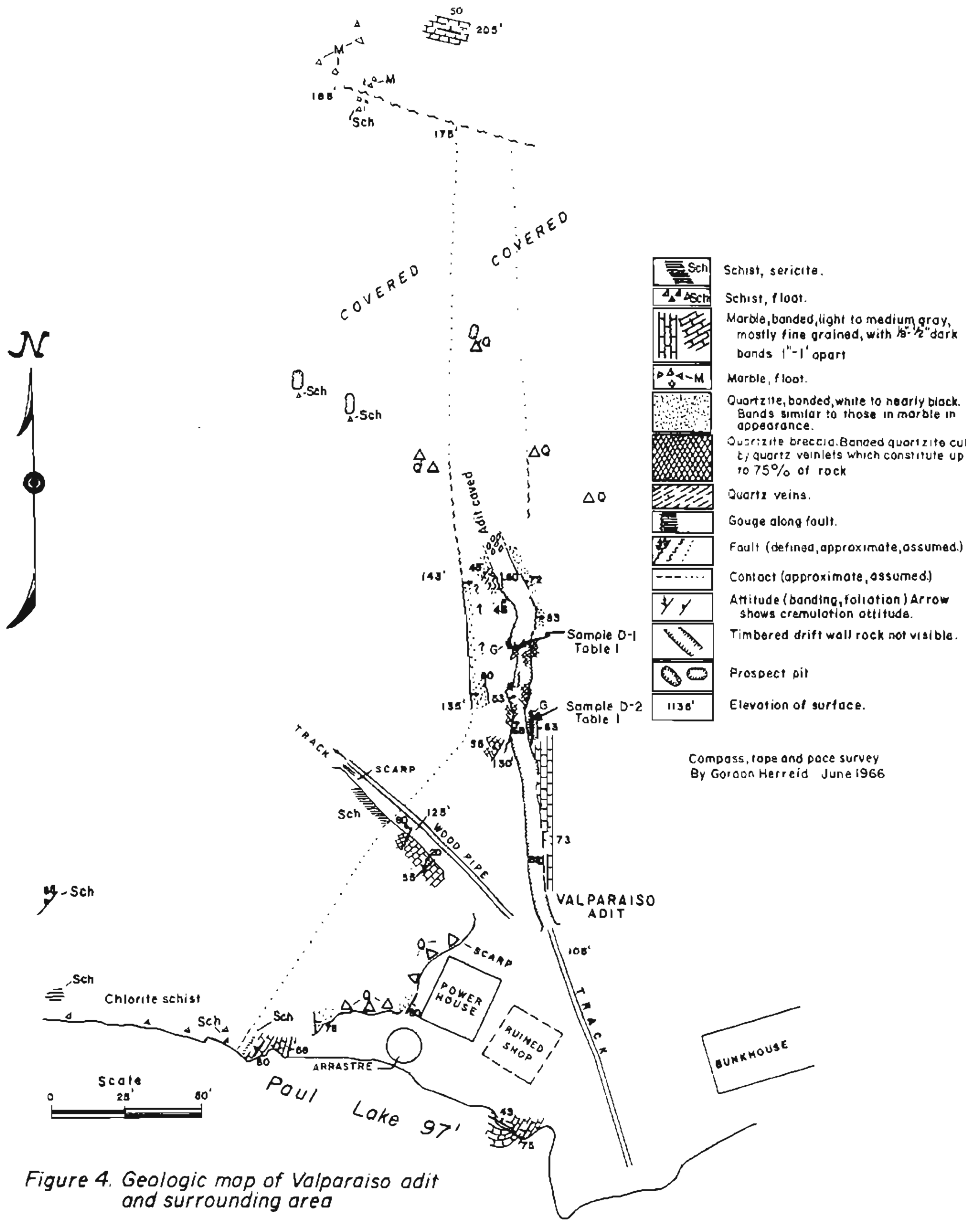


Figure 4. Geologic map of Valparaiso adit and surrounding area

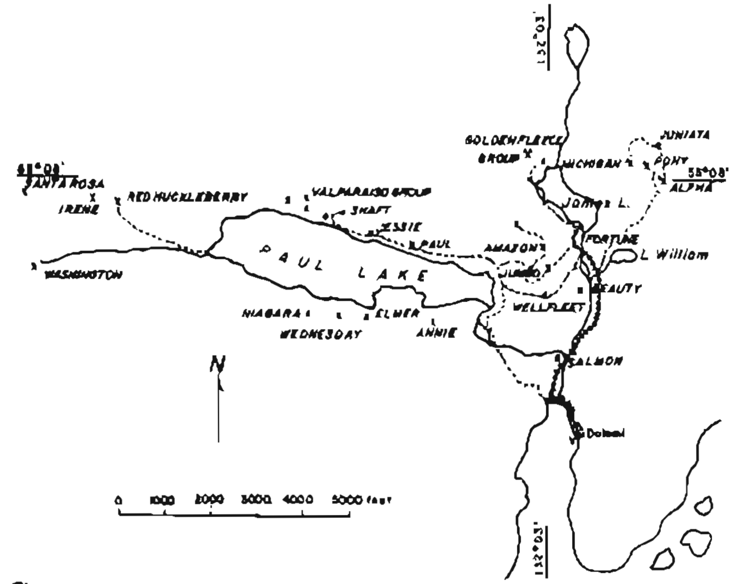


Figure 6. Prospects near Dolomi, circa 1907 (Wright and Wright, 1908, figure 18)

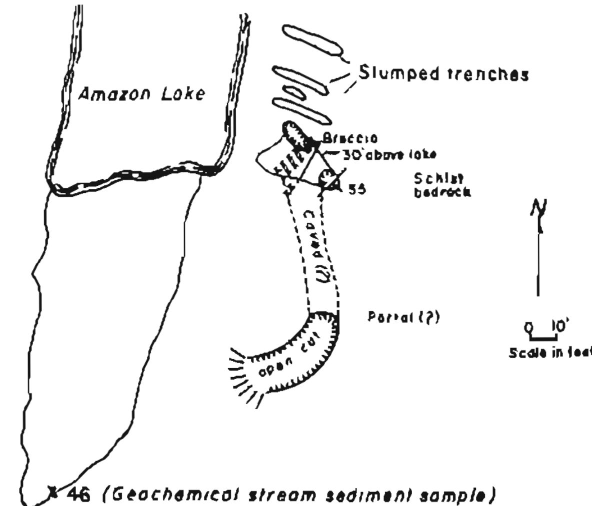


Figure 7. Geologic sketch map of prospect east of Amazon Lake outlet

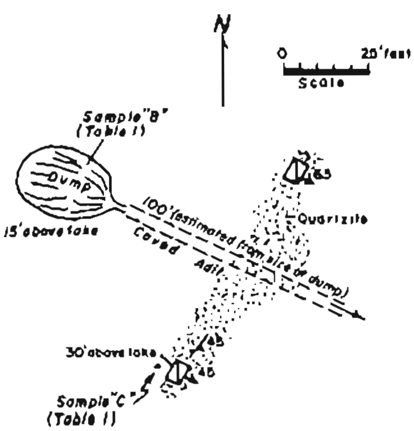


Figure 8. Geologic sketch map of prospect east of central Amazon Lake

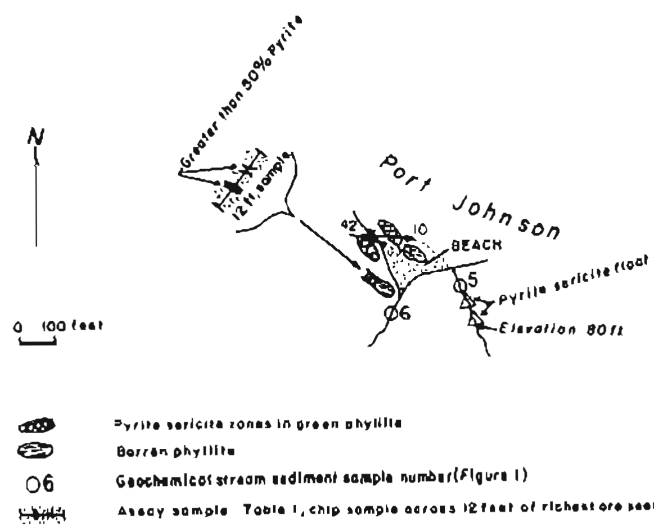


Figure 9. Geologic sketch map of pyrite zones on the south shore of Port Johnson, one half mile east-southeast of Moss Point

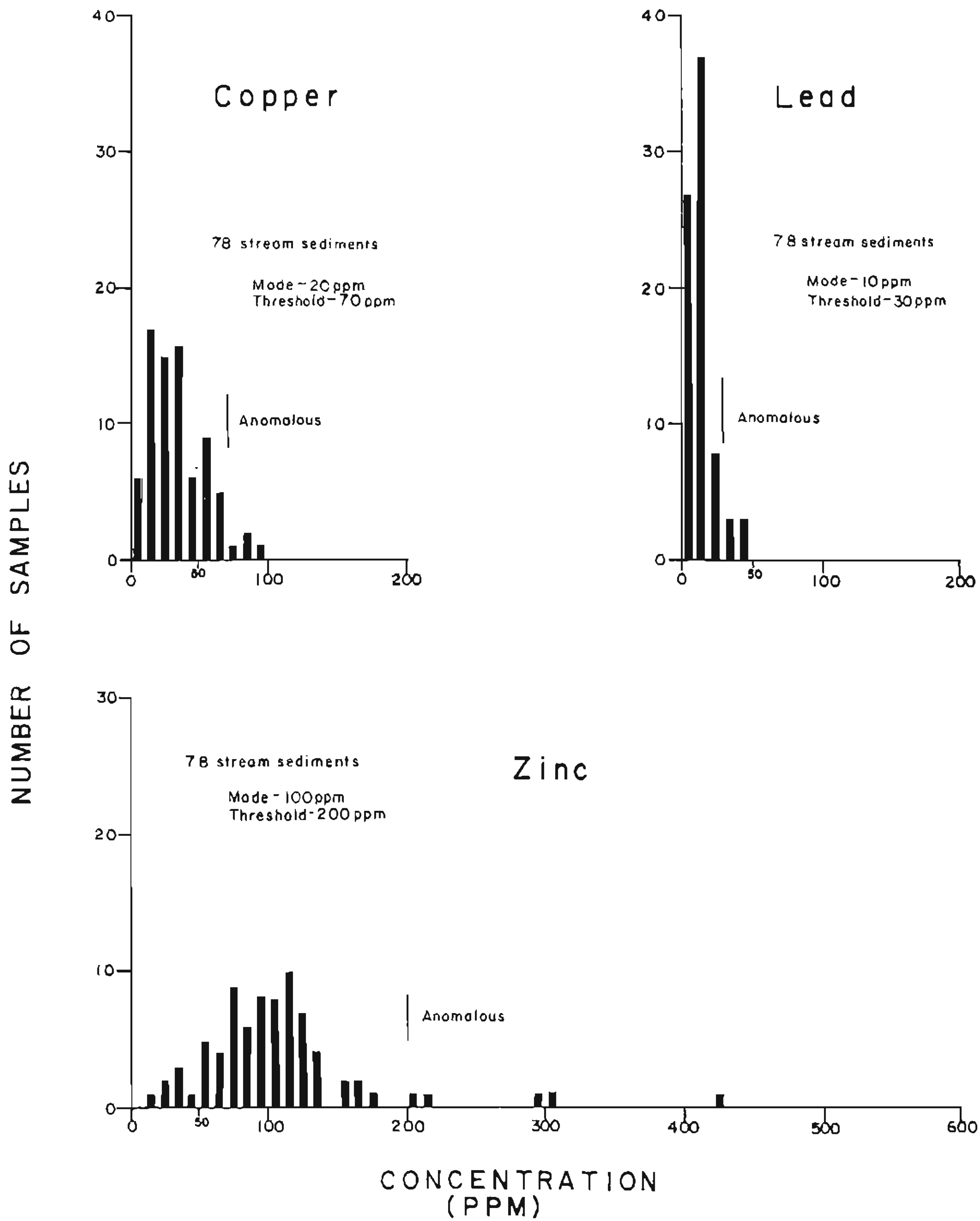


Figure 10. Frequency-concentration graphs of copper, lead, and zinc in stream sediment from the Dolomi area